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(*Manihot esculenta* Crantz)

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Information and conclusions reported herein do not necessarily reflect the position of any of the aforementioned entities.

Abstracts on Cassava

(*Manihot esculenta* Crantz)

Vol. XII **No. 1** **Abril, 1986**

CONTENTS

	INTRODUCTION	iii
	COMPONENTS OF AN ABSTRACT	iv
	HOW TO USE THE INDEXES	v
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY AND MORPHOLOGY	1
C00	PLANT PHYSIOLOGY	3
	C01 Plant Development	4
	C02 Cyanogenesis	5
	C03 Chemical Composition, Methodology and Analyses	5
	C04 Plant Nutrition	7
D00	CULTIVATION	9
	D01 Soil, Water, Climate and Fertilization	9
	D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting	14
	D03 Energy Productivity and Yields	19
	D04 Postharvest Studies	22
E00	PLANT PATHOLOGY	25
	E02 Bacterioses	26
	E03 Mycoses	29
	E04 Viroses	31
	E05 Mycoplasmoses	-
	E06 Nematodes	32

F00 PEST CONTROL AND ENTOMOLOGY 33
F01 Injurious Insects and their Control 33
F02 Rodents and other Noxious Animals 42
F03 Injurious Mites and their Control 42

G00 GENETICS AND PLANT BREEDING 43
G01 Breeding, Germplasm, Varieties and Clones, Selection 43
G02 Cytogenetics 47

H00 NUTRITION 48
H01 Cassava Foods and Nutritive Value 48
H02 Nutritive Disorders in Humans 51
H03 Animal Feeding 52
H04 HCN Toxicity and Detoxification 58

I00 PROCESSING, PRODUCTS AND USES 58
I01 Cassava Starch and its Properties 59
I02 Uses, Industrialization, Processing and Storage 63
I03 Industrial Microbiology 66

J00 ECONOMICS AND DEVELOPMENT 69

K00 OTHER ASSOCIATED COMMODITIES 85
K01 Rotational Schemes and Intercropping 85
K02 Descriptive and Comparative Studies 89

Z00 GENERAL -

ABBREVIATIONS AND ACRONYMS 91

AUTHOR INDEX 93

SUBJECT INDEX 100

INTRODUCTION

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide a specialized guide to the world's literature on cassava (*Manihot esculenta* Crantz), disseminating research results and ongoing activities related to the crop.

The abstracts report condensed information from journal articles, booklets, mimeographed reports, theses, manuals and other conventional and nonconventional material, categorized into broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are author and subject indexed to enable more comprehensive consultation.

When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users who request this search service. The full text of every article abstracted by the Documentation Center is also available, through the photocopy service.

CIAT's Documentation Center also publishes journals of analytical abstracts on field beans (*Phaseolus vulgaris* L.) grown under tropical conditions and on tropical pastures. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include: Pages of Contents, Cassava Newsletter, Pastos Tropicales - Boletín Informativo, and Hojas de Fríjol.

COMPONENTS OF AN ABSTRACT

Accesion number (for photocopy requests)

Authors

Sequential number in the journal (for use of indexes)

Year of publication

19527 IKEDIOBI, C.O.; ONYIKE, E. 0145 1982. The use of linamarase in gari production. Process Biochemistry 17(4):2-5. Engl., Sum. Engl., 12 Refs., Illus. [Dept. of Biochemistry, Ahmadu Bello Univ., Zaria, Nigeria]

Original title

Author address

Additional notes

Source

Pages

Language of paper

Language of summary

Cassava. Linamarase. Uses. Gari. Fermentation. Detoxification processes. Enzymes. Nigeria.

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. [AS]

Abstract

Abstractor and/or translator

ERRATUM

In volume XI, number 1, of the journal of Abstracts on Cassava, on page 8, line 8 of the abstract of the document no. 22016, where it reads "of diuron + paraquat (2.8 + 2.8 kg/ha)" it should read "of diuron + paraquat (2.8 kg/ha)...."

HOW TO USE THE INDEXES

The numbers listed under each entry in the author and subject indexes correspond to the abstract's sequential number, found above each abstract within the journal.

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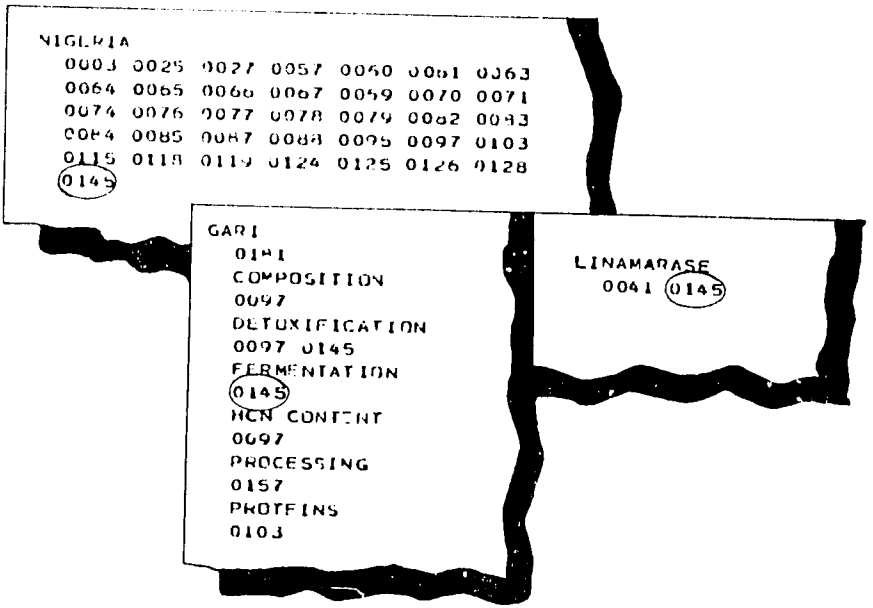
Author Index

The Author Index can be used to find abstracts when the personal or corporate authors are known. The Author Index, which is alphabetically arranged, lists *all* author and co-author names cited in the publicaction.

Subject Index

The Subject Index presents an alphabetical list of descriptors used in cassava research, many of which are combined with other descriptors, allowing the identification of more specific topics.



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A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

See 0105 0167

B00 PLANT ANATOMY AND MORPHOLOGY

0001

24559 CASTILLO H., A.; CASTILLOA, J.J. 1984. Comparaciones histológicas y citológicas de dos cultivares de yuca (Manihot esculenta Crantz): UCV 2143 (dulce) y UCV 2368 (amarga) en edad de ser cosechadas. [Histological and cytological comparisons between two cassava cultivars: UCV 2143 (sweet) and UCV 2368 (bitter) at harvesting age]. In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.156-157. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Cultivars. Electron microscopy. Analysis. Research. Roots. Venezuela.

Sections of sweet and bitter cassava roots, both 10-mo.-old, were compared under the electron microscope. In bitter cassava, the abaxial epidermis presented protective papillae surrounding the stomata. In both cv. the plastids of the mesophyll presented 2 types of ergastic inclusions: starches and lipoid globules. However, in the bitter cassava the latter ones prevailed whereas the 1st ones did so in sweet cassava. Illustrations are included. [CIAT]

0002

24560 CASTILLO H., A.; CASTILLOA, J.J. 1984. Variaciones en los cloroplastos del mesófilo de 2 cultivares de yuca (Manihot esculenta Crantz): UCV 2143 (dulce) y UCV 2368 (amarga), con respecto a la hora de la toma de la muestra. [Variations in the chloroplasts of the mesophyll of two cassava cultivars: UCV 2143 (sweet) and UCV 2368 (bitter) in relation to the time of sampling]. In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.158-159. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Cultivars. Bitter cassava. Sweet cassava. Electron microscopy. Analysis. Research. Leaves. Plant tissues. Starch content. Fat content. Venezuela.

Leaf samples coming from 45-day-old cassava plants (bitter and sweet) were compared under the electron microscope; samples were taken every 6 h during 1 day. The content of the starch granules and the lipoid globules was not constant during the different hours of the day. The variation curve of the starch granules was similar in both cv.; the distribution of the lipoid globules differed in both cv. Starch and lipoid globules contents of the bitter cassava were always higher than those of the sweet cassava. In both clones a large quantity of cells with tannins and/or vesicles of microvillis was observed. Illustrations are included. [CIAT]

0003

24565 CASTRONI, S.; CASTILLOA, J.J.; QUINTERO, F.; COLINA, R. 1984. Estudio sobre la morfología de almidones en raíces reservantes de cuatro cultivares de yuca (Manihot esculenta Crantz). (Study on the starch morphology in storage roots of four cassava cultivars). In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.188-189. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Cultivars. Cassava brown streak virus. Resistance. Cassava starch. Particle size. Analysis. Research. Electron microscopy. Venezuela.

Six-mo.-old cassava cv. UCV 2129, UCV 2277, UCV 2320, and UCV 2459, resistant and susceptible to cassava brown streak virus, were studied to compare the morphology and starch aggregation patterns in the storage roots. The starches were present in the cells forming double, triple, and quadruple aggregates, and occasionally with 5 or more granules. The av. size of the granules were 10.3, 11.0, 9.9, and 11.4 micra for cv. UCV 2129, UCV 2277, UCV 2320, and UCV 2459, resp. Apparently there is no relationship between the size or aggregation patterns and the tolerance or susceptibility to the cassava brown streak virus. Illustrations are included. [CIAT]

0004

24562 LUCIANI, J.F.; CASTILLOA, J.J.; FERRARI, G.; DIAZ, M. 1984. Polinización y polen en yuca y batata. (Pollination and pollen in cassava and sweet potato). In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.166-167. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Electron microscopy. Flowers. Pollen. Carpels. Research. Venezuela.

Under the electron microscope, the flower of cassava was studied. It was observed that the stigma has trichomes to remove the pollen adhered to the insects' legs. The pollen grains are round with a diameter of approx. 122 micra. Illustrations are included. [CIAT]

0005

24561 PINO P., L.T. 1984. Contribución al conocimiento de la epidermis foliar en yuca (Manihot esculenta Crantz). (Contribution to the knowledge of the leaf epidermis in cassava). In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.160-161. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Cultivars. Electron microscopy. Analysis. Research. Leaves. Stomata. Venezuela.

The leaf epidermis of 4 cassava cv. was studied. The 4 cv. presented leaves with stomata on both surfaces, unistrate epidermis, few stomata on the adaxial surface located adjacent to the main nervations, 3 types of normal epidermal cells in the adaxial epidermis, presence of cells with druses of similar shape and distribution, and presence of small stomata isolated on the main nervation in the abaxial epidermis. They presented

differences in relation to the presence or absence of papillae and trichomes, with the degree of ondulation of the anticlinal cell walls of the adaxial surface, size of the trichomes, and the stomatic density. Illustrations are included. [CIAT]

0006

23787 POUZET, D. 1980. Compte rendu de prospection manioc, en septembre 1979 en vue de l'établissement de collections régionales. (Report on the cassava survey, September 1979, with a view to the establishment of regional collections). In _____. Rapport analytique d'activites dans la région de Touba, Savanes du Nord-Ouest, campagne 1979-1980. Bouaké, Cote d'Ivoire, Institut des Savanes. Département des Cultures Vivriéres. pp.14-17. Fr.

Cassava. Cultivars. Cassava African mosaic virus. Mycoses. Ivory Coast.

The characteristics of 40 cassava var. grown in the Ivory Coast, as given by the farmers, are presented. In all the var. symptoms of CAMD and cercosporioses were observed. [CIAT]

C00 PLANT PHYSIOLOGY

0007

24701 PORTO, M.C.M. 1983. Physiological mechanisms of drought tolerance in cassava (Manihot esculenta Crantz). Ph.D. Thesis. Tucson, University of Arizona. 125p. Engl., Sum. Engl., 68 Refs., Illus.

Cassava. Cultivars. Soil water. Water requirements (plant). Plant height. Leaves. Growth. Productivity. Stems. Roots. Cuttings. Water stress. Planting. Spacing. Weeding. Fertilizers. N. P. K. Photosynthesis. Leaf area. Stomata Transpiration. Climatic requirements. Temperature. Rainfall data. Soil physical properties. Carbon dioxide. Tetranychus urticae. Oligonychus peruvianus. Thrips. USA. Colombia.

The response of cassava to water stress was studied in 2 distinct sites: Tucson (Arizona, USA) and Santander de Quilichao (Colombia). A 3rd expt. was conducted in Palmira, Colombia, to evaluate the relationship between photosynthesis, RH, and yield of cassava cv. MCol 1684, MVen 218, CMC 40, MCol 22, and MIta 1158. Plants stressed after 2 mo. of growth in Tucson reduced growth by reducing leaf formation, expansion, and area. Reductions in LAI due to stress imposed to MCol 1684 in Quilichao were attained by reducing leaf expansion rates and leaf formation in plants stressed after 3 mo. of age. Plants stressed later increased leaf fall and did not reduce leaf formation. Stress reduced DM production in all cv., especially on young plants. Stress also altered the patterns of DM partitioning in 3-mo.-old plants of MCol 1684, but not in those stressed at 6 mo. Transpiration and diffusive conductances of MCol 1684 were reduced after 40 days of stress. These parameters were correlated to photosynthesis and leaf temp. for unstressed plants, and additionally with RH in the plants stressed after 3 mo. of growth. Leaf temp. were lower in stressed plants of MCol 1684, which suggests that stressed cassava plants can avoid excessive heating caused by stomatal closure by simply changing leaf orientation and increasing reflectance. Leaf water potential was slightly reduced by stress in Tucson, except for MVen 218. Stressed plants of MCol 1684 in Quilichao showed lower values of leaf water potential than those of unstressed plants after 30-40 days of treatment, suggesting an adaptation

of stressed plants acquired during the stress period. The effects of air humidity on stomatal functioning of MCol 1684 seems to be strong as suggested by the dependence of transpiration, conductances, and photosynthesis on RH. [Dissertation Abstracts International]

C01 Plant Development

0008

24059 ROCA, W.M.; NARVAEZ, J.; RODRIGUEZ, J.; REYES, R.; MAFLA, G.; BELTRAN, J.; ROA, J.; RAMIREZ, H.; RODRIGUEZ, A. 1984. Utilization of tissue culture techniques for the conservation and international exchange of cassava (Manihot esculenta) germplasm. Cali, Colombia, Centro Internacional de Agricultura Tropical. 22p. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Tissue culture. Apical meristems. Plant tissues. Germplasm. Storage. Clones. Plant anatomy. Agronomic characters. Biochemistry. Analysis. Enzymes. Culture media. Manihot. Plant development. Colombia.

With graphs, illustrations, photos, and tables, the utilization of tissue culture techniques for the conservation and international exchange of cassava is briefly described. Likewise, the results of the phenotypic stability of cassava cv. M. Mex 20, M. Col 650, M. Col 2197, CM 305-38, and CM 323-375, stored under min. growth culture conditions for 42, 1?, 18, 30, and 30 mo., resp., are given. To evaluate the phenotypic stability, morphological, agronomic, and biochemical parameters were considered. With the exception of variation in the color of root epidermis and cortex, no changes resulted solely from in vitro storage in any of the morphological, agronomic, and biochemical characters evaluated. Finally the use of a modified Murashige and Skoog medium, supplemented with GA, thiourea, and sucrose, to achieve embryo germination and plant development in 10 wild Manihot spp., is reported. [CIAT]

0009

23647 RODRIGUEZ, J.A.; ROCA, W.M.; HERSHEY, C. 1985. Cultivo de embriones de semilla sexual de yucas silvestres y cultivadas. (Embryo culture of the sexual seed of wild and cultivated cassava). Cali, Colombia, Centro Internacional de Agricultura Tropical. 6p. Span. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Seed. Manihot esculenta. Manihot. Tissue culture. Embryo. Temperature. Illumination. Plant growth substances. Mexico. Colombia.

At CIAT, a group of seed of Manihot carthagenensis (from Colombia) and M. michaelis, M. ooxacana, M. caudata, and M. aesculifolia (from Mexico), as well as seed of M. esculenta var., were treated with heat (60°C) during 14 days, while another group of seed of the same species was not treated with heat. All seeds were disinfected with mercury bichloride, washed with distilled sterilized water, and the embryos dissected from each specie placed in culture media and incubated at 32 and 27°C (day and night, resp.) with a photoperiod of 12 light h at 5000 lux. Initially the embryos of wild species grew more rapidly than those of M. esculenta, but after 1 mo. the survival of M. esculenta embryos was greater than that of the other species. Heat treatment, before culturing the embryos, favored embryo development, resulting in twice as many plants in comparison with untreated seeds. M. ooxacana and M. carthagenensis did not form plants in both

cases. The need to carry out more research on the effect of heat treatment on seeds and on new culture media is indicated. [CIAT]

See also 0014 0018 0034 0174

C02 Cyanogenesis

0010

24072 DUNSTAN, W.R.; HENRY, T.A.; AULD, S.J.M. 1906. Cyanogenesis in plants. 5. The occurrence of phaseolunatin in cassava (Manihot aipi and Manihot utilissima). Proceedings of the Royal Society of London 78:152-158. Engl., 17 Refs.

Cassava. Manihot. Sweet cassava. Bitter cassava. Cyanogenic glucosides. Enzymes. Analysis. Isolation. United Kingdom.

Expt. to demonstrate the presence of cyanogenic glucosides in dried cassava roots (pith and cortex) of both sweet and bitter cassava are described. The physical and chemical characteristics of the purified crystalline extract are presented and compared with a mixture of phaseolunatin, prepared from the seeds of Phaseolus lunatus. [CIAT]

See also 0034 0146 0174

C03 Chemical Composition, Methodology and Analyses

0011

24046 ARAUJO, E.F. DE; CALDAS, L.S.; CALDAS, R. DE A. 1984. Glutamine synthetase from cassava (Manihot esculenta Crantz) leaves. Phyton (Argentina) 44(1):63-74. Engl., Sum. Engl., 33 Refs., Illus. [Depto. de Biologia Geral, Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil]

Cassava. Cultivars. Leaves. Enzymes. Analysis. Biochemistry. pH. Brazil.

The properties of glutamine synthetase (GS) from cassava leaves grown in nutrient solution were studied. Its specific activity did not vary when plants were grown in different levels of N. The enzyme was partially purified and characterized. Half of the enzyme activity was lost in 10 days when the enzyme preparation (8 mg/ml) was stored either at 0-4 or -13°C. The stability of the enzyme preparation decreased greatly when stored at higher temp. (25-45°C). The optimum pH for the biosynthetic reaction was in the range of 7.2. Two peaks of activity were found when the enzyme was chromatographed on DEAE-cellulose. For ATP and L-glutamate, the K_m values were 0.87 and 5.54 mM, resp. [AS]

0012

24064 EKPENYONG, T.E. 1984. Composition of some tropical tuberous foods. Food Chemistry 15(1):31-36. Engl., Sum. Engl., 18 Refs. [Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Yams. Sweet potatoes. Starch crops. Composition. Water content. Fat content. Protein content. Carbohydrate content. Food energy. Fibre content. Ash content. Mineral content. Ca. P. Fe. Zn. Mg. Mn. Analysis. Nigeria.

Four tropical crops were evaluated for their chemical compositions and amino acid patterns. Winged bean (Psophocarpus tetragonolobus), yam, sweet potato, and cassava contained, resp.: moisture 56.2, 71.8, 70.7, and 65.2; fat 0.7, 0.1, 0.3, and 0.1; CP 11.0, 2.0, 1.2, and 1.5; carbohydrate 28.8, 25.1, 27.1, and 32.8; fiber 2.4, 0.5, 0.8, and 0.9; and ash 2.0, 1.0, 0.7, and 0.5%. Their resp. values for Ca, P, and Fe were, in mg/100 g: 30, 22, 36, and 30; 42, 39, 56, and 31; and 2.6, 1.0, 0.9, and 1.0. Values are also tabulated for amino acids. Total content of essential amino acids was much greater in winged bean tubers than in the other tuberous roots. However, cassava roots had the highest content of S-containing amino acids. Energy values were 148, 108, 115, and 136 kcal/100 g, resp. [Nutrition Abstracts and Reviews]

0013

23097 HUSSAIN, A.; BUSHUK, W.; RAMIREZ, H.; ROCA, W. 1985. Identification of cassava (Manihot esculenta Crantz) varieties by isozyme electrophoregrams. Winnipeg, Canada, Department of Plant Science. University of Manitoba. Publication no.716. 20p. Engl., 18 Refs., Illus. [Dept. of Plant Science, Univ. of Manitoba, Winnipeg, R3T 2N2, Canada]

Cassava. Cultivars. Analysis. Laboratory experiments. Temperature. Light. Cuttings. Plant tissues. Isolation. Enzymes. Biochemistry. Colombia.

The electrophoretic pattern of various cassava cv. from CIAT's germplasm collection was studied to establish a rapid cv. identification method. Five plant tissues (roots, stems, leaves, petioles, and terminal buds) were isolated from standardized plants (emergence of lateral buds, 2 wk. after planting), with 3 buffer solutions having a different pH (7.0, 7.4, and 8.3). Five buffer solution systems of gel electrophoresis were tested with 16 enzymes; samples were run in polyacrylamide and starch gels. Of the 16 enzymes tested, only phosphoglucomutase, peroxidase, and shikimic dehydrogenase showed an accumulative concn. effect in the zone far from the meristematic region of the stem; the other 13 enzymes proved to be homogeneously distributed. Esterase, a complex group of isoenzymes, showed great variation in the fast migration zone with little variability among different tissues; its resolution was quite good in 12% polyacrylamide gels and in the tris-borate electrode buffer. Further research work is required to optimize electrophoretic conditions for rapid identification of cassava var. [CIAT]

0014

23096 INDIRA, P.; RAMANUJAM, T. 1984. Proline accumulation, relative water content and dry matter in cassava under moisture stress. Indian Journal of Agricultural Sciences 54(4):336-337. Engl., 6 Refs. [Central Tuber Crops Research Inst., Trivandrum, Kerala 695 017, India]

Cassava. Cultivars. Amino acids. Cuttings. Soil physical properties. pH. Soil analysis. Fertilizers. N. P. K. Planting. Timing. Water stress. Water content. Leaves. Dry matter. India.

The extent of proline accumulation and relative MC in 14 cassava var. were studied in a glasshouse in Trivandrum, India. Uniform cuttings were planted in pots containing laterite soil, fertilized with NPK, and watered regularly. One mo. after planting, the plants were subjected to water stress during 5 days. Relative MC, proline content, and DM production were determined in the leaves; there were var. differences. The correlation of DM with relative MC was positive (0.18) and with the proline content, it was negative (-0.41). It is recommended to use the relative MC and total DM

production as selection indices for the initial evaluation of drought tolerance in cassava. [CIAT]

0015

24719 JESUS, V.S. DE 1985. Teor de carboidratos, proteína e ácido cianídrico de dez variedades de mandioca, Manihot esculenta Crantz, durante o primeiro ciclo. (Carbohydrate, protein, and hydrocyanic acid contents of ten cassava varieties during the first cycle). Tese Mag.Sc. Vicosa-MG, Brasil, Universidade Federal de Vicosa. 70p. Port., Sum. Port., 46 Refs., Illus.

Cassava. Cultivars. Composition. Protein content. Carbohydrate content. HCN content. Analysis. Field experiments. Soil analysis. Climatic requirements. Cuttings. Bitter cassava. Sweet cassava. Harvesting. Timing. Roots. Stems. Leaves. Statistical analysis. Brazil.

Carbohydrate, protein, and HCN contents were studied in cassava var. Rosa, Manteiga, Pao de Chile, Aipim Quintal, Branquinha, Sao Pedro, Iracema, Chagas, Harmonica, and Vara de Canoa, between the 5th and 10th mo. of age, to identify the age and var. that would allow a better integral utilization of the plant. Carbohydrate content in the DM of all var. increased and CP content of leaf DM decreased with age; root HCN content was influenced by plant age. During the study period, root HCN content did not surpass the 100-ppm threshold in var. Rosa, Manteiga, Pao de Chile, and Aipim Quintal, classified as sweet cassava. Var. Rosa was the most promising for its integral utilization (high carbohydrate content and wt. of stems and roots, large no. of leaves, and low HCN content). [CIAT]

0016

22332 OLIVEIRA, H. DE F. 1982. Classificacao de cultivares de mandioca quanto a toxicidade das raizes. (Classification of cassava cultivars for root toxicity). Campos-RJ, Brasil, Empresa de Pesquisa Agropecuária do Estado do Rio de Janeiro. Estacao Experimental de Campos. Comunicado Técnico no.108. 4p. Port. [Empresa de Pesquisa Agropecuária do Estado do Rio de Janeiro, Estacao Experimental de Campos, Av. Francisco Lamego, 134, 28.100 Campos-RJ, Brasil]

Cassava. Cultivars. Bitter cassava. Sweet cassava. Roots. HCN content. Analysis. Brazil.

Fifty-two cassava cv. obtained from a no. of areas in Brazil and grown at Campos were classified for HCN toxicity; 10 cv. were toxic. Some cv. recognized as toxic in other areas were not toxic when grown locally and vice versa. [Field Crop Abstracts]

See also 0002 0008 0010 0018 0029 0033 0035 0056 0104 0115 0135 0146 0174

C04 Plant Nutrition

0017

23225 CARVALHO, P.C. DE; EZETA, F.N.; CALDAS, R.C.; RODRIGUES, E.M. 1982. Contribuicao da endomicorriza para absorcao de nutrientes e crescimento da mandioca (Manihot esculenta Crantz). (Contribution of endogenous mycorrhizae to the nutrient absorption and growth of cassava). Revista Brasileira de Mandioca 1(1):55-60. Port., Sum. Port., Engl., 12 Refs., Illus.

Cassava. Mycorrhizae. Soil physical properties. Growth-chamber experiments. Cultivars. Inoculation. Fertilizers. P. Harvesting. Dry matter. Growth. Absorption. Mineral content. Ca. Mg. Zn. K. Analysis. Statistical analysis. Brazil.

In a greenhouse expt. the dependence of cassava on the association with vesicular-arbuscular fungi was demonstrated by inoculating sterile soil with the species Gigaspora margarita, under different levels of P. The fungus increased the absorption of P, K, and Mg but did not influence absorption of Ca and Zn. Addition of P reduced the levels of root infection, especially in the treatments where the fungus was inoculated. The no. of spores of G. margarita was high in sterilized soil, but low under natural conditions. [AS]

0018

24083 CHAN, S.K.; TAI, L.H.; ABAS, A.G. 1982. Study of cassava response to phosphorus with and without mycorrhizal inoculation. In Pushparajah, E.; Sharifuddin, H.A., eds. Phosphorus and potassium in the tropics. Kuala Lumpur, Malaysian Society of Soil Science. pp.383-393. Engl., Sum. Engl., 13 Refs., Illus. [Malaysian Agricultural Research & Development Inst., Selangor, Malaysia]

Cassava. Cultivars. Mycorrhizae. Inoculation. Fertilizers. P. Soil physical properties. Soil analysis. N. K. Cuttings. Leaves. Ca. Mg. Cu. Mn. Zn. Mineral content. Growth. Harvest index. Productivity. Root productivity. Statistical analysis. Malaysia.

Inoculated and uninoculated cuttings of cassava cv. Black Twig were planted in pots with sterilized, low-P soil mixtures and tested for response to 7 P fertilizer application rates. The effects on fresh wt. of tops, yield of tuberous roots, HI, content of P and other nutrients in the leaf and stem tissues were assessed within 6 mo. after planting. Cassava inoculated with native vesicular-arbuscular mycorrhizae produced substantially higher yields than uninoculated cassava even at low P application rates. P, K, Mg, and Cu contents were significantly higher in inoculated cassava, but Ca content was higher in uninoculated plants. [AS]

0019

25216 SIEVERDING, E. 1985. Influence of method of VA mycorrhizal inoculum placement on the spread of root infection in field-grown cassava. Zeitschrift fur Acker-und Pflanzenbau 154(3):161-170. Engl., Sum. Engl., 24 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Mycorrhizae. Inoculation. Cultivars. Soil physical properties. Agricultural lime. Soil analysis. Fertilizers. N. K. P. Climatic requirements. Harvesting. Timing. Roots. Growth. Colombia.

Three methods of placement of VA mycorrhiza inoculum to cassava were compared in the field in order to determine the effect of inoculation methodology on the spread of the introduced fungus in the soil. The spread of the indigenous fungi and of the introduced fungus, Glomus manihotis, with the roots was monitored at 3 soil depths and 3 distances from the planting stake, during 30 wk. of plant growth, corresponding to a cycle of rainy season-dry season-rainy season. In the dry season highest infection ratings were found in the deeper soil horizons; in the wet seasons they were higher in the surface soil. Placement of the inoculum under the stakes, or planting the stake in the inoculum band, increased root infection and the competitive ability of the introduced fungus in those zones where the inoculum was applied, especially during the 1st 3 mo. of

growth. Best lateral spread of the introduced fungus was found with side banded inoculum, especially after the dry season. It is suggested that inoculum should be placed under the stakes at planting and reinoculated in side bands during or after the dry season in order to get best spread of the introduced fungus in the field. [AS]

0020

24058 SIEVERDING, E. 1984. Posibilidades de aumentar la producción de yuca en suelos ácidos de regiones montañosas con el uso de hongos micorrízicos. (Possibilities of increasing cassava production on acid soils of hilly regions with the use of mycorrhizal fungi). Suelos Ecuatoriales 14(1):190-198. Span., Sum. Span., 7 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Mycorrhizae. Cultivars. Inoculation. Temperature. Fertilizers. P. N. K. Zn. Soil physical properties. pH. Soil analysis. Field experiments. Root productivity. Colombia.

Cassava inoculation trials using different fungi species that form vesicular-arbuscular mycorrhiza (VAM) were carried out in the field and in the greenhouse to select strains of fungi capable of adapting to existing edaphoclimatic conditions in mountainous zones (high tropics, 1400-2000 m.a.s.l.). From the greenhouse tests, it was concluded that among the selected species there is great variability in their capacity to compete with native VAM present in the soil. This variability is also seen in the effective use of phosphated fertilizer sources, levels of applied P, and degree of adaptation to low soil temp.; therefore cassava yields will depend on P sources used, type of soil, and selected fungus species. Field trials carried out in Agua Blanca and Pescador (mountainous regions of the department of Cauca, Colombia) consisted in inoculating cassava with 3 different species of VAM (Glomus manihotis and G. occultum, Entrophospora colombiana) and fertilizing the soil with 50 kg P/ha from 2 different sources. In the clayey Agua Blanca soil, inoculation with G. manihotis increased fresh root production by 38% (5.0 t/ha) when the P source was triple superphosphate and by 22% (2.8 t/ha) when the source was Huila phosphate rock. The other species used for inoculation resulted in lower yields. In the clay loam soil of Pescador, yields were comparatively superior to those of Agua Blanca, thus increasing production by 24% (4.4 t/ha) when inoculated with G. manihotis and fertilized with triple superphosphate and by 81% (9.1 t/ha) when inoculated with G. occultum and fertilized with Huila phosphate rock. [AS-CIAT]

See also 0014 0174

D00 CULTIVATION

See 0170 0171

D01 Soil, Water, Climate and Fertilization

0021

23471 BENNETT, D.E. 1985. Cassava research and development an update. Kingston, Jamaica, Ministry of Agriculture. 13p.

Paper prepared for a Symposium on Cassava—Its Potential to the Jamaican Economy, Kingston, Jamaica, 1985.

Cassava. Research. History. Cultivars. Fertilizers. N. P. K. Irrigation. Productivity. HCN content. Dry matter. Agronomic characters. Intercropping. Groundnut. Maize. Cowpea. Sorghum. Jamaica.

Results are summarized of cassava research conducted jointly by the Inter-American Institute for Cooperation on Agriculture and the Ministry of Agriculture of Jamaica during 1982-84 in the parishes of St. Catherine, St. Elizabeth, and St. James. In the var. evaluation trials, results indicated that there are local and introduced cv. with potential yields superior to 37.0 t/ha. Agronomic characteristics of the main 8 cv. identified as promising in these trials are indicated. In fertilization trials, the 6 levels of N applied (0-150 kg/ha) to local var. J69 did not present significant differences and av. yield was 39.5 t/ha; no significant differences were observed with the application of 6 levels of P (0-200 kg/ha) to var. M Col 22 (av. yield 32.4 t/ha). Local var. J69 and Smalling were evaluated under 12 levels of NPK without significant differences between treatments; av. yields were 24.7 and 22.2 t/ha for J69 and Smalling, resp. In other trials similar treatments were applied to var. J69, Smalling, and M Col 22 without significant differences among treatments, but differences among var. were significant with av. yields of 26.4, 17.3, and 37.0 t/ha. resp. Cassava/peanuts, cassava/cowpea, cassava/sorghum, and cassava/maize intercropping systems were evaluated; the most promising combinations were cassava/peanuts and cassava/sorghum. During 1983-84 the cassava/peanuts association was studied in more detail, cassava yielding 37.8 and 25.2 t/ha with spatial arrangements of 1.0 x 1.0 m and 1.5 x 1.5 m, resp. The principal factor limiting cassava production in Jamaica is the scarce availability of planting material of improved var.; plans to solve this problem are described. [CIAT]

0022

22033 BOJANIC H., A.J.; MAXWELL, S. 1981. Yuca: descripción de prácticas culturales y sus costos de producción en las áreas de colonización en el norte del departamento de Santa Cruz-Bolivia. (Cassava: description of cultural practices and costs of production in the areas of colonization of northern Santa Cruz, Bolivia). Santa Cruz, Centro de Investigación Agrícola Tropical. Documento de Trabajo no.21. 15p. Span., 4 Refs.

Cassava. Cultivation. Cultivation systems. Fallowing. Cultivars. Cuttings. Planting. Timing. Weeds. Weeding. Hoeing. Injurious insects. Insecticides. Harvesting. Root productivity. Marketing. Prices. Costs. Inter-cropping. Banana-plantains. Maize. Rodents. Economics. Bolivia.

In July 1979, a survey was conducted in the colonization zone of northern Santa Cruz (Santa Cruz de la Sierra, Bolivia) to study production systems and cultural practices of a randomly selected crop (cassava). Av. planting area of cassava for the zone is 0.6 ha/farmer, in fallow systems. Planted var. include La Blanca or Monja Blanca (38%), Gancho (19%), Amarilla (7.8%), and Chaparral (7.8%). Planting time ranges from April to Oct. and is done manually in a horizontal position at a predominant spacing of 1 x 1 m (78% of the farmers interviewed). Only manual weed control is used. Overall, problems with insects were not reported. Harvesting is done manually and yields ranged between 1.2-15.0 t/ha, with an av. of 10.2 t/ha for 11 farmers. Intercroppings with maize or plantain were also observed. Dicotyles tajacu, Stenomys spp., and Euphactus sexcintus boliviae, and floods were listed as problems. Included among the economic problems were the lack of resources (credit), low prices, marketing problems due to middlemen, and deficient transportation infrastructure. Costs associated

with the different practices are presented. Among settlers, cassava occupies the 3rd place, after rice and maize. [CIAT]

0023

24578 COOPER, B.R. 1985. Agronomic aspects of cassava production. In Seminar on Cassava Production, St. Thomas, Barbados, 1985. Papers presented. St. Michael, Barbados, Caribbean Agricultural Research and Development Institute. pp.9-21. Engl. [Caribbean Agricultural Research & Development Inst., Trinidad & Tobago]

Cassava. Climatic requirements. Cultivation. Soil physical properties. Cultivation systems. Inter-cropping. Cultivars. Selection. Root productivity. Cuttings. Planting. Spacing. Timing. Land preparation. Soil fertility. Fertilizers. N. P. K. pH. Weeding. Diseases and pathogens. Harvesting. Caribbean.

Climatic and soil requirements, cultivation systems, and var. characteristics necessary to improve cassava productivity are briefly reviewed. Also discussed are the cuttings (selection, treatment, and storage), land preparation, planting and harvesting times, nutritional requirements, and weed and disease control. [CIAT]

0024

24080 DOORMAN, F.; BERNARD, V. 1984. Evaluación de los efectos de labranza parcial y zanjas de ladera sobre los rendimientos y la erosión en la siembra de la yuca en La Sierra de la República Dominicana. (Evaluation of the effects of partial tillage and slope ditches on yield and erosion in cassava crops in La Sierra, Dominican Republic). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 'lp. Span., Sum. Span., Illus.

Cassava. Cultivation. Soil physical properties. Erosion. Land preparation. Soil conservation practices. Rainfall data. Productivity. Dominican Republic.

The effect of different tillage systems used for cassava planting on soil erosion was compared in the municipality of Monción, La Sierra, Dominican Republic. The amount of soil eroded from six 5 x 25 m erosion plots, located in a field with a 13 up to 21% slope, was measured. The most promising treatment consisted in leaving, at 5-m intervals, a 1-m-wide contour strip without tillage. This resulted in a 43% decrease in the lixiviated soil in relation to the control, i.e., the system used by farmers: plowing in favor of the slope. Treatments with hillside ditches running into a ditch parallel to the slope were very susceptible to erosion, due mainly to the fact that this ditch erodes easily. Therefore, it is recommended not to use this practice in arid areas of La Sierra. [AS-CIAT]

0025

24054 HOBT, H. 1982. Avaliacao da resposta das culturas ao potassio, em ensaios de longa duracao. A experiencia mundial. (Evaluation of crop response to potassium in long-term trials. World experience). In Yamada, T.; Igue, K.; Muzillio, O.; Usherwood, N.R., eds. Potássio na Agricultura Brazileira. Piracicaba-SP, Brasil, Instituto da Potassa e Fosfato. pp.305-322. Port., 17 Refs., Illus. [Buntehof Agricultural Research Station, Hannover, German Federal Republic]

Cassava. Cultivation. Cultivation systems. Fertilizers. Nutritional requirements. N. P. K. Productivity. Soil impoverishment. Malaysia.

Through the presentation of exptl. cases of K fertilization in different crops and in various countries of the world, the importance of long-term trials to accurately evaluate response to K fertilization is shown. The case of continuous cassava crops in Malaysia is summarized, and it is demonstrated that results obtained with fertilization during the 1st cropping year can lead to erroneous conclusions. In 5 consecutive plantings harvested at 7-9 mo. of age, with 1-3 wk. intervals between harvesting and planting of the following crop, it was found that the optimum level of N and K was 134 and 101 kg/ha, resp. Treatments with N and P, without K, produced max. yields in the 1st year, but in the 3rd, 4th, and 5th harvest, yields were lower than even those reached in unfertilized plots, indicating the exhaustion of K reserves in the soil. In this case, the application of high levels of K increased yields significatively, especially when fertilized with doses of 134, 101, and 303 kg N, P, and K/ha, resp. Emphasis is made on the fact that in countries with high yields/ha, farmers supplement their crops with K. [CIAT]

0026

23065 INSTITUT DE RECHERCHES AGRONOMIQUES TROPICALES ET DES CULTURES VIVRIERES. 1982. Les tubercules et racines: manioc. (Tubers and roots: cassava). In _____. Rapport Annuel 1982. Paris, France. pp.109-119. Fr.

Cassava. Cultivars. Cultivation. Weeding. Erosion. Soil conservation practices. Cultivation systems. Rotational crops. Planting. Spacing. Root productivity. Clones. Fertilizers. N. P. K. Ca. Mg. Harvesting. Xanthomonas campestris pv. manihotis. Inoculation. Resistance. Mononychellus. Soil physical properties. Selection. Ivory Coast. French Guiana. French Polynesia.

Results are presented of studies in Ivory Coast, Guyana, and Polynesia on: cassava cv.; cultivation; soil protection; rotations; planting methods; fertilizer application; control of weeds, pests, and diseases; and harvesting techniques. [Field Crop Abstracts]

0027

24079 LEESBERG, J.; HOWELER, R.; DOORMAN, F. 1984. Evaluación de la erosión y los rendimientos en la siembra de la yuca en monocultivo e intercalada en La Sierra de la R.D. (Evaluation of the erosion and yields of cassava planted in monoculture or in association in La Sierra, Dominican Republic). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 5p. Span., Sum. Span., Illus.

Cassava. Cultivation. Cultivation systems. Inter-cropping. Erosion. Phaseolus vulgaris. Ipomoea batatas. Rainfall data. Weeding. Dominican Republic.

Susceptibility to erosion was evaluated for 2 cassava planting systems in fields with a 10% slope in the municipality of Monción, La Sierra, Dominican Republic. Cassava was planted alone and intercropped with green beans and sweet potato in 3 x 30 m erosion plots. The intercropping system had greater erosion, although it was expected that intercropping would contribute to decrease erosion by providing better soil coverage. This phenomenon was due to severe rains at the time of the green bean harvest and during sweet potato planting; in other words, when the soil of

intercropped cassava plots was looser than that of monocropped plots. [AS-CIAT]

0028

22766 MONDARDO, E.; MORAES, O. DE; ANJOS, J.T. DOS 1984. Capacidade de suprimento de fósforo e potássio do solo Araranguá para a cultura da mandioca. (Phosphorus and potassium supply capacity of Araranguá soil to cassava crops). Florianópolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Pesquisa em Andamento no.26. 5p. Port., 3 Refs. [Empresa Catarinense de Pesquisa Agropecuária, Estacao Experimental de Urussanga, Caixa Postal 49, Urussanga-SC, Brasil]

Cassava. Soil physical properties. Soil analysis. Cultivars. Cuttings. Fertilizers. N. P. K. Harvesting. Productivity. Starch content. Cultivation systems. Brazil.

The capacity of Araranguá soil (low fertility, sandy texture, and low OM availability) to supply P and K was determined along the Santa Catarina coast, Brazil, and later calibrated by the North Carolina method. The expt. was begun in 1979-80 and continued during 4 successive plantings until 1982-83. Treatments of randomized blocks with 4 replications included 50-0-0, 50-30-0, 50-0-40, and 50-30-40 NPK, resp., applied to var. Mandim Braca planted at 1 x 6 m spacing. Response to P was slight and more marked to K. Av. yield of the 4 crops was 8.4 t/ha in the absence of P and K, and 9.9 and 11.5 t/ha with the resp. application of P and K. Production was 14.4 t/ha with both elements present. Production of aerial parts also decreased progressively, but was less marked than the reduction in root production. High P response was observed in the production of aerial parts with an av. of 3.7 t/ha in the absence of P and K, and 4.2 and 4.1 t/ha with P and K present, resp.; with the application of P and K the yield was 4.8 t/ha. Starch content was kept constant, around the overall mean of all treatments (27.06%), with a slight increase in presence of K. Under the Araranguá soil conditions, the application of 50-30-40 NPK, recommended for production systems, does not satisfy this crop's requirements. [CIAT]

0029

24052 NDIOKWERE, C.L. 1984. A study of heavy metal pollution from motor vehicle emissions and its effect on roadside soil, vegetation and crops in Nigeria. Environmental Pollution 7(1):35-42. Engl., Sum. Engl., 18 Refs. [Chemistry Dept., Univ. of Benin, Benin City, Nigeria]

Cassava. Soil analysis. Leaves. Analysis. Nigeria.

Concn. of Cd, Cu, Cr, Ni, Pb, and Zn in samples of soil, wild grasses and weeds, and leaves of pumpkin, cassava, and maize collected from sites adjacent to a major federal highway in Nigeria were markedly higher than in samples collected 50 m from the highway. Higher concn. were observed in pumpkin and cassava leaves than in maize leaves. Concn. of metals in the vegetation could be reduced to 1/2-1/3 by washing the samples with deionized water. [Field Crop Abstracts]

0030

24576 SEMINAR ON CASSAVA PRODUCTION, ST. THOMAS, BARBADOS, 1985. Papers presented. St. Michael, Barbados, Caribbean Agricultural Research and Development Institute. 37p. Engl.

Cassava. Production. Cultivation. Cultivars. Propagation. Tissue culture. Planting. Harvesting. Processing. Injurious insects. Injurious mites. Caribbean.

A seminar on cassava production was held at the Caribbean Agricultural Research and Development Institute in Jan. 1985 to present the techniques and technologies associated with it. The reasons to produce cassava in Barbados, agronomic aspects and profitability of its production, and pests and their control were analyzed. The papers presented at this seminar are recorded individually in this publication under the following consecutive no.: 0023, 0031, 0079, and 0184. [CIAT]

See also 0020 0032 0033 0035 0042 0043 0044 0045
0050 0068 0107 0162 0165 0167 0168 0172
0174 0175 0176 0180 0181 0182 0183 0195
0196 0197 0198 0199 0200 0202 0203 0204

D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting

0031

24579 CHANDLER, F. 1985. The profitable production of cassava. In Seminar on Cassava Production, St. Thomas, Barbados, 1985. Papers presented. St. Michael, Barbados, Caribbean Agricultural Research and Development Institute. pp.22-25. Engl. [Caribbean Agricultural Research & Development Inst., Cave Hill Campus, St. Michael, Barbados]

Cassava. Propagation. Cultivars. Tissue culture. Leaves. Cuttings. Planting. Harvesting. Mechanization. Processing. Cassava chips. Drying. Caribbean.

The use of var. with high yield potential, tissue culture, and propagation from leaf cuttings and from 2-node cuttings are discussed as important factors to make cassava production profitable. The mechanization of cassava planting and harvesting, as well as the chipping and drying of cassava, are also mentioned. [CIAT]

0032

23786 CHEVREAU, B. 1980. Recherche-developpement dans les régions de l'Ouest. (Research and development in western regions). In _____. Rapport analytique d'activites dans la région de Touba, Savanes du Nord-Ouest, campagne 1979-1980. Bouaké, Cote d'Ivoire, Institut des Savanes. Département des Cultures Vivriéres. pp.31-34. Fr., 13 Refs.

Cassava. Cultivars. Research. Development. Productivity. Cultivation. Planting. Timing. Cultivation systems. Spacing. Harvesting. Ivory Coast.

Research and development carried out by the Ministere de la Recherche Scientifique (Ivory Coast) and by the Institut des Savannes/Groupement d'Etudes et the Recherches por le Developpement de l'Agronomie Tropicale in the western region of the country concentrate on defining stable exploitation systems to increase crop production and maintain soil fertility. A bibliography is presented and agroclimatic, agrotechnical, and edaphic results are summarized. Cassava is the most important crop after rice; it is planted in multiple associations, with planting dates programmed between April-Nov., at different planting densities and with different cultivation systems. Main local cassava var. are Banagoubere, Banagougbe (Vahidougouka), Canvili (Comade), and Toussin (Dabouka). The most promising var. is Banagougbe with yields of 42.5 and 55.9 t/ha 16 and 20 mo. after planting, resp. [CIAT]

0033

24704 FIORETTO, R.A. 1985. Efeito da manipueira aplicada em solo cultivado com mandioca (Manihot esculenta, Crantz). (Effect of the use of cassareep on the soil planted with cassava). Tese Mag.Sc. Botucatu-SP, Brasil, Universidade Estadual Paulista Julio de Mesquita Filho. 116p. Port., Sum. Port., Engl., 39 Refs., Illus.

Cassava. Cassareep. Uses. Cultivation. Cultivars. Soil physical properties. Climatic requirements. Rainfall data. Temperature. Composition. Mineral content. N. P. K. Ca. Mg. S. pH. Cyanides. Planting. Fertilizers. Statistical analysis. Weeding. Weeds. Cuttings. Germination. Plant development. Root system. Roots. Dry matter. Stems. Leaves. Petioles. Plant height. Soil analysis. Brazil.

The application of "manipueira" (cassareep) to a cassava plantation was studied. Parameters considered were soil fertility, weeds and germination, growth, and initial yield of cassava plants using 2 dosages (80 and 160 m^3/ha) applied at planting, 30 and 60 days later. The compound was applied on a clayey soil, classified as Terra Roxa Estruturada, 26 days after planting. Var. Branca de Santa Catarina was used. Germination and speed of germination of the plants were assessed by counting the no. of buds until the final stand, 54 days later; these parameters were not affected by the treatments. Root and canopy DM yields were also evaluated at 130 days of age. In relation to the studied parameters, the dosage of 160 m^3/ha was always significantly superior to that of 80 m^3/ha. The effect of cassareep on the weed population was evaluated using the European Weed Research Council's toxicity table; the compound did not produce toxicity symptoms on the cassava plants, although its effect was verified on Brachiaria plantaginica, Acanthospermum australe, Sida spp., and Raphanus raphanistrum but not on Cyperus rotundus. To determine the influence of the cassareep application on soil concn. of Al^{3+}, K^+, Ca^{2+}, Mg^{2+}, and PO_4^{3-}, pH, and OM content, soil samples were collected at 2 different depths (0-15 cm and 15-30 cm) from the plots which received treatments at intervals of 30, 60, 90, and 170 days. Five simple samples were taken from each one and a composed sample was made which underwent physical and chemical analyses. Plots which received cassareep showed a higer potash disposal in the soil for the dosage of 160 m^3/ha than for 80 m^3/ha. K content was higher for both treatments than the control, and 30 days after the application these values were as high as 0.70 and 0.89 meq K^+/100 g for the dosages of 80 and 160 m^3/ha, resp.; the value corresponding to the control was 0.22 meq/100 g. For P the dosage of 160 m^3/ha showed higher levels in relation to the control; however, the same was not verified for the levels of Ca and Mg, since the lowest values for these elements corresponded to the 160 m^3/ha dosage. [AS]

0034

21191 HRUSKA, A.J. 1984. Plant density, varietal diversity and cyanogenic glucoside level effects in a cassava (Manihot esculenta Crantz) agroecosystem in Costa Rica. Mag.Sc. Thesis. Durham, North Carolina, Duke University. 118p. Engl., 154 Refs., Illus.

Cassava. Climatic requirements. Temperature. Rainfall data. Soil physical properties. pH. Cultivars. Agronomic characters. HCN content. Cultivation. Land preparation. Insecticides. Herbicides. Cuttings. Germination. Irrigation. Plant height. Planting. Spacing. Statistical analysis. Erinnyis ello. Cercospora caribaea. Cercosporidium henningsii. Anastrepha manihoti. Cassava common mosaic virus. Analysis. Biological control. Predators and parasites. Cultivation systems. Fallowing. Phyllophaga. Anomala. Costa Rica.

The role of cyanogenic glucoside levels, var. diversity, and plant density in a cassava agroecosystem in Costa Rica, in 1982, is examined. Plant density, var. diversity, and cassava var. produced important and differing effects on plant growth, behavior and damage levels of cassava pests, and pathogen incidence. Results of lab. work suggest that the level of cyanogenic glucosides does not affect larval host preference of Erinnyis ello; therefore, cyanogenic glucosides are not a defense mechanism against this pest. The effects of ground cover on white grub populations in cassava fields were also examined. Significant correlations between ground cover and plant stunting score and white grub populations suggest a causal relation: the ground cover provides food, microclimate, and protection against natural enemies. An annotated list of insects of a Costa Rican cassava field is included. [CIAT]

0035

24715 ISMAYADI, S. 1978. Ubi kayu sebagai sumber makanan pokok di samping beras. (Cassava as staple food source besides rice). Buletin Kebun Raya 3(5):173-175. Indon., Sum. Engl., 11 Refs.

Cassava. Plant geography. Climatic requirements. Cultivation. Diseases and pathogens. Injurious mites. Planting. Spacing. Fertilizers. Harvesting. Nutritive value. Vitamin content. Uses. Indonesia.

The origin of cassava, climatic requirements, main diseases and pests, cultivation, nutritive value, and uses are briefly discussed. [CIAT]

0036

21120 LUNA R., J.M. 1984. Influencia do armazenamento de manivas de mandioca (Manihot esculenta Crantz) na producao de raizes e ramas. (Influence of the storage of cassava cuttings on the production of roots and stems). Tese Mag.Sc. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 100p. Span., Sum. Port., Span., Engl., 39 Refs., Illus.

Cassava. Climatic requirements. Temperature. Rainfall data. Soil physical properties. Soil analysis. Cultivars. Cuttings. Storage. Timing. Planting. Fertilizers. K. Irrigation. Herbicides. Plant height. Productivity. Root productivity. Dry matter. Statistical analysis. Diplodia. Injurious insects. Fusarium. Aspergillus. Germination. Stems. Colombia.

In 1982-83, the effect of chemical treatments, storage positions and periods on planting material of cassava var. Mcol 1684 was studied under field conditions at the Centro Regional de Investigaciones Agrícolas Caribia near Sevilla (Magdalena, Colombia), on nonflooded soils grouped in Alluvial Plain Association with clay loam to loamy texture. The characteristics evaluated were fresh wt. loss and loss of planting material due to storage, initial germination process, plant height, final stand, stem diameter, canopy yield, no. of commercial cuttings/plant, total fresh root yield, root DM yield, total no. of roots/plant, and root length and girth. The treatments consisted of chemical protection (with and without) of stems prior to storage, storage position (horizontal and vertical), and storage periods (0, 30, 60, and 90 days). A split plot design with 6 replicates was used. Cuttings stored in vertical position were well conserved up to 90 days of storage with little loss of fresh wt. and viability. This storage position also had a positive influence on germination 20 days after planting. The greatest germination at 20, 40, 60, and 80 days after planting and the best plant establishment were obtained when the cuttings were treated with fungicides. None of the treatments affected plant height. The no. of commercial cuttings/plant was greatest with plants grown from cuttings stored for 90 days (fewer plants/plot and less

competition); however, the greatest no. of commercial cuttings/unit area was obtained with fresh (nonstored) cuttings. The greatest stem diameter was found at 90 days of storage with untreated cuttings. Fresh root yield, root DM yield, total root no./plant, root length and girth, and canopy yield were not affected by chemical treatments, storage position or period. [AS]

0037

24552 MONTAGNER, W. 1983. Rendimento de raizes de mandioca, em funcao do uso de herbicidas. (Cassava root yield in relation to herbicide use). In Reuniao Tecnica Anual de Culturas Energeticas do IPAGRO, Porto Alegre, RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronômicas. pp.146-148. Port. [Inst. de Pesquisas Agronômicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil]

Cassava. Weeds. Weeding. Herbicides. Cultivation. Planting. Spacing. Root productivity. Brazil.

At the Estacao Exptl. Fitotécnica of Taquari, Brazil, the efficiency of 6 herbicides in controlling weeds and their effect on cassava productivity were studied. A randomized block design with 4 replications was used. The control consisted of 2 treatments, one without herbicides and the other without hoeing. There was no relation between the no. of weeds and root production. [CIAT]

0038

24095 PAZ, J.E. 1975. Efectos de insecticidas-acaricidas y fungicidas en la germinación de cangres de yuca (Manihot esculenta Crantz). (Effects of insecticides-acaricides and fungicides on the germination of cassava cuttings). Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 46p. Span., Sum. Span., Engl., 17 Refs., Illus.

Cassava. Climatic requirements. Temperature. Rainfall data. Cultivars. Insecticides. Acaricides. Disease control. Cuttings. Germination. Timing. Leaves. Plant height. Spacing. Colombia.

At CIAT-Palmira the effects of the insecticides diazinon, dimethoate, carbaryl, methamidophos, and metyl parathion, and of the fungicides methoxyethylmercury chloride (MEMC), thiram, and copper hydroxide, on the germination of cassava cuttings were estimated. For the treatments, 3 doses (low, normal, and high) and 2 immersion times, 1 short (5 min) and 1 long (20 min), were considered. Var. Mcol 1438 and Mcol 1513 were used. The products giving the best results regarding germination and vegetative development were, in their resp. order, carbaryl, methamidophos, dimethoate, diazinon, and methyl parathion. Low and normal doses were the most effective, and there were no significant differences among them. The 20 min immersion time showed the best av. in germination and vegetative development. In the trials with fungicides, thiram followed by methoxyethylmercury chloride were the best in germination as well as vegetative development. [AS]

0039

20063 TABLANTE T., O.J. 1984. Determinación experimental de la fuerza ejercida por el suelo, sobre una cosechadora de yuca (Manihot esculenta Crantz) mediante el uso de un modelo estructural. (Experimental determination of the pressure exerted by the soil on a cassava harvester, through the use of a structural model). Acta Científica Venezolana 35(5-6):386-393. Span., Sum. Span., Engl., 25 Refs., Illus.

[Univ. Central de Venezuela, Facultad de Ingeniería, Apartado 4718, Caracas 1041-A, Venezuela]

Cassava. Agricultural equipment. Harvesting. Mathematical model. Development. Venezuela.

The pressure exerted by the soil on a cassava harvester deflector plate was determined, as a basis to optimize the design of the machine. A scale model of the structure was built, using the Buckingham theorem. A frame-mechanism that stimulates the action of the soil was also constructed. Several curves expressing the normal deformation on the central bar of the structure were obtained for different values and inclinations of the force acting on the deflector plate. Finally, some field exptl. trials were carried out in order to obtain the value and direction of the force exerted by the soil through the curves obtained with the model. With this value, a force polygon was constructed to calculate the force exerted by the hydraulic system of a tractor, needed for harvesting, and with which the power requirements for different tractor velocities were calculated as well. [AS]

0040

22699 TALATALA, R.L. 1982. Weed control in root crops. Baybay, Leyte, Philippine Root Crop Research and Training Center. 13p. Engl., 20 Refs. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines].

Paper presented at Regional Root Crops Production Training Course, 1st., Baybay, Leyte, Philippines, 1982.

Cassava. Root crops. Sweet potatoes. Yams. Taro. Weeds. Weeding. Herbicides. Hoeing. Timing. Productivity. Philippines.

Based on literature reviews, critical periods for weed control and weed competition are presented for cassava, sweet potato, yam, and taro. Chemical and physical weed control methods are given for each crop. Reports indicate that very few trials with herbicides have been carried out in the Philippines; most of the weed control is done by hand weeding. Recommendations on herbicide use and dosage are given for each crop. [CIAT]

0041

23438 VILLAMAYOR JUNIOR, F.G. 1982. Yield evaluation of cassava stakes produced under different populations. Radix 4(2):14-15,11. Engl., 3 Refs. [Philippine Root Crop Research & Training Center, VISCA, Leyte, Philippines]

Cassava. Cultivars. Stems. Cuttings. Planting. Spacing. Germination. Root productivity. Harvest index. Philippines.

The production of cuttings from cassava cv. Golden Yellow, grown under different plant population densities, was evaluated in 2 trials. In the 1st, stems from 7-mo.-old plants were cut into 25-cm-long cuttings and planted at population densities of 13,333, 17,777, 26,666, and 53,333 plants/ha. In the 2nd, the same expt. was run but cuttings, both fresh and after 1 mo. storage, were evaluated. The treatments did not significantly affect the % of germination, root yield, root no./plant, % of large roots, and HI. Both trials showed that the differences in stem diameter, as a result of the variation in planting densities, do not influence the yield potential of cassava. [CIAT]

0042

24722 WARGIONO, J. 1983. Yield of cassava varieties at different plant spacings. Penelitian Pertanian 3(2):53-56. Engl., Sum. Indon., 4 Refs., Illus.

Cassava. Cultivars. Cultivation. Planting. Spacing. Soil fertility. Fertilizers. N. P. K. Productivity. Root productivity. Indonesia.

Two field expt. were conducted in Indonesia to evaluate the effect of plant spacing on cassava yields. The 1st expt. was conducted at Tamanbogo substation and in a farmer's field in Sleman; nonbranching var. Gading was planted at 4 plant populations, arranged in 11 different plant spacings. The 2nd expt. was conducted at Muara, Jakenan, and Tamanbogo substations, and at a farmer's field in Playen; nonbranching var. Gading, Muara, and Adira 1, and branching var. Adira 11 were planted at 4 distances. The plant population of 20,000 gave the highest yield on the low fertile soil of Sleman. On both fertile and unfertile soils, cassava yields decreased significantly as plant population increased above 10,000 plants/ha. Nonbranching var. gave the highest yields on the poor soils of Playen and Jakenan at a plant spacing of 1.00 x 0.60 m. For Muara (narrow-leaved var.) a plant spacing of 1.00 x 0.40 m was also good in poor soils; in fertile soils, this same var. gave higher yields in relation to the other var. [AS]

See also 0021 0022 0023 0024 0025 0026 0027 0030 0043 0044 0045 0046 0048 0050 0068 0074 0107 0162 0165 0167 0168 0169 0172 0174 0175 0180 0181 0182 0183 0184 0193 0195 0198 0199 0200 0202 0203 0204

D03 Energy Productivity and Yields

0043

23767 MANNAN, M.A.; RASHID, M.M. 1981. A comparative study on the yield and morphological characters of four cultivars of cassava. Bangladesh Horticulture 9(1-2):33-40. Engl., Sum. Engl., 9 Refs. [Horticulture Division, Bangladesh Agricultural Research Inst., Joydebpur, Dacca, Bangladesh]

Cassava. Cultivars. Cultivation. Climatic requirements. Rainfall data. Land preparation. Fertilizers. N. P. K. Planting. Agronomic characters. Plant height. Branching. Stems. Leaves. Roots. Root productivity. Dry matter. Bangladesh.

In trials with cassava cv. Genjapati, Bogor, and Nari (all from Indonesia) and C-004 (from Bandarban, Bangladesh) in 1981-82, fresh root yields were in the range of 22.73-25.28 t/ha. Significant differences among cv. yields were found in stems but not in roots; stem yield of C-004 was significantly higher (25.04 t/ha) than those of the other cv. (17.83-19.05 t/ha). The differing morphological characteristics of the cv. were also recorded. [Field Crop Abstracts]

0044

23227 MATTOS, P.L.P. DE; SOUZA, A. DA S.; CALDAS, R.C. 1982. Direcionamento do sistema radicular da mandioca cultivada em fileiras duplas. (Orientation of the root system of cassava grown in double rows). Revista Brasileira de Mandioca 1(1):67-69. Port., Sum. Port., Engl., 13 Refs.

Cassava. Cultivation. Planting. Spacing. Fertilizers. Inter-cropping. Sweet potatoes. Root productivity. Root system. Brazil.

Results are given of an expt. on the orientation of the root system of cassava grown in double rows, conducted at the Centro Nacional de Pesquisa de Mandioca e Fruticultura (Cruz das Almas, BA, Brazil) with the cv. BGM-001 Aipim Bravo. Sweet potato was planted in between the double rows of cassava. Data on the total root yield and the root yield between double rows, within double rows, below the cutting, and at the end of the seed cutting show that roots grow in larger quantities between the double rows. [AS]

0045

24716 O'HAIR, S.K. 1982. Root crop evaluation, selection and improvement in Florida for energy applications. In Symposium on Energy from Biomass and Wastes, Lake Buena Vista, Florida, 1982. Paper presented. Gainesville, University of Florida. pp.135-165. Engl., Sum. Engl., 41 Refs. [Univ. of Florida, Inst. of Food & Agriculture Sciences, Homestead, FL 33031, USA]

Cassava. Root crops. Development. Biomass production. Cultivars. Tissue culture. Cultivation. Planting. Soil physical properties. Root productivity. Starch content. Starch productivity. Productivity. USA.

The U. of Florida (USA) Institute of Food and Agricultural Sciences root crops biomass program includes the input from 14 project leaders with plots on the grounds of 14 research centers. Nine distinct root crops are being evaluated for their potential in biomass production: arrowroot, Brassica, cassava, chicory, cocoyam, fodder beet, fodder carrot, Jerusalem artichoke, jicama, sweet potato, and taro. Specific objectives are to screen, select, and improve root crops with the best potential for biomass production. Preliminary results indicate that a mixed group of crops will be needed to provide a year-round supply of fresh substrate. Specific recommendations will depend on geographic location and local growing conditions. According to input needs and yield results the sweet potato has the greatest potential. Genetic improvement through conventional and novel techniques is in progress as well as the development of tissue culture propagation of planting material. [AS]

0046

24716 POESPODARSONO, S.; NUGROHO, J.H. 1977. Hubungan antara umur dengan hasil dari ketela pohon mukibat dengan ketela pohon biasa. (The relation of length of growth period and yield on "mukibat" and normal cassava). Maros, Indonesia, Lembaga, Pusat Penelitian Pertanian. 10p. Indon., Sum. Engl., 9 Refs., Illus.

Paper presented at the Symposium 1 Peranan Hasil Penelitian Tadi dan Palawija dalam Pembangunan Pertanian, Maros, Indonesia, 1977.

Cassava. Cultivation. Mukibat system. Cultivars. Planting. Timing. Harvesting. Productivity. Indonesia.

The effect of the length of the growth period and yield on both mukibat and normal cassava was studied at the exptl. field of the Central Research Institute for Agriculture, Muneng (Probolinggo, Indonesia). A split plot design was used in which the main plot was the var. (Faroka, Pandesi, and Doro) and the subplots, harvest time (10, 12, 14, 16, 18, and 20 mo. after planting). Mukibat and normal cassava were planted separately using the same design, and the site of the mukibat expt. was adjacent to that of

normal cassava. The highest yields for all mukibat cassava var. tested were obtained 16 mo. after planting. For normal cassava the highest yields for var. Pandesi and Doro were obtained at 12 mo. after planting and for var. Faroka, 16 mo. after planting. Mukibat cassava yielded about twice as much as normal cassava. [AS]

0047

24714 SADJAD, S. 1979. Konsepsi pertanian energi; kasus posisi tanaman ubi kayu. (The concept of energy farming: a case study of the cassava plant). Berita Ilmu Pengetahuan dan Teknologi 23(3):9-16. Indon., Sum. Engl., 8 Refs., Illus.

Cassava. Food energy. Energy productivity. Indonesia.

Energy farming is a new concept for Indonesia. It not only means farming for producing energy (cultivating some species for producing firewood or for other new energy sources) but an agricultural pattern which considers energy balance. Therefore, cassava might have a top score of energy output compared with other crops. Among cultivated species, there would be a need to increase the no. of energy cycles to increase the total output in the energy farming pattern. Energy utilization can become more efficient by either improving the crops or by minimizing the energy losses, e.g. during processing. [AS]

0048

24711 SOSA V., M.; MATOS F., R.; FERNANDEZ, M. 1985. Comparación de producción de raíces de cinco variedades de yuca (Manihot esculenta) en la zona de "Palo Alto", Barahona. (Comparison of root production of five cassava varieties in the Palo Alto zone, Barahona). Investigación 9(1):49-53. Span., Sum. Span., 4 Refs. [Centro Sur de Desarrollo Agropecuario, Programa de Raíces y Tubérculos, San Cristóbal, República Dominicana]

Cassava. Cultivars. Climatic requirements. Temperature. Rainfall data. Soil physical properties. pH. Nutritional requirements. Zn. Cuttings. Planting. Statistical analysis. Productivity. Dominican Republic.

Yield of 5 cassava var. (Blanquita de la Loma, Machetazo Alta, Zenón, Señorita está en la Mesa, and Tres Ganchos - local) were compared in the Palo Alto zone, Barahona, Dominican Republic. Var. were planted at 1.0 x 1.0 m. Highest yields, among which there were no significant differences, were obtained with var. Tres Ganchos, Blanquita de la Loma, and Señorita está en la Mesa with 28.77, 26.06, and 25.87 kg/ha, resp. Var. Machetazo Alta and Zenón produced 14.30 and 13.85 kg/ha, resp. Var. Tres Ganchos presented the greatest av. diameter of commercial roots (7.32 cm) and Machetazo Alta the smallest (5.14 cm). Señorita está en la Mesa presented the greatest av. length of commercial roots (27.52 cm) and Tres Ganchos the shortest (19.68 cm). [AS-CIAT]

0049

23230 SOUZA, A. DA S.; MATTOS, P.L.P. DE; MACEDO, M.M.C.; CALDAS, R.C. 1982. Teste de combinacoes de espacamentos com épocas de colheita, em cultivares de mandioca. (Trials combining different spacings and harvesting dates in cassava cultivars). Revista Brasileira de Mandioca 1(1):79-81. Port., Sum. Port., Engl., 7 Refs.

Cassava. Cultivars. Cultivation. Climatic requirements. Temperature. Rainfall data. Soil physical properties. Planting. Spacing. Fertilizers. N. P. K. Timing. Harvesting. Root productivity. Brazil.

Results are given of a trial carried out at the Centro Nacional de Pesquisa de Mandioca e Fruticultura (Cruz das Almas, BA, Brazil) in 1978-79 to test different combinations of spacing and harvesting dates in cassava. A split plot explt. design was used with 8 treatments and 3 replications. Cassava spaced at 1.00 x 0.60 m and harvested 10 mo. after planting was statistically superior to the other treatments. [AS]

0050

23236 VILLAMAYOR JUNIOR, F.G.; LABAYAN, A.L. 1982. Detopping and its effect on cassava production. Radix 4(2):7-8. Engl., 5 Refs.

Cassava. Pruning. Productivity. Root productivity. Shoots. Biomass production. Harvest index. Cuttings. Planting. Spacing. Fertilizers. N. P. K. Cultivars. Philippines.

The effect of pruning on cassava root production was studied. Cuttings of cv. Golden Yellow (35 cm long) were planted vertically at 1.00 x 0.75 m and fertilized with 25-25-25 kg NPK/ha; 95 kg N/ha were applied additionally 1 mo. after planting. The treatments consisted in pruning the tops at lengths of 0, 20, 25, and 30 cm from the shoot tip 3 mo. after planting. Root yield was adversely affected by the length of the portion of the plant pruned. Pruning decreased the no. and wt. of marketable roots and the total root yield but not the no. and wt. of nonmarketable roots and total root no. [AS]

See also 0015 0020 0021 0025 0028 0030 0032 0036 0041 0042 0083 0183 0195 0196 0197 0198 0199 0200 0201 0204

D04 Postharvest Studies

0051

23220 CARVALHO, V.D. DE; CHALFOUN, S.M.; HUEI-WANG, S. 1982. Armazenamento pós-colheita de mandioca: 1. Influencia da composicao química de raizes de cultivares de mandioca sobre a resistencia a deterioracao pós-colheita (fisiológica e microbiológica). [Postharvest storage of cassava: 1. The influence of the chemical composition of the roots of cassava cultivars on the resistance to postharvest deterioration (physiological and microbiological)]. Revista Brasileira de Mandioca 1(1):15-23. Port., Sum. Port., Engl., 15 Refs., Illus. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 176, 37.200 Lavras-MG, Brasil]

Cassava. Cultivars. Roots. Storage. Deterioration. Composition. Analysis. Resistance. Statistical analysis. Moulds. Brazil.

The physiological and microbiological postharvest deterioration and the chemical composition of roots of cassava cv. Engana Ladrao, IAC-12829, Guaxupé, Iracema, Branca de Santa Catarina, Mantiqueira, and Sonora, stored during 14 days in plastic bags at root temp., were determined. Cv. Mantiqueira, Sonora, Branca de Santa Catarina, and Guaxupé were classified as resistant to physiological deterioration (PD), and IAC-12829, Engana Ladrao, and Iracema as susceptible to PD. Roots of PD-resistant cv., compared with those of PD-susceptible cv., presented higher reducing, nonreducing, and total sugars, total phenolic compounds and their monomeric forms. Cv. Engana Ladrao was the most resistant to microbiological deterioration (MD) whereas Branca de Santa Catarina, Iracema, and IAC-12829

presented an inter. :te degree of resistance to MD; Guaxupé and Mantiqueira were the most susceptible. Fungi of the genera Verticillium, Fusarium, Aspergillus, Penicillium, and Phytophthora were associated with MD. Fungi attack started on day 6 after harvesting and increased until it reached a peak on day 14. MC and reducing, nonreducing, and total sugar contents (expressed on dry and wet base) presented significant positive correlations with the several degrees of MD. Cv. characteristics indicated that PD and MD are separate processes but this does not impede that they occur simultaneously in the same cv. [AS]

0052

23221 CARVALHO, V.D. DE; CHALFOUN, S.M.; JUSTE, F.S.G.; MORAES, A.R. DE 1982. Armazenamento pós-colheita de mandioca: 2. Efeito das alteracoes no grau de deterioracao fisiológica na composicao físico-química e química de seis cultivares de mandioca. (Postharvest storage of cassava: 2. The effect of the changes of the degree of physiological deterioration on the physical and chemical composition of six cassava cultivars). Revista Brasileira de Mandioca 1(1):25-34. Port., Sum. Port., Engl., 9 Refs. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 176, 37.200 Lavras-MG, Brasil]

Cassava. Cultivars. Roots. Storage. Deterioration. Water content. Starch content. Sugar content. Statistical analysis. Brazil.

At 0, 2, 4, 6, and 8 days of postharvest storage of cassava roots, the degree of physiological deterioration (PD) was correlated with contents of: moisture; reducing, nonreducing, and total sugars; total phenolic compounds; monomeric, dimeric, oligomeric, and polymeric phenols. Cassava var. employed were Mantiqueira, Guaxupé, Sonora, and Branca de Santa Catarina (PD-resistant), and Iracema and IAC-12829 (PD-susceptible). PD increased as root MC decreased. Cassava var. were scored with degree 5 of PD when root MC ranged from 55.10 to 58.35%. The pattern changes of starch and sugar contents varied depending on the var. analyzed. Var. Sonora, Iracema, IAC-12829, and Guaxupé presented significant positive correlations between the degree of PD and monomeric phenolic content during storage periods. No relation between the initial decrease in total phenolic content and PD resistance or susceptibility was observed. [AS]

0053

23222 CHALFOUN, S.M.; CARVALHO, V.D. DE; MORAES, A. 1982. Armazenamento pós-colheita de mandioca: 3. Efeito de alteracoes físico-químicas e químicas sobre a resistencia de cultivares de mandioca a deterioracao microbiológica. (Postharvest storage of cassava: 3. The effect of physical and chemical changes on the resistance of cassava cultivars to microbiological deterioration). Revista Brasileira de Mandioca 1(1):35-42. Port., Sum. Port., Engl., 16 Refs. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 176, 37.200 Lavras-MG, Brasil]

Cassava. Cultivars. Roots. Storage. Deterioration. Water content. Starch content. Sugar content. Statistical analysis. Brazil.

The physical and chemical changes that occur before and after microbiological deterioration (MD) were determined on cassava var. Engana Ladrao, Branca de Santa Catarina, Iracema, IAC-12829, Guaxupé, and Mantiqueira, to identify which compounds could be correlated with the deterioration process. A significant increase was observed in the contents of dimeric, oligomeric, polymeric, and total and dry phenolic compounds (expressed on wet and dry base), and in the dimeric, oligomeric, and total phenolic

compounds (expressed as DM) during the MD process. This increase was higher in the more MD-resistant var. After MD occurrence, the nonreducing sugars contents were lower in the more susceptible var. The contents of the total and reducing sugars and of starch were not statistically correlated with the degree of MD. [AS]

0054

23223 CHALFOUN, S.M.; CARVALHO, V.D. DE 1982. Armazenamento pós-colheita de mandioca: 4. Efeito de tratamentos químicos no controle da deterioracao microbiológica em pós-colheita de cultivares de mandioca. (Postharvest storage of cassava: 4. The effect of chemical treatments on the control of postharvest microbiological deterioration of cassava cultivars). Revista Brasileira de Mandioca 1(1):43-45. Port., Sum. Port., Engl., 7 Refs. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 176, 37.200 Lavras-MG, Brasil]

Cassava. Cultivars. Roots. Storage. Deterioration. Moulds. Brazil.

The control of microbiological deterioration of the cassava var. Sonora, Mantiqueira, and Engana Ladrao was carried out with the use of sodium hypochlorite at 1% and maneb at 3%. The treatment with maneb gave the best control whereas sodium hypochlorite was not effective in controlling microbiological deterioration. Fungi of the genera Verticillium, Rhizopus, and Fusarium were identified and associated with deterioration after 90 days of storage. [AS]

0055

23777 PHILIPPINE COUNCIL FOR AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT. 1984. Cassava storage for small farmers. Technology 6(2):1-12. Engl., 8 Refs., Illus.

Cassava. Roots. Storage. Deterioration. Post-harvest technology. Technological package. Economics. Income. Costs. Production. Philippines.

A technology for postharvest storage of cassava roots is presented. The method consists of storing cassava underground in 1.00 x 0.30 x 0.40 m trenches, with a capacity of 70-80 kg cassava roots, and then covering with sea and river sand. Necessary conditions are given as well as recommendations on prestorage treatment of roots (harvesting, cleaning, handling, sorting). This technology allows the farmers to store cassava roots up to 6 mo. and to benefit from the market price fluctuations. Economic benefits are given and compared with those of the traditional cassava production system, in which no storage is used. [CIAT]

0056

23706 PLUMBLEY, R.A.; HUGHES, P.A. 1982. DEAE-cellulose separation of peroxidases from cassava (Manihot esculenta Crantz) root tissue. Journal of Food Biochemistry 6(3):197-206. Engl., Sum. Engl., 20 Refs., Illus. [Tropical Products Inst., 56-62 Gray's Inn Road, London WC1X 8LU, England]

Cassava. Roots. Enzymes. Deterioration. Analysis. Biochemistry. Plant physiology. United Kingdom.

Extracts from nondiscolored and vascular discolored cassava root tissue contained numerous electrophoretically distinct peroxidases, which could be separated into 3 groups (A, B, and C) according to their mobility. Partial separation of these groups was attained by DEAE-cellulose ion-exchange

chromatography at pH 7.5. Electrophoresis demonstrated that groups A and B passed through the exchanger without being bound. Certain group B enzymes were also shown to be bound to the DEAE-cellulose; they were less strongly bound than group C and were eluted by a lower NaCl concn. Extracts from cassava tissue which exhibited vascular discoloration gave increased staining in bands of groups A and B and also contained a unique group B enzyme with a weak binding capacity and an electrophoretic mobility slower than the 2 normal group B enzymes found in nondiscolored tissue. This enzyme and group C enzymes were not found in the column eluates. It is suggested that the change in activity and pattern of the peroxidases is related to the vascular discoloration of the tissue. [AS]

0057

23771 WHEATLEY, C.C.; SCHWABE, W.W. 1985. Scopoletin involvement in post-harvest physiological deterioration of cassava root (Manihot esculenta Crantz). Journal of Experimental Botany 36(166):783-791. Engl., Sum. Engl., 26 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Roots. Deterioration. Cultivars. Hybrids. Pruning. Storage. Analysis. Colombia.

A study of the mechanism of the rapid deterioration of cassava roots has shown that this requires the presence of O_2 and scopoletin, the latter acting, apparently, in some autocatalytic fashion. Roots from plants whose tops were pruned several days prior to harvest were less liable to spontaneous deterioration, but responded vigorously to the applied scopoletin, whereas roots stored for some time in the absence of O_2 (cured roots) were no longer susceptible to exogenously-applied scopoletin. The 2 methods for prevention of deterioration differ metabolically: pruning may be effective due to internally-reduced scopoletin supply or absence of some factor involved in the primary oxidation; curing may involve loss of a scopoletin precursor or inactivation of an enzyme system. [AS]

See also 0036 0174

E00 PLANT PATHOLOGY

0058

24737 AUTRIQUE, A. 1981. Manioc. (Cassava). In _____. Principaux ennemis des cultures de la région des Grands Lacs d'Afrique Centrale. Bujumbura, Institut des Sciences Agronomiques du Burundi. pp.60-[illegible]. Fr., Illus. [Inst. des Sciences Agronomiques du Burundi, B.P. 795, Bujumbura, République du Burundi]

Cassava. Diseases and pathogens. Mononychellus tanajoa. Mononychellus mcgregori. Cassava African mosaic virus. Xanthomonas campestris pv. manihotis. Xanthomonas campestris pv. cassavae. Colletotrichum manihotis. Cercosporidium henningsii. Cultivars. Symptomatology. Pest damage. Acaricides. Insecticides. Climatic requirements. Rainfall data. Disease control. Vectors. Bemisia. Cultivation systems. Cuttings. Africa.

The damage caused by the main diseases and pests of cassava in the Great Lakes region, Africa, and their control are described; color photos are included. Among the pests are Phenacoccus sp., Zonocerus variegatus, and Mononychellus sp. The diseases considered include CAMD, Xanthomonas campestris pv. manihotis, X. campestris pv. cassavae, Colletotrichum manihotis, and Cercosporidium henningsii. [CIAT]

0059

24736 AUTRIQUE, A. 1981. Principaux ennemis des cultures de la région des Grands Lacs d'Afrique Centrale. (Major crop enemies in the Great Lakes region of Central Africa). Bujumbura, Institut des Sciences Agronomiques du Burundi. 144p. Fr., Illus. [Inst. des Sciences Agronomiques du Burundi, B.P. 795, Bujumbura, République du Burundi]

Cassava. Phenacoccus. Zonocerus variegatus. Mononychellus tanajoa. Mononychellus mcgregori. Cassava African mosaic virus. Xanthomonas campestris pv. manihotis. Xanthomonas campestris pv. cassavae. Colletotrichum manihotis. Cercosporidium henningsii. Cultivars. Symptomatology. Pest damage. Insecticides. Acaricides. Climatic requirements. Rainfall data. Disease control. Vectors. Bemisia. Cultivation systems. Cuttings. Africa.

As an introduction, the causal factors of physiological diseases and of parasite affections of crops, in general, are briefly discussed. Then, the damage caused by the enemies of the major crops, including cassava, in the Great Lakes region, Africa, is described. For each one, control measures and color photos are included. [CIAT]

0060

23098 TERRY, E.R.; PERREAUX, D. 1984. Cassava diseases, their spread and control. In Bawksworth, D.L., ed. Advancing Agricultural Production in Africa, Arusha, Tanzania, 1984. Proceedings. Farnham Royal, Slough, England, Commonwealth Agricultural Bureaux. pp.105-110. Engl., 14 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Diseases and pathogens. Disease transmission. Symptomatology. Cassava African mosaic virus. Xanthomonas campestris pv. manihotis. Xanthomonas campestris pv. cassavae. Colletotrichum gloeosporioides. Cercosporidium henningsii. Cercospora caribaea. Cercospora vicosae. Root productivity. Disease control. Climatic requirements. Rainfall data. Temperature. Cultivation. Germplasm. Vectors. Quarantine measures. Africa.

The symptomatology and yield losses in cassava due to systemic (CAMD, Xanthomonas campestris pv. manihotis, and X. campestris pv. cassavae) and nonsystemic disease causal agents are described. The effect of climatic and biotic factors, cultural practices, and germplasm exchange on the spread of these diseases is also discussed. An integrated approach combining host plant resistance, cultural practices, and quarantine regulations (exclusion and eradication of the disease pathogens) is recommended for the control of cassava diseases [CIAT]

See also 0182

E02 Bacterioses

0061

24053 ALVES, M.L.B. 1979. Variabilidade em Xanthomonas manihotis (Arthaud - Berthet) Starr. (Variability in Xanthomonas manihotis). Tese Mag.Sc. Brasilia, Universidade de Brasilia. 45p. Port., Sum. Port., Engl., 52 Refs., Illus.

Also in Fitopatologia Brasileira 9(3):485-494. 1984.

Cassava. Xanthomonas campestris pv. manihotis. Isolation. Cultivars. Inoculation. Symptomatology. Analysis. Enzymes. Brazil.

Five levels of virulence, not associated with geographic distribution, were distinguished among 32 isolates from different areas of Brazil and from

CIAT on inoculating 2 cassava cv. differing in resistance (Mamao and Sutinga). Virulent and weak isolates both came from areas where cassava bacteriosis was a major disease and where it was unimportant. Amylase production varied greatly, but could not be correlated with virulence or geographic distribution. No hypersensitive reaction to the bacterium was observed, even when resistant cv. were infiltrated with less virulent isolates. Infiltration of a bacterial suspension into cassava leaves was a good method of testing pathogenicity. In agar-gel double diffusion tests, 28 of the 32 isolates were grouped into 3 distinct serovars. [Review of Plant Pathology]

0062

23218 ATHAYDE, J.T.; SANTOS, A.F. DOS; FURTADO, M.J. 1982. Bacteriose (Xanthomonas campestris pv. manihotis) da mandioca na Regiao Norte do Estado do Espírito Santo. [Cassava bacteriosis (Xanthomonas campestris pv. manihotis) in the northern region of the state of Espírito Santo]. Revista Brasileira de Mandioca 1(1):7-10. Port., Sum. Port., Engl., 6 Refs., Illus. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 391, 29.000 Vitória-ES, Brasil]

Cassava. Xanthomonas campestris pv. manihotis. Identification. Cultivars. Brazil.

A survey was carried out in the northern region of the state of Espírito Santo, Brazil, to detect the presence of Xanthomonas campestris pv. manihotis. Results show that the disease is endemic in this region, with epidemics occurring principally between May-July. [AS]

0063

24063 IKOTUN, T. 1984. Pectolytic enzymes produced by Xanthomonas campestris pathovar cassavae and their involvement in pathogenesis. Zeitschrift für Allgemeine Mikrobiologie 24(6):363-368. Engl., Sum. Engl., 15 Refs., Illus. [Dept. of Agricultural Biology, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Xanthomonas campestris pv. cassavae. Culture media. Laboratory experiments. Analysis. Enzymes. Isolation. Nigeria.

The plant cell wall-degrading activity of culture filtrates of Xanthomonas campestris pv. cassavae, grown in liquid medium supplemented with salts and galacturonic acid, was higher than the activity found in culture filtrates grown in 2 other media. The pathogen produced pectin-methylesterase, pectate lyase, and a small amount of polygalacturonase. These enzymes were thought to be involved in the pathogenic process since they were present in the infected tissues. The presence of Ca pectate in plant tissue stimulated the activity of pectate lyase. The low enzymatic activity detected only at high dilutions in the infected host tissue is most likely to be responsible for the slow development of the disease caused by this pathogen. [AS]

0064

23217 ROMEIRO, R. DA S.; FUKUDA, C.; ATHAYDE, J.T. 1982. Cinética da producao de anticorpos por coelhos como resposta a diferentes planos de imunizacao com Xanthomonas campestris pv. manihotis. (Kinetics of antibody production by rabbits in response to different immunization plans with Xanthomonas campestris pv. manihotis). Revista Brasileira de Mandioca 1(1):1-6. Port., Sum. Port., Engl., 14 Refs., Illus. [Univ. Federal de Vicosa, Depto. de Fitopatologia, 36.570 Vicosa-MG, Brasil]

Cassava. Xanthomonas campestris pv. manihotis. Isolation. Analysis. Biochemistry. Animal physiology. Research. Brazil.

The kinetics of antibody production by rabbits against Xanthomonas campestris pv. manihotis was investigated. The antigen consisted of a bacterial cell suspension at 10^9 cells/ml in emulsified saline in Freund's incomplete adjuvant (1:1) and injected (0.5 ml) into the rabbit's posterior limb according to 4 different immunization plans: (1) a single injection and (2), (3), and (4) another injection 10, 15, and 20 days after the 1st one, resp. In all plans, the blood was sampled every 5 days until day 45 after the 1st injection and the titer of antisera was estimated by both the drop agglutination and the gel double diffusion tests. Immunization plans did not differ in terms of antibody production and response curves. For all plans, high agglutination titers (1:32.000) were obtained. It can be concluded that only 1 injection of antigen is sufficient and therefore plan 1 is recommended. [AS]

0065

23224 ROMEIRO, R. DA S.; ATHAYDE, J.T.; FUKUDA, C.; BATISTA, U.G. 1982. Métodos para extracao de lipopolissacarídeos de Xanthomonas campestris pv. manihotis (Berthet & Bondar, 1915) Dye, 1978 (Methods for extracting lipopolysaccharides from Xanthomonas campestris pv. manihotis). Revista Brasileira de Mandioca 1(1):47-53. Port., Sum. Port., Engl., 25 Refs., Illus. [Univ. Federal de Vicosa, Depto. de Fitopatologia, 36.570 Vicosa-MG, Brasil]

Cassava. Xanthomonas campestris pv. manihotis. Isolation. Laboratory experiments. Analysis. Brazil.

The efficiency of 6 methods to extract lipopolysaccharides (LPS) from cells of an avirulent strain of Xanthomonas campestris pv. manihotis, which combined boiling or freezing-thawing followed by phenol extraction, were compared. After extraction, the samples were dialyzed against distilled water and the dialysates were tested for the amount of LPS, antigenic purity, and contamination with other substances. The amount of LPS was assayed either directly by the 2-keto-3-deoxycoctonate method or indirectly by the drop-precipitation technique and by agarose gel immunoelectrophoresis (rocket assay). Antigenic purity was also verified by immunoelectrophoresis. The method of boiling the baterial cell suspension for 30 min followed by phenol extraction was the best to extract high amounts of LPS, the level of contamination was lower, and the antigenic purity was acceptable. [AS]

0066

24048 SUGIMORI, M.H. 1981. Diferenciacao serológica entre tres patovares de Xanthomonas campestris (Pammel) Dowson aplicando a técnica do linfonódulo e da suspensao bacteriana. (Serological differentiation among three pathovars of Xanthomonas campestris using lymph node technique and bacterial suspension). Tese Mag.Sc. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz, da Universidade de Sao Paulo. 70p. Port., Sum. Port., Engl., 44 Refs., Illus.

Cassava. Xanthomonas campestris pv. manihotis. Isolation. Plant tissues. Analysis. Identification. Brazil.

Xanthomonas campestris pv. malvacearum, X. campestris pv. manihotis, and X. campestris pv. phaseoli, isolated resp. from cotton, cassava, and bean plants, were serologically compared. The bacteria grown on PDA and incubated at 28°C during 48 h were standardized in a colorimeter at 5% transmittance (578 nm), emulsified in Freund's complete adjuvant, and used as antigen in the preparation of specific antisera. Each rabbit received 2 antigen injections in the lymph node at a 15-day-interval. Bacterial suspensions were obtained on sterile distilled water, 0.85% saline solution,

and 2% acetic acid. For exopolysaccharide extraction from the isolate, sterile saline solution with 0.6% neutral formaldehyde was used. Bacterial suspensions as exopolysaccharide extract were standardized in a colorimeter at 5% transmittance and used as antigen for serological tests. Intra-lymph node injections with concentrated antigens produced specific antisera after the 1st injection. Agar double-diffusion tests used with inter- and intra-specific antigens and antisera showed that the pathovars malvacearum, manihotis, and phaseoli of X. campestris were serologically distinct. In these tests, 1, 2 and 3 precipitation lines were observed over a period of 65 h. Exopolysaccharide antigens showed more specific reactions, indicating that this technique is the most efficient since it allows reactions with homologous antigens only. Results demonstrated high sensibility and viability for the serological technique as a valuable auxiliary instrument in the diagnosis, identification, and taxonomy of bacteria of the genus Xanthomonas. [AS]

See also 0023 0071 0167 0174 0183

E03 Mycoses

0067

23219 ATHAYDE, J.T.; SANTOS, A.F. DOS; FURTADO, M.J. 1982. Avaliacao de cultivares de mandioca em relacao a antracnose (Colletotrichum gloeosporioides f. sp. manihotis). [Evaluation of cassava cultivars in relation to anthracnose (Colletotrichum gloeosporioides f. sp. manihotis)]. Revista Brasileira de Mandioca 1(1):11-13. Port., Sum. Port., Engl., 8 Refs. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 391, 29.000 Vitoria-ES, Brasil]

Cassava. Cultivars. Glomerella cingulata. Symptomatology. Brazil.

In Linhares, ES, Brazil, the reaction of 30 cassava cv. to natural infection with Colletotrichum gloeosporioides f. sp. manihotis in field conditions was evaluated. Cv. Entre Rios showed resistance and the other cv. were classified as moderately resistant, susceptible, and highly susceptible. [AS]

0068

24084 LIAN, T.S.; LAN, G.S. 1984. Methods in the screening for field resistance to Cercospora henningsii Allescher in cassava. MARDI Research Bulletin 12(3):366-372. Engl., Sum. Engl., Mal., 13 Refs., Illus. [Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Cercosporidium henningsii. Hybrids. Field experiments. Cultivation. Fertilizers. N. P. K. Mg. Herbicides. Symptomatology. Malaysia.

Two methods were evaluated for the screening of cassava clones for disease severity of brown leaf spot (Cercosporidium henningsii). Results obtained by the method of scoring on the basis of % diseased leaf area showed a curvilinear relationship with those obtained using the method of counting diseased spots. While the former method is easy and rapid, it is more suited for the screening of a large no. of clones when resistant ones are to be picked out from among susceptible ones. This method should be used at an early stage of crop growth. The 2nd method provides greater precision in identifying varying degrees of resistance or susceptibility between clones, and can be applied at any stage of crop growth. [AS]

0069

23768 MAKAMBILA, C. 1984. Etude de quelques interactions de la lumiere et de la température sur la croissance linéaire et la sporulation chez Colletotrichum manihotis Henn. (Study of some interactions of light and temperature on the linear growth and sporulation of Colletotrichum manihotis). Phyton 44(1):1-7. Fr., Sum. Fr., 13 Refs., Illus. [Département de Biologie et Physiologie Végétales, Faculté des Sciences, Université Marien Ngouabi, BP 69, Brazzaville, Congo]

Cassava. Colletotrichum manihotis. Light. Illumination. Temperature. Research. Laboratory experiments. Congo.

Linear growth of Colletotrichum manihotis isolated from cassava was inhibited on exposure to 7887, 10,140, and 15,744 (ergs/cm²)/s and at 30°C, inhibition increasing with illumination. On exposing the thalli to 15,744 (ergs/cm²)/s, linear hyphal growth was inhibited at 30°C for all the light periods tested. This growth was stimulated for certain light periods at 25°C and for all of them tested at 20°C. The inhibitory effect varied directly, and the stimulatory effect inversely, with temp. There appeared to be 2 types of light receptors within the mycelium, one responsible for its growth and the other for its sporulation. [AS-Review of Plant Pathology]

0070

24069 PUNITHALINGAM, E. 1984. New microfungi from Malaysia and Papua New Guinea. Nova Hedwigia 39(1-2):57-74. Engl., Sum. Engl., Germ., 26 Refs., Illus. [Commonwealth Mycological Inst., Kew, Surrey, England]

Cassava. Mycoses. Proboscispora manihotis. Papua New Guinea.

Lasiostemma leersiae Punith. sp. nov. and Chaetosticta leersiae Punith. sp. nov. (state of L. leersiae), both found on leaves of Leersia hexandra, and Proboscispora manihotis gen. et sp. nov., found on the bark of cassava, are described. Illustrations are included. [AS]

0071

22778 WARWICK, D.R.N. 1982. Relacao de plantas hospedeiras: Manihot esculenta (Euphorbiaceae) mandioca. [Report on host plants: Manihot esculenta (Euphorbiaceae) cassava]. In _____. Catálogo de patógenos de plantas cultivadas nao registrados no Brasil. Brasilia, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Recursos Genéticos. v.1.pp.78-79. Port.

Cassava. Agrobacterium. Cylindrocladium floridanum. Ganoderma pseudoferreum. Colletotrichum manihotis. Guignardia manihoticola. Macrophoma cassavae. Macrophoma manihotis. Phyllosticta. Pseudomonas. Sphaceloma manihoticola. Xanthomonas campestris pv. manihotis. Cassava African mosaic virus. Symptomatology. Colombia. New Zealand. India. Indonesia. Malaysia. Nigeria. Zaire. Ivory Coast. Liberia. Ghana. Taiwan. Irak. Philippines. Ethiopia.

A description is given of the damage caused by Agrobacterium sp., Cylindrocladium floridanum, Ganoderma pseudoferreum, Colletotrichum manihotis, Guignardia manihoticola, Macrophoma cassavae and M. manihotis, Phyllosticta cassavae and P. manihoticola, Pseudomonas solanacearum, Sphaceloma manihoticola, Xanthomonas campestris pv. manihotis, and CAMD. The places where they have been reported are mentioned. [CIAT]

See also 0006 0023 0034 0038 0054 0167 0174 0183

0072

24569 BOCK, K.R. 1984. Contributions to cassava research in Kenya. In Kenya Agricultural Research Institute. Crop Virology Research Project (R3177); Final Report. London, England, Overseas Development Administration. pp.1-63. Engl., 16 Refs., Illus.

Cassava. Cassava African mosaic virus. Research. Vectors. Root productivity. Cultivars. Epidemiology. Plant breeding. Selection. Disease control. Kenya.

Results of the work carried out on the CAMD in Kenya by the UK Overseas Development Administration Crop Virology Research Project are summarized. Information on the virus, strains, distribution, effects on yields, epidemiology, and field control using virus-free plant propagation materials is presented. Finally, the yields obtained with the var. used and recommendations on the available cv. in different localities of Kenya, based on the reported results, are given. [CIAT]

0073

24570 BOCK, K.R. 1984. Final report on studies on cassava brown streak virus. In Kenya Agricultural Research Institute. Crop Virology Research Project (R3177); Final Report. London, England, Overseas Development Administration. pp.64-83. Engl., Sum. Engl., 5 Refs.

Cassava. Cassava brown streak virus. Cultivars. Symptomatology. Root productivity. Isolation. Identification. Electron microscopy. Vectors. Bemisia. Kenya.

Cassava brown streak virus (CBSV) was present in all coastal districts of Kenya but field incidence was in general low. CBSV was not observed under field conditions in western Kenya. When healthy plants of highly sensitive var. were exposed at Mtwapa under exacting conditions, 7 plants out of 113 became infected. In other exposures, where var. known to display leaf symptoms were used, only 2 plants out of 1989 became infected, indicating a very low rate of natural spread. CBSV did not cause significant loss in root wt. in the highly sensitive cv. F279, but the internal necrosis of roots rendered most uneatable. CBSV was readily sap-transmissible to many species in the Solanaceae, of which Nicotiana debneyi was the most sensitive and was used both as assay and as diagnostic host. Two variants of the virus occurred together in affected cassava; they were isolated and subsequently maintained in N. debneyi in which they induced readily distinguisable and characteristic symptoms. Leaf dip preparations of CBSV in N. debneyi and in many other hosts of the 2 isolated variants, and of CBSV-affected cassava, all contained o50 nm filamentous particles similar in morphology to those of the carlavirus group. Virus concn. was very low in all hosts and this effectively precluded advances in purification and characterization. Attempts at transmission using several aphid species and Bemisia tabaci were not successful. Circumstantial evidence suggests that Bemisia hancocki might prove to be the vector but his possibility was not tested. [AS]

0074

23473 MATHEW, A.V.; BALAKRISHNAN, S.; JOSEPH, P.J. 1983. Mosaic of Ceara rubber (Manihot glaziovii Muell. Arg.)-a new report from India. Madras Agricultural Journal 70(4):280. Engl., 3 Refs. [Dept. of Plant Pathology, College of Agriculture, Vellayani, Trivandrum-695522, India]

Cassava. Manihot glaziovii. Manihot. Cassava mosaic virus. India.

Severe mosaic symptoms were found in Manihot glaziovii plants used in cassava cultivation systems and a virus was transmitted to healthy M. glaziovii and cassava plants by grafting but not by sap. When healthy M. glaziovii plants were grafted with cassava affected by mosaic disease, typical mosaic symptoms developed. The possibility is being investigated of M. glaziovii acting as a collateral host of CAMD in Kerala, India. [Review of Plant Pathology]

See also 0003 0006 0023 0034 0071 0167 0174

E06 Nematodes

0075

22770 ATU, U.G.; OGBUJI, R.O. 1983. Root-knot susceptibility of crops grown with yam in Nigeria. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.147-148. Engl., Sum. Engl. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Nematodes. Inoculation. Inter-cropping. Yams. Nigeria.

Ten crops traditionally grown with yam in southern Nigeria were tested for resistance to Meloidogyne incognita race 2 in 1979-80. Results, based on gall indices and recovery of the larvae from soil and roots, showed that: Corchorus olitorus, Sphenostylis stenocarpa, Hibiscus esculentus, and Cucurbita pepo were highly susceptible; Amaranthus sp., Citrullus sp., Zea mays, and Manihot esculenta, moderately susceptible; Telfairia occidentalis, resistant; and Mucuna pruriens, highly resistant. Planted on yam mounds, these crops could play an important role in altering the populations of root knot nematodes. [AS]

0076

22780 LUC, M.; GUIRAN, G. DE 1960. Les nématodes associés aux plantes de l'Ouest Africain. Liste préliminaire. (Nematodes associated with plants of western Africa. Preliminary list). L'Agronomie Tropicale 15(4):434-449. Fr., 14 Refs.

Cassava. Nematodes. Ivory Coast. Guinea. Togo. Senegal. Cameroon. Ghana.

A list of phytoparasitic nematodes and host plants in western Africa (Ivory Coast, Guinea, Togo, Senegal, Cameroon, and Ghana) is presented. In Ivory Coast the nematodes associated with cassava were Aphelenchus avenae, Helicotylenchus n. sp., Meloidogyne incognita acrita, and Pratylenchus brachyurus; in Togo, Criconemoides citri, P. brachyurus, and Scutellonema bradys; and in Ghana, Meloidogyne sp. and Rotylenchulus reniformis. With the exception of C. citri and Helicotylenchus n. sp., whose parasitism in cassava could not be demonstrated, all the others were found parasitizing cassava roots. [CIAT]

0077

24100 SAKA, V.W.; MAKINA, D.W. 1983. Nematicidal activities of aqueous extracts of bitter cassava peel and tung cake against Meloidogyne

javanica (Treub) Chitwood. Luso:Journal of Science and Technology 4(1):31-37. Engl., Sum. Engl., 11 Refs., Illus. [Bunda College of Agriculture, P.O. Box 219, Lilongwe, Malawi]

Cassava. Bitter cassava. Sweet cassava. Cortex. Toxicity. Uses. Nematodes. Malawi.

Ground dry Montana tung cake (Aleurites montana) and fresh peel of bitter cassava local selection masangwi, when separately tested, significantly reduced root galling on tomato plants infected with Meloidogyne javanica. Tung cake was more effective than cassava peel and considerably increased whole plant dry wt. Crude extracts from both residues, used as drenches into soil heavily infested with root knot nematodes, reduced galling. The extracts immobilized 2nd stage larvae and significantly inhibited egg hatch. [AS]

F00 PEST CONTROL AND ENTOMOLOGY

See 0182

F01 Injurious Insects and their Control

0078

23720 ABE, T.; WATANABE, H. 1983. Soil macrofauna in a subtropical rain forest and its adjacent cassava plantation in Okinawa; with special reference to the activity of termites. Physiology and Ecology Japan 20(2):101-114. Engl., Sum. Engl., 22 Refs., Illus. [Dept. of Biology, Univ. of the Ryukyus, Okinawa 903-01, Japan]

Cassava. Climatic requirements. Temperature. Rainfall data. Land preparation. Cultivation. Soil physical properties. Soil analysis. Entomology. Cuttings. Injurious insects. Odontotermes formosanus. Coptotermes formosanus. Japan.

Soil macrofauna in a subtropical rain forest and its neighboring cassava plantation were compared with special reference to the activity of termites in Iriomote Island, Okinawa, Japan (24°20'N and 123°50'E). In the forest the density and biomass of soil macrofauna were 182-848/m^2 and 4.8-24.2 g.w.w./m^2, the most important soil animals in terms of biomass being those of the family Oligochaeta, followed by those belonging to the orders Araneae, Isopoda, and Coleoptera. Most of these animals inhabited the surface layer of the soil on the forest floor. When the forest was cleared and burnt most soil animals died in the areas where fire was intense, but in the area where the fire was not so intense some soil animals dwelling in the deeper layers in the soil, such as termites, safely survived. In the burnt area where cassava was planted, the density and biomass of soil macrofauna were 32-517/m^2 and 0.06-5.40 g.w.w./m^2; in the forest these were much lower. The decrease in the biomass of Oligochaeta was remarkable. The bulldozing work damaged soil macrofauna much more seriously than the burning. Eight species of termites were found in the forest, consuming living wood, the bark of living trees, standing dead trunks and branches, fallen trunks, branches and leaves, and humus. In the forest they usually did not attack the living parts of trees. However, in the neighboring field, 2 species of termites, Odontotermes formosanus and Coptotermes

formosanus, attacked living cassava cuttings. The process through which some species of termites become pests of cultivated plants (cassava) is discussed from a coevolutionary point of view. [AS]

0079

24580 ALAM, M.M. 1985. Cassava pests and their control in Barbados W.I. In Seminar on Cassava Production, St. Thomas, Barbados, 1985. Papers presented. St. Michael, Barbados, Caribbean Agricultural Research and Development Institute. pp.26-33. Engl., Sum. Engl. [Caribbean Agricultural Research & Development Inst., Cave Hill Campus, St. Michael, Barbados]

Cassava. Thrips. Leptopharsa illudens. Lepidosaphes alba. Empoasca. Corythaica carinata. Corythucha gossypii. Eudiplosis brasiliensis. Carpolonchaea chalybea. Pseudococcus. Tetranychus. Insect control. Mite control. Insecticides. Acaricides. Biological control. Predators and parasites. Barbados.

In Barbados, the main cassava pest is the cassava hornworm, Erinnyis ello, particularly in weedy areas. As Euphorbia spp. are the alternate host plants and the pest breeds and feeds in abundance on them, special attention is required to keep out these plants from in and around the cassava fields. An unidentified thrips (probably Euthrips manihoti) causes leaf deformation and needs special attention. Other pests (Corynothrips stenopterus, Leptopharsa illudens, Corythaica carinata, Corythucha gossypii, Lepidosaphes alba, Pseudococcus sp., Empoasca sp., Eudiplosis brasiliensis, Tetranychus sp., and Carpolonchaea chalybea) are generally of less concern and have only a minor effect on crop production. However, efforts should be made to avoid a buildup in their populations on the island. Cultural, chemical, and biological control measures are given for each. [AS]

0080

23791 BENNETT, F.D.; YASEEN, M. 1980. Investigations on the natural enemies of cassava mealybugs (Phenacoccus spp.) in the neotropics. Final report April 1977-October 1980. Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 20p. Engl., Sum. Engl., 9 Refs.

Cassava. Phenacoccus. History. Insect biology. Biological control. Predators and parasites. Colombia. Guyana. Surinam. French Guiana. Brazil. Zaire. Nigeria.

The neotropical cassava mealybug (CMB) Phenacoccus manihoti, considered to be a recently introduced pest in tropical West Africa, has assumed great economic importance. A project funded by the International Development Research Centre (Canada) was commenced at the West Indian Station, Commonwealth Institute of Biological Control, in April 1977 to carry out surveys for natural enemies of this and other related mealybugs and to provide nucleus cultures of promising parasites and predators for trials against the pest in Africa. Surveys were carried out in several territories in the Caribbean, South, Central, and southern North America. The CMB was found only in Guyana, French Guiana, and Brazil; it was also reported by CIAT. Several primary encyrtid parasites and coccinellid, staphylinid, syrphid, cecidomyiid, chrysopid, and anthocorid predators usually kept pest populations in check. The complex of natural enemies associated with the related mealybug, Phenacoccus grenadensis, on cassava and several other hosts was also investigated. Several species of parasites and predators warrant trials against the CMB in tropical West Africa. Some parasites shipped to Zaire in 1978 were released and initial recoveries of 1 species

have been reported. However, due to the absence of trained personnel and adequate facilities to handle the incoming shipments in target West African countries, and to political disturbances, releases have not been made elsewhere. Since the CMB is absent from Trinidad, many details of the bioecology remain to be investigated. It is proposed that the project be extended f r 3 yr (Phase III) so as to undertake more intensive studies on the South American mainland. This would be centered initially in Guyana where there is ready access to mealybug infestations and to lab. accommodations. Additional surveys in other cassava areas in South and Central America to locate the center of origin of the uniparental form are warranted as they may reveal additional, possibly more promising, parasites and predators. The extension of the program will also allow cultures of the parasites and predators to be kept on hand in Trinidad until strong cultures are established in West Africa. In view of the recruitment of staff and the construction of breeding facilities at International Institute of Tropical Agriculture (IITA, Nigeria) for the specific purpose of work on the biological control of cassava mealybugs on a regional basis in West Africa, the extension of the program should be closely coordinated with the IITA program. [AS]

0081

24096 BORRERO B., H.M. 1981. Ciclo biológico de la chinche de encaje Vatiga manihotae Drake (Hemiptera:Tingidae), del Zelus nugax Stal (Hemiptera:Reduviidae) y factibilidad de cría del predator. [Life cycle of the lace bug Vatiga manihotae (Hemiptera:Tingidae) and of Zelus nugax (Hemiptera:Reduviidae), and feasibility of predator rearing]. Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 62p. Span., Sum. Span., Engl., 10 Refs., Illus.

Cassava. Vatiga manihotae. Predators and parasites. Biological control. Insect biology. Laboratory experiments. Temperature. Colombia.

At CIAT the life cycles of Vatiga manihotae and of the predator Zelus nugax were studied under field conditions in a screen house (23.9°C and 72% RH av.) and under lab. conditions (22.0°C and 67% RH av.), resp. The different stages of the life cycle of the lace bug V. manihotae lasted, on the av.: 12.6, 17.3, 38.9, and 42.3 days for the egg, nymph (5 instars), male, and female, resp. The av. length of the different stages of the life cycle of Z. nugax was 14.6, 56.8, 36.3, and 49.0 days for egg, nymph (5 instars), male, and female, resp. Z. nugax is a very valuable polyphagous predator which could contribute to regulating the population of V. manihotae and other cassava pests. Lab. rearing of Z. nugax is possible by feeding it with Galleria mellonella larvae. [AS]

0082

24097 BRITO, J.A.Q. DE 1982. fecto de cinco tratamientos químicos en el control de la escama blanca de la yuca Aonidomytilus albus Cockerell (Homoptera: Diaspididae). [The effect of five chemical treatments on the control of the white scale of cassava Aonidomytilus albus (Homoptera: Diaspididae)]. Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 72p. Span., Sum. Span., Engl., 22 Refs., Illus.

Cassava. Aonidomytilus albus. Cultivars. Insecticides. Insect control. Cuttings. Germination. Statistical analysis. Colombia.

At CIAT, the effec of insecticides and their doses on the control of the white scale (Aonidomytilus albus) was studied. The substances used were dimethoate, malathion, Triona (petroleum oil 80%, inert ingredients 20%), and the combinations of dimethoate with Triona and malathion with Triona.

The cuttings were treated by dipping them into the resp. solutions for 5 min. Cassava cuttings treated with phosphated insecticides mixed with Triona gave better results than those treated just with the insecticides; treatment with malathion (2%) plus Triona (2%) was the most effective. Cuttings with degrees 2, 3, and 4 of infestation showed poor germination even though they had been treated with insecticides. It is recommended to use insect-free planting material. [AS]

0083

23229 FARIAS, A.R.N.; COELHO, Y. DA S.; CALDAS, R.C.; NASCIMENTO, A.S. DO 1982. Níveis de desfolhamento para avaliacao de dano causado por mandarová em mandioca. (Levels of defoliation to evaluate the damage caused by the hornworm in cassava). Revista Brasileira de Mandioca 1(1):75-78. Port., Sum. Port., Engl., 4 Refs. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Empresa Brasileira de Pesquisa Agropecuária, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Erinnyis ello. Simulation models. Cultivars. Cultivation. Planting. Spacing. Defoliation. Mononychellus tanajoa. Acaricides. Vatiga illudens. Insecticides. Root productivity. Starch content. Brazil.

The effect of the level of damage caused by the cassava hornworm and of the age of the cassava crop at the time of the attack on root yield was studied at Cruz das Almas, BA, Brazil. A randomized complete block design was used with 6 treatments and 4 replications. Defoliation of 6-mo.-old plants reduced root yield by 27.5%. Defoliation only affected the % of starch in 2- and 4-mo.-old plants. [AS]

0084

24094 GARCIA G., C.A. 1981. Biología y morfología de Cyrtomenus bergi Froeschner (Hemiptera: Cydnidae), nueva plaga de la yuca. [Biology and morphology of Cyrtomenus bergi (Hemiptera:Cydnidae), a new pest of cassava]. Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 33p. Span., Sum. Span., Engl., 5 Refs., Illus.

Cassava. Sweet cassava. Bitter cassava. Cyrtomenus bergi. Insect biology. Entomology. Roots. Pest damage. Mycoses. Aspergillus. Diplodia. Fusarium. Phytophthora. Simulation models. Predators and parasites. Colombia.

In 1980 in Caicedonia (Valle, Colombia), roots of cassava var. Chiroza Gallinaza were attacked by Cyrtomenus bergi, commonly called the subterranean bug or small pox bug, and therefore affecting root quality. Given its incidence and its potential as a pest, the biology of this insect was studied in the lab. (av. temp. 23°C and 65% RH) at CIAT. Adult hugs have an oval body, approx. 7.1 mm long, and are dark brown to bright black in color; they have spined tibiae and the 1st pair of legs are fitted for burrowing. The egg stage lasts an av. of 13.6 days; the nymphs pass through 5 instars totalling 111.2 days and the adult longevity is of 293.4 days. Each insect stage is described as well as the damage it causes. In the lab. the fungus Metarhizium sp. was found attacking C. bergi. Recommendations for the control of this new cassava pest are given. [AS]

0085

23099 HERREN, H.R.: BENNETT, F.D. 1984. Cassava pests, their spread and control. In Hawksworth, D.L., ed. Advancing Agricultural Production in Africa, Arusha, Tanzania, 1984. Proceedings. Farnham Royal, Slough, England, Commonwealth Agricultural Bureaux. pp.110-114. Engl., 11 Refs. [IITA P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Mononychellus caribbeanae. Mononychellus progresivus. Zonocerus variegatus. Zonocerus elegans. Bemisia. Economics. Production. Biological control. Plant breeding. Resistance. Pest control. Africa.

The origin, spread, control, and economic losses caused in Africa by cassava pests, especially Phenacoccus manihoti, Mononychellus tanajoa, M. caribbeanae, and M. progresivus, Zonocerus variegatus and Z. elegans, and Bemisia tabaci, are reviewed. Special attention is paid to biological control of P. manihoti and Mononychellus spp. and the breeding of resistant host plant cassava var. These 2 kinds of measures will eventually provide an integrated approach to the control of major pests. [Review of Applied Entomology]

0086

24099 HERREN, H.R.; LEMA, K.M.; NEUENSCHWANDER, P. 1983. Biological control of the mealybug Phenacoccus manihoti and the green spider mite complex Mononychellus spp. on cassava Manihot esculenta in Africa. In International Congress of Plant Protection, 10th., Brighton, England, 1983. Plant protection for human welfare: proceedings. Croydon, England, British Crop Protection Council. p.782. Engl. [IITA, P.M.B. 5320, Oyo Road, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Mononychellus. Biological control. Predators and parasites. Nigeria.

A species of Apoanagyrus (possibly A. lopezi De Santis) and Diomus sp. from South America proved to be very effective in exptl. releases against Phenacoccus manihoti in Nigeria in 1981-82. A predacious phytoseiid is being reared and released against Mononychellus spp. in Nigeria. [Biocontrol News and Information]

0087

24040 HERRERA F., C.J. 1985. Desarrollo y comportamiento de Epidinocarsis (=Apoanagyrus) diversicornis Howard (Hym: Encyrtidae), enemigo natural del piojo harinoso, Phenacoccus herreni Cox & William (Hom: Pseudococcidae) en el cultivo de la yuca. [Development and behavior of Epidinocarsis (=Apoanagyrus) diversicornis (Hym:Encyrtidae), natural enemy of the mealybug, Phenacoccus herreni (Hom:Pseudococcidae) in cassava crops]. Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 86p. Span., Sum. Span., Engl., 24 Refs., Illus.

Cassava. Phenacoccus herreni. Predators and parasites. Biological control. Laboratory experiments. Research. Temperature. Entomology. Statistical analysis. Colombia.

A new parasitoid of the cassava mealybug in Colombia was identified and described as Epidinocarsis (=Apoanagyrus) diversicornis Howard (Hym: Encyrtidae) in studies undertaken at CIAT under controlled temp. conditions in the lab. Development time from egg to formation of the mealybug mummy was 19.23, 10.85, and 10.32 days at 20, 25, and 30°C, resp., and from the mummy stage to adult emergence, 16.47, 9.29, and 7.80 days at the same temp. The av. total development time was 35.72, 20.15, and 18.12 days at 20, 25, and 30°C, resp. The development times at different temp. were significantly different at the 5% level (Duncan's test). Different diets were tested, namely, sugar, sugary water, honey water, and mealybugs. Best results were obtained with sugary water with which av. longevity was 26.34 days. Studies on feeding preference for the mealybug stages showed that the 3rd instar was the most susceptible to parasitoid attack, and the adult

male the least susceptible. Mealybug mortality, attributed to E. diversicornis considering the oviposition wounds, was greatest in the 1st instar (13.22%) and was significantly different from that of other mealybug stages. The 2nd instar female, 2nd instar male, 3rd instar female, and adult female mortalities were 3.7, 6.1, 5.1, and 5.3%, resp., and did not differ significantly. Encapsulation of the immature stages of the parasitoid by the mealybug was studied for 2 stages of the mealybug and at 2 constant temp. The % of encapsulation by the 2nd instar and by the 3rd instar + adult female was 14.01 and 7.71% at 25°C and 4.43 and 2.68% at 30°C, resp. Encapsulation at 25°C was significantly greater than at 30°C. The lower developmental threshold (LDT) for E. diversicornis and its physiological time (day-degrees) were determined. The LDT was 13.52°C for the egg to mummy stages, and 13.53°C for the mummy to adult stages and for total development. Physiological times were 124.60 degree-days for the development from egg to mummy, 106.54 from mummy to adult, and 230.90 for the total development. [AS]

0088

23715 IHEAGWAM, E.U.; ELUWA, M.C. 1983. The effects of temperature on the development of the immature stages of the cassava mealybug, Phenacoccus manihoti MAT-FERR. (Homoptera, Pseudococcidae). Deutsche Entomologische Zeitschrift 30(1-3):17-22. Engl., Sum. Engl., 17 Refs., Illus. [Dept. of Zoology, Univ. of Nigeria, Nsukka, Nigeria]

Cassava. Phenacoccus manihoti. Insect biology. Entomology. Temperature. Laboratory experiments. Nigeria.

The duration of development of eggs, nymphs, and immature adults of the cassava mealybug, Phenacoccus manihoti, were determined at 3 or 4 constant temp. (25, 28, 31, and 33°C). The duration of development of each stage decreased with increase in temp. The rate of development was slowest in the egg and fastest in the 2nd instar nymph. The calculated lower threshold temp. were 14.0, 20.0, 19.0, 19.5, 17.0, and 20.0°C for egg, instar I, instar II, instar III, immature adult, and egg-adult, resp. Likewise, thermal constants were 131.4, 34.1, 33.0, 32.5, 58.5, and 260.9 degree-days for egg, instar I, instar II, instar III, immature adult, and egg-adult, resp. [AS]

0089

22775 LUNDBORG, G. 1984. Insectos vs. insectos. (Insects vs. insects). CIID Informa 13(3):22-23. Span., Illus.

Cassava. Phenacoccus manihoti. Mononychellus. Cassava programs. Predators and parasites. Biological control. Cultivars. Resistance. Africa.

The history of the introduction and dissemination of the cassava mealybug (Phenacoccus manihoti) and the green mite (Mononychellus sp.) in the African continent is briefly presented. Control measures that have been taken are indicated, particularly the biological control approach, with which the International Institute of Tropical Agriculture, CIAT, and the Commonwealth Institute of Biological Control have faced the problem. A description is given of the way in which the predator beetles Diomus sp. and Hyperaspis sp., and the parasitoid Apoanagyrus lopezi act; the possibility of their rapid multiplication (in the lab.) and dissemination by air is discussed, and the economic benefits that this can represent are presented. [CIAT]

0090

23717 SALICK, J. 1983. Natural history of crop-related wild species: uses in pest habitat management. Environmental Management 7(1):85-89.

Engl., Sum. Engl., 14 Refs., Illus. [Dept. of Ecology & Systematics, Cornell Univ., Ithaca, NY 14853, USA]

Cassava. Manihot. History. Ecosystems. Plant geography. Biological control. Leaves. Petioles. Chrysopa. Resistance. Central America. South America.

Studying the natural history of crop-related wild plant species in their native habitats is discussed as a means of developing novel pest management strategies. Traditionally, such studies have provided insights for biological control, plant breeding, crop management, and applied ecology. As examples, studies on potato in Peru, cassava in Central and South America and forestry in Malaysia are reviewed. [Review of Applied Entomology]

0091

24078 SANTOS, C.D.; TERRA, W.R. 1984. Plasma membrane-associated amylase and trypsin. Intracellular distribution of digestive enzymes in the midgut of the cassava hornworm, Erinnyis ello. Insect Biochemistry 14(5):587-594. Engl., Sum. Engl., 40 Refs., Illus. [Depto. de Bioquímica, Inst. de Química, Univ. de Sao Paulo, Caixa Postal 20780, Sao Paulo, Brasil]

Cassava. Erinnyis ello. Enzymes. Analysis. Brazil.

Differential centrifugation of homogenates of midgut cells from Erinnyis ello prepared in isotonic solutions was carried out and hydrolase and enzyme marker activities were determined in the isolated fractions. Alpha- and beta-glucosidase and trehalase seem to occur loosely associated with large structures, from which they are set free by homogenizing in water. They are also found in the cytosolic fraction. Aminopeptidase activity follows that of alkaline phosphatase, whereas that of amylase and trypsin occur mainly among particulate fractions. Part of the amylase present in the particulate fractions seems to correspond to soluble amylase bound by membranes. The enrichment factor for alkaline phosphatase and aminopeptidase in microvilli purified from midgut cells is 4 and for amylase, 1.5. Amylase and trypsin are only partly released from a membrane fraction after several washings in different media, including ultracentrifugation in a discontinuous glycerol gradient. About 50% of the amylase and trypsin are solubilized from the membranes by treatment with Triton X-100. The results support the proposal that intermediate and final digestion in E. ello occur under the action of glycocalyx-associated hydrolases (alpha- and beta-glucosidase and trehalase) and of plasma membrane-bound enzymes (aminopeptidase, and perhaps also amylase and trypsin). [AS]

0092

24045 SANTOS, C.D.; FERREIRA, C.; TERRA, W.R. 1983. Consumption of food and spatial organization of digestion in the cassava hornworm, Erinnyis ello. Journal of Insect Physiology 29(9):707-714. Engl., Sum. Engl., 24 Refs. [Depto. de Bioquímica, Inst. de Química, Univ. de Sao Paulo, Caixa Postal 20780, Sao Paulo, Brasil]

Cassava. Erinnyis ello. Laboratory experiments. Animal nutrition. Leaves. Biochemistry. Analysis. Brazil.

Hydrolases in different regions of the gut of Erinnyis ello were determined. Fifth-instar E. ello larvae ate 2.1 times their own wt./day of Euphorbia pulcherrima leaves, with a coefficient of digestibility of 45% and an efficiency of food conversion into tissue of 25%. The food took about 150 min to go through the gut. Midgut contents had a pH of 9.3-9.8

depending on the region. Cellulase was absent from the gut in E. ello. Significant gut hydrolase activities were found only in midgut. Amylase and trypsin occurred in the midgut tissue and contents and in regurgitated material, whereas aminopeptidase, alpha-glucosidase, beta-glucosidase, and trehalase were found in major amounts in the midgut tissue and in minor amounts in the midgut contents, and were absent from regurgitated material. The results support the hypothesis that digestion starts in the endoperitropic space under the action of amylase and trypsin, and is largely completed in the ectoperitrophic space through the catalytic action of several oligomer and dimer hydrolases. Involvement of a membrane-bound aminopeptidase in the terminal digestion of oligopeptides cannot, at present, be excluded. The finding that less than 7% of the total amylase and trypsin are excreted, after a time identical to the passage time of the food bolus, leads to the proposal for the existence of some mechanism by which those enzymes are recovered from the undigested food before it is excreted. [AS]

0093

25214 SILVA, A.B. 1977. Cochonilha das ponteiras da mandioca Phenacoccus sp. (Cochineal of cassava tips Phenacoccus sp.). Anais da Sociedade Entomologica do Brasil 6(2):315-317. Port., 3 Refs., Illus.

Cassava. Phenacoccus. Insect biology. Pest damage. Insect control. Insecticides. Brazil.

The biological stages of Phenacoccus manihoti and the damage it causes are briefly described, and control measures are given. [CIAT]

0094

21426 VILLEGAS G., A. 1984. Biología, morfología y hábitos de Lagocheirus araneiformis Linne (Coleoptera:Cerambycidae) barrenador de la yuca en Palmira (Valle del Cauca). [Biology, morphology, and habits of the stemborer Lagocheirus araneiformis (Coleoptera:Cerambycidae) in cassava in Palmira, Valle del Cauca]. Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 75p. Span., Sum. Span., Engl., 13 Refs., Illus.

Cassava. Field experiments. Laboratory experiments. Lagocheirus araneiformis. Insect biology. Cuttings. Pest damage. Colombia.

Under lab. and field conditions, the life cycle of Lagocheirus araneiformis, a potential pest of cassava, was studied at CIAT. Under lab. conditions (28.4°C; 65% RH), the life cycle of the egg, pupa, adult female, and adult male stages lasted 3.13, 7.60, 45.85, and 71.85 days, resp.; depending on the methodology used for its study, larval stages lasted 53.79 and 87.60 days, resp. The no. of larval instars varied between 4-9. Under field conditions, the time of development from egg to adult was 128.18 days. The adult female and male lived 89.72 and 91.62 days, resp. The females oviposited an av. of 150 eggs over 28.8 days. In the field L. araneiformis can attack either recently planted or stored cuttings, or mature plants. Damage on mature plants is generally located around the base of the main stem; in severe attacks plant lodging occurs. Infested plants can be recognized by sawdust around the base of the plant; roots can be attacked as well. It is recommended to establish the economic damage levels and to evaluate the different control methods. [AS]

0095

24060 WALTER-ECHOLS, G.; AGOUNKE, D.; AKPALOO, Y. 1983. Importance of cassava, cowpea and maize pests in Togo, West Africa. In International

Congress of Plant Protection, 10th., Brighton, England, 1983. Proceedings of a Conference: Plant Protection for Human Welfare. Croydon, England, British Crop Protection Council. v.1,p.103. Engl. [Direction de la Protection des Végétaux, B.P. 1263, Lomé, Togo, Africa]

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Predators and parasites. Togo.

The major pests of cassava in Togo are Phenacoccus manihoti and Mononychellus tanajoa; the coccinellids Chilocorus nigritus and Hyperaspis sp. are important predators of the former pest. [Plant Breeding Abstracts (extract)]

0096

23793 YASEEN, M.; BENNETT, F.D. 1979. Investigations on the natural enemies of cassava mealybugs (Phenacoccus spp.) in the neotropics. Report for April 1978 - March 1979. Curepe, Trinidad, Commonwealth Institute of Biological Control. 11p. Engl., Sum. Engl., 6 Refs.

Cassava. Phenacoccus. Biological control. Predators and parasites. Trinidad and Tobago. Bahamas. Caribbean. Colombia. Brazil. Surinam. Guyana. Zaire. Nigeria.

A project funded by the International Development Research Centre (Canada) was commenced at the West Indian Station, Commonwealth Institute of Biological Control, in April 1977 to carry out surveys for natural enemies of Phenacoccus manihoti and related mealybugs in the neotropics and to provide nucleus cultures of promising parasites and predators for trials against the pest in Africa. During the 1st yr, surveys were made in Trinidad, Tobago, Bahamas, the Caribbean, Colombia, Brazil (Macapa), Surinam, and Guyana. P. manihoti was found in Guyana and Brazil and several primary parasites including Aenasius sp.? vexans, Anagyrus sp.? pseudococci, Anagyrus sp., Blepyrus insularis (Encyrtidae) and predators Hyperaspis quinquenotata, Hyperaspis sp., Scymnobius sp. (Coccinellidae), Ocyptamus sp. nr. stenogaster (Syrphidae) and a chrysopid were obtained. Phenacoccus grenadensis on cassava and several ornamentals yielded a very rich complex of natural enemies including Aenasius masti and A. phenacocci, Acerophagus coccois, Anagyrus sp. nr. jucundus, and Apoanagyrus sp. as parasites, and Hyperaspis oneratus and H. quinquenotata, Hyperaspis sp., Pullus sp., O. sp. nr. stenogaster, and Toxomerus dispar as predators. Surveys during the 2nd yr revealed new areas of distribution of P. manihoti and, in addition to the natural enemies encountered previously, A. phenacocci and Apoanagyrus diversicornis were reared as parasites and Cardiastethus sp. (Anthocoridae) and Euvira sp. (Staphylinidae) as predators. Observations showed that P. grenadensis yielded Acerophagus nubilipennis, Bothriocraera bicolor, and Anagyrus sp. as additional parasites. Lab. cultures of several of the parasites were set up and/or maintained in order to supply nucleus cultures of affected areas in Africa. Stocks of A. phenacocci, A. coccois, Anagyrus sp. greeni, A. sp. nr. jucundus and Nephus (S) sp. were sent to Zaire, and A. phenacocci, A. coccois, and A. sp. nr. jucundus were provided to Senegal. Initial establishment of A. greeni in Zaire has been reported. Arrangements are in progress to provide additional stocks to Senegal and other affected territories and cooperative liaison with the International Institute of Tropical Agriculture (Nigeria) is being established. [AS]

0097

23795 YASEEN, M. 1978. Report on a survey of cassava mealybugs (Phenacoccus spp.) and their natural enemies in Cayenne and Brazil -

1978. Curepe, Trinidad, Commonwealth Institute of Biological Control. 6p. Engl., 3 Refs.

Cassava. Phenacoccus. Predators and parasites. French Guiana. Brazil.

Phenacoccus manihoti was found in 3 localities of Pernambuco, Brazil; no parasites were observed, but predators like Hyperaspis sp. and Ocyptamus sp. nr. stenogaster were abundant. In Cayenne, French Guiana, a rich complex of natural enemies occurs; Apoanagyrus diversicornis, Euvira sp., and Cardiastethus sp. were recorded with P. manihoti for the 1st time. [CIAT]

See also 0022 0030 0034 0038 0058 0059 0100 0167 0174 0183

F02 Rodents and other Noxious Animals

See 0022 0174

F03 Injurious Mites and their Control

0098

24068 PILLAI, K.S.; PALANISWAMI, M.S. 1983. Economics on the control of spidermites on cassava. Entomon 8(4):373-375. Engl., Sum. Engl., 3 Refs. [Central Tuber Crops Research Inst., Trivandrum 17, India]

Cassava. Injurious mites. Eutetranychus orientalis. Oligonychus biharensis. Tetranychus cinnabarinus. Tetranychus neocaledonicus. Acaricides. Mite control. Root productivity. Economics. Prices. Costs. India.

A complex of 4 species of mites, Eutetranychus orientalis and Oligonychus biharensis (dorsum feeders), and Tetranychus cinnabarinus and T. neocaledonicus (ventrum feeders) in India, cause significant yield reduction (17-33%) in cassava. The most effective chemicals for the control of mites, dimethoate, methyl demeton, and monocrotophos at 150 ml a.i./ha, were economically evaluated. The cost:benefit ratios were in order of 1:6.42, 1:5.09, and 1:2.55, resp. The efficacy of water spraying and its economics were also studied, the cost:benefit ratio being 1:2.60. [AS]

0099

23701 SCHICHA, E. 1983. New species, new records, and redescription of phytoseiid mites from Australia, Tahiti and the African region (Acari:Phytoseiidae). International Journal of Entomology 25(2-3):103-126. Engl., Sum. Engl., 44 Refs., Illus. [Biological & Chemical Research Inst., New South Wales Dept. of Agriculture, Rydalmere, N.S.W. 2116, Australia]

Cassava. Injurious mites. Biological control. Predators and parasites. French Polynesia.

New species of phytoseiid mites from Australia, Africa, and Tahiti are described from the females, and supplementary information on morphology and distribution are given for 7 others. The species of economic interest were Amblyseius juliae sp. n. on cassava in Tahiti and A. peltatus Merwe on

strawberry, Typhlodromus machaon Vainshtein on apple, pear, and Eucalyptus sp., and T. corrugatus sp. n. under cardboard shelters on the trunks of apple trees, all from Australia. A. peltatus, at least, was recorded as a predator of tetranychids on the food plant. [Entomology Abstracts]

0100

23074 YANINEK, J.S.; HERREN, H.R. 1984. Biological control of cassava pests with special reference to cassava green mites. Ibadan, Nigeria, International Institute of Tropical Agriculture. 19p. Engl., Sum. Engl., 41 Refs. [IITA, P.M.B. 5320, Oyo Road, Ibadan, Nigeria]

Paper presented at the Eastern and Southern Africa Regional Root Crops Workshop in Kampala, Uganda, 1984.

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Mononychellus progresivus. Biological control. Predators and parasites. Insect biology. Entomology. Research. Nigeria.

A program to control the cassava mealybug (CM) and cassava green mites (CGM) using classical biological control has been under way at the International Institute of Tropical Agriculture (Nigeria) since 1980. The initial effort was concentrated on CM; however, as a result of the strengthening of the biological control program, increased attention has been given to CGM. Work on CGM has been divided into complementary basic and applied research components. The basic research component includes measuring biotic potentials of CGM and exotic CGM natural enemies in the lab., and quantifying ecological characteristics of CGM in the field. Regarding applied research, an efficient sampling protocol has been developed for determining the no. of CGM present in a field. This protocol is then used to monitor CGM populations prior to and following the release of CGM natural enemies. Additionally, procedures for mass-rearing CGM natural enemies are also being studied. These results will be used to increase the possibilities of a successful biological control campaign by planning a release strategy that takes biological advantage of CGM. [AS]

See also 0030 0038 0058 0059 0079 0085 0086 0089 0095 0167 0168 0174 0183

G00 GENETICS AND PLANT BREEDING

See 0170

G01 Breeding, Germplasm, Varieties and Clones, Selection

0101

23215 ACOSTA-ESPINOZA, J. 1984. Variabilidade e associacoes genéticas entre caracteres de mandioca (Manihot esculenta Crantz) combinando policruzamentos e propagacao vegetativa. (Genetic variability and relationships among characters in cassava by combining the polycross technique and vegetative propagation). Tese Doutor Agr. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de Sao Paulo. 130p. Port., Sum. Port., Engl., 96 Refs.

Cassava. Genetics. Cultivars. Agronomic characters. Field experiments. Branching. Plant height. Canopy. Plant development. Harvest index. Roots. Statistical analysis. Statistical data. Brazil.

At the Anhembí Exptl. Station, state of Sao Paulo, Brazil, research was carried out to characterize the procedures involved in the combination of the polycross technique with vegetative propagation. The expt. consisted of 17 treatments involving 8 genotypes, selected for their high root productivity and designated as parents, and their polycrossed progenies. After the 1st yr, cuttings of the selected parents and seeds of their progenies were planted in a randomized complete block design with 10 replications. From these plots, 4 cuttings/plant were collected and used in another randomized block design expt. with 10 replications, thus each one of the 17 treatments was tested with vegetative propagation material. The parameters evaluated were height of 1st ramification, plant height, canopy diameter, wt. of aerial part, HI, and root distribution, no., and productivity. Variance and covariance analyses were performed to determine the genotypic and phenotypic parameters. HI, plant height, wt. of aerial part, and no. of roots had enough genetic variability to respond to selection. Root arrangement, no., and yield showed the highest values of phenotypic and genetic correlations. The best prediction of root yield could be done by combining wt. of aerial part and HI; wt. of aerial part and canopy diameter were the aerial characters most correlated with root yield. Height of 1st ramification was the unique character showing a negative correlation with root yield. Combined use of the polycross technique and vegetative propagation was an appropriate procedure for estimating parameters related to the genetic variability and relationship among characters. [CIAT]

0102

23216 ACOSTA-ESPINOZA, J. 1983. Eficiencia de policruzamentos para recombinacao genica e estimacao de parametros genéticos em mandioca (Manihot esculenta Crantz). (Efficiency of polycrosses on genetic recombination and appraisal of genetic parameters in cassava). Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de Sao Paulo. 88p. Port., Sum. Port., Engl., 61 Refs.

Cassava. Climatic requirements. Temperature. Rainfall data. Soil physical properties. Soil analysis. pH. Clones. Sweet cassava. Bitter cassava. Crossbreeding. Cultivation. Cuttings. Planting. Spacing. Insecticides. Insect control. Pollination. Seed. Plant height. Canopy. Roots. Root productivity. Harvest index. Statistical analysis. Genetics. Brazil.

The efficiency of ' polycross technique in promoting genetic recombination and in appraising genetic parameters such as plant height and diameter, root no. and yield, and HI in cassava, was evaluated at the Anhembí Exptl. Station in Piracicaba, SP, Brazil. Nine high yielding genotypes, and 8 of their corresponding polycrossed progenies, were used in a randomized complete block design with 10 replications. Characters were evaluated 8 mo. after planting. Plant height and HI showed high values of genotypic determination and high heritability coefficients, based on the performance of the parents and polycrossed progenies, resp. Plant diameter, root yield and no. showed low genotypic determination coefficients, based on parental performance, and very low heritability coefficients, based on polycrossed progeny performance. Plant height and diameter indicated dominance variance, with partial dominance and overdominance for plant height and plant diameter, resp. Some genotypes exhibited high root yield and vigor for plant height and diameter, resulting in an almost ideal HI of approx. 0.60. The highest root yields

from each polycrossed progeny varied from 21.5 to 35.7 t/ha. These values indicated the existence of genotypes adapted to acid soils with low fertility, and promising genotypes for future screening programs. Genotype SRT 1099-Taquari was outstanding regarding root yield and transferred this yield capacity to its corresponding polycrossed progeny. [AS]

0103

23497 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1984. Grow improved varieties of tapioca. Trivandrum, India. 4p. Engl., Illus.

Cassava. Cultivars. Selection. Hybrids. Root productivity. Roots. Resistance. Cassava African mosaic virus. Injurious insects. Injurious mites. Dry matter. Starch content. Harvesting. Timing. Agronomic characters. Water stress. India.

Five cassava var. developed by the Central Tuber Crops Research Institute, Trivandrum, India, are described. Var. H-97 has a high starch content (30.0%), a productivity of 35 t/ha, and a development cycle of 10 mo. Var. H-165 is an early maturing var. (7 mo.), with a productivity of 39 t/ha and a starch content of 24.60%; it is recommended for cultivation after rice fallows. Var. H-226, with a productivity of 38 t/ha, is recommended for human consumption for its good cooking qualities. These 3 var. are resistant to CAMD, scale insects, and the red spider mite. Var. H-1687 (Sri Visakham) is also recommended for human consumption, particularly for its high carotene content; its DM content and av. productivity are 30.70% and 44.05 t/ha, resp. Var. H-2304 (Sri Sahya) has a DM content of 33.50%, a duration of 11 mo., and a productivity of 44.99 t/ha, besides being highly resistant to drought and CAMD. [CIAT]

0104

22175 LIAN, T.S. 1984. G x E interactions, heritability estimates and varietal adaptability in important agronomic characters of cassava. MARDI Research Bulletin 12(1):136-147. Engl., Sum. Mal., Engl., 13 Refs., Illus. [Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Cultivars. Germplasm. Agronomic characters. Germination. Harvesting. Plant height. Root productivity. Starch content. HCN content. Harvest index. Starch productivity. Statistical analysis. Malaysia.

The results are given of the combined analyses of variance of a series of 6 trials testing 16 cassava var. from the germplasm collection of the Malaysian Agricultural Research and Development Institute at 5 locations in Malaysia. Highly significant germplasm x environment (G x E) interactions were observed for all important agronomic traits. However, regarding the genotype variance component, the G x E component was only important in determining germination, root yield, HI, commercial root no., and starch yield. Broad-sense heritability estimates derived from variance components suggest that characters which showed a smaller G x E interaction as well as a small environment variance component were heritable. By this definition, total root no. and starch content were highly heritable traits. Stability analyses on var. performance identified Bangkok 1 as the most stable var. among the top 5 starch yielders. All other high yielding var. were rated unstable; whereas Buluh, a low yielder, proved most stable. The results suggest that, in conjunction with stability parameters, overall mean yield (over environments) is still an important criterion in the selection for adaptability of cassava var. Most var. with high root starch contents were stable for this trait. [AS]

0105

20032 LIAN, T.S.; ABIDIN K., Z.; YUSUF H., M. 1984. Pembaikbiakan tanaman ubi kayu. 1. Botani bunga dan teknik pengacukan. (Improvement of cassava. 1. Floral botany and breeding technique). Teknologi Pertanian 5(1):62-66. Mal., Sum. Mal., Engl., 3 Refs., Illus. [Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Flowers. Crossbreeding. Pollen. Pollination. Fruits. Seed. Germination. Malaysia.

The floral botany of cassava is described as well as the implications of floral structure in relation to hand crossing. Important details are discussed, including the best time for crossing and the methods of protecting the pollinated flowers, collecting fruits and seeds, and germinating the seeds. Illustrations are included. [AS]

0106

20037 LIAN, T.S.; YUSOF, M. 1984. Pembaikbiakan tanaman ubi kayu. 2. Cara membaikbiak dan memilih. (Improvement of cassava. 2. Breeding and selection methods). Teknologi Pertanian 5(1):67-72. Mal., Sum. Mal., Engl., 4 Refs. [Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Plant breeding. Selection. Clones. Cuttings. Propagation. Germplasm. Hybridizing. Productivity. Malaysia.

The system of breeding and selection of cassava practiced in the Malaysian Agricultural Research and Development Institute is related to the ability of the crop to be vegetatively propagated, i.e. through the selection of seedling clones. Selection criteria are listed and the importance of each is discussed. The breeding and selection scheme begins with evaluation of the germplasm collection to identify parental var. for use in hybridizations, and continues with the selection of seedlings, clones in single rows, preliminary and advanced yield trials, and finally on-farm trials. [AS]

0107

24547 ROWE, A.G. 1983. Cassava research; report for the year 1982-83. Harare, Zimbabwe, University of Zimbabwe. 29p. Engl., Sum. Engl., Illus. [Univ. of Zimbabwe, P.O. Box MB 167, Mount Pleasant, Harare, Zimbabwe]

Cassava. Cassava programs. Research. Cultivars. Cultivation. Planting. Spacing. Plant breeding. Germplasm. Selection. Dry matter. Roots. Irrigation. Root productivity. Herbicides. Costs. Fertilizers. N. P. K. Timing. Harvesting. Forage. Cattle. Animal nutrition. Composition. Uses. Adhesives. Zimbabwe.

Results of research work on cassava, carried out at the U. of Zimbabwe, are presented. Trials were conducted on plant breeding, resistance to drought and herbicides, fertilizer requirements, the effects of plant population and arrangement and of planting and harvesting times on root yield, and the utilization of the whole plant. Costs of production are included. [CIAT]

0108

23732 SILVA, J.R. DA 1984. Hibridacao interespecifica no gênero Manihot Adans. (Interspecific hybridization in the Manihot species). Tese Mag.Sc. Vicosa-MG, Brasil, Universidade Federal de Vicosa. 74p. Port., Sum. Port., 88 Refs., Illus.

Cassava. Manihot. Manihot glaziovii. Manihot pseudoglaziovii. Manihot caerulescens. Manihot pohlii wawra. Manihot esculenta. Clones. Flowers. Inflorescences. Plant anatomy. Flowering. Pollination. Crossbreeding. Hybridizing. Tissue culture. Culture media. Chromosomes. Cytology. Anthers. Seed. Fruits. Brazil.

Compatibility of 4 wild species of the genus Manihot (M. glaziovii, M. pseudoglaziovii, M. caerulescens, and M. pohlii wawra) was studied in crosses with 3 cassava clones (Catelo, Vassourinha, and Branca de Santa Catarina). Crosses were done by hand pollination. M. glaziovii, M. pseudoglaziovii, and M. caerulescens were not compatible with the 3 cassava clones used in the crosses; M. pohlii wawra showed limited compatibility. No differences were observed among the 3 cassava clones as to their compatibility with wild species. Trials carried out to obtain an artificial medium which would facilitate the development of hybrid embryos from fruit obtained by hand pollination were not successful. The no. of haploid chromosomes of the species studied is 18. [CIAT]

0109

23228 SILVA, S. DE O.E.; MEDINA, V.M.; MORALES, E.A. 1982. Utilizacao de micro-computador no agrupamento de cultivares de mandioca com características desejáveis. (Utilization of the microcomputer for grouping cassava cultivars with desirable characteristics). Revista Brasileira de Mandioca 1(1):71-74. Port., Sum. Port., Engl., 4 Refs. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Empresa Brasileira de Pesquisa Agropecuária, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Germplasm. Cultivars. Agronomic characters. Plant anatomy. Productivity. Root productivity. Brazil.

In 1979-80, 224 cassava cv. from the germplasm bank of the Centro Nacional de Pesquisa de Mandioca e Fruticultura (Cruz das Almas, BA, Brazil) were evaluated in relation to 42 different descriptors. The data was coded, processed, and stored in a Polymax 101-SS microcomputer. Special computer programs permit cv. to be grouped according to numerical, alpha, and alphanumerical descriptors. The use of microcomputers in studies of germplasm characterization permits the grouping of cv. and important information to be obtained in a short time, reducing manual labor and mistakes. [AS]

See also 0008 0013 0068 0090 0174 0182

G02 Cytogenetics

0110

23764 JOS, J.S.; NAIR, R.B. 1984. Genetics of male sterility in a genotype of cassava. Current Science 53(9):494-496. Engl., 6 Refs., Illus. [Central Tuber Crops Research Inst., Trivandrum 695017, India]

Cassava. Clones. Crossbreeding. Cytogenetics. Microsporogenesis. Anthers. Pollen. Pollination. Genetics. India.

The male sterile (MS) cassava clone Ce-539 was crossed with the male fertile (MF) clone Ce-613. Crosses were made between 2 other MF clones, Ce-584 and Ci-326, and open-pollinated (OP) seeds were collected from the MS 539, MF 584, and OP-4 clones. The resulting seedling progenies were

screened for male sterility, and microsporogenesis and sequence of pollen development in MS and MF clones were compared. Microsporogenesis was normal for the MF clone; the anthers were filled with pollen and the pollen fertility was above 90%. For the MS clone 539, the anthers were shrivelled at the time of anthesis and the microspores failed to separate from the tetrads and degenerated. The segregation pattern of the progenies showed that the MF clone 584 was homozygous for male fertility while the MF clone OP-4 was heterozygous; the MS clone 539 was homozygous recessive while the MF clone 613 was heterozygous and male fertility was dominant over male sterility. It is concluded that the male sterility in the clone 539 is controlled by a single pair of recessive genes. [CIAT]

See also 0108

H00 NUTRITION

See 0170

H01 Cassava Foods and Nutritive Value

0111

24049 AMOROZO, M.C. DE M.; SHRIMPTON, R. 1984. The effect of income and length of urban residence on food patterns, food intake and nutrient adequacy in an Amazonian peri-urban slum population. Ecology of Food and Nutrition 14(4):307-323. Engl., Sum. Engl., 39 Refs., Illus. [Inst. Nacional de Pesquisas da Amazonia, Caixa Postal 478, 69.000 Manaus-AM, Brasil]

Cassava. Cassava flour. Income. Economics. Fe. Food energy. Human nutrition. Brazil.

The influence of income and length of urban residence on the dietary patterns, food intakes, and nutrient adequacies was investigated in a slum suburb of Manaus (AM, Brazil). The staple diet consisted of CF, bread, rice, fish, meat, sugar, and coffee. The consumption of vegetables, pulses, and fruits was low. The diet did not meet recommended levels of intake at the family level for Zn, vitamin A, thiamin, riboflavin, and energy, but was satisfactory for protein and Fe. CF (consumed with an av. frequency of 94.5% by both lower and higher income groups) and bread were the main energy sources; in the low income group CF accounted for 25% of the energy intake. Cassava was also the main source of Fe, providing 40 and 30% of the total for the lower and higher income groups, resp. Little utilized, cheap sources of vitamin A are available and indicate a scope for nutrition education. It is estimated that income was the predominant factor limiting dietary adequacy for 30-60% of the Manaus population at the time of the survey. [AS]

0112

24050 AUGUSTIN, M.A.; BERRY, S.K. 1984. Stability of tapioca chips fried in RBD palm olein treated with antioxidants. Journal of the American Oil Chemists' Society 61(5):873-877. Engl., Sum. Engl., 19 Refs. [Dept. of Food Science, Faculty of Food Science & Technology, Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia]

Cassava. Roots. Processed products. Cassava products. Storage. Analysis. Malaysia.

The effectiveness of tertiarybutylhydroquinone (TBHQ), butylated hydroxyanisole (BHA), and butylated hydroxytoluene (BHT) in stabilizing cassava chips was assessed by determining the peroxide and p-anisidine values, with absorbances at 232 and 268 nm, resp., and the 18:2/16:0 ratios of oil extracted from cassava chips. The order of effectiveness of the antioxidants in stabilizing the chips was found to be TBHQ more than BHT more than BHA. The same order of effectiveness of the antioxidants was maintained for chips from corresponding 1st, 4th, and 7th fryings. The loss of antioxidants during storage could not be directly related to oxidation parameters. [AS]

0113

24705 BRESSANI, R.; NAVARRETE, D.A.; ELIAS, L.G. 1984. The nutritional value of diets based on starchy foods and common beans. Qualitas Plantarum Plant Foods for Human Nutrition 34(2):109-115. Engl., Sum. Engl., 18 Refs. [Inst. of Nutrition of Central America & Panama, P.O. Box 1188, Guatemala City, Guatemala]

Cassava. Beans. Sweet potatoes. Banana-plantains. Potatoes. Protein content. Amino acids. Methionine. Nutritive value. Composition. Analysis. Laboratory experiments. Cassava flour. Guatemala.

Feeding trials were carried out to determine the min. amount of common beans, with and without met. supplementation, needed to obtain positive wt. gains of rats fed cassava, sweet potato, plantain, and potato flours. The protein content of these materials was 1.4, 3.8, 3.1, and 9.5%, resp., on a dry wt. basis compared with 22.8% in common beans. The amount of beans added varied from 0 to 40.0%, without and with 0.3% met. Without met. addition, the amount of beans required to maintain body wt. was 24.8, 19.3, 20.0, and 40.1% for plantain, cornstarch, cassava, and sweet potato, resp. With just potato flour in diet, the animals gained wt. With met. addition, the amount of beans required for body wt. maintenance was 20.1, 10.1, 14.5, 14.6, and 29.3% for plantain, cornstarch, cassava, potato, and sweet potato, resp. [AS (extract)]

0114

24571 CHANDRA SHEKARA, S.; SHURPALEKAR, S.R. 1983. Some chemical, pasting, rheological and textural characteristics of composite flours based on wheat and tubers. Journal of Food Science and Technology 20(6):308-312. Engl., Sum. Engl., 17 Refs., Illus. [Central Food Technological Research Inst., Mysore-570 013, India]

Cassava. Composite flours. Wheat flour. Cultivars. Cassava flour. Processing. Composition. Protein content. Ash content. Fat content. Carbohydrate content. Starch content. Sugar content. Analysis. Viscosity. India.

Cassava and potato flours were blended at levels of 5-25% with wheat flour, and the pasting and dough characteristics were evaluated by viscograph, farinograph, extensograph, and texturometer studies prior to baking studies. The wide variation in the damaged starch content in potato (31.3%), cassava (4.8%), and wheat (11.4%) flours caused significant variation in the rheological, textural, and handling properties of the dough. CF had low diastatic activity of 130 mg maltose/10 g flour compared with 299 mg maltose/10 g flour for wheat. Even a low level of CF caused a steep rise in viscosity, steep breakdown, and a negative setback. A dough

consistency of 500 Brabender units was optimum for wheat/cassava flour blends at all levels. At the same level of blending the changes in farinograph characteristics were greater with potato flour than with CF. Wheat/potato flour blend took more time for dough development than wheat/cassava flour blends. The band width of farinogram was not affected in wheat/cassava flour blends (50 Brabender units). Resistance to extension was observed at 20% level in wheat/cassava flour blends. [Food Science and Technology Abstracts]

0115

23711 McDOWELL, I.; ODURO, K.A. 1983. Investigation of the beta-carotene content of yellow varieties of cassava (Manihot esculenta Crantz). Journal of Plant Foods 5(3):169-171. Engl., 10 Refs. [Tropical Development & Research Inst., 56-62 Gray's Inn Road, London WC1X 8LU, England]

Cassava. Cultivars. Gari. Vitamin A. Vitamin content. Composition. Analysis. Ghana.

Beta-carotene contents of 4 Colombian cassava cv. (0-100A, 0-137, 0-799, and M Col 1816), a yellow heart cv. from Jamaica, and of yellow and white gari processed from Bankye Borode 3 (a local cv. from Ghana) were measured. Results are tabulated and show beta-carotene content to vary from 0.01 mg/100 g in white gari to 1.13 mg/100 g in the yellow heart cv.; the corresponding vitamin A contents were 17 and 1833 IU/100 g. [Food Science and Technology Abstracts]

0116

23470 OKEZIE, B.O.; KOSIKOWSKI, F.V. 1982. Cassava as a food. CRC Critical Reviews in Food Science and Nutrition 17(3):259-275. Engl., 79 Refs. [Office of International Programs, Alabama A & M Univ., Normal, Alabama, USA]

Cassava. History. Plant geography. Cultivation. Climatic requirements. Composition. Roots. Leaves. Cyanogenic glucosides. Cassava programs. Food energy. Pellets. Animal nutrition. Cassava chips. Trade. Uses. Industrialization. Deterioration. Storage. Economics. Costs. Labour. Toxicity. Development. Consumption.

Different aspects related to cassava as food are reviewed. After a description of its origin and cultural characteristics, the biochemical and nutritional characteristics of cassava roots and leaves and the cyanogenic glucoside content are discussed. The current state and future potential of cassava production and utilization are analyzed based on the currently existing cassava research network, the role of cassava in meeting caloric requirements in developing countries, cassava as animal feed, and industrial uses of cassava. The constraints that limit cassava production and utilization are discussed, including postharvest and storage problems, labor requirements, nutritional deficiencies, and toxicity. Finally, the future projections of cassava are discussed. [CIAT]

0117

24731 PINTO C., G. 1980. Sustitución parcial de harinas de trigo por otras harinas para panificación, pastas y otros productos. (Partial substitution of other flours for wheat flour in bakery products, noodles, and others). Venezuela, Consejo Nacional de Investigaciones Científicas y Tecnológicas. 36p. Span., 13 Refs., Illus.

Paper presented at Seminario sobre Líneas de Producción en el Area de la Alimentación, Venezuela, 1980.

Cassava. Composite flours. Starch crops. Wheat flour. Cassava flour. Cultivars. Processing. Pressing. Drying. Grinding. Economics. Pasta. Bakery products. Venezuela.

A summary of studies, research work, experiences, and recent efforts carried out by different organizations in Venezuela to partially substitute other flours for wheat flour in bakery products, noodles, and other products is presented. The Fundación Centro de Investigaciones del Estado para la Producción Exptl. Agroindustrial conducted in 1977-79 a project of partial CF substitution for wheat in breadmaking; among the 30 cassava var. studied, acceptable results were found by the consumer for substitution levels of up to 20% CF. However, current high prices of the raw material do not make wheat replacement profitable in the short term. Furthermore, the lack of sufficient raw material and other factors make difficult the availability of bread flour in the short term. Among research work related with food technology development contemplated in the Andean projects for technological development, there is a subproject, not yet started, for the exptl. manufacture and commercialization of modified flour replacing wheat by other products, among them cassava. [CIAT]

0118

24725 SEFA-DEDEH, S. 1984. An old processing method, a new protein food. Food and Nutrition Bulletin 6(1):77-80. Engl., 5 Refs., Illus. [Dept. of Nutrition & Food Science, Univ. of Ghana, P.O.B. 25, Legon, NR. Accra, Ghana]

Cassava. Gari. Processing. Peeling. Washing. Rasping. Fermentation. Pressing. pH. Screening. Drying. Water content. Storage. Maize. Cowpea. Protein enrichment. Economics. Ghana.

A new protein food called abropa (14-20% protein content) was developed based on the traditional method of processing gari in Ghana. The new process, known as the Legon process, is described. Cowpea and maize are used as raw materials because of their nutritive value. The economics of the new process and the corresponding product, using local and available equipment, are analyzed. No significant differences in particle size, crispness, color, flavor, and taste were found between gari and abropa. [CIAT]

See also 0006 0012 0035 0103 0119 0135 0136 0137 0145 0165 0167 0171 0173 0174 0182 0183 0185 0186 0193

H02 Nutritive Disorders in Humans

0119

24074 CASADEI, E.; JANSEN, P.; RODRIGUEZ, A.; MOLIN, A.; ROSLING, H. 1984. Mantakassa: an epidemic of spastic paraparesis associated with chronic cyanide intoxication in a cassava staple area of Mozambique. 2. Nutritional factors and hydrocyanic acid content of cassava products. Bulletin of the World Health Organization 62(3):485-492. Engl., Sum. Engl., Fr., 18 Refs., Illus.

Also in Revista Medica de Mocambique 2(1):1-34. 1984.

Cassava. Bitter cassava. Cassava products. Human nutrition. Metabolism. Human health. Toxicity. HCN content. Cyanides. Detoxification processes. Sun-drying. Analysis. Biochemistry. Mozambique.

An outbreak of spastic paraparesis which mostly affected women and children occurred in a northern province of Mozambique in 1981. The epidemic was related to chronic cyanide intoxication associated with a diet consisting almost exclusively of cassava. A prolonged drought in the area had exhausted all food resources except cassava, especially the bitter var. A nutritional, toxicological, and botanical investigation was carried out in 2 of the 5 districts affected. The main findings were that cyanide levels were unusually high in the cassava plant as a consequence of the drought with daily intakes estimated at 15.0-31.5 mg HCN. Detoxification of the bitter var. by sun drying was inadequate because of the general food shortage, and metabolic detoxification was probably reduced owing to the absence of S-containing amino acids in the diet. The raw and dried uncooked cassava was eaten mostly by women and children. The nutritional status of the population, however, was not very poor and symptoms of advanced undernutrition were rarely seen. [AS]

0120

24073 CLIFF, J.; MARTELLI, A.; MOLIN, A.; ROSLING, H. 1984. Mantakassa: an epidemic of spastic paraparesis associated with chronic cyanide intoxication in a cassava staple area of Mozambique. 1. Epidemiology and clinical and laboratory findings in patients. Bulletin of the World Health Organization 62(3):477-484. Engl., Sum. Engl., Fr., 11 Refs., Illus.

Also in Revista Medica de Mocambique 2(1):1-34. 1984.

Cassava. Human nutrition. Malnutrition. Human health. Toxicity. Cyanides. Analysis. Biochemistry. Mozambique.

Investigation of an epidemic of more than 1000 cases of spastic paraparesis in a drought-striken cassava staple area of Mozambique strongly suggests an association between this disease (called mantakassa), chronic cyanide intoxication, and cassava consumption. In previous reports of neurological disease with similar associations, the disease affected an older age group with usually a gradual onset, and the predominant clinical feature was an ataxic neuropathy. In mantakassa the onset was acute, and mostly women of reproductive age and children were affected. Serum SCN levels in these patients were much higher than previously reported; while spastic paraparesis of unknown etiology occurs in many tropical countries, it has not previously been linked with raised SCN levels. The present evidence linking cassava consumption to the disease is circumstantial, and dietary deficiency is also probably involved. When there is a shortage of food production, e.g. during a drought in areas where cassava is an important food crop and a major source of energy for people, the inhabitants may be exposed to the risk of dietary cyanide intoxication. Further research is needed on the causes of mantakassa to prevent repetition of this disaster. [AS]

H03 Animal Feeding

0121

18429 BECKER, J.; SCHULZE, W.D.; SCHMIDT, A.; KNAPE, G. 1980. Weitere Ergebnisse zum Einsatz von Tapioka im Mischfutter. (Other results on

the inclusion of cassava in the feed mixture). Tierzucht 34(12):564-565. Germ., Sum. Germ.

Cassava. Animal nutrition. Swine. Poultry. Feeds and feeding. Lysine. Methionine. Germany.

Trials to demonstrate the quality of cassava indicated that it can be used to replace wheat and maize, without affecting performance, in animal feed rations at 30, 15, 18, and 30% for pigs, layers, chicks (1 g met. at 20% should be added), and ducks. Due to the low lysine content of the feeds it is necessary to add 1.0-1.5% of soy cake for each 10% of cassava. [AS-CIAT]

0122

24091 BUITRAGO A., J.; GOMEZ, G.G.; PORTELA, R.; SANTOS, J.; TRUJILLO, C. 1978. Yuca ensilada para alimentación de cerdos. (Ensiled cassava for swine nutrition). Cali, Colombia, Centro Internacional de Agricultura Tropical. 50p. Span., Sum. Span., 6 Refs., Illus.

Cassava. Animal nutrition. Swine. Roots. Washing. Fermentation. Lactic acid. pH. Nutritive value. Protein content. Water content. Fibre content. Fat content. Ash content. Feed constituents. Cassava meal. Bone meal. Cottonseed cake. Soybean flour. Maize meal. Fresh products. Meals. Colombia.

Research work carried out at CIAT demonstrated that it is possible to develop swine feeding programs based on the utilization of cassava roots ensiled during periods ranging from 2 wk. to over 1 yr. In all studies conducted, simple and practical ensilage methods, within the reach of the producers, were used. Ensiled roots were used as main constituent of swine rations during the various production phases, especially during growth and finishing. A slightly inferior consumption in relation to that obtained with recently harvested cassava roots was observed, but swine yields did not present important differences. Ensilage duration did not result in differences in swine yields, according to comparisons done with cassava roots ensiled for more than 6 mo. vs. less than 5 mo. Addition of salt decreased, and addition of molasses increased, ensilage intake; a tendency to improve swine yield in terms of wt. increase and efficiency of feed conversion was also observed. Ensiled cassava roots, as well as recently harvested roots, require high protein supplementation due to the low concn. of this nutrient in cassava. Various products can be used as protein source to supplement rations based on root ensilage, but in each case controlled amounts of supplement must be provided to avoid overconsumption of protein and underconsumption of cassava. According to the studies carried out, the use of soybean cake or a mixture of soybean and cotton cakes results in higher yields with rations having ensiled cassava roots as the source of carbohydrates. These results offer a new alternative in the preservation and use of cassava roots in swine feeding, through a simple and inexpensive storage system that allows small or large vol. of the product to be handled, from the moment of harvest up to periods over 1 yr. [AS (extract)-CIAT]

0123

24044 FURTADO, M.J. 1985. Mandioca na alimentacao animal. (Cassava for animal feed). Cariacica-ES, Brasil, Empresa Capixaba de Pesquisa Agropecuária. 4p. Port. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 391, 29.000 Vitoria-ES, Brasil]

Cassava. Animal nutrition. Poultry. Swine. Cattle. Cassava leaves (vegetable). Foliage. Cassava chips. Forage. Nutritive value. Food energy. Dietary value. Brazil.

The use and nutritive value of fresh cassava and cassava products (leaves, foliage, chips, cortex) in the state of Espirito Santo, Brazil, are reviewed. [CIAT]

0124

23472 GORDON, C.I. 1985. Cassava utilization in animal feed ration. Kingston, Jamaica, Ministry of Agriculture. 17p.

Paper prepared for a Symposium on Cassava—Its Potential to the Jamaican Economy, Kingston, Jamaica, 1985.

Cassava. Cassava meal. Animal nutrition. Cattle. Goats. Processing. Feeds and feeding. Feed constituents. Economics. Jamaica.

Literature on the utilization of CM in animal feed rations and results of 2 expt. on the use of these rations to feed goats and heifers in Jamaica are briefly reviewed. The nutritional value of CM is analyzed, emphasis being placed on carbohydrates, proteins and amino acid profile, lipids, minerals, vitamins, and cyanogenic glucosides. In expt. 1, the objective was to reach a slaughter goat wt. of 27.24 kg at 6 mo.; results were favorable, with a final wt. of 26.20 kg compared with 29.20 kg obtained with commercial flour, and wt. gain with CM was 13.25 kg, whereas with commercial flour it was 15.44 kg. In expt. 2, with 15 to 18-mo.-old heifers until mating season, the control diet again showed better results than the CM-based diet. Utilization of cassava in cattle rations is not economical. The literature review and the expt. indicate that CM can be a good feed source for cattle; its limitations can be overcome easily with complementary ingredients such as SBM or fish meal. However, so that its use can be feasible, higher yields and lower production costs must be achieved. [CIAT]

0125

24062 KIRILOV, M.P.; BUZIK, R.B.; ILYUKHINA, L.A.; SAMOKHIN, A.V. 1984. [Tapioca in diets for lactating cows]. Zhivotnovodstvo no.3:38-39. Russ.

Cassava. Cattle. Animal nutrition. Feed constituents. Concentrates. Metabolism.

Lactating cows were distributed in 4 groups and fed for 145 days on a basal diet of silage, haylage, grass briquettes, and fodder beet, together with a feed mixture containing (%) barley 30, 10, 0, or 10; oat 10, 10, 0, or 10; wheat 12, 10, 0, or 10; wheat bran 35, 31, 35, or 30; urea concentrate 5, 5, 5, or 0; cassava 0, 20, 40, or 20; sunflower oilmeal 4, 10, 16, or 16; feed concentrate 2 in all groups; NaCl 1 in all; and a premix (P 60-1) 1 in all. Av. daily yield of 4% fat-corrected milk was, resp., 12.3, 11.5, 13.3, and 12.1 kg. Cassava had no adverse effect on nutrient digestibility. [Nutrition Abstracts and Reviews]

0126

24070 LONGE, O.G.; ADETOLA, J.A. 1983. Metabolisable energy values of some agricultural wastes and industrial by-products for layers and the effects of these ingredients on gut dimensions. Journal of Animal Production Research 3(1):1-13. Engl., Sum. Engl., 24 Refs. [Dept. of Animal Science, Univ. of Ibadan, Nigeria]

Cassava. Poultry. Cortex. Feed constituents. Composition. Dry matter. Protein content. Fat content. Fibre content. Ash content. Food energy. Dietary value. Waste utilization. Metabolism. Nigeria.

A maize-based diet with or without 20% agricultural wastes and industrial by-products (cowpea shell, cassava starch residue, maize cob, sawdust, maize starch residue, cassava peel, brewer's grain, and palm kernel meal) were offered to 24-wk.-old layers for 8 wk. and their effects on gut dimensions measured at the end of the period. Approximate digestibility and ME values of the materials were also determined. ME values ranged between 0.382-2.332 kcal/g; ME values for cassava starch residue and cassava peel were 1.417 and 1.588 kcal/g, resp. All fibrous ingredients resulted in larger gut size, particularly the caeca, compared with the control. The duodenal fold was not affected. Effects exerted on gut size appear to depend on the nature of the fiber. [AS (extract)]

0127

23092 MADRID B., M.A.; MARTINEZ G., J.E. 1982. Evaluación de cuatro niveles de yuca (Manihot sculenta) picada y secada al sol en raciones de cerdos en crecimiento y ceba. (Evaluation of four levels of chipped and sun-dried cassava in rations for growing and fattening pigs). Tesis Ing.Agr. Panamá, Universidad de Panamá. 65p. Span., Sum. Span., 33 Refs., Illus.

Cassava. Swine. Animal nutrition. Cassava chips. Solar drying. Feed constituents. Composition. Analysis. Metabolism. Statistical analysis. Costs. Income. Economics. Panama.

At the Centro de Enseñanza e Investigaciones Agropecuarias in Tocumen, Panama, an expt. on swine nutrition during the growing and fattening phases was carried out to evaluate possibilities of partially substituting chipped and sun-dried cassava for the energy source, maize. Fifteen pigs (initial av. wt. 14.30 kg) from pure-bred crosses were used. Pigs were confined during 140 days and fed on treatment I with rations of 30.15 and 39.40% chipped and sun-dried cassava, plus feed concentrates during the growing and fattening stages, resp. Rations in treatment II had 36.50 and 44.90% cassava, resp. The control was fed on the maize-based conventional ration. Statistical analyses of wt. gain did not reveal significant differences between treatments. The control and treatment I presented better av. wt. gains/day. The control was less expensive than the 2 cassava treatments, treatment II being the least expensive. Chipped and sun-dried cassava, as energy source in swine feeding, is efficient at certain levels as partial replacement of maize, even though protein supplementation must be kept in mind. In addition, the cost of acquiring cassava is lower than that for maize. [AS (extract)-CIAT]

0128

24557 MAKHAMBERA, P.E.; KANYENDA, E.E. 1983. Reproductive performance of sows/gilts fed cassava. LUSO: Journal of Science and Technology 4(1):47-51. Engl., 2 Refs. [Dept. of Livestock Production, Bunda College of Agriculture, Univ. of Malawi, P.O. Box 219, Lilongwe, Malawi]

Cassava. Swine. Animal nutrition. Cortex. Roots. Feed constituents. Composition. Metabolism. Malawi.

Eighteen Landrace x Large White crossbred sows/gilts were randomly fed with either a maize-based ration (G1), a peeled, dried cassava-based ration (G2), or an unpeeled, dried cassava ration (G3). The gestation periods and the feed consumed during the gestation period did not differ significantly, although the pigs fed with G3 tended to have a slightly shorter gestation period and their feed consumption rate was the lowest. There was not a significant difference among the treatments for piglets born alive; however, with G1 there was a significantly higher no. of piglets born dead. [CIAT]

0129

24728 MONTILLA S., J. DE J. 1985. Recursos alimenticios energéticos no convencionales para aves. (Nonconventional energetic feed resources for poultry). Maracay, Universidad Central de Venezuela. 15p. Span., Sum. Span., 28 Refs. [Facultad de Ciencias Veterinarias, Univ. Central de Venezuela, Apartado 4563, Maracay 2101A, Venezuela]

Cassava. Poultry. Animal nutrition. Cassava meal. Feeds and feeding. Feed constituents. Venezuela.

A literature review on the use of CM, sweet potato, banana and plantain, sugar cane products and by-products, and palm oil in poultry nutrition is presented. The divergence in the results obtained by different authors is discussed. [CIAT]

0130

24043 PERALTA D., S.V. 1982. Utilización de tres niveles de harina de yuca en raciones de cerdos, durante la etapa de ceba. (Utilization of three levels of cassava flour in swine rations, during the fattening period). Tesis Ing.Agr. Panamá, Universidad de Panamá. 53p. Span., Sum. Span., 22 Refs., Illus.

Cassava. Swine. Fattening. Animal nutrition. Cassava flour. Feed constituents. Composition. Metabolism. Statistical analysis. Economics. Panama.

Different types of CF-based rations were evaluated to substitute maize in diets for pigs during the fattening period. Forty-eight pigs were divided into groups of 12 and supplied the following diets twice a day: group 1, 36.33% maize and no CF; group 2, 17.26% maize and 20.00% CF; group 3, 8.25% maize and 36.33% CF; and group 4, no maize and 60.00% CF. During the fattening period, the pigs remained 90 days in confinement. Best results were obtained with animals receiving the highest levels of CF. Utilization of levels of 36.33 and 60.00% CF in rations notoriously affected wt. gain of pigs and av. net gain/pig. [AS (extract)-CIAT]

0131

24056 TEWE, O.O. 1984. Cyanogenic glucoside, protein interaction in cassava peel based rations: effect on some haematological parameters in growing pigs. Nutrition Reports International 30(2):425-431. Engl., Sum. Engl., 10 Refs. [Nutritional Biochemistry Division, Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Animal nutrition. Swine. Cortex. Proteins. Solar drying. HCN content. Analysis. Metabolism. Animal physiology. Statistical analysis. Uses. Nigeria.

For 90 days 64 Large White x Landrace weanling pigs were given, in a 2 x 4 factorial design, diets without or with 40% cassava peel and 20, 15, 10, or 5% protein. The cassava peel contained 280.6 ppm total HCN. There were highly significant decreases in most hematological values except monocyte and red cell counts in pigs given diets low in protein. Pigs given cassava peel had increased lymphocyte count and decreased neutrophil and total white blood cell counts. Interaction of cassava peel and protein deficiency decreased white blood cell count. [Nutrition Abstracts and Reviews]

0132

24067 TEWE, O.O. 1984. Serum and tissue thiocyanate concentrations in growing pigs fed cassava peel or corn based diets containing graded

protein levels. Toxicology Letters 23(2):169-176. Engl., Sum. Engl., 13 Refs. [Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Animal nutrition. Swine. Cortex. Solar drying. HCN content. Thiocyanates. Analysis. Metabolism. Animal physiology. Statistical analysis. Nigeria.

SCN concn. of serum, liver, kidney, spleen, and longissimus dorsi were determined in 64 growing Large White x Landrace pigs offered 8 exptl. isocaloric diets containing different levels of cassava peel and CP. Cassava peel increased serum SCN on day 60 ($P < 0.05$) and day 90 ($P < 0.01$) of the trial, while the CP level increased it ($P < 0.05$) on days 30 and 90, resp. There was a correlation between cyanide intake and serum SCN level. The coefficient of determination revealed that cyanide alone accounted for 28.5, 63.6, and 48.8% variation in serum SCN on days 30, 60, and 90, resp. Liver kidney, and longissimus dorsi SCN were affected by dietary protein intake ($P < 0.05$). SCN concn. was higher ($P < 0.05$) on the cassava peel diet. Generally, CP at 5% reduced organ and muscle SCN concn. A diet containing 112.2-117.3 mg HCN/kg affected serum but not organ and muscle SCN in protein-sufficient diets. [AS]

0133

24075 THANGAVELU, K.; PHUKON, J.C.D. 1983. Food preference of eri silkworm (Philosamia ricini Hutt.) (Saturniidae:Lepidoptera). Entomon 8(4):311-315. Engl., Sum. Engl., 5 Refs. [Regional Sericultural Research Station, Central Silk Board, Titabar, India 785 632]

Cassava Animal nutrition. Uses. Silkworm. India.

Among 4 different food plants evaluated for suitability to the eri silkworm (Philosamia ricini), the order of preference was castor, kesseru (Heteropanax fragans), cassava, and barkesseru (Ailanthus excelsa). The no. of eggs/laying varied from 395 on castor to 331 on barkesseru, cassava presenting 342. The highest hatching % was on castor (90.0%) and the lowest on barkesseru (74.0%), cassava presenting 77.0%. Larval period was shorter (16 days) and larval mortality lower (32.6%) on castor, with corresponding values of 19.25 days and 63.4% for cassava. Effective rearing rate was higher on castor and kesseru, and lower on cassava and barkesseru (67.4, 64.9, 36.6, and 18.6%, resp.). Green cocoon and shell wt. were higher on castor and cassava than on kesseru and barkesseru (2.81 and 0.265, 2.67 and 0.250, 2.52 and 0.228, and 2.18 and 0.203 g, resp.). [AS]

0134

23765 TUDOR, G.D. 1984. Intensive beef production from dried cassava tubers. Proceedings of the Australian Society of Animal Production 15:763. Engl., 2 Refs. [Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia]

Cassava. Roots. Animal nutrition. Cattle. Dried roots. Feed constituents. Sorghum. Concentrates. Metabolism. Australia.

For a period of 85 ± 13 days, the performance of 48 Hereford steers fed on high concentrate diets based on dried cassava roots or rolled sorghum grains was measured. The diets consisted of 90% concentrate and 10% Chloris gayana chaff. Sixty cattle were classified on live wt. into blocks of 5 and then randomly allocated into 5 treatments, each with 3 replicates of 4 animals. Cattle fed the grain diet ate more OM and gained live wt. faster than cattle fed cassava. The differences between the treatments in

estimated daily carcass gain were not significant, resulting in better conversions of OM to hot carcass wt. for the cattle fed cassava. This latter group of animals ate many small rations rather than 2-4 large rations and had more butyric acid to total acids in rumen fluid than cattle fed grain. [CIAT]

See also 0031 0035 0107 0135 0150 0153 0161 0165 0167 0171 0174 0182 0183 0184 0185 0189

H04 HCN Toxicity and Detoxification

0135

23476 GOMEZ, G.; VALDIVIESO, M.; ZAPATA, L.E.; PARDO, C. 1984. Technical note: cyanide elimination, chemical composition and evaluation in breadmaking of oven dried cassava peeled root chips or slices. Journal of Food Technology 19:493-498. Engl., 17 Refs. [Centro Agronómico Tropical de Investigación y Enseñanza, 7170, Turrialba, Costa Rica]

Cassava. Cassava chips. Cassava flour. Composite flours. Wheat flour. Breads. Composition. Dry matter. Protein content. Fat content. Fibre content. Ash content. Starch content. Sugar content. HCN content. Cyanogenic glucosides. Cultivars. Washing. Peeling. Drying. Grinding. Analysis. Colombia.

Preliminary observations are presented of the effect of oven drying (60°C) thin chips or thick slices of peeled cassava roots on cyanide elimination, chemical composition (including starch and sugar contents of the resulting flour), and use of CF in breadmaking. Information is also presented on chemical composition and cyanide content of the root peel, a by-product of CF processing. Cassava roots from 8-mo.-old plants of local cv. M Col 113 cut in chips varying in length, width, and thickness (5.0-10.0, 2.0-4.0, and 0.3-0.6 cm, resp.) were used. Oven drying of chips eliminated 72 ± 7% of total or bound cyanide, while 1-cm-thick slices only lost 49 ± 16% of the initial cyanide content. These results clearly show the effect that the form and size of cassava root chips have on cyanide elimination. However, dried chips and slices showed cyanide levels which were low enough to be acceptable for human consumption. Inclusion of 10-15% CF levels in mixtures of wheat/cassava flour resulted in bread quality similar to that obtained with wheat flour only. Total cyanide concn. in bread samples were not significantly different. Cyanide concn. in root peels was higher than that of the parenchyma and oven drying eliminated approx. 2/3 of total and bound cyanide. However, the final cyanide content of dried peel was 4 times the max. permissible HCN level set by the EEC for cassava products to be used as animal feed. Further research is required on the chemical composition and cyanide content of dried peel in order to evaluate its nutritional potential as animal feed. [CIAT]

See also 0119 0131 0132

I00 PROCESSING, PRODUCTS AND USES

See 0035 0170 0175 0176

0136

23722 AHMED, S.Y.; GHILDYAL, N.P.; KUNHI, A.A.M.; LONSANE, B.K. 1983. Confectioner's syrup from tapioca processing waste. Starch/Stärke 35(12):430-432. Engl., Sum. Engl., Germ., 6 Refs., Illus. [Central Food Technological Research Inst., Mysore, 570013, India]

Cassava. Cassava starch. Wastes. Waste utilization. Sugar content. Confectioneries. Processing. India.

The possibility to produce confectioner's syrup from cassava processing waste by acid hydrolysis was explored at different substrate as well as acid concn., pressures, and times. Syrup for confectioner's use can be effectively produced at various combinations of the parameters though severe hydrolysis conditions have to be employed as compared with commercial starch. Economic considerations demand the use of waste slurry of 20% concn. with 4% sulfuric acid and the hydrolysis at 15 Pa for 15 min. The problem of disposal of the waste could be solved by gainfully utilizing it for the production of syrup meeting required standards. [AS]

0137

24703 CHIU, C.W. 1983. Process for preparing instant gelling starches. United States Patent 4,391,836. 10p. Engl., Sum. Engl., 11 Refs.

Cassava. Cassava starch. Food products. Processing. pH. Drying. Viscosity. Patents. Uses. USA.

Instant gelling cassava or potato starches that form at least a weak gel having Bloom strengths of approx. 70 g are described. They are prepared by forming an aqueous slurry of native cassava or potato starch at pH (approx.) 5-12, drum drying the slurry to render the starches cold-water-dispersible, and heat treating the drum-dried starch to reduce its viscosity to within defined Brabender viscosity limits. The heat treatment is performed in a conventional heating device, such as an electric or gas oven or a dextrinizer, for approx. 1.5-24.0 h at approx. 125-180°C. Lightly converted (fluidity) starches can also be used to prepare instant gelling starches provided the pH is more than 6.5 and the proper heating time and temp. are selected. The instant gelling starches are particularly useful in food systems of the type which gel upon standing, such as pie fillings, jellies, and puddings. [AS]

0138

24710 EDIRISAH-AIDOO, K. 1979. Saccharification of local cassava starch. Ghana Journal of Science 17(1):101-105. Engl., Sum. Engl., Fr., 7 Refs., Illus.

Cassava. Cassava starch. Analysis. Sugar content. Confectioneries. Gelatinization. Processing. Ghana.

The hydrolysis of starch from local Ghanese cassava was successfully carried out with the aid of dilute sulfuric acid under steam pressure. Quantitative output of dextrose was obtained although traces of mannose, maltose, and dextrine were also presented in the sugary syrup. A method is presented for the large-scale production of glucose from cassava starch. [AS]

0139

23721 KAZANTZIS, D.; LEE, C.M. 1983. Effect of rheological interrelationships between starch gel and fat on the fat dispersion in farinaceous gel matrix. Journal of Texture Studies 14(3):303-313. Engl., Sum. Engl., 8 Refs., Illus. [Dept. of Food Science & Technology Nutrition & Dietetics, Univ. of Rhode Island, Kingston, RI 02881, USA]

Cassava. Cassava starch. Uses. Analysis. Statistical analysis. USA.

The rheological interrelationships between starch gel and fat clearly affected the fat dispersion pattern in the farinaceous matrix when soybean oil-based plastic fat was dispersed in modified cassava starch gel. A gradual increase in fat particle size with concomitant decrease in fat particle no. (r = 0.95) was seen as both viscosity and rigidity of starch gel were decreased. The fat particle size got larger with an increase in fat hardness, increasing sharply as the fat reached its plastic range (30-40% solid fat). The fat particle size was markedly reduced as both the starch gel:fat viscosity ratio and the shear rate were increased. The viscosity of fat/starch gel mix was highly correlated with fat particle size (r = 0.94). The fat viscosity, the rigidity of gel matrix, and the shear rate applied during dispersion appeared to be the most important rheological parameters which determine the overall dispersion pattern of fat in the farinaceous gel matrix. [AS]

0140

24098 LUALLEN, T.E. 1985. Starch as a functional ingredient. Food Technology 39(1):59-63. Engl., 2 Refs., Illus. [Food Starch Applications & Technical Services, Food & AgriProducts Research, A.E. Staley Manufacturing Co., Decatur, IL 62525, USA]

Cassava. Cassava starch. Particle size. Food products. Uses. Composition. Analysis. Viscosity.

The chemical composition and modifications of starch, and their effect on starch properties and characteristics, are discussed. The quality control measures of functional properties and the selection of starches for specific food applications are presented. [CIAT]

0141

21189 NARANJO P., A.J. 1975. Evaluación de rallanderías de extracción de almidón de yuca (Manihot esculenta Crantz) a nivel de pequeño productor. (Evaluation of small factories for the extraction of cassava starch at the small producer level). Tesis Ing.Mecánico. Bogotá, Colombia, Universidad Nacional de los Andes. 190p. Span., Sum. Span., Illus.

Cassava. Cassava starch. Cultivars. Harvesting. Storage. Processing. Washing. Peeling. Rasping. Screening. Analysis. Fermentation. pH. Timing. Solar drying. Small-scale processing. Small-scale equipment. Colombia.

Detailed evaluations were conducted of the operating conditions of 2 small rasping factories for cassava starch production located in Palmira, Valle del Cauca (Colombia) and representative of this activity typical in the country. The 2 rasping factories and their equipment are described in detail, and models used to obtain data on the different parts of the starch production process are included. During the exptl. phase, the processing of 1500 kg roots was observed in each of the rasping factories. In the root peeling stage, 18% corresponds to the peel and the rest to the pulp. Although the peel contains starch and other substances that would make it potentially profitable, it is discarded due to the lack of equipment and

labor to process it; peeling efficiency for factory 1 was 46.64 kg/man-h, whereas for factory 2 it was 52.77 kg/man-h, depending on the ability of the operators. In factory 1 root washing took 0.72 s/kg and in factory 2, 9.18 s/kg, since this process is done mechanically in the 1st factory. Rasping time also varied for both factories in relation to the diameter of the rasp; for factory 1, av. time was 19 min for 75 kg at a linear speed of 7.32 m/s with a 0.6-m-long rasp, and in factory 2, 8 min at a speed of 2.70 m/s and a 0.5-m-long rasp. Screening was similar for both factories. After screening a bran is obtained; this by-product is used in the manufacture of feedstuffs. The slurry left after screening contains only 1.7% solids; the liquid remaining after decantation is thrown away even though it contains dissolved sugars, supernatant fats, and fibers which could be used. Another by-product obtained from screening is the "stain" (fibers and small chips of cassava); the stain accounts for 3% of the total wt. of the slurry and contains nutritive substances used in swine feeding. Of the total wt. of the slurry, 3% is starch, which goes on to the fermentation process. The starch is dried to a 15% final MC and sent to the market. Data obtained in measuring the different parameters during the multiple processing stages are presented in detail. [CIAT]

0142

24093 PARAGUAY. MINISTERIO DE AGRICULTURA Y GANADERIA. 1981. Proyecto de industrialización de la mandioca. (Cassava industrialization project). Asunción. 74p. Span., Illus.

Cassava. Cassava starch. Industrialization. Factories. Development. Trade. Costs. Prices. Economics. Processing. Cassava products. Paraguay.

A project to install and put into operation a cassava starch plant in Paraguay is presented; it is expected to enhance expansion of area planted to this crop in the country, create new alternatives for cassava commercialization, increase and/or diversify small farmers' income, encourage increasing cassava yields, and diversify the sources of foreign exchange income. The plant will have a processing capacity of 36,000 t cassava roots/yr (8280 t starch, with an av. industrial yield of 23%). Starch produced will go mainly to the export market. Regarding the raw material, aspects on the importance of its production, botanical data, particular characteristics, ecologic requirements, commercialization, and production costs are given in detail. The production process, localization, size of the industrial plant, and raw material demand for the plant are described. Production, commerce, and worldwide prices are discussed, and project costs and the economic evaluation of the project are presented. [CIAT]

0143

24088 PINTO S., R.; RINCON C., C.J. 1981. Propuesta para la generación de tecnología en los procesos de obtención de almidón de yuca. (Proposal for the generation of technology in cassava starch processing). Tibaitatá, Colombia, Instituto Colombiano Agropecuario. 37p. Span., 11 Refs., Illus. [Programa de Procesos Agropecuarios, Inst. Colombiano Agropecuario, Tibaitatá, Apartado Aéreo 151123, El Dorado, Bogotá, Colombia]

Cassava. Cassava starch. Production. Factories. Small-scale processing. Processing. Washing. Peeling. Rasping. Screening. Silting. Fermentation. Drying. Uses. Industrial starches. Adhesives. Textiles. Paper industry. Food products. Cultivation. Maps. Costs. Prices. Economics. Development. Technology. Technology evaluation. Technological package. Technology transfer. Colombia.

A preliminary proposal is presented for technology generation in cassava starch processing in order to solve different technical problems faced by small manufacturing plants in Colombia. Research methodology includes evaluation, improvement and/or adaptation of equipment and systems currently used in rasping factories, and diffusion of developed technology. Project site and areas of influence are indicated as well as activities and infrastructure required for its establishment. Personnel and budget requirements for general expenses, operating expenses, and investment expenditures are presented. Among the results expected are the utilization of the starch contained in the peel, increased extraction from 60-65% to 70-75%, improved starch quality, and reduced time used in each stage. An additional potential benefit from the project is the proportional reduction in maize and other starch imports. [CIAT]

0144

24089 PINTO S., R. 1977. Generalidades sobre procesamiento, utilización y comercialización del almidón de yuca. (General aspects of the processing, utilization, and commercialization of cassava starch). Tibaitatá, Colombia, Instituto Colombiano Agropecuario. 101p. Span., 46 Refs., Illus.

Cassava. Cassava starch. Cultivars. Starch content. HCN content. Productivity. Processing. Washing. Peeling. Rasping. Screening. Silting. Fermentation. Grinding. Packaging. Factories. Small-scale processing. Small-scale equipment. Industrial machinery. Industrialization. Water requirements (processing). pH. Particle size. Drying. Solar drying. Storage. Industrial starches. Uses. Food products. Textiles. Paper industry. Dextrins. Marketing. Trade. Colombia.

Detailed information is presented related to processing, utilization, and commercialization of cassava starch to thus contribute to the promotion of the crop's industrialization in Colombia. Characteristics of cassava roots and available cultivated var. are discussed since these must be taken into account for industrialization. Stages of the cassava starch extraction process and extraction methods in small, medium, and large factories are also discussed. Emphasis is placed on quality and vol. of water required in the process. For the washing, peeling, and decortication stages, the cylindrical washer (on bearings, with a central axis, or on fillets), the cylindric tank immersed in water, and the tank washer with compartments are described in detail. For rasping, the perforated, metallic rotors and the saw rotors (mounted on wooden fillets and placed on grooves) are described; power requirements of the rasps and evaluation of rasping techniques are also discussed. The rotating, endless-screw, and oscillating screens for screening are described. Factors influencing sedimentation speed of the starch slurry, such as height of the suspension, temp., density of water and of suspended materials, diameter of particles in suspension, concn. of the slurry, pH, gravity acceleration, and water viscosity are discussed. The fall of starch granules in sedimentation tanks, distance travelled, and speed of starch granules on tables are also discussed; feed chutes, sedimentation tanks, and sedimentation and sulfonation channels and tables are described. In the drying stage, centrifugation, sun drying, and artificial (oven) drying—in chambers with air circulation, endless cylinder belts, isolation chambers, fast pneumatic and tunnel drier—are discussed. Final starch treatment is presented, including pulverization, packaging, storing, and specifications for its various uses. Uses of starch in foodstuffs, textiles and paper industries, manufacture of dextrine and

glues, and others are indicated. Aspects on production and national and international marketing are detailed. [CIAT]

See also 0003 0126 0150 0151 0154 0155 0156 0164 0165 0167 0171 0174 0182 0183 0185 0189 0193

I02 Uses, Industrialization, Processing and Storage

0145

'4563 CASTRONI, S.; CASTILLOA, J.J.; QUINTERO, F.; HERRERA, E.; DIAZ, M. 1984. Cambios en la microestructura de harinas de dos cultivares de yuca (Manihot esculenta Crantz.) durante el proceso de fabricación de casabe crocante. (Changes in the microstructure of the flours of two cassava cultivars during the elaboration of crispy casave). In Jornadas Venezolanas de Microscopía Electrónica, Iras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.194-195. Span., Illus. [Depto. de Agronomía, Facultad de Agronomía, Univ. Central de Venezuela, Maracay 2101, Venezuela]

Cassava. Cultivars. Cassava flour. Casave. Processing. Analysis. Research. Cassava starch. Electron microscopy. Venezuela.

Samples of casave made from 2 cassava cv. (UCV 2129 and UCV 2459) were studied under the electron microscope. A partial or gradual fusion of the starches was observed; no traces of the cell walls were observed; the scalariform tracheae kept their original architecture, although the lateral punctures were sealed with the fused starch. Illustrations are included. [CIAT]

0146

24575 CIPTADI, W. 1977. Umbi ketela pohon sebagai bahan industri. (Cassava roots as raw material for industrial purposes). Bogor, Indonesia, Institut Pertanian Bogor. Fakultas Mekanisasi dan Teknologi Hasil Pertanian. 44p. Indon., 16 Refs., Illus.

Cassava. Roots. Cultivars. Processing. Protein content. Storage. Plant geography. Cyanogenesis. Sweet cassava. Bitter cassava. Uses. Processing. Deterioration. Detoxification. Indonesia.

General data on the botanical aspects, origin, distribution, cultivation, and var. characteristics of cassava, and on processing, protein content, and storage of the roots, are given. The problem of cyanogenesis, and how it varies with var., age, soil fertility, climate, and cultural practices, is discussed. In general, roots from sweet var. are used for direct human consumption, whereas bitter var. are used as raw material for industrial purposes since processing reduces the HCN content. Product quality is affected by the time of processing, since the longer it takes to process the roots after harvesting, the more damaged they will be due to the action of polyphenols present in them. [CIAT]

0147

24733 GONZALEZ C., J.F. 1984. Estudio de factibilidad de procesamiento de yuca en el municipio Autónomo Bolívar del Estado Monagas. (Study on the feasibility of cassava processing in the Autónomo municipality of Bolivar in the Monagas state). Tesis Ing.Agr. Jusepín, Venezuela, Universidad de Oriente. 83p. Span., Sum. Span., Engl., 21 Refs., Illus.

Cassava. Casave. Production. Root productivity. Socio-economic aspects. Processing. Peeling. Washing. Rasping. Pressing. Screening. Drying. Prices. Economics. Income. Storage. Marketing. Distribution. Venezuela.

In the municipality of Autónomo Bolívar (Monagas, Venezuela), a zone of great economic projection from the agricultural point of view, casave producers were interviewed in order to determine the feasibility of processing cassava in this area. Although they have all the public services, the lack of technical and financial assistance has notably conditioned the production of casave in the area. A project of casave enterprises has been designed to offer an incentive to producers and investors to develop agroindustrial plants in the area. [AS]

0148

23434 LORETO, A.B. 1982. Design, development and evaluation of a chain-driven chipper-grater for root crops. Radix 4(2):1-3. Engl., 3 Refs., Illus. [Philippine Root Crop Research & Training Center, VISCA, Leyte 7127-A, Philippines]

Cassava. Development. Processing. Cassava chips. Small-scale processing. Small-scale equipment. Root crops. Economics. Philippines.

A chain-driven chipper-grater machine for root crops was designed at the Visayas State College of Agriculture in Baybay (Leyte, Philippines) to determine the applicability of using the foot as the prime motion element and a chain and sprockets as the driving mechanism. The main components of the machine are described and the results of the trials carried out to evaluate its performance are given. A higher output in chipping and grating was obtained with sweet potato than with cassava. The designed machine can chip 47 times more than hand chipping and the disc grater can grate approx. 10 times more than the circumferential grater. The foot as the main motion element, with chain and sprockets for power and transmission, was a very satisfactory mechanism. [CIAT]

0149

24085 MACHADO, J.E.O. 1980. Quantificacao da deterioracao de mandioca durante a secagem em barzaca por conveccao forcada de ar aquecido com coletor solar. (Quantification of cassava deterioration during drying in bins through convection with forced air heated with solar energy). Tese Mag.Sc. Campinas-SP, Brasil, Universidade Estadual de Campinas. 113p. Port., Sum. Port., Engl., 54 Refs., Illus.

Cassava. Cultivars. Cassava chips. Solar drying. Deterioration. Research. Analysis. Mathematical model. Brazil.

An empirical mathematical model was developed to predict cassava losses during drying in bins, using forced air heated with solar collectors. The model was based on the deterioration of cassava when cut in round slices (5 mm thick; 35-40 mm in diameter), as a function of the decoloration evaluation of cassava. The index of deterioration was preestablished on a 0.0-1.0 scale in which 0.0 was equal to 100% deterioration and 1.0 was equal to 0% deterioration; the index of deterioration was related to spectrophotometric values. Min. air flow rates for cassava drying were calculated for the following conditions: air temp. of 20, 30, and 40°C; 25, 40, and 55% RH. [AS (extract)]

0150

24082 MONTALDO, A.; MONTILLA, J.J.; BARRIOS, J.R. 1984. Usos de los cultivos de raíces y tubérculos distintos de la alimentación humana. (Different uses of root and tuber crops other than human nutrition). Revista de la Facultad de Agronomía (Venezuela) 13(1-4):215-262. Span., Sum. Span., Engl., 77 Refs., Illus. [Univ. Central de Venezuela, Apartado 97, Maracay, Venezuela]

Cassava. Uses. Feeds and feeding. Animal nutrition. Cassava starch. Ethanol. Venezuela.

The utilization of the underground organs (roots, tubers, rhizomes, and corms) of cassava, sweet potato, yam, cocoyam, and taro, different from that of human nutrition, is reviewed, namely, the feeding of domestic animals, the production of alcohol (ethanol) and of starch and its derivatives. [AS]

0151

24564 PEREZ S., E.E.; MOSQUEDA, M. 1984. Cambios en la ultraestructura de harinas de arroz, maíz y yuca por efecto de los tratamientos de gelatinización y dextrinización. (Changes in the ultrastructure of the flours of rice, maize, and cassava by effect of the gelatinization and dextrinization treatments). In Jornadas Venezolanas de Microscopía Electrónica, 1ras., Maracay, Venezuela, 1984. Memorias. Maracay, Universidad Central de Venezuela. pp.198-199. Span., Illus. [Depto. de Tecnología de Alimentos, Facultad de Ciencias, Univ. Central de Venezuela, Apartado 47097, Caracas 1041-A, Venezuela]

Cassava. Cassava flour. Gelatinization. Processing. Electron microscopy. Analysis. Research. Cassava starch. Venezuela.

The changes that take place in the microstructure of rice, maize, and cassava flours by effect of the gelatinization process, with and without added surfactant, under different temp. and pressure conditions, were studied. The subsequent dehydration to the gelatinization and dextrinization treatments had a minor effect on the microstructure of the starch granules of rice, maize, and cassava flours. No differences were observed among the gelatinization treatments, but some were seen between gelatinization and the dextrinization process in which the micropieces were finer. No differences were observed in the microstructure due to the effect of added surfactant. Illustrations are included. [CIAT]

0152

24709 RAMOS F., J.R.; VILLAMIZAR S., J.C. 1984. Potencial de secado de yuca con aire natural y energía solar en la Costa Atlántica. (Potential of drying cassava with natural air and solar energy on the Atlantic Coast). Tesis Ing.Agr. Bogotá, Universidad Nacional de Colombia. 231p. Span., Sum. Span., 29 Refs., Illus.

Cassava. Drying. Solar drying. Water content. Deterioration. Temperature. Statistical analysis. Statistical data. Colombia.

The potential of drying cassava with natural air and solar energy on the Atlantic Coast of Colombia was evaluated, through the adaptation and validation of a computer program that simulates the drying and deterioration processes and optimizes air flow, determining the min. flow rate required to dry cassava under specific operating conditions before reaching mean deterioration of 15%. Taking into account that the climatic conditions of the region are similar, Zacapa, in the municipality of

Aracataca (Magdalena, Colombia), was chosen as the type station to study the monthly variation in required flow rate. The agitation pattern, drying time initiation, fan operation pattern, and level of supplementary heat, were determined here. Optimum operation of the drying system at a low temp. required that the fan operate continuously, with an av. room temp. increase of 5°C. The process started at 10 a.m. and cassava was mixed every 4 h until MC in the last layer reached 35% humid base. Once the process was complete, the product presented an av. MC of 14% humid base. The range of flow rates required to dry cassava in this region (av. final humidity less than 14% humid base) was between 154.5-260.0, 110.0-150.0, and 68.0-85.0 m^3/min x t for levels of 3, 5, and 10°C supplementary heat, resp., and drying time between 39-52, 33-36, and 26-30 h, resp. The region under study has a good potential for drying cassava with solar energy. [AS-CIAT]

0153

23788 SENG, Y.Y. 1976. Development of a drying system for cassava using a high temperature rotary drier. Mag.Sc. Thesis. Kuala Lumpur, University of Malaya. 230p. Engl., 86 Refs., Illus.

Cassava. Drying. Development. Temperature. Cassava chips. Composition. Water content. Particle size. Costs. Solar drying. Malaysia.

A detailed description is given of a prototype cassava rotary drier; assembly plans and parts are included. The rotary drier is made up of furnace, a drying drum, and a cyclone, with a processing capacity of 3 t/h. Detailed results of the drying expt. are given, including a discussion on the thermic efficiency and temp. profile of the drier. Costs for drying cassava root chips using a rotary drier are compared with those of sun drying. These are comparable; however, artificial drying results in a better quality product. It is necessary to carry out studies on particle size to achieve good chipping, dehydration, and drying performance. Dehydration is an essential process to improve product quality and handling, and reduce drying costs. Performance of the drier was satisfactory but improvements can be made to the pneumatic injection system, the design of distributor and cyclone, and the drum drive. The main difficulty in the expt. was the dehydration process; therefore, it is necessary to design and modify mechanical presses for large-scale dehydration. [CIAT]

See also 0031 0033 0107 0112 0114 0117 0126 0133 0136 0137 0138 0139 0141 0142 0143 0144 0155 0156 0161 0165 0167 0173 0174 0178 0182 0183 0185 0189 0193

I03 Industrial Microbiology

0154

24076 BENDER, H. 1984. Studies on the non-cyclic products of the cyclodextrin glycosyltransferase from Klebsiella pneumoniae M 5 al; isolation and characterization of highly branched clusters from digests with manioc starch. Starch/Stärke 36(2):46-50. Engl., Sum. Engl., Germ., 36 Refs., Illus. [Inst. fur Organische Chemie und Biochemie der Universitat Freiburg i. Br., Albertstrabe 21, D-7800 Freiburg i. Br., Germany]

Cassava. Cassava starch. Enzymes. Analysis. Industrial microbiology. Germany.

From 48 h digests of the starch with cyclodextrin glycosyltransferase, 49.4% of cassava amylopectin was recovered as noncyclic products from Klebsiella pneumoniae M 5 al. Highly branched clusters of different sizes (av. degree of polymerization 26.9-173.0) were obtained by fractionation. The extents of beta-amylolysis varied between 16.6-23.0% indicating that the cyclodextrin glycosyltransferase has left larger parts of unsubstituted (mainly A-), and the exterior B-chains. By debranching with pullulanase and analysis of the linear chains, it was evident that the beta-limit dextrins of the fragments contained populations of longer chains, carrying branching points near the nonreducing chain ends. From the molar distribution of the chains, calculated from the data obtained by quantitative high pressure liquid chromatography, indications of the structure of the branched fragments were obtained. Of the amylopectin, 35% was found to be glucose to maltotetraose, indicating that coupling and disproportionation reactions were negligible even in the course of long-term incubation. The smallest branched saccharides were found to be fragments with 6 D-glucose residues. [AS]

0155

23728 CHANDRASEKARAN, S.; DHAR, S.C. 1983. A low-cost method for the production of extracellular alkaline proteinase using tapioca starch. Journal of Fermentation Technology 61(5):511-514. Engl., Sum. Engl., 12 Refs., Illus. [Biochemistry Laboratory, Central Leather Research Inst., Madras 600 020, India]

Cassava. Cassava starch. Ipomoea batatas. Enzymes. Industrial microbiology. Culture media. pH. India.

Cassava starch was liquefied using beta-amylase of sweet potato by a simple procedure and this cassava starch hydrolyzate was used as an inexpensive source of C for the production of extracellular alkaline proteinase. Of about 45 strains investigated for the production, Streptomyces moderatus NRRL 3150 was found to produce the max. amount of the enzyme. The cassava starch hydrolyzate was found to produce more than some of the conventionally used C sources (glucose, maltose, and soluble starch). The highest amount of extracellular proteinase was obtained on a medium containing 35 g cassava starch hydrolyzate, 20 g SBM, 3 g $CaCO_3$, and 2 g NaCl/l of water between pH 6.0-7.0. Enzyme production was carried out in a lab. fermenter and the max. proteolytic activity was observed after 120 h of cultivation. [AS]

0156

24065 MANILAL, V.B.; BALAGOPAL, C.; NARAYANAN, C.S. 1983. Physico-chemical and microbiological characteristics of cassava starch factory effluents. Journal of Root Crops 9(1-2):27-31. Engl., Sum. Engl., 12 Refs. [Regional Research Laboratory, Council of Scientific & Industrial Research, Trivandrum 695 019, India]

Cassava. Cassava starch. Processing. Small-scale processing. Wastes. Composition. Analysis. pH. Culture media. Biochemistry. Identification. Moulds. India.

The characteristics of the effluents discharged from cassava starch processing industries are discussed. Tabulated results are presented of the physical, chemical, and microbiological analysis of effluent samples from large-scale and small-scale starch factories. The analysis discloses high levels of COD, BOD, reducing sugars, suspended solids, and a heterogeneous group of microorganisms (bacteria, yeasts, fungi, and actinomycetes) in the effluents. Candida sp. and Trichosporon sp. were

identified as the dominant yeasts, suggesting a possible use of effluents for SCP production. [AS]

0157

24051 RAIMBAULT, M.; ALAZARD, D. 1980. Culture method to study fungal growth in solid fermentation. European Journal of Applied Microbiology and Biotechnology 9:199-209. Engl., Sum. Engl., 18 Refs., Illus.

Cassava. Fermentation. Cassava meal. Inoculation. Aspergillus. pH. Temperature. Biochemistry. Protein content. Carbohydrate content. Water content. Industrial microbiology.

A new culture method is described to study the growth of Aspergillus niger on CM in the solid state. This method uses preparations of the cooked starchy substrate as a homogeneous granulated product containing spores, salts, and water. An incubation device aerates the mass with humidified air at a controlled temp. Homogeneous development of mycelia, without sporulation, occurred in the substrate mass. From physiological studies, optimal conditions for A. niger growth on cassava in the solid state were 50-55% moisture, 35°C, a N source comprising 60% ammonium and 40% urea (on a N basis), and 2 x 10^7 spores/g of substrate. Growth kinetics were established and changes in pH, protein, carbohydrate, and water contents were determined during the incubation. Growth rate and yield were quite similar to those described in the literature for A. niger cultivated in liquid media under optimal conditions. [AS]

0158

23006 ROSARIO, E.J. DEL; WONG, R.L. 1984. Conversion of dextrinized cassava starch into ethanol using cultures of Aspergillus awamori and Saccharomyces cerevisiae. Enzyme and Microbial Technology 6(2):60-64. Engl., Sum. Engl., 10 Refs., Illus. [Inst. of Chemistry & National Inst. of Biotechnology & Applied Microbiology, Univ. of the Philippines at Los Baños, College, Laguna 3720, Philippines]

Cassava. Cassava flour. Industrial microbiology. Enzymes. Culture media. Ethanol. Analysis. Philippines.

Aspergillus awamori and Saccharomyces cerevisiae were used to convert dextrinized CF into ethanol. A batch culture of the combined microorganisms produced 4.3% alcohol by wt. from 15% CF slurry in 39 h. Two-stage continuous fermentation was done using A. awamori in an airlift fermenter and yeast in a tower fermenter. A residence time of 12.5 h for the 1st stage resulted in 12.5% sugar concn. and a saccharification efficiency of 88%. A residence time of 5.6 h for the 2nd stage gave an alcohol concn. of 5.3% and a conversion efficiency of starch into ethanol of 72.5%. [AS]

0159

24077 TAN, K.H.; FERGUSON, L.B.; CARLTON, C. 1984. Conversion of cassava starch to biomass, carbohydrates, and acids by Aspergillus niger. Journal of Applied Biochemistry 6(1-2):80-90. Engl., Sum. Engl., 12 Refs., Illus. [Biology/Project Strengthen Laboratory, Winston-Salem State Univ., Winston-Salem, NC 27110, USA]

Cassava. Carbohydrate content. Aspergillus. Culture media. Analysis. Enzymes. Biomass production. USA.

The filamentous fungus, Aspergillus niger, efficiently converted cassava polysaccharides to mycelial mass, simple sugars, and acids during the

course of its growth. A typical 70-ml culture broth containing 2% cassava polysaccharides yielded 0.38 g dry mycelial mass, 1.14 mmol reducing sugars, and 1.17 meq acids at the end of 42 h. About 70% of the initial total carbohydrate in the medium was degraded during the same period. The sugars and acids in the culture broths were analyzed by high pressure liquid chromatography on a single Aminex HPX-87 column at 55°C, using 0.013 N H_2SO_4 as the eluting solvent. Cassava polysaccharides were degraded to oligosaccharides, maltotriose, maltose, and glucose beyond the 20-h growth periods, with maltotriose emerging as the major simple sugar. The appearance of citric, malic, gluconic, succinic, and fumaric acids accounted mostly for the decreasing pH in the growth media. Formation of carbohydrate species in the culture broths was closely related to the biosynthesis and secretion of several carbohydrases by A. niger. The extracellular carbohydrases were separated and identified by chromatofocusing and polyacrylamide gel electrophoresis to be amyloglucosidase (EC 3.1.2.3), alpha-amylase (EC 3.2.1.1), and alpha-glucosidase (EC 3.2.1.20), resp. [AS]

See also 0174

J00 ECONOMICS AND DEVELOPMENT

0160

21192 ALVARADO, M.I.; ELIZONDO, D.; ARAYA, V.M.; ROJAS, M. 1983. Estudio de producción de yuca en Costa Rica. (Study of cassava production in Costa Rica). San José, Costa Rica, Ministerio de Agricultura y Ganadería. Departamento de Servicios Básicos. Doc. B.B.I Serie: Pronóstico de cosecha. 52p. Span., Sum. Span., 3 Refs., Illus.

Cassava. Production. Economics. Costs. Marketing. Post-harvest losses. Costa Rica.

In order to predict cassava production in Costa Rica, studies were initiated to establish overall aspects of the crop, producers, and product commercialization, and to quantify planted area. Among producers, 90.5% live on their own farm and among them, 92.8% own the land. However, these cassava producers only own farms ranging from 1 to 14 ha (80.0%), scarcely use credit, and do not belong to any type of organization. Total planted area in 1982 was 2697.1 ha and expected production for 1983 was 43,603 MT. Most producers (83.2%) sell their product to middlemen, and only 23.0% classify and clean their product before selling it. Postharvest losses amount to only 8.81% of which 5.06% is due to mechanical damage. [CIAT]

0161

24574 ANANG, K.A. 1978. Menentang sistim ijon. [Against the ijon system (crop prepayment at preharvesting time)]. Berita Pajak 12(551):22-23. Indon., Illus.

Cassava. Pellets. Production. Cassava starch. Economics. Trade. Marketing. Indonesia.

The National Sumatra Pelletizing Trading Company was created in 1972; production started in 1974. The production capacity of the factory is 90,000 t cassava pellets/yr, for which 78 permanent workers and 200-400 seasonal workers are required; its production highly depends on the availability of the raw material. The product is exported to the

Netherlands, West Germany, Taiwan, and Hong Kong. In 1974, 1975, 1976, and 1977, the exports were 46,083, 87,816, 39,633, and 46,907 t, resp. After 1976, the demand for fresh cassava increased because of the creation of cassava starch factories; this reduced the exports of pellets and increased the price of fresh cassava as well. The increase in price and demand led to the purchase of fresh cassava by middlemen before harvesting, a system that did not favor the farmers pricewise. However, the National Sumatra Pelletizing Trading Company is against this marketing system and buys the raw material directly from the farmer. In order to compete with other companies, the company is also planning on having its own cassava plantation. [CIAT]

0162

23036 ATEGA, P.C.; BAENTE, C.M.; REDONDO, T.R. 1979. Cassava socio-economic and marketing study. 9. Western Mindanao. Los Baños, Laguna, Philippines, Philippine Council for Agriculture and Resources Research. 60p. Engl., Illus.

Cassava. Economics. Production. Costs. Income. Prices. Marketing. Productivity. Socioeconomic aspects. Distribution. Philippines.

The results of a cassava socioeconomic and marketing study in the Philippines are presented, based on official production data and on a survey among 106 cassava producers and 40 buyers located in the areas of Katipunan, Polanco, Sinuyak, and Dipolog City in North Zamboanga; Ipil, Molave, Midsalip, Tukuran, Labangan, San Pablo, San Miguel, Dumalinao, Aurora, Ramon Magsaysay, and Pagadian City in South Zamboanga; and in the districts of Tungawan, Lubigan, and Tarlangit in Zamboanga City. The socioeconomic part describes land tenure, age and size of households, education, occupation of women and other members of the household (including children), aspects referring to the dwelling itself, and indicators of life status of the producers. Regarding production, discussion covers cultivated var., yields, cost components (labor, investment, chemical fertilizers), and origin of incomes. Marketing aspects include vol. sold, type of product (fresh, dry, ground, and cooked cassava), prices received, practices prior to selling and costs, marketing investment and cost, middlemen, marketing channels, and availability of services and facilities (credit, technical assistance, and associated problems). Problems requiring more attention include formal education, working opportunities, use of fertilizers and chemicals, credit, technical assistance, and information on prices. [CIAT]

0163

23730 ATIKUL, J. 1978. An econometric model of Thai cassava. Bangkok, Thailand, National Institute of Development Administration. School of Development Economics. 225p. Engl., Sum. Engl., 17 Refs., Illus.

Cassava. Economics. Production. Productivity. Cultivation. Costs. Trade. Marketing. Cassava flour. Cassava chips. Pellets. Cassava meal. Waste utilization. Consumption. Prices. Mathematical model. Thailand.

An econometric model was constructed to examine the basic structural relationship in the Thai cassava economy. The model included production and land use, exports, domestic consumption and inventory, and prices; it had 67 endogenous variables and 21 exogenous variables in 67 equations. The model was subjected to 2 standard tests: the error and multiplier analyses. Results and analyses of the use of the model show that the production of cassava is increasing rapidly. During 1952-75, the vol. of production increased at an av. annual rate of 19.2% and the area of cultivation rose

26.4%/yr. The model predicted that the production of cassava would continue to grow, though with a lower av. rate (16.46%), during 1975-81. Land area planted to cassava increased rapidly but at a lower rate (13.38%) than that during the sample period. However, there was a strong indication for a need to encourage increased yields rather than area expansion. Cassava is a recent export crop. The model showed that it will continue to be a major foreign exchange earner. However, the growth of cassava export was estimated to be on decline. The av. rate of growth of cassava exports from 1975 to 1981 was estimated to be 17.55%, as compared with 25.09% during 1956-76. Furthermore, there was also a clear tendency for export, and hence production, to be specialized in pellets. CF was the 2nd major exporting item but its significance is much less than that of pellets. The effect of an increase in import tariffs on Thai cassava product was substantial. The major problems of cassava exports were found to be the quality of cassava products and export prices. Domestic wholesale prices of cassava strongly and positively correlated with export prices while the farm prices showed negative correlation with export prices. In relation to domestic consumption and inventory, there seemed to be no accurate way to estimate them. Therefore they were treated as residuals. The model did not predict major increases in these items. Finally, the following policy recommendations were implied as a result of the study: (1) More intensive cassava cultivation should be promoted by encouraging increased use of fertilizers; this is related to the government agricultural price policies. (2) New markets should be found and products diversified. Research on the possible uses of various parts of cassava should be undertaken. Furthermore, EEC agricultural policy was found to be a major factor limiting Thai cassava exports; therefore efforts should be made to strengthen the bargaining power in the Thai cassava trade. (3) The cost of cassava exports should be reduced by expanding government supportive facilities such as those related with loading and shipping. [AS (extract)]

0164

24581 AZMANSYAH, Dt. A. 1978. Purbaganda yang terbaik se sumut. Calon produsen tapioka. [Candidate for producing tapiocas: Purbaganda, the best of northern Sumatra (Indonesia)]. Trubus no.100:69-70. Indon., illus.

Cassava. Cassava starch. Tapiocas. Development. Indonesia.

In 1977, Purbaganda, in the Province of Northern Sumatra, Indonesia, was selected as the best village in the province because of its development, achieved through mutual aid of the village community. The total area of the village consists of 615.5 ha, out of which 121.0 are for irrigated rice fields, 80.0 for nonirrigated rice fields, 111.5 for other crops, and 103.0 for housing; the rest (200.0 ha) are dry land. The village also has a 14-ha cassava plantation and intends to produce cassava starch, for which it ordered the required machinery from the government. [CIAT]

0165

22325 BARRIOS B., D.D.; CALDERON D., R.A. 1980. La yuca: su producción y comercialización en Panamá. (Cassava: its production and commercialization in Panama). Tesis Lic. Comercio. Panamá, Universidad de Panamá. 248p. Span., 23 Refs.

Cassava. Cultivars. Production. Cultivation. Industrialization. Cassava products. Cassava starch. Processed products. Fresh products. Roots. Cassava flour. Dextrins. Adhesives. Costs. Prices. Economics. Labor. Processing. Washing. Pressing. Rasping. Screening. Silting. Drying.

Industrial machinery. Cassava meal. Cassava chips. Grinding. Packaging. Storage. Consumption. Trade. Panama.

In a comprehensive study of cassava production and commercialization in Panama, main crop characteristics and production and marketing problems were identified; factors limiting cassava production in the country were also detected. Industrial installations for cassava processing are described in terms of capacity, localization, planted area, infrastructure, production process, investment and required financing; their problems are also discussed. Domestic and international markets are analyzed as well as the production forms of fresh cassava, flour for human and animal consumption, cassava chips, and frozen cassava. A project for establishing a cassava plant to produce starch and dextrine for the manufacture of adhesives is described. It was found that most cassava farmers use traditional technology and are small farmers with scarce resources and whose main activity is cassava cultivation. Soils, in general, present low, intermediate, and high contents of N, P, and K, resp. Ninety-five % of the cassava crop costs correspond to labor and land costs; weeding uses the greatest amount of labor. Flour obtained to date presents bacteriological problems and consumption risks. Research should be conducted on cassava production systems, economic weed control methods, factors affecting yields, and impact of introduced technology. The program to encourage cassava production must be developed parallel to industrialization projects. Also, it is recommended to (1) create a legal instrument to promote the use of CF in breadmaking, (2) carry out studies on methods of manufacturing CF to maximize its yield and on its use in the manufacture of sweet pasta, and (3) train personnel. Wheat and maize imports should be substituted with CM. It is suggested to restructure the production objectives of the plants of Montijo and Los Pozos. [CIAT]

0166

22083 BASLER, A. 1983. Maniok für die menschliche ernährung — eine sektoranalyse unter besonderer berücksichtigung Afrikas südlich der Sahara. (Cassava for human consumption—a sectoral analysis with particular reference to Africa south of the Sahara). Berichte über Landwirtschaft 61(4):548-588. Germ., Sum. Germ., Engl., Fr., 42 Refs., Illus. [Inst. für Landwirtschaftliche Marktforschung, Bundesforschungsanstalt für Landwirtschaft Braunschweig-Völkenrode, Bundesalle 50, 3300 Braunschweig, German Federal Republic]

Cassava. Plant geography. Production. Consumption. Economics. Processing. Marketing. Development. Cassava products. Prices. Costs. Starch crops. Trade. Uses. Africa.

Despite the fact that cassava is the main subsistence crop in many African countries, Brazil, and Thailand, yields/ha have been falling in recent years. On av. more land and more working hours were used in 1980 to produce the same quantity produced in 1960. A major obstacle to increased use of cassava for human consumption is the lack of adequate processing and marketing facilities. A better use of the nutritional potential of this crop would require an integrated program that included breeding of better var., modernization of cultivation techniques and use of plant protection, the setting up of processing units producing CF, the introduction of CF to urban wholesalers, development of a protein-enriched mixed flour based on cassava, the provision of advisory services to apply these new technologies in local food industries, and the adjustment of consumer prices to make locally produced cassava products cheaper than imported wheat products. [World Agricultural Economics and Rural Sociology Abstracts]

0167

24735 BENVENUTI, G. 1976. La yuca: técnica del cultivo y usos. (Cassava: crop technology and uses). Ecuador, Ministerio de Agricultura y Ganadería. Programa de Tubérculos y Raíces. Proyecto FAO-ECU/71/522. 39p. Span., 7 Refs., Illus.

Cassava. Plant geography. Agronomic characters. Plant anatomy. Cultivation. Climatic requirements. Temperature. Rainfall data. Light. Soil physical properties. pH. Nutritional requirements. Toxicity. Roots. Cultivars. Soil analysis. Land preparation. Cuttings. Propagation. Planting. Cultivation systems. Inter-cropping. Spacing. Timing. Fertilizers. Water requirements (plant). Weeding. Herbicides. Erinnyis ello. Coelosternus. Silba pendula. Bemisia. Mononychellus. Tetranychus urticae. Oligonychus peruvianus. Thrips. Atta. Rosellinia. Xanthomonas campestris pv. manihotis. Cercosporidium henningsii. Cercospora caribaea. Oidium. Colletotrichum manihotis. Cassava African mosaic virus. Cassava common mosaic virus. Cassava vein mosaic virus. Pruning. Harvesting. Root productivity. Storage. Rotational crops. Uses. Leaves. Vitamin content. Ecuador.

To promote cassava cultivation in Ecuador, a detailed monograph on its cultivation and uses is presented. Regarding cultivation, aspects on the plant, climate and soil requirements, root toxicity, planted var., and crop management are described. Lists of different herbicides (dose and form of application) and of main pests are included, and the different uses that can be given to cassava (leaves, branches, stems, and roots) are discussed. [CIAT]

0168

22700 BERNAL DE GOMEZ, R. 1984. Evaluación de un plan de transferencia de tecnología agrícola distrito San Juan del Cesar. (Evaluation of an agricultural technology transfer plan for the San Juan del Cesar district). Tibaitatá, Colombia, Instituto Colombiano Agropecuario. Boletín de Investigación no.69. 76p. Span., 16 Refs. [Inst. Colombiano Agropecuario, Sección de Investigación en Comunicación, Tibaitatá, Apartado Aéreo 151123, El Dorado, Bogotá, Colombia]

Cassava. Technology. Technology evaluation. Technology transfer. Statistical analysis. Socio-economic aspects. Cultivars. Productivity. Cuttings. Mite control. Acaricides. Timing. Weeding. Herbicides. Colombia.

The Instituto Colombiano Agropecuario (ICA) designed a technology transfer plan to train farmers of the San Juan del Cesar district, Guajira, on seed selection and disinfection and pest and weed control; the increase of knowledge acquired by farmers participating in the plan would also be determined. The hypothesis, methodology, population, variables, data collection techniques, and statistical analyses are described in detail. Age of 88.5% of the users ranged between 31-70 yr and 65.4% are literate. Knowledge on seed selection and disinfection and mite and weed control increased considerably. All practices were adopted after the plan was completed. Before the execution of the plan, information sources used by the farmers were family, friends, and ICA technicians, in that order; after the plan, this order was inverted. Communication media used in the technology transfer plan included visits to the farms, demonstration of methods and results, circular letters, information bulletins, rural newspaper, billboards, and a mobile public address system; combined use of these media contributed to the success of the plan. Age, scholarity, or farm size did not affect technology adoption. It is recommended to broaden transfer plans in the entire southern area of the dept. of Guajira. In designing transfer plans, analysis of available media and human and economic resources must be kept in mind. Communication media preferred by

users must be selected. It is recommended to promote these transfer plans not only in the agricultural area but also in the cattle raising area. Visits to farms constitute one of the most effective means in the southern Guajira zone. It was proved that the users consult written media when technicians are not available. [CIAT]

0169

23425 BOX, L. 1984. Cuadros preliminares: encuesta de yuca. (Preliminary results of a cassava survey). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 59p. Span., Sum. Span. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Bitter cassava. Sweet cassava. Cultivars. Cultivation. Socio-economic aspects. Productivity. Economics. Dominican Republic.

In the regions of Moca and Monción, Dominican Republic, 247 sweet and bitter cassava producers were surveyed. Both populations are quite different and a sample was selected from each to compare socioeconomic, agronomic, and animal husbandry data. Different tables are presented on crop, land, cultivated var., inputs, and productivity. [CIAT]

0170

24717 BOX, L. 1982. Food, feed or fuel? Agricultural development alternatives and the case for technological innovation in cassava (Manihot esculenta Crantz) cultivation. Quarterly Journal of International Agriculture 1982 (Special issue):34-38. Engl., 37 Refs.

Cassava. Development. Cassava programs. Research. Uses. Human nutrition. Animal nutrition. Economics.

The case of cassava is used to demonstrate 3 different types of development, depending on its use, each with its own rationalization and its own groups of interest: (1) as food for humans (small producers), (2) as animal feed (livestock in temperate zones), (3) as fuel substitute (in view of petroleum prices). Recent history of technological development is outlined in terms of CIAT's achievements. Based on this experience, an argument is presented in favor of an adaptive research approach which considers the need to remember small farmer conditions. The dominant model in the development policies of the countries is oriented toward the urban sector causing technological innovation to be directed toward the selection of particular crops, farmers, and crop utilization. CIAT's Cassava Program has placed more emphasis on animal feed than on human food, with fuels at an intermediate position. However, since 1980 the priority of var. selection or plant breeding has decreased in comparison with the development of cultural practices; the research team is dedicated to conduct research on and develop alternative cropping systems for small farmers. The adaptive research approach is discussed as an alternative for agricultural development. [CIAT]

0171

23779 BRUINSMA, D.H.; WITSENBURG, W.W.: WURDEMANN, W. 1983. Cassava. In _____. Selection of technology for food processing in developing countries. Wageningen, Netherlands, Centre for Agricultural Publishing and Documentation. pp.113-158. Engl., 47 Refs., Illus.

Cassava. Cultivation. Uses. Food products. Nutritive value. Toxicity. Trade. Marketing. Cassava chips. Cassava products. Pellets. Cassava starch.

Gari. Processing. Technology evaluation. Washing. Peeling. Rasping. Screening. Sifting. Drying. Tapiocas. Small-scale processing. Factories. Industrialization. Labour. Production. Economics. Socio-economic aspects. Fermentation.

Aspects of cassava food processing in various countries are thoroughly reviewed. Cassava planting and its uses as foodstuff, as well as its nutritional and toxicity values, are discussed. World marketing and supply of raw materials are described. Aspects of the basic process and of small-, medium-, and large-scale processing of cassava starch are covered as well as the processing of chips and pellets; available starch, chip, and pellet production technologies are evaluated and revised. Technical, ecological, economic, and sociopolitical aspects are discussed. Gari production systems (traditional, post-traditional, and modern) are presented and these techniques are evaluated from the economic, administrative, and social points of view. [CIAT]

0172

23426 CAPELLAN H., P.J.; PEREZ C., L.E. 1983. Estudio económico sobre el costo de producción de la yuca amarga para diferentes niveles tecnológicos. (Economic study of the cost of production of bitter cassava for different technological levels). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 40p. Span. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Cultivation. Production. Technology. Economics. Land preparation. Cultivation systems. Cuttings. Fertilizers. Insecticides. Planting. Weeding. Harvesting. Distribution. Cultivars. Bitter cassava. Productivity. Casave. Costs. Socio-economic aspects. Inter-cropping. Income. Marketing. Dominican Republic.

Between April-May, 1982, 49 bitter cassava producers of the region of Monción, Dominican Republic, were interviewed to find out production costs and the variations of such costs depending on the level of technology. Costs of bitter cassava estimated by the producers of La Sierra are 2.74 times higher than the production cost estimated and used by the Secretaría de Agricultura and the Banco Agrícola to finance cassava planting; these production costs can be reduced by plowing with oxen and planting cassava in association with other crops. If the labor used in the production process is family labor, crop profitability is DR$43.13/tarea (1 tarea = 0.6 ha) at a market price of $5.00/quintal (1 quintal = 45.5 kg). If paid labor is used, 93.10% of the expenses are absorbed by this cost and the net benefit is negative. Market insecurity and low cassava prices are 2 problems that severely affect cassava producers of La Sierra. Market surveys should be conducted to determine support prices that guarantee that the bitter cassava producer can sell his product with a margin of profit. [CIAT]

0173

23761 CARVALHO, L.E. 1982. Pesquisa tecnológica no desenvolvimento agroindustrial e comunitário. (Technological research in agroindustrial and communal development). Alimentacao & Nutricao. Marzo 1983:30-32, 34-36. Port., illus.

Casrava. Cassava meal. Development. Socio-economic aspects. Research. Technology. Small-scale equipment. Marketing. Economics. Technology transfer. Brazil.

The experience of a farinha agroindustrial community module project, conducted in the Sapezinho community (San Felipe, Brazil) during 1979-81, is reported. The project faced numerous obstacles due to the difficulty in adapting a technological research center to this new situation, methodology, and objectives. However, results are highly positive for an integrated rural development project that has introduced technological change at the intermediate level in the regional cassava community, serving as a development and technology transfer center for producers. Development of projects of this nature at the farm level for other commodities is recommended. [CIAT]

0174

22345 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1983. Two decades of research: 1963-1983. Trivandrum, India. Publication no.6. 223p. Engl., Illus.

Cassava. Cassava programs. Development. Research. Genetics. Cytogenetics. Germplasm. Plant breeding. Hybrids. Cultivation. Land preparation. Planting. Cuttings. Spacing. Timing. Nutritional requirements. N. P. K. Irrigation. Agricultural lime. Root productivity. S. Salinity. Cultivation systems. Inter-cropping. Mycorrhizae. Plant physiology. Root development. Growth. Developmental stages. Plant development. Diseases and pathogens. Cassava African mosaic virus. Cercosporidium henningsii. Fusarium. Pseudomonas. Tissue culture. Apical meristems. Plant growth substances. Eutetranychus orientalis. Oligonychus biharensis. Tetranychus cinnabarinus. Acaricides. Thrips. Rodents. Bemisia. Aonidomytilus albus. Uses. Cassava chips. Small-scale equipment. Processing. Roots. Deterioration. Storage. Vascular streaking. Moulds. Cyanogenic glucosides. Toxicity. Biochemistry. Alcohol. Fermentation. Cassava starch. Protein enrichment. Food products. Feeds and feeding. Statistical analysis. India.

Research activities of the Central Tuber Crops Research Institute in Trivandrum, India, from 1963 to 1983, are summarized, covering historical perspective, genetics, cytogenetics and breeding, crops and soils, physiology, pathology, entomology, technology, extension education, and the regional center in Bhubaneswar. Objectives proposed for the center included improvement of yield, quality, and pest and disease resistance of root and tuber crops, among them cassava with relation to CAMV, Cercosporidium henningsii, Fusarium sp., Pseudomonas sp., Eutetranychus orientalis, Oligonychus biharensis, Tetranychus cinnabarinus, Retithrips syriacus, Bemisia tabaci, Aonidomytilus albus, Araecerus fasciculatus, and rodents. Technology emphasizes the processing of cassava chips, manual equipment to cut cassava, postharvest root deterioration. vascular streaking, microorganisms associated with root deterioration (Rhizopus oryzae), techniques to lengthen the shelf life of cassava, cyanogenic glucosides, effects of processing on glucosides, and cassava utilization in human and animal nutrition and for industrial purposes. The training and extension process as well as statistic, biometric, and econometric studies are described in detail. [CIAT]

0175

23780 GOMEZ F., I. 1984. El cultivo mecanizado de yuca, como aportación en el nuevo horizonte alimentario mexicano. (Mechanized cassava cultivation as a contribution to the Mexican food horizon). México, Secretaría de Agricultura y Recursos Hidráulicos. 22p. Span.

Paper presented at Seminario Nacional sobre Yuca, Perspectivas del cultivo en México, 1o., México, 1984.

Cassava. Cultivation. Mechanization. Socio-economic aspects. Labour. Intercropping. Cultivation systems. Costs. Economics. Planting. Spacing. Agricultural equipment. Distribution. Development. Uses. Mexico.

The current cassava production problems in Mexico are discussed, with emphasis on labor and the need for mechanization. The potential of cassava for its production in intercropping systems, using the ridge-alley system (double rows), is analyzed. The bases for proper management of a central office for cassava machinery are discussed. The proposed operations for the mechanization include the construction of a road infrastructure as far as the cassava crops, land preparation, planting, irrigation, herbicide and fungicide applications, supervision, integrated harvest, and the transportation of the product from the field to the agroindustry. It is recommended to eliminate within the form of cassava exploitation the system of employing by the day, and to take advantage of the whole plant. [CIAT]

0176

24739 JACKSON, J.C. 1968. The Chinese tapioca industry. In _____. Planters and speculators: Chinese and European Agricultural Enterprise in Malaya 1786-1921. Kuala Lumpur, Malaysia, University of Malaya Press. pp.52-83. Engl., 66 Refs.

Cassava. Economics. Industrialization. Development. Cultivation. Cultivation systems. Shifting cultivation. Factories. Power sources. Swine. Animal nutrition. Prices. Legal aspects. Trade. Marketing. Cassava products. Cassava flour. Tapiocas. Socio-economic aspects. History. China.

A brief historical overview of the introduction, cultivation, and processing of cassava in China is presented. The cultivation system and planting of cassava in Malacca (1850-96) and in other parts of Western Malaya, and the expansion toward Negri Sembilan between 1875-1901 are described. Finally, the socioeconomic characteristics of the cassava industry in China, the colonization based on the planting of cassava, and the decline in the planting of cassava in the country as a result of different governmental policies during early XX century are discussed. [CIAT]

0177

24727 JARA, R. 1985. Análisis comparativos físicos y económicos de los principales rubros explotados a nivel nacional correspondientes a las campañas agrícolas 1982/83-1983/84. (Comparative physical and economic analyses of the main items exploited at the national level corresponding to the 1982/83-1983/84 agricultural campaigns). San Lorenzo, Paraguay, Ministerio de Agricultura y Ganadería. Servicio de Extensión Agrícola Ganadera. Proyecto de Tecnología para Pequeños Agricultores. 19p. Span., Sum. Span., 2 Refs.

Cassava. Economics. Prices. Costs. Income. Paraguay.

The Rural Administration Subprogram of Paraguay was partially evaluated at the national level, during 2 agricultural campaigns (1982-83 and 1983-84), and during the same period the physical and economic results of 9 crops (cassava, cotton, maize, bean, groundnut, onion, rice, watermelon, and sugar cane) were analyzed. For the 1st campaign, the data were extracted from the records and analyses of the rural enterprise of a total of 352 producers and 6 regional rural development centers (Ybycuí, Caacupé, Cnel. Bogado, Itá, Pilar, and San Juan Bta. Misiones), including a total of 32 agencies and 34 paratechnicians. For the 1983-84 agricultural campaign, the data were taken from 540 producers and 7 regional rural development centers (Ibycuí, Caazapá, Cnel. Bogado, Itá, Pilar, San Juan Bta. Misiones,

and Caacupé) with a total of 48 agencies and 54 paratechnicians. All the crops increased their harvested area and their total production by 89%; cassava increased by 65%. The total cost, gross income, net income, and income return ratio of cassava increased by 39, 49, 52, and 5%, resp. The gross income and total net income in real values increased for all crops by 27 and 41%, resp., which indicates an economic advance achieved by the producers. [AS-CIAT]

0178

22032 JOHNSON, B.B. 1981. Necessidades sociais, P & D e potencialidades da mandioca do PROALCOOL. (Social needs, production and development, and potential of the cassava of PROALCOOL). Sao Paulo-SP, Brasil, Universidade de Sao Paulo. Programa de Administracao em Ciencia e Tecnologia. 27p. Port., Sum. Port.

Paper presented at Simposio de Pesquisa em Administracao de Ciencia e Tecnologia, 6o., Sao Paulo, 1981.

Cassava. Development. Economics. Socio-economic aspects. Income. Technology. Technology transfer. Alcohol. Production. Processing. Uses. Cultivation. Productivity. Industrialization. Brazil.

The social and economic feasibility of cassava cultivation, especially in NE Brazil, is discussed. Technological projections are given to show the importance of this option in the National Alcohol Program (PROALCOOL) and the need to pay more attention to the agricultural and industrial technological development of cassava. [AS-CIAT]

0179

24572 JOHNSON, I.M.; KEMP, D.C.; PAYNE, P. 1981. Mechanisation of cassava production. Bedford, England, National Institute of Agricultural Engineering. Overseas Division. 17p. Engl., Sum. Engl. [Overseas Division, National Inst. of Agricultural Engineering, Wrest Park, Silsoe, Bedford, England]

Paper presented at International Workshop on Cassava, Bangkok, Thailand, 1981.

Cassava. Agricultural equipment. Development. Cultivation. Mechanization. Weeding. Harvesting. Economics. Planting.

A general outline is given of the options for mechanizing the various stages of cassava production up to transporting to the factory. Harvesting constitutes the main problem for mechanization at the present. As a harvesting aid, the CIAT blade is cheap and effective in drier soils, whereas for wet soils elevator diggers have proved the most reliable. Plant breeding could ease the harvesting problem, particularly to reduce the spread of roots, and line planting, preferably by machine, is essential for mechanical harvesting. Finally, the case history of the development of a cassava planter and harvester by Agri Projects International is given. [AS]

0180

24713 MacBAILEY, F.E. 1983. The social and cultural factors involved in production by small farmers in Cameroon of plantain and cassava and their marketing. Paris, United Nations Educational, Scientific and Cultural Organization. Division for the Study of Development. Reports/Studies no.21. 87p. Engl., 10 Refs., Illus.

Cassava. Economics. Socio-economic aspects. Cultivation. Land preparation. Cultivation systems. Marketing. Cameroon.

A brief overview of Africa's food production situation is presented, and cassava and plantain producing regions in Cameroon are described in terms of history, climatic requirements, and national economy. The situation of the Cameroonian farmers in relation to land use patterns, size of landholdings, and living conditions is analyzed. Production processing and marketing of cassava and plantain, structural and cultural factors involved, technical knowledge, and use of farm equipment are discussed. Finally, social relations of production, work organization, types of labor used (family, work team, or community labor), coordination of tasks, and management are considered. Recommendations are made regarding government policy on food crop production, farmer education, infrastructural development, agricultural research and extension. [CIAT]

0181

23775 NGHIEP, L.T.; LYNAM, J.K. 1985. The impact of improved cassava technology on small farming in Colombia. In Ohkawa, K.; Ranis, G., eds. Japan and the developing countries: a comparative analysis. Tokyo, International Development Center of Japan and the Economic Growth Center of Yale University. pp.110-131. Engl., 3 Refs.

Cassava. Cultivars. Cultivation. Income. Economics. Technology. Cultivation systems. Inter-cropping. Maize. Prices. Costs. Labour. Harvesting. Timing. Marketing. Fresh products. Cassava starch. Fallowing. Soil fertility. Technological package. Planting. Spacing. Cuttings. Technology transfer. Fertilizers. Productivity. Mathematical model. Colombia.

An attempt to specify potential impact of new cassava var. on cropping patterns, farm incomes, participation of production factors, and supply of food and farm products for industrial use is presented with emphasis on small farms and based on data obtained in Media Luna, Colombia. A linear programming model is used in which a representative farmer maximizes his agricultural income by allocating his family labor and land among different crops. Impacts of improved cassava technology are derived by comparing solutions of the model with and without technology. In the case of traditional technology, technical coefficients of cassava var. and alternative crops and market constraints are based on data from a farm survey conducted in Media Luna. Yields, labor input, and fertilizer input/ha for improved technology are summarized on the basis of several interim results obtained by CIAT's Cassava Program. The model consists of 21 activities, 1 objective function, 9 labor constraints, 9 land constraints, and 9 market constraints. The main effect of improved cassava technology is the increase in effective area of cultivated land, followed by an increase in labor demand. The process of substituting fallow land by fertilizer use would increase labor productivity and farm incomes, and at the same time would allow the supply of food (fresh cassava, maize) and raw materials for industrial use (cassava and sesame). Improved cassava technology, expected to have the described impacts, would adjust to the small-scale component of the agricultural development strategy for Latin American countries. [CIAT]

0182

24081 PARAGUAY. MINISTERIO DE AGRICULTURA Y GANADERIA. SERVICIO DE EXTENSION AGRICOLA GANADERA. 1985. Informaciones básicas sobre la mandioca en el Paraguay. (Basic information on cassava in Paraguay). San Lorenzo. 25p. Span., 13 Refs.

Cassava. Cultivation. Climatic requirements. Temperature. Rainfall data. Soil physical properties. pH. Land preparation. Timing. Planting. Spacing. Cultivars. Cuttings. Weeding. Diseases and pathogens. Injurious insects. Injurious mites. Insect control. Storage. Harvesting. Root productivity. Cultivation systems. Inter-cropping. Production. Costs. Prices. Consumption. Marketing. Cassava products. Cassava starch. Development. Paraguay.

A detailed preliminary diagnosis is presented on different aspects of cassava in Paraguay. Climate and soil conditions, and cultural practices used are described. Total supply and demand vol., prices for 1982, 1983, and 1984, and data on cassava production costs and productivity are presented. The country produces excess cassava that could be used for crop industrialization and diversification. Principal cassava research areas include var. characterization and classification; their response to NPK, pests, diseases, and low fertility acid soils; var. performance in different ecosystems and in association with oth species; and harvesting methods. Postharvest aspects such as storage systems, DM determination, and var. resistant to deterioration should be studied. It is proposed to carry out trials in pilot plants on natural cassava drying for feed concentrates and on the manufacture of cassava bread flour, and to study starch extraction and drying methods, the use of their by-products, the economic feasibility of alcohol production, and the perspectives of the domestic and foreign trade of by-products. [CIAT]

0183

23498 PHILIPPINE COUNCIL FOR AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT. 1983. The Philippines recommends for cassava. Los Baños, Laguna. Technical Bulletin no.19-A. 70p. Engl., 39 Refs., Illus.

Cassava. Cultivation. Climatic requirements. Temperature. Rainfall data. Soil requirements. Cultivars. Land preparation. Planting. Cuttings. Timing. Spacing. Weeding. Fertilizers. N. P. K. Zn. Mg. S. Tetranychus telarius. Tetranychus kansawai. Saissetia nigra. Noxious animals. Cercosporidium henningsii. Cercospora caribaea. Xanthomonas campestris pv. manihotis. Fomes lignosus. Harvesting. Roots. Storage. Processing. Cassava products. Cassava starch. Cassava chips. Tapiocas. Pasta. Tapioca macaroni. Uses. Alcohol. Waste utilization. Economics. Income. Costs. Philippines.

Recommendations for the production and processing of cassava in the Philippines are given. Climate (temp., precipitation, and alt.) and soil requirements are indicated. Recommended cv. PRC-24, PRC-13, Hawaiian 5, Datu 1, and Lakan 1 are described. Recommendations for soil preparation, planting, planting time and spacing, cutting treatment, weeding, and fertilization are presented. Mite damage is described and control measures are given for Tetranychus telarius and T. kansawai. Important insects include Chrysomphalus ficus, Saissetia nigra and S. coffeae; other pests include rats and wild boars. The diseases caused by Cercosporidium henningsii, Cercospora caribaea, Xanthomonas campestris pv. manihotis, and Fomes sp. are described. Recommendations are presented for root harvest and storage. The production of starch, chips (gaplek), tapiocas, noodles, and food for humans and feed for animals are discussed. Alcohol production is highlighted among the industrial uses of cassava; its process is described as well as the utilization of by-products such as bagasse, leaves, stems, and stem pith. Cassava production costs and net returns are given. Appendixes include recipes, animal rations, and recommendations in case of pesticide poisoning. [CIAT]

0184

24577 PROVERBS, G. 1985. Why cassava production in Barbados. In Seminar on Cassava Production, St. Thomas, Barbados, 1985. Papers presented. St.

Michael, Barbados, Caribbean Agricultural Research and Development Institute. pp.6-8. Engl. [Caribbean Agricultural Research & Development Inst., Cave Hill Campus, St. Michael, Barbados]

Cassava. Production. Mechanization. Cultivation. Planting. Harvesting. Drying. Feeds and feeding. Swine. Poultry. Barbados.

The history of cassava cultivation in Barbados is briefly discussed. Reasons to increase its production are presented and analyzed, the main one being the substitution of cassava for imported maize in animal feed. However, there are some constraints that make cassava production not economically competitive. Work carried out by the Caribbean Agricultural Research and Development Institute, the Barbados Agricultural Development Corporation, the Barbados Sugar Industries Limited, and the Ministry of Agriculture, to overcome these constraints, is mentioned. [CIAT]

0185

23451 SANARRUSIA V., E. 1983. Estudio analítico sobre situación y expectativas del cultivo de yuca en Costa Rica. (Analytical study of the situation and expectations of cassava cultivation in Costa Rica). San José, Costa Rica, Ministerio de Agricultura y Ganadería. Dirección de Mercadeo Agropecuario. 54p. Span.

Cassava. Cultivation. Socio-economic aspects. Technology. Economics. Consumption. Trade. Prices. Cassava meal. Fresh products. Roots. Storage. Uses. Human nutrition. Animal nutrition. Cassava chips. Drying. Costs. Labour. Cassava flour. Composite flours. Bakery products. Development. Costa Rica.

A preliminary program is presented with solutions to avoid the economic and social consequences of cassava overproduction in Costa Rica in late 1983. The case of overproduction, estimated to be 30,783 MT, originated in 1982 when the low production did not supply the external market, with considerable increases in prices and high incomes for producers, in addition to promotion by interested foreigners. The internal and external markets are analyzed and possible solutions are given on how to use the surplus for human food, animal feed, and industrial purposes. An analysis is made of the reopening of a cassava chip dehydration plant, a proposal made by exporters to increase exports, production of CF for breadmaking, and of an indemnity plan for cassava producers. [CIAT]

0186

23783 SANINT, L.R. 1983. Demand for carbohydrate foods in Colombia and Venezuela. Washington, D.C., United States Department of Agriculture. Economic Research Service. Foreign Agricultural Economic Report no.187. 27p. Engl., Sum. Engl., 67 Refs.

Cassava. Economics. Consumption. Trade. Rice. Maize. Wheat flour. Potatoes. Banana-plantains. Colombia. Venezuela.

The changes in availability and consumption of 6 staple carbohydrate foods (wheat, maize, potatoes, rice, cassava, and plantains) in Colombia and Venezuela were analyzed. The study period covered 1956-77 and 1959-77 for Colombia and Venezuela, resp., during which remarkable increases in rice production occurred in both countries. Retail rice prices fell compared with other carbohydrates (except wheat flour) and consumers more than

doubled their consumption of rice. Yet both countries continued to increase their imports of U.S. wheat and maize. The study explains that the increase in rice consumption was mostly due to its favorable price and rising consumer incomes. Although Venezuelan consumers did substitute rice for such traditional staples as potatoes, cassava, and plantains, substitution of domestically produced rice for imported wheat and maize was minimal in both countries. [AS]

0187

23784 SANINT, L.R. 1983. A statistical and methodological supplement to demand for carbohydrate foods in Colombia and Venezuela. Washington, D.C., United States Department of Agriculture. Economic Research Service. International Economics Division Staff Report no.AGES830718. 42p. Engl., Sum. Engl., 67 Refs.

Cassava. Economics. Statistical analysis. Statistical data. Prices. Trade. Consumption. Income. Costs. Food energy. Rice. Maize. Wheat flour. Potatoes. Banana-plantains. Colombia. Venezuela.

A complete description of data, definitions, sources, and methods used in analyzing carbohydrate demand in Venezuela and Colombia from 1956 to 1977 is presented. The 6 staples studied were rice, maize, wheat, potatoes, cassava, and plantains. Remarkable increases in rice production have occurred in Colombia and Venezuela during the past 25 yr. Retail rice prices fell compared with other carbohydrates (except wheat flour) and consumers more than doubled their consumption of rice. Yet both countries continued to increase their imports of U.S. wheat and maize. The increase in rice consumption was mostly due to its favorable price and rising consumer incomes. [AS]

0188

23781 SOLEY M., A. 1983. Estudio de oferta de yuca; tiquisque, ñampí, malanga y ñame en siete ferias del agricultor durante ocho meses 1982-1983. (Study of the supply of cassava, cocoyam, taro, and yam in seven agricultural fairs during eight months of 1982-83). San José, Costa Rica, Ministerio de Agricultura y Ganadería. Dirección de Mercadeo Agropecuario. Departamento de Análisis y Proyectos. Serie: Oferta de Productos Hortifruticolas no.1-83. 31p. Span., Illus.

Cassava. Dioscorea. Xanthosoma sagittifolium. Colocasia esculenta. Starch crops. Production. Consumption. Economics. Trade. Marketing. Costa Rica.

Based on weekly collected data by the Dirección de Mercadeo Agropecuario during 8 mo. starting Oct. 1982 through direct interviews to farmers at the main fairs of Costa Rica (Guadalupe, Zapote, Desamparados, Alajuela, San Ramón, Heredia, and Hatillo), the main producing zones of 5 crops (including cassava), periods of the year with high and low production levels in each zone and in the country, and total supply of crops were determined. The largest vol. of cassava in the fairs (125,862 kg) was offered in Jan. 1983, followed by that of Feb. (115,045 kg); the lowest vol. was offered in Dec. (84,910 kg). Cassava production, exports, and internal consumption estimates for 1983 are included. Cassava vol. sold at the 7 fairs represent a low % of national production according to 1983 harvest projections. Expected demand, according to preliminary data covering consumption in the metropolitan area and estimated exports, seems to be insufficient in relation to national production. [CIAT]

0189

24586 SPIESMAIER, A.K. 1975. Industrialización de la mandioca - productos finales. (Cassava industrialization—end products). Asunción,

Paraguay, Instituto Nacional de Tecnología y Normalización. Proyecto PAR/70/522. 12p. Span., Sum. Span.

Cassava. Industrialization. Development. Cassava chips. Pellets. Costs. Prices. Cassava flour. Consumption. Cassava starch. Uses. Paraguay.

A preliminary analysis of the possibilities of a better utilization of cassava in Paraguay is presented. The unpredictable fluctuations in the price of cassava chips and pellets (export products exclusively) do not justify their production in Paraguay. The use of cassava starch in other products is recommended and a list of these products is given. [CIAT]

0190

24549 SUPERINTENDENCIA DO PLANO DE VALORIZACAO ECONOMICA DA REGIAO DA FRONTEIRA SUDOESTE DO PAIS. BRASIL. 1966. Mato Grosso: agricultura-pecuaria. (Mato Grosso: agriculture and animal husbandry). Brasil, Servico de Estatistica. 82p. Port.

Cassava. Economics. Production. Brazil.

Statistical data on agriculture and animal husbandry are presented for the municipalities of the Pantanal region, state of Mato Grosso, Brazil; these were taken from the Depto. Estadual de Estatística do Mato Grosso. In relation with the area, production, and av. yield from 1959 to 1965, the data of the 5 main products of the region (rice, sugar cane, beans, cassava, and maize) are presented by product and by municipality. [AS (extract)-CIAT]

0191

23029 TANZANIA. MINISTRY OF AGRICULTURE. 1982. Price policy recommendations for the July 1982 agricultural price review. Annex 2: sorghum, millets, cassava & beans (prices for 1983/84 marketing season). Dar es Salaam, Marketing Development Bureau. 51p. Engl., Sum. Engl.

Cassava. Cassava flour. Economics. Production. Marketing. Costs. Prices. Consumption. Trade. Tanzania.

Cassava, sorghum, and bulrush millet are considered as the main drought-resistant staples in Tanzania. Among pulses, beans are considered to be the most important since they satisfy more protein requirements in low income groups in both rural and urban areas. No reliable figures exist on the production of drought-resistant staples and beans. In 1982-83 the government decided to introduce differentiated producer prices with the purpose of achieving self-sufficiency in food for every region and finally the nation as a whole. The same policy was recommended for the 1983-84 crop marketing year. The returns to labor for smallholder production by traditional and improved means in 1982-83 were estimated to be Sh 8.87 and Sh 21.34/man-days, resp., for cassava. Since 1979 the purchase of drought-resistant staples and beans has declined; the possible reasons are discussed. It is recommended to allow the sale of drought-resistant staples and beans, and their products, at full cost prices and differentiated among regions according to the comparative cost advantage. Transportation was identified as the most costly element of marketing costs; therefore rationalization of the interregional transport was initiated based on anticipated food supply status. [CIAT]

0192

24066 UNNEVEHR, L.J. 1983. Transport costs, tariffs and the influence of world markets on Indonesian domestic cassava prices. Bulletin of

Indonesian Economic Studies 20(1):30-43. Engl., 10 Refs., Illus. [International Rice Research Inst., Manila, Philippines]

Cassava. Economics. Prices. Trade. Marketing. Distribution. Dried roots. Cassava starch. Mathematical model. Indonesia.

The high and stable world cassava prices set by the European Community determine the level of export and import price bounds for Indonesian domestic prices. But domestic prices can vary independently of world prices, due to transport costs and government policy. During exporting periods there are strong variations between world and domestic supply and demand. Cassava prices rise above the export determined floor when there are domestic shortages, as reflected in the rising real price of rice. Because of international transport costs and an import tariff, domestic prices at port can nearly double before reaching the import price bound. Internal transport costs further reduce the influence of world prices. Transport costs also reduce integration among domestic prices, especially during periods of shortages. Fluctuations in cassava prices do not indicate imperfect markets but rather the importance of internal transport costs. Government policies such as the devaluation of the rupiah in 1978 had a dramatic effect on cassava prices and exports. The normally redundant starch import tariff allowed greater domestic price variation during periods of food shortage especially in 1975 and 1976, which stopped poorer consumers, who shift to cassava when rice is expensive, benefiting. [World Agricultural Economics and Rural Sociology Abstracts]

0193

23173 WATTS, R. 1980. Cassava—Can it become a foreign exchange earner?. Technical and Commercial Message. September/October 1980:21,28. Engl., Illus.

Cassava. Production. Gari. Food energy. Processing. Development. Economics. Trade. Costs. Cassava chips. Cassava starch. Research. Cuttings. Selection. Cassava bacterial blight. Cassava African mosaic virus. Nigeria.

The worldwide importance of cassava, particularly in Africa, is discussed. Its nutritional role is analyzed as well as that of the gari processing plants installed in Nigeria. The export potential of cassava is presented and the uses of cassava chips and cassava starch are indicated. Finally, a new rapid production system of cuttings and the work of the International Institute of Tropical Agriculture on the production of disease-free propagation material are mentioned. [CIAT]

0194

24729 WELSCH, D.E. 1984. Prospects for cassava in the world economy in the year 2000. Minneapolis, University of Minnesota. 12p. Engl., 6 Refs.

Paper presented at the Workshop on the Future Potential of Cassava in Asia and the Research Development Needs, Bangkok, Thailand, 1984.

Cassava. Economics. Consumption. Production. Prices. Marketing. Trade. Africa. South America. Asia. Thailand. Europe.

Based on political, scientific, and demand and supply assumptions, the prospects for cassava in the year 2000 are presented. The current production and utilization of cassava in Africa, Latin America, Asia, and the Pacific are described. Four possible alternatives for the future trade

of cassava between Thailand and the EEC are discussed. Possible government policies involved are indicated. [CIAT]

See also 0021 0022 0030 0032 0045 0089 0103 0107 0111 0116 0117 0118 0124 0141 0142 0143 0144 0147 0148 0149 0152 0153 0198 0202 0203

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0195

237/8 ARIAS F., J.; OBANDO G., L. 1984. Siembre yuca intercalada con fríjol y aumente la productividad de su cultivo de yuca. (Grow cassava intercropped with beans and increase the productivity of cassava). Tibaitatá, Instituto Colombiano Agropecuario. Programa de Cultivos Múltiples. Plegable Divulgativo no.179. 4p. Span., Illus. [Centro Nacional de Investigación Tibaitatá, Apartado Aéreo 151123, El Dorado, Bogotá, Colombia]

Cassava. Beans. Cultivation systems. Inter-cropping. Planting. Timing. Fertilizers. Weeding. Pest control. Harvesting. Productivity. Costs. Development. Colombia.

The planting of cassava in association with bush beans is recommended as a good alternative to increase crop productivity, improve the income, and obtain foods with high nutritive value. Planting distances, planting and harvest times, weeding, fertilization, pest and disease control, costs, and yields are indicated. [CIAT]

0196

21155 CAETANO, L.F. 1983. Comportamento de cultivares de mandioca (Manihot esculenta Crantz) e de feijao (Phaseolus vulgaris L.) em plantio consorciado. (Performance of cassava and bean cultivars grown in association). Tese Mag.Sc. Vicosa-MG, Brasil, Universidade Federal de Vicosa. 61p. Port., Sum. Port., 21 Refs., Illus.

Cassava. Phaseolus vulgaris. Climatic requirements. Soil physical properties. Soil analysis. Rainfall data. Cultivars. Cultivation systems. Inter-cropping. Spacing. Planting. Fertilizers. N. P. K. Productivity. Plant height. Harvest index. Dry matter. Carbohydrate content. Stems. Statistical analysis. Brazil

In the municipality of Coimbra, MG, Brazil, the performance of 2 cassava cv. Branca de Santa Catarina and Iracema, intercropped with 2 bean cv. with different growth habits and vegetative cycles, and with different bean population densities, were studied; implications of the association over the productivity components of both crops were also considered. A randomized block design with 4 replications was used. Cassava and beans were planted at the same time with 0.40 m distance between cassava plants and 1.40 m between rows; bean populations consisted in 1, 2, and 3 rows between cassava. Cassava was harvested 272 days after planting, considering the following parameters: height and diameter of the stem at 90 days and at harvest, final stand. no. of stems, productivity of aerial part

and of roots, root diameter and length, HI, root DM content, and carbohydrate content in the green part. LER and gross income of the association were also evaluated, considering the price ratios between the 2 products. Productivity of cassava roots was reduced by 25.1, 35.6, and 48.2% when cassava was intercropped with 1, 2, and 3 rows of beans, resp. Cv. Branca de Santa Catarina produced more roots and carbohydrates and was more competitive than Iracema, even though the wt. of the aerial part of Iracema was greater. [CIAT]

0197

23175 CAETANO, L.F.; SILVEIRA, A.J. DA; VIEIRA, C.; CARDOSO, A.A. 1982. Produtividade da mandioca e do feijoeiro-comum cultivados em consorcio. (Productivity of intercropped cassava/beans). In Reuniao Nacional de Pesquisa de Feijao, 1a., Goiania, Brasil, 1982. Goiania-GO, Centro Nacional de Pesquisa-Arroz, Feijao. pp.109-111. Port. [Depto. de Fitotecnia, Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil]

Cassava. Phaseolus vulgaris. Inter-cropping. Cultivars. Cultivation. Fertilizers. N. P. K. Root productivity. Productivity. Statistical analysis. Brazil.

In a field trial at Coimbra, MG, Brazil, cassava cv. Branca de Santa Catarina and Iracema were planted in 1.40-m rows with 0.40 m between plants and given a basal dressing of 90 kg P and 90 kg K, and 30 kg N/ha broadcasted 60 days after planting. Phaseolus vulgaris cv. Negrito 897 and Preto Sessenta Dias 53 were sown between the cassava rows at 10-15 seeds/m and in 1, 2, or 3 rows and given N, P, and K at 30, 80, and 40 kg/ha, resp., with an additional 30 kg N 27 days after emergence. Mean cassava root and P. vulgaris seed yields were 18.9, 16.3, and 12.9 t/ha and 1317, 1545, and 1816 kg/ha for 1, 2, and 3 rows, resp. The interaction between cassava and P. vulgaris cv. was significant. [Field Crop Abstracts]

0198

22784 FEAU, C. 1980. Les cultures vivrieres. (Food crops). In _____. Section agropedologie. Rapport de synthese avril 1977 juin 1980. Yaounde, Cameroon, Societe de Developpement du Cacao. pp.23-50. Fr., 9 Refs.

Cassava. Cultivation. Cultivation systems. Inter-cropping. Groundnut. Maize. Fallowing. Fertilizers. N. P. K. Root productivity. Socio-economic aspects. Prices. Cameroon.

The subsistence cultivation system used by cacao producers in Cameroon is described. It is basically a fallow system whose duration depends on demographic pressure. Peanuts, cassava, tania, and maize are intercropped; the system utilizes a large part of arable land. In order to eliminate this barrier to land and labor availability, continuous planting trials were established in 3 localities with paid labor to insure constant conditions. Plantain, peanut, tania, sweet potato, cassava, and maize were planted. Some plots were under shade (provided by plantains); others, such as where cassava was planted, did not have shade. Cassava was intercropped with peanuts at 1 x 1 m, for a plant density of 10,000 plants/ha. Plots in one of the localities had to be abandoned after the 1st yr because the head of the village considered it was not of their interest. Av. cassava productivity was between 15.00-17.19 t/ha. The need to continue with these trials as long as possible in order to confirm results is indicated; in addition, since the system does not satisfy traditional food requirements (excess of maize, peanuts, and plantains and deficit of cassava and tania), adjustments to the system are recommended. [CIAT]

0199

23226 MATTOS, P.L.P. DE; SOUZA, A. DA S.; CALDAS, R.C. 1982. Consorciacao de mandioca em fileiras duplas com Vigna. (Intercropping cassava grown in double rows with Vigna). Revista Brasileira de Mandioca 1(1):61-65. Port., Sum. Port., Engl., 11 Refs.

Cassava. Cultivation. Planting. Spacing. Inter-cropping. Cowpea. Climatic requirements. Land preparation. Fertilizers. N. P. K. Productivity. Root productivity. Starch productivity. Statistical analysis. Brazil.

Results are presented of an expt. on cassava cv. BGM-116 (erect type) associated with cowpea cv. CV 489 conducted in 1981-82 at the Centro Nacional de Pesquisa de Mandioca e Fruticultura (Cruz das Almas, BA, Brazil). A randomized complete block design was used which consisted of different planting distances. It is possible to intercrop cassava grown in double rows since this system gave higher productivity than the traditional intercropping system. The best combination was cassava grown in double rows spaced at 2.00 x 0.60 x 0.60 m with 4 rows of cowpea between the double rows of cassava. [AS]

0200

24061 MORENO, R.A. 1979. Algunos sistemas de producción de cultivos anuales de pequeños agricultores en el Istmo Centroamericano. (Some production systems of annual crops of small farmers in the Central American Isthmus). In Curso sobre Control Integrado de Plagas en Sistemas de Producción para Pequeños Agricultores, Turrialba, Costa Rica, 1979. Documento presentado. Turrialba, Centro Agronómico Tropical de Investigación y Enseñanza. Programa de Cultivos Anuales. pp.35-65. Span., 5 Refs., Illus.

Cassava. Cultivation. Cultivation systems. Rotational crops. Maize. Planting. Spacing. Weeding. Land preparation. Fertilizers. Root productivity. Central America.

The broad production range of annual crops existing among small farmers in the Central American Isthmus is analyzed, using rainfall as the determinant variable and with examples organized according to rainfall pattern in: (1) humid tropics—without dry season, with lightly pronounced dry season, and with marked dry season, and (2) dry humid tropics—lightly pronounced interestival dog days and pronounced interestival dog days (1500 and less than 1000 mm total annual rainfall). For humid tropical regions with no dry season and with total annual rainfall over 4000 mm/yr, the maize-cassava production system of small farmers in the Atlantic zone of Costa Rica is presented. The sequence of activities of the system is detailed; once maize has flowered (March-April or Sept.-Oct.), cassava is intercropped at 1.0 x 1.0 m (10,000 plants/ha) between maize plants planted at 0.5 x 1.0 m (40,000 plants/ha). Advantages of this relay crop production system include a longer LAD, soil preparation common to both crops, reduction in weed biomass increase, and only one fertilization for maize, leaving the residual fertilizer for cassava. Farmers obtain an av. of 2 t maize and 30 t cassava/ha. [CIAT]

0201

24573 PASARIBU, D.; EFFENDI, S. 1977. Pengaruh tipe, jarak tanam dan populasi ubi kayu terhadap hasil ubi-kayu, jagung, padi gogo, kacang tanah dan kacang uci dalam satu pola pertanaman. [The effect of cassava plant type, plant spacing and density on the productivity of cassava, maize, upland rice, groundnut, and rice bean (Phaseolus calcaratus) in a cropping system]. Bogor, Indonesia, Lembaga Pusat Penelitian. 10p. Indon.

Paper presented at the Seminar on Cropping System, 3rd., Bogor, Indonesia, 1977.

Cassava. Cultivation systems. Inter-cropping. Planting. Spacing. Cultivars. Root productivity. Indonesia.

At the Tamanbogo substation of the Central Research Institute for Agriculture (Lampung, Indonesia), a field trial was conducted to determine the effect of plant density on the yield of intercropping system components. A split plot design with 3 replications was used and cassava var. with or without suckers were planted in the main plot. One month before planting cassava, maize and upland rice were planted in between rows; after harvesting the rice, groundnut was planted, and after the latter was harvested, rice bean (Phaseolus calcaratus) was planted. Maize and upland rice were not affected by the space occupied by cassava plants nor by plant density. However, groundnut yield was affected by plant spacing; the wider the space between cassava rows, the smaller the reduction in groundnut yield. Cassava yield was also affected by plant population; the highest yield (33.21 t/ha) was obtained with a plant population of 20,000 plants/ha, and the lowest (25.96 t/ha) with a plant population of 6600 plants/ha. [CIAT]

0202

23770 PRABHAKAR, M.; NAIR, G.M. 1984. Intercropping in cassava. Indian Farming 34(1):9-10. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum 695-017, India]

Cassava. Cultivation systems. Inter-cropping. Groundnut. Cowpea. Phaseolus vulgaris. Root productivity. Costs. Income. Dung. Fertilizers. N. P. K. India.

The advantages of intercropping cassava with peanut, cowpea, and green beans in India are analyzed. Cassava is planted at a distance of 0.90 x 0.90 m and is fertilized with FYM or compost (12.50 t/ha) and a dose of 50:100:50 kg NPK/ha. For each of the associated crops, the planting distances, the fertilizer doses, and harvest times are given. The highest yield of cassava in association (24.04 t/ha) was obtained with the association cassava/green beans; this association also gave the highest net income. Cassava yield in monoculture (control) was 26.58 t/ha. [CIAT]

0203

24702 ROCHE, F.C. 1983. Cassava production systems on Java and Madura. Ph.D. Thesis. California, Stanford University. 208p. Engl., 86 Refs., Illus.

Cassava. Production. Cultivation. Economics. Consumption. Prices. Costs. Income. Productivity. Labour. Climatic requirements. Rainfall data. Erosion. Fertilizers. Nutritional requirements. N. P. K. Cultivation systems. Inter-cropping. Legume crops. Maize. Rice Planting. Timing. Harvesting. Cultivars. HCN content. Cuttings. Storage. Germination. Tetranychus urticae. Oidium. Xanthomonas campestris pv. manihotis. Development. Gaplek. Socio-economic aspects. Statistical analysis. Statistical data. Cassava programs. Indonesia.

Current and potential costs and returns at the farm level to the production of cassava on the densely populated island of Java (Indonesia) were assessed. Cassava is an important staple food among Java's rural poor and can also be exported. During 18 mo. of field research on Java, farm surveys were conducted in 3 distinct cassava-producing regions and the

results of agronomic research on cassava cropping systems were evaluated. Throughout most of Java, cassava is not intensively cultivated and yields are considerably below those obtained in agronomic trials. The analysis of cassava production is complicated because this crop is more commonly intercropped with rainfed cereals and legumes than it is planted in pure stand. Because cassava tolerates drought and infertile soils, it is a particularly important crop in Java's marginal agricultural areas where the potential for productivity increases is low. In contrast, some farmers in better-endowed environments are currently obtaining high cassava yields under good cultivation practices. Comparison of the base-line survey data with derived estimates of costs and returns under improved cultivation practices indicates that greater intensification of cassava cropping systems would be profitable for farmers in all 3 survey areas at recent relative prices. These results are insensitive generally to variations in input and output prices that could arise through changes in domestic subsidy policies or world demand for cassava. The profitability of improved cassava intercropping is higher and more stable than that of improved pure stand cassava alone. The improved cropping systems could significantly increase incomes from crop production in Java's poorer upland areas. At the farm level, underdeveloped input distribution systems, a lack of appropriate extension programs, and limited capital will constrain the adoption of these new technologies. These constraints reflect macro-level agricultural policies which give little attention to unirrigated nonrice crops. Factors which could effect a redirection of these policies include the export potential of cassava in combination with either the prospects for continued increases in domestic rice output or the economy's capacity to import rice when domestic paddy production is inadequate. [Dissertation Abstracts International]

0204

23435 VILLAMAYOR JUNIOR, F.G.; DESTRIZA, T.T. 1982. The effect of double row planting and intercropping on cassava yield. Radix 4(2):4-5. Engl., 1 Ref., Illus. [Philippine Root Crop Research & Training Center, VISCA, Leyte, Philippines]

Cassava. Cultivars. Inter-cropping. Legume crops. Cultivation. Planting. Spacing. Land preparation. Cuttings. Fertilizers. N. P. K. Weeding. Timing. Root productivity. Philippines.

The double-row system, planting cassava cv. Kadabao alone or in combination with different no. of mung bean rows, was studied at the Philippine Root Crop Research and Training Center. The expt. was laid out using a randomized complete block design with 3 replications and a 6 x 6 m plot size. Mung bean pods were harvested at 58, 65, 70, 78, and 87 days after planting; cassava roots were harvested 7.5 mo. after planting. The double-row planting system had no advantage over single-row planting in terms of cassava root no. and yield. The optimum treatment consisted of 3 rows of mung beans intercropped between the double rows of cassava, since no reduction in cassava yield was observed. [CIAT]

See also 0021 0022 0026 0027 0044 0075 0175 0176 0181

K02 Descriptive and Comparative Studies

0205

24071 ZITNAK, A.; HILL, D.C.; ALEXANDER, J.C. 1977. Determination of linamarin in biological tissues. Analytical Biochemistry 77:310-314. Engl., Sum. Engl., 8 Refs.

Cassava. Linamarin. Cyanogenic glycosides. Analysis.

A new paper chromatography method for the determination of intact cyanogenic glucosides (linamarin) is presented. It is based on the reaction of linamarin with p-anisaldehyde, at 85°C, which produces a pink color fluorescent under UV light (lambda = 366 nm). [AS]

ABBREVIATIONS AND ACRONYMS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxigen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CAMD	Cassava African mosaic disease
CMV	Cassava African mosaic virus
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
COD	Chemical oxigen demand
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
EP	Preliminary Trials, CIAT
expt.	Experiment(s)
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
hp	Horsepower
IAA	Indoleacetic acid
IBA	Indolebutyric acid
IBYAN	International Bean Yield and Adaptation Nursery, CIAT
Illus.	Illustrated
in.	Inches
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilocalorie(s)
kg	Kilogram(s)
kJ	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio

LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	Alpha-naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
p.	Page
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pp.	Pages
pphm	Parts per hundred million
PPI	Pre planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGR	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
rpm	Revolutions per minute
Russ.	Russian
s	Second
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Species
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with N-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VEF	Bean Team Nursery, CIAT
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
vs.	Versus
W	West, watt
wk.	Week
WP	Wettable powder
wt.	Weight
yr	Year(s)
/	Per
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus

Author Index

ABAS, A.G.
0018

ABE, T.
0078

ABIDIN K., Z.
0105

ACOSTA-ESPINOZA, J.
0101 0102

ADETOLA, J.A.
0126

AGOUNKE, D.
0095

AHMED, S.Y.
0136

AKPALOO, Y.
0095

ALAM, M.M.
0079

ALAZARD, D.
0157

ALEXANDER, J.C.
0205

ALVARADO, M.I.
0160

ALVES, M.L.B.
0061

AMOROZO, M.C. DE M.
0111

ANANG, K.A.
0161

ANJOS, J.T. DOS
0028

ARAUJO, E.F. DE
0011

ARAYA, V.M.
0160

ARIAS F., J.
0195

ATEGA, P.C.
0162

ATHAYDE, J.T.
0062 0064 0065 0067

ATIKUL, J.
0163

ATU, U.G.
0075

AUGUSTIN, M.A.
0112

AULD, S.J.M.
0010

AUTRIQUE, A.
0058 0059

AZMANSYAH, DT. A.
0164

BAENTE, C.M.
0162

BALAGOPAL, C.
0156

BALAKRISHNAN, S.
0074

BARRIOS B., D.D.
0165

BARRIOS, J.R.
0150

BASLER, A.
0166

BATISTA, U.G.
0065

BECKER, J.
0121

BELTRAN, J.
0008

BENDER, H.
0154

BENNETT, D.E.
0021

BENNETT, F.D.
0080 0085 0096

BENVENUTI, G.
0167

BERNAL DE GOMEZ, R.
0168

BERNARD, V.
0024

BERRY, S.K.
0112

BOCK, K.R.
0072 0073

BOJANIC M., A.J.
0022

BORRERO B., H.M.
0081

BOX, L.
0169 0170

BRESSANI, R.
0113

BRITO, J.A.O. DE
0082

BRUINSMA, D.R.
0171

BUITRAGO A., J.
0122

BUSHUK, W.
0013

BUZIK, R.B.
0125

CAETANO, L.F.
0196 0197

CALDAS, L.S.
0011

CALDAS, R. DE A.
0011

CALDAS, R.C.
0017 0044 0049 0083 0199

CALDERON D., R.A.
0165

CAPELLAN H., F.J.
0172

CARDOSO, A.A.
0197

CARLTON, C.
0159

CARVALHO, L.E.
0173

CARVALHO, P.C. DE
0017

CARVALHO, V.D. DE
0051 0052 0053 0054

CASADEI, E.
0119

CASTILLO H., A.
0001 0002

CASTILLOA, J.J.
0001 0002 0007 0004 0145

CASTRONI, S.
0003 0145

CENTRAL TUBER CROPS RESEARCH INSTITUTE
0103 0174

CHALFOUN, S.M.
0051 0052 0053 0054

CHAN, S.K.
0018

CHANDLER, F.
0031

CHANDRA SHEKARA, S.
0114

CHANDRASEKARAN, S.
0155

CHEVREAU, B.
0032

CHIU, C.W.
0137

CIPTADI, W.
0146

CLIFF, J.
0120

COELHO, Y. DA S.
0083

COLINA, R.
0003

COOPER, B.R.
0023

DESTRIZA, T.T.
0204

DHAR, S.C.
0155

DIAZ, M.
0004 0145

DOORMAN, F.
0024 0027

DUNSTAN, W.R.
0010

EDIRISAH-AIDOO, K.
0138

EFFENDI, S.
0201

EKPENYONG, T.E.
0012

ELIAS, L.G.
0113

ELIZONDO, D.
0160

ELUWA, M.C.
0088

EZETA, F.N.
0017

FARIAS, A.R.N.
0083

FEAU, C.
0198

FERGUSON, L.B.
0159

FERNANDEZ, M.
0048

FERRARI, G.
0004

FERREIRA, C.
0092

FIORETTO, R.A.
0033

FUKUDA, C.
0064 0065

FURTADO, M.J.
0062 0067 0123

GARCIA G., C.A.
0084

GHILDYAL, N.P.
0136

GOMEZ F., I.
0175

GOMEZ, G.
0122 0135

GONZALEZ C., J.F.
0147

GORDON, C.I.
0124

GUIRAN, G. DE
0076

HENRY, T.A.
0010

HERREN, H.R.
0085 0086 0100

HERRERA F., C.J.
0087

HERRERA, E.
0145

HERSHEY, C.
0009

HILL, D.C.
0205

HOBT, H.
0025

HOWELER, R.
0027

HRUSKA, A.J.
0034

HUEI-WANG, S.
0051

HUGHES, P.A.
0056

HUSSAIN, A.
0013

IHEAGWAM, E.U.
0088

IKOTUN, T.
0063

ILYUKHINA, L.A.
0125

INDIRA, P.
0014

INSTITUT DE RECHERCHES AGRONOMIQUES TROPICALES ET DES CULTURES VIVRIERES
0026

ISMAYADI, S.
0035

JACKSON, J.C.
0176

JANSEN, P.
0119

JARA, R.
0177

JESUS, V.S. DE
0015

JOHNSON, B.B.
0178

JOHNSON, I.M.
0179

JOS, J.S.
0110

JOSEPH, P.J.
0074

JUSTE, E.S.G.
0052

KANYENDA, E.E.
0128

KAZANTZIS, D.
0139

KEMP, D.C.
0179

KIRILOV, M.P.
0125

KNAPE, G.
0121

KOSIKOWSKI, F.V.
0116

KUNHI, A.A.M.
0136

LABAYAN, A.L.
0050

LAN, G.S.
0068

LEE, C.M.
0139

LEESBERG, J.
0027

LEMA, K.M.
0086

LIAN, T.S.
0068 0104 0105 0106

LONGE, O.G.
0126

LONSANE, B.K.
0136

LORETO, A.B.
0148

LUALLEN, T.E.
0140

LUC, M.
0076

LUCIANI, J.F.
0004

LUNA R., J.M.
0036

LUNDBORG, G.
0089

LYNAM, J.K.
0181

MACBAILEY, F.E.
0180

MACEDO, M.M.C.
0049

MACHADO, J.E.O.
0149

MADRID B., M.A.
0127

MAFLA, G.
0008

MAKAMBILA, C.
0069

MAKHAMBERA, P.E.
0128

MAKINA, D.W.
0077

MANILAL, V.B.
0156

MANNAN, M.A.
0043

MARTELLI, A.
0120

MARTINEZ G., J.E.
0127

MATHEW, A.V.
0074

MATOS F., R.
0048

MATTOS, P.L.P. DE
0044 0049 0199

MAXWELL, S.
0022

MCDOWELL, I.
0115

MEDINA, V.M.
0109

MOLIN, A.
0119 0120

MONDARDO, E.
0028

MONTAGNER, W.
0037

MONTALDO, A.
0150

MONTILLA S., J. DE J.
0129

MONTILLA, J.J.
0150

MORAES, A.R. DE
0052 0053

MORAES, O. DE
0028

MORALES, E.A.
0109

MORENO, R.A.
0200

MOSQUEDA, M.
0151

NAIR, G.M.
0202

NAIR, R.B.
0110

NARANJO P., A.J.
0141

NARAYANAN, C.S.
0156

NARVAEZ, J.
0008

NASCIMENTO, A.S. DO
0083

NAVARRETE, D.A.
0113

NDIOKWERE, C.L.
0029

NEUENSCHWANDER, P.
0086

NGHIEM, L.T.
0181

NUGROHO, J.H.
0046

O'HAIR, S.K.
0045

OBANDO G., L.
0195

ODURO, K.A.
0115

OGBUJI, R.O.
0075

OKEZIE, B.O.
0116

OLIVEIRA, H. DE F.
0016

PALANISWAMI, M.S.
0098

PARAGUAY. MINISTERIO DE AGRICULTURA Y GANADERIA. SERVICIO DE EXTENSION AGRICOLA Y GANADERA
0142 0182

PARDO, C.
0135

PASARIBU, D.
0201

PAYNE, P.
0179

PAZ, J.E.
0038

PERALTA D., S.V.
0130

PEREZ C., L.E.
0172

PEREZ S., E.E.
0151

PERREAUX, D.
0060

PHILIPPINE COUNCIL FOR AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT
0055 0183

PHUKON, J.C.D.
0133

PILLAI, K.S.
0098

PINO P., L.T.
0005

PINTO C., G.
0117

PINTO S., R.
0143 0144

PLUMBLEY, R.A.
0056

POESPODARSONO, S.
0046

PORTELA, R.
0122

PORTO, M.C.M.
0007

POUZET, D.
0006

PRABHAKAR, M.
0202

PROVERBS, G.
0184

PUNITHALINGAM, E.
0070

QUINTERO, F.
0003 0145

RAIMBAULT, M.
0157

RAMANUJAM, T.
0014

RAMIREZ, H.
0008 0013

RAMOS F., J.R.
0152

RASHID, M.M.
0043

REDONDO, T.R.
0162

REYES, R.
0008

RINCON C., C.J.
0143

ROA, J.
0008

ROCA, W.M.
0008 0009 0013

ROCHE, F.C.
0203

RODRIGUES, E.M.
0017

RODRIGUEZ, A.
0008 0119

RODRIGUEZ, J.
0008

RODRIGUEZ, J.A.
0009

ROJAS, M.
0160

ROMEIRO, R. DA S.
0064 0065

ROSARIO, E.J. DEL
0158

ROSLING, H.
0119 0120

ROWE, A.G.
0107

SADJAD, S.
0047

SAKA, V.W.
0077

SALICK, J.
0090

SAMOKHIN, A.V.
0125

SANARRUSIA V., E.
0185

SANINT, L.R.
0186 0187

SANTOS, A.F. DOS
0062 0067

SANTOS, C.D.
0091 0092

SANTOS, J.
0122

SCHIGHA, E.
0099

SCHMIDT, A.
0121

SCHULZE, W.D.
0121

SCHWABE, W.M.
0057

SEFA-DEDEH, S.
0118

SEMINAR ON CASSAVA PRODUCTION,
ST. THOMAS, BARBADOS, 1985.
0030

SENG, Y.Y.
0153

SHRIMPTON, R.
0111

SHURPALEKAR, S.R.
0114

SIEVERDING, E.
0019 0020

SILVA, A.B.
0093

SILVA, J.R. DA
0108

SILVA, S. DE O.E.
0109

SILVEIRA, A.J. DA
0197

SOLEY M., A.
0188

SOSA V., M.
0048

SOUZA, A. DA S.
0044 0049 0199

SPIESMAIER, A.K.
0189

SUGIMORI, M.H.
0066

SUPERINTENDENCIA DO PLANO DE VALORIZACAO ECONOMICA DA REGIAO DA FRONTEIRA SUDOESTE DO PAIS. BRASIL
0190

TABLANTE T., O.J.
0039

TAI, L.H.
0018

TALATALA, R.L.
0040

TAN, K.H.
0159

TANZANIA. MINISTRY OF AGRICULTURE
0191

TERRA, W.R.
0091 0092

TERRY, E.R.
0060

TEWE, O.O.
0131 0132

THANGAVELU, K.
0133

TRUJILLO, C.
0122

TUDOR, G.D.
0134

UNNEVEHR, L.J.
0192

VALDIVIESO, M.
0135

VIEIRA, C.
0197

VILLAMAYOR JUNIOR, F.G.
0041 0050 0204

VILLAMIZAR S., J.C.
0152

VILLEGAS G., A.
0094

WALTER-ECHOLS, G.
0095

WARGIONO, J.
0042

WARWICK, D.R.N.
0071

WATANABE, H.
0078

WATTS, R.
0193

WELSCH, D.E.
0194

WHEATLEY, C.C.
0057

WITSENBURG, W.W.
0171

WONG, R.L.
0158

WURDEMANN, W.
0171

YANINEK, J.S.
0100

YASEEN, M.
0080 0096 0097

YUSOF, M.
0106

YUSUF H., M.
0105

ZAPATA, L.E.
0135

ZITNAK, A.
0205

Subject Index

ABSORPTION
0017

ACARICIDES
0058 0059 0079 0098 0168 0174

ADHESIVES
0107 0143 0165

AGRICULTURAL EQUIPMENT
COSTS
0175
HARVESTING
0179
PLANTING
0175 0179

AGRICULTURAL LIME
0019 0174

ALCOHOL
FERMENTATION
0174
PROCESSING
0174 0178 0183
PRODUCTION
0178
USES
0150 0158 0174 0178 0183

ALEYRODIDAE
0073 0085 0167

AMINO ACIDS
0121
ANALYSIS
0113
LEAVES
0014

ANASTREPHA MANIHOTI
INSECTICIDES
0034

ANIMAL PHYSIOLOGY
0064 0131 0132

ANTHERS
0004 0105 0110
TISSUE CULTURE
0108

AONIDOMYTILUS ALBUS
0174
INSECTICIDES
0082

APICAL MERISTEMS
TISSUE CULTURE
0008 0174

ASH CONTENT
0012 0114 0122 0126 0135

ASPERGILLUS
0036 0084
INDUSTRIAL MICROBIOLOGY
0157 0159

ATTA
0167

AUSTRALIA
0134

BACTERIOSES
0061 0062 0063 0064 0065 0066 0071
0167 0183 0193 0203
DISEASE CONTROL
0058 0059 0060
RESISTANCE
0026

BAKERY PRODUCTS
CASSAVA FLOUR
0117 0135 0185
COMPOSITE FLOURS
0117 0135 0185
WHEAT FLOUR
0117 0135

BANANA-PLANTAINS
0022 0113 0186 0187

BEMISIA
0073 0167 0174
BIOLOGICAL CONTROL
0058 0059
INSECTICIDES
0058 0059
RESISTANCE
0085

BIOCHEMISTRY
0008 0011 0013 0056 0064 0092 0119
0120 0156 0157 0174

BIOLOGICAL CONTROL
INJURIOUS INSECTS
0034 0079 0080 0081 0085 0086 0087
0090 0095 0096 0097 0100
INJURIOUS MITES
0079 0085 0086 0095 0099 0100
MYCOSES
0034
VIROSES
0034

BIOMASS PRODUCTION
0045 0050 0159

BITTER CASSAVA
0010 0015 0016 0077 0084 0119 0146
0169 0172
ROOT PRODUCTIVITY
0102
STARCH CONTENT
0002

BOLIVIA
MARKETING
0022

BRANCHING
0043 0101

BRAZIL
0011 0015 0016 0017 0028 0033 0049
0051 0052 0053 0054 0061 0062 0064
0065 0066 0067 0080 0083 0091 0092
0093 0096 0097 0101 0102 0108 0111
0123 0149 0196 0197 0199
GERMPLASM
0109
MARKETING
0173
PRODUCTION
0178 0190
SOCIO-ECONOMIC ASPECTS
0173 0178

BREADS
ANALYSIS
0135
CASSAVA FLOUR
0135

CALCIUM
0012 0017 0033
ROOT PRODUCTIVITY
0018 0026

CAMEROON
0076
MARKETING
0180
SOCIO-ECONOMIC ASPECTS
0180 0198

CANOPY
0101 0102

CARBOHYDRATE CONTENT
0012 0083 0104 0114 0135 0136 0138
0157 0159
LEAVES
0015
ROOTS
0015 0052 0053 0103
STEMS
0015 0196

CARBON DIOXIDE
0007

CARIBBEAN
0021 0023 0024 0026 0027 0031 0048
0079 0080 0096 0097 0124
PRODUCTION
0030 0184
SOCIO-ECONOMIC ASPECTS
0169

CARPOLONCHAEA CHALYBEA
INSECTICIDES
0079

CASAVE
0145 0147 0172

CASSAREEP
USES
0033

CASSAVA AFRICAN MOSAIC VIRUS
0006 0167 0174 0193
DISEASE CONTROL
0058 0060 0072
EPIDEMIOLOGY
0072
RESISTANCE
0103
SYMPTOMATOLOGY
0058 0060 0071

CASSAVA BACTERIAL BLIGHT
0193

CASSAVA BREAD
0147 0172
ANALYSIS
0145

CASSAVA BROWN STREAK VIRUS
RESISTANCE
0003
SYMPTOMATOLOGY
0073

CASSAVA CHIPS
CATTLE
0123
CONSUMPTION
0116 0163 0165 0185 0189
COSTS
0116 0127 0153 0163 0165 0183 0185
0189 0193
DRYING
0031 0135 0149 0153 0165 0171 0185
HCN CONTENT
0135
INDUSTRIAL MACHINERY
0165
INDUSTRIALIZATION
0116 0165 0171 0189
MARKETING
0116 0163 0171 0193
PACKAGING
0165
PRICES
0163 0165 0185 0189
PROCESSING
0031 0135 0148 0149 0153 0165 0171
0174 0183 0193
SOLAR DRYING
0127 0149 0153
STORAGE
0116 0165 0185
INJURIOUS INSECTS
0174 0183
SWINE
0123 0127
TRADE
0116 0163 0165 0171 0185 0193

CASSAVA COMMON MOSAIC VIRUS
0034 0167

CASSAVA FLOUR
0111
COMPOSITION
0113 0114 0130 0135
CONSUMPTION
0163 0165 0185 0189 0191
COSTS
0163 0165 0172 0185 0189 0191

DRYING
0117 0135 0147 0165 0185
INDUSTRIAL MACHINERY
0165
INDUSTRIAL MICROBIOLOGY
0158
INDUSTRIALIZATION
0165 0176 0189
MARKETING
0147 0163 0172 0176 0191
NUTRITIVE VALUE
0113
PRICES
0147 0163 0165 0176 0185 0189 0191
PROCESSING
0114 0117 0135 0145 0147 0151 0165
PRODUCTION
0147 0163 0165 0172 0191
PROTEIN CONTENT
0113 0114 0135
STORAGE
0147 0165 0185
SWINE
0130 0176
TRADE
0163 0165 0176 0185 0191

CASSAVA LEAVES (VEGETABLE)
ANIMAL NUTRITION
0123
NUTRITIVE VALUE
0123

CASSAVA MEAL
0129 0173
COMPOSITION
0122 0157
CONSUMPTION
0163 0165 0185
DRYING
0165 0185
INDUSTRIALIZATION
0165
NUTRITIVE VALUE
0122
PELLETS
0163
PRICES
0163 0165 0185
PROCESSING
0122 0124 0157 0165
STORAGE
0165 0185
SWINE
0122
TRADE
0163 0165 0185

CASSAVA MOSAIC VIRUS
0074

CASSAVA PRODUCTS
0119 0166 0182
FRESH PRODUCTS
0122 0165 0181 0185
PROCESSED PRODUCTS
0112 0134
CASAVE
0145 0147 0172
CASSAREEP
0033
CASSAVA BREAD
0145 0147 0172
CASSAVA CHIPS
0031 0116 0123 0127 0135 0148
0153 0163 0165 0171 0174 0183
0185 0189 0193
CASSAVA FLOUR
0111 0113 0114 0117 0130 0135
0145 0147 0151 0158 0163 0165
0172 0176 0185 0189 0191
CASSAVA MEAL
0129 0157 0163 0165 0173 0185
CASSAVA STARCH
0003 0136 0137 0138 0139 0140
0141 0142 0143 0144 0145 0150
0151 0154 0155 0156 0161 0164
0165 0171 0174 0176 0181 0183
0189 0192 0193
GAPLEK
0203
GARI
0171 0193
PELLETS
0116 0161 0163 0171 0189
TAPIOCAS
0164 0171 0176 0183

CASSAVA PROGRAMS
0203
ANIMAL NUTRITION
0107 0116 0170
GERMPLASM
0107 0174
HUMAN NUTRITION
0170
PLANT BREEDING
0107 0174

CASSAVA STARCH
0164
ALCOHOL
0150 0174 0183
ANALYSIS
0003 0138 0139 0140 0141 0145 0151
0154 0156
CONSUMPTION
0165 0182 0189
COSTS
0142 0143 0165 0181 0182 0183 0189
0193
DETERIORATION
0174
DEXTRINS
0144 0165
DRYING
0137 0141 0143 0144 0165 0171
ENZYMES
0154 0155
FACTORIES
0142 0143 0144 0171 0176
FERMENTATION
0141 0143 0144 0171 0174
GELATINIZATION
0138 0151
INDUSTRIAL MICROBIOLOGY
0154 0155
INDUSTRIAL STARCHES
0143 0144 0165
INDUSTRIALIZATION
0142 0143 0144 0165 0171 0176 0189
MARKETING
0144 0161 0171 0176 0181 0182 0192
0193

MOULDS
0156 0174
PACKAGING
0144 0165
PARTICLE SIZE
0003 0140 0144
PRICES
0142 0143 0165 0176 0181 0182 0189
0192
PROCESSING
0136 0137 0138 0141 0142 0143 0144
0145 0151 0156 0165 0171 0174 0183
0193
STORAGE
0141 0144 0165 0174 0182 0183
TEXTILES
0143 0144
TRADE
0142 0144 0161 0165 0171 0176 0192
0193
USES
0137 0138 0139 0140 0143 0144 0150
0161 0165 0171 0174 0183 0189 0193
VISCOSITY
0137 0140
WATER REQUIREMENTS (PROCESSING)
0144

CASSAVA VEIN MOSAIC VIRUS
0167

CATTLE
0107 0123 0124 0125 0134

CERCOSPORA CARIBAEA
0034 0167 0183
DISEASE CONTROL
0060
DISEASE TRANSMISSION
0060
SYMPTOMATOLOGY
0060

CERCOSPORA VICOSAE
DISEASE CONTROL
0060
SYMPTOMATOLOGY
0060

CERCOSPORIDIUM HENNINGSII
0034 0167 0174 0183
DISEASE CONTROL
0058 0059 0060
DISEASE TRANSMISSION
0060
SYMPTOMATOLOGY
0058 0059 0060 0068

CEREALS
0021 0022 0118 0134 0181 0186 0187
0198 0200 0203

CHROMOSOMES
0108

CLIMATIC REQUIREMENTS
0009 0013 0015 0033 0034 0058 0059
0069 0078 0081 0087 0088 0116 0152
0153 0157 0183
GROWTH
0007 0019
PRODUCTIVITY
0007 0020 0023 0036 0048 0049 0060
0102 0167 0182 0196 0199 0203

CLONES
0026 0102 0110
AGRONOMIC CHARACTERS
0008
HYBRIDIZING
0106 0108

COLOMBIA
0007 0009 0013 0019 0020 0036 0038
0057 0071 0080 0081 0082 0084 0087
0094 0096 0122 0135 0141 0152 0195
GERMPLASM
0008
MARKETING
0144 0181
PRODUCTION
0143
SOCIO-ECONOMIC ASPECTS
0168
TRADE
0144 0186 0187

COMPOSITE FLOURS
0114 0117 0135 0185

COMPOSITION
0012 0017 0021 0035 0045 0083 0104
0115 0118 0119 0121 0127 0152 0153
0159 0203
CASSAVA FLOUR
0113 0114 0130 0135
CASSAVA MEAL
0122 0157
CASSAVA STARCH
0136 0138 0140 0144 0156
LEAVES
0002 0014 0015 0018 0033 0043 0116
0167
ROOTS
0015 0016 0033 0043 0051 0052 0053
0103 0107 0116 0122 0126 0128 0131
0132 0146 0167
STEMS
0015 0033 0036 0043 0196

CONCENTRATES
0125 0134

CONFECTIONERIES
0136 0138

CONGO
0069

COPPER
0018

CORTEX
COMPOSITION
0126 0128 0131 0132
HCN CONTENT
0131 0132
USES
0077 0126 0128 0131

COSTA RICA
0034
MARKETING
0160 0188
PRODUCTION
0160 0188
SOCIO-ECONOMIC ASPECTS
0185

TRADE
0185 0188

CROSSBREEDING
0102 0105 0108 0110

CULTIVARS
0001 0002 0003 0005 0006 0007 0011
0013 0014 0015 0016 0019 0028 0030
0031 0032 0033 0046 0048 0051 0052
0053 0054 0057 0058 0059 0061 0067
0082 0114 0115 0117 0135 0141 0144
0145 0146 0149 0165 0168 0169 0172
0181 0183 0196 0203
AGRONOMIC CHARACTERS
0021 0034 0101 0103 0104 0109 0167
GERMPLASM
0104 0107 0109
IDENTIFICATION
0062 0073
ROOT PRODUCTIVITY
0020 0022 0023 0026 0036 0045 0049
0050 0072 0073 0103 0104 0107 0109
0167 0182 0197 0201 0204
SELECTION
0023 0026 0072 0103 0107
STARCH PRODUCTIVITY
0045 0104
TOXICITY
0167

CULTIVATION SYSTEMS
0025 0028 0032 0044 0058 0059 0180
FALLOWING
0022 0034 0181 0198
INTER-CROPPING
0021 0022 0023 0027 0075 0167 0172
0174 0175 0181 0182 0195 0196 0197
0198 0199 0201 0202 0203 0204
ROTATIONAL CROPS
0026 0167 0200
SHIFTING CULTIVATION
0176

CULTURE MEDIA
0063 0155 0156 0158 0159
TISSUE CULTURE
0008 0108

CUTTINGS
0013 0014 0015 0028 0048 0058 0059
0078 0094 0168 0172 0193
GERMINATION
0033 0034 0082
TIMING
0036 0203
PROPAGATION
0031 0106 0167
ROOT PRODUCTIVITY
0018 0022 0023 0036 0050 0102 0167
0174 0182 0204
SPACING
0007 0023 0034 0050 0102 0167 0174
0181 0182 0183 0204
STORAGE
0036 0167 0174 0182 0183 0203

CYANIDES
0033
DETOXIFICATION
0119
HUMAN HEALTH
0119 0120

METABOLISM
0119
TOXICITY
0119 0120

CYANOGENESIS
ROOTS
0146

CYANOGENIC GLUCOSIDES
0010 0116 0135 0174 0205

CYTOGENETICS
0110 0174

CYTOLOGY
0108

DETERIORATION
0149 0152
CASSAVA STARCH
0174
ROOTS
0051 0052 0053 0054 0055 0056 0057
0116 0146 0174

DETOXIFICATION
0119 0146

DEVELOPMENTAL STAGES
0038 0041
BRANCHING
0043 0101
FLOWERING
0108
GERMINATION
0033 0034 0036 0082 0104 0105 0203
ROOT DEVELOPMENT
0174

DEXTRINS
0144 0165

DIOSCOREA
0108

DIPLODIA
0036 0084

DISEASE CONTROL
BACTERIOSES
0058 0059 0060
MYCOSES
0058 0059 0060
VIROSES
0058 0059 0060 0072

DISEASE TRANSMISSION
VECTORS
0060

DOMESTIC ANIMALS
0107 0121 0122 0123 0124 0125 0126
0127 0130 0131 0132 0134 0176 0184

DOMINICAN REPUBLIC
0024 0027 0048
MARKETING
0172
PRODUCTION
0172
SOCIO-ECONOMIC ASPECTS
0169 0172

DRIED ROOTS
0031 0123 0127 0134 0135 0148 0149
0153 0165 0174 0183 0185 0189 0203
DISTRIBUTION
0192
MARKETING
0116 0163 0171 0192 0193

DRYING
0119 0131 0132 0184
CASSAVA CHIPS
0031 0135 0149 0153 0165 0171 0185
CASSAVA FLOUR
0117 0135 0147 0165 0185
CASSAVA STARCH
0137 0141 0143 0144 0165 0171
INDUSTRIAL MACHINERY
0144 0165
PELLETS
0171
TAPIOCAS
0171
WATER CONTENT
0118 0152 0153

ECOSYSTEMS
0090

ECUADOR
0167

ENERGY PRODUCTIVITY
0047

ENTOMOLOGY
0078 0080 0081 0084 0087 0088 0093
0094 0100

EPIDEMIOLOGY
0072

ERINNYIS ELLO
0091 0092 0167
INSECTICIDES
0034

ETHANOL
0150 0158

ETHIOPIA
0071

EUDIPLOSIS BRASILIENSIS
INSECTICIDES
0079

EUTETRANYCHUS ORIENTALIS
0098 0174

FACTORIES
CASSAVA CHIPS
0171
CASSAVA FLOUR
0176
CASSAVA STARCH
0142 0143 0144 0171 0176
GARI
0171
PELLETS
0171
TAPIOCAS
0171 0176

FALLOWING
0022 0034 0181 0198

FATTENING
SWINE
0130

FEED CONSTITUENTS
0124 0125 0126 0127 0128 0129 0130
0134
BONE MEAL
0122
COTTONSEED CAKE
0122
FLOURS
0122
MAIZE MEAL
0122
MEALS
0122

FEEDS AND FEEDING
0107 0116 0121 0122 0123 0124 0125
0126 0127 0128 0129 0130 0150 0161
0163 0171 0174 0184 0189

FERMENTATION
0122 0141 0143 0144 0157 0171
PROTEIN ENRICHMENT
0118 0174

FERMENTED PRODUCTS
0150 0158 0174 0178 0183

FLOWERING
0108

FLOWERS
0004 0105 0108 0110

FOLIAGE
0101 0102
FORAGE
0123

FOMES LIGNOSUS
0183

FOOD ENERGY
0012 0047 0111 0116 0123 0126 0187
0193

FOOD PRODUCTS
0115 0117 0118 0135 0137 0138 0140
0143 0144 0171 0174 0185 0193

FORAGE
0107 0123

FRENCH GUIANA
0026 0080 0097

FRUITS
0105 0108

FUSARIUM
0036 0084 0174

GAPLEK
PRODUCTION
0203

GARI
COMPOSITION
0115 0118
FACTORIES
0171
FERMENTATION
0118 0171
NUTRITIVE VALUE
0171
PROCESSING
0118 0171 0193
STORAGE
0118

GELATINIZATION
0138 0151

GENETICS
0101 0102 0110 0174

GERMINATION
0104
CUTTINGS
0033 0034 0036 0082 0203
SEED
0105
TIMING
0036 0203

GERMPLASM
0008 0060 0104 0106 0107 0109 0174

GHANA
0071 0076 0115 0118 0138

GLOMERELLA CINGULATA
DISEASE CONTROL
0060
SYMPTOMATOLOGY
0060 0067

GLOMERELLA MANIHOTIS
0069 0167
DISEASE CONTROL
0058 0059
SYMPTOMATOLOGY
0058 0059 0071

GOATS
0124

GRINDING
0117 0135 0144 0165

GROWTH
0007 0017 0018 0019 0174

GUATEMALA
0113

GUINEA
0076

GUYANA
0080 0096

HARVEST INDEX
0018 0050 0101 0102 0104 0196

HARVESTING
0026 0028 0030 0031 0104 0172 0184
AGRICULTURAL EQUIPMENT
0179
TIMING
0015 0019 0022 0023 0032 0046 0049
0103 0107 0141 0167 0181 0182 0183
0195 0203

HCN CONTENT
0021 0034 0104 0119 0203
CASSAVA CHIPS
0135
CASSAVA FLOUR
0135
CASSAVA STARCH
0144
CORTEX
0131 0132
LEAVES
0015
ROOTS
0015 0016 0131 0132
STEMS
0015

HERBICIDES
0034 0036 0068 0107 0167 0168

HUMAN NUTRITION
0035 0111 0113 0119 0120 0170 0171
0185

HYBRIDS
0057 0068
PRODUCTIVITY
0174
RESISTANCE
0103
SELECTION
0103
ROOT PRODUCTIVITY
0103 0174

ILLUMINATION
0009 0069

INCOME
0055 0111 0127 0147 0162 0172 0177
0178 0181 0183 0187 0202 0203

INDIA
0014 0071 0074 0098 0103 0110 0114
0133 0136 0155 0156 0202
GERMPLASM
0174

INDONESIA
0035 0042 0046 0047 0071 0146 0164
0201
MARKETING
0161 0192
PRODUCTION
0161 0203
SOCIO-ECONOMIC ASPECTS
0203
TRADE
0161 0192

INDUSTRIAL MACHINERY
0144 0165

INDUSTRIAL STARCHES
0107 0143 0144 0165

INFLORESCENCES
0004 0105 0108 0110

INJURIOUS INSECTS
0022 0030 0036 0078 0080 0081 0083
0084 0087 0090 0096 0097 0103 0182
0183
ANASTREPHA MANIHOTI
0034
AONIDOMYTILUS ALBUS
0082 0174
ATTA
0167
BEMISIA
0059 0085 0167 0174
CARPOLONCHAEA CHALYBEA
0079
ERINNYIS ELLO
0034 0091 0092 0167
EUDIPLOSIS BRASILIENSIS
0079
PHENACOCCUS MANIHOTI
0085 0086 0088 0095 0100
SILBA PENDULA
0167
ZONOCERUS VARIEGATUS
0085

INJURIOUS MITES
0026 0030 0059 0079 0083 0086 0089
0099 0103 0182 0183
OLYGONYCHUS PERUVIANUS
0007 0167
MONONYCHELLUS TANAJOA
0058 0085 0095 0100
TETRANYCHUS CINNABARINUS
0098 0174
TETRANYCHUS URTICAE
0007 0167 0203

INOCULATION
0019 0020 0075 0157
DISEASES AND PATHOGENS
0026 0061

INSECT BIOLOGY
0080 0081 0084 0088 0093 0094 0100

INSECTICIDES
0022 0034 0058 0059 0079 0082 0093
0102 0172

INTER-CROPPING
0023 0167 0172 0174 0175 0182 0201
BANANA-PLANTAINS
0022
BEANS
0195
COWPEA
0021 0199 0202
GROUNDNUT
0021 0198 0202
LEGUME CROPS
0021 0027 0195 0196 0197 0199 0202
0203 0204
MAIZE
0021 0022 0181 0198 0203
RICE
0203
SORGHUM
0021
YAMS
0075

IPOMOEA BATATAS
0027 0155

IRON
0012 0111

IRRIGATION
0021 0034 0036 0107 0174

ISOLATION
0010 0013
DISEASES AND PATHOGENS
0061 0063 0064 0065 0066 0073

IVORY COAST
0006 0026 0032 0071 0076

KENYA
0072 0073

LABOUR
0116 0185
HARVESTING
0181 0203
PLANTING
0175 0181 0203
PROCESSING
0165 0171

LACTIC ACID
0122

LAND PREPARATION
0024 0034 0078 0172 0180 0183
ROOT PRODUCTIVITY
0023 0167 0174 0182 0199 0200 0204

LEAF AREA
0007

LEAVES
0007 0031 0038 0043 0090
AMINO ACIDS
0014
ANALYSIS
0002 0005 0011 0015 0029 0092
ANIMAL NUTRITION
0092 0116
HCN CONTENT
0015
MINERAL CONTENT
0018 0033
PROTEIN CONTENT
0014 0015
VITAMIN CONTENT
0167

LEGAL ASPECTS
0176

LIGHT
0009 0013 0069 0167

LINAMARIN
0205

LYSINE
0121

MAGNESIUM
0012 0033 0068 0183
ABSORPTION
0017
ROOT PRODUCTIVITY
0018 0026

MALAYSIA
0018 0025 0068 0071 0105 0112 0153
GERMPLASM
0104 0106

MALNUTRITION
0120

MANGANESE
0012 0018

MANIHOT GLAZIOVII
0074 0108

MANIHOT POHLII
0108

MANURES
DUNG
0202

MARKETING
0022 0160 0162 0166 0180 0188 0194
CASSAVA CHIPS
0116 0163 0171 0193
CASSAVA FLOUR
0147 0163 0172 0176 0191
CASSAVA MEAL
0163 0173
CASSAVA STARCH
0144 0161 0171 0176 0181 0182 0192
0193
GARI
0171 0193
PELLETS
0116 0161 0163 0171
ROOTS
0116
TAPIOCAS
0171 0176

MECHANIZATION
HARVESTING
0031 0179 0184
PLANTING
0031 0175 0179 0184
PROCESSING
0031 0184

METHIONINE
0113 0121

MEXICO
0009
SOCIO-ECONOMIC ASPECTS
0175

MICROSPOROGENESIS
0110

MINERALS
0012 0014 0017 0018 0019 0020 0021
0025 0026 0028 0033 0036 0042 0043
0044 0048 0049 0050 0068 0107 0111
0174 0183 0197 0198 0199 0202 0203

MITE CONTROL
0038 0083
ACARICIDES
0058 0059 0079 0098 0168 0174

MONONYCHELLUS CARIBEANAE
RESISTANCE
0085

MONONYCHELLUS TANAJOA
0095 0100
BIOLOGICAL CONTROL
0058
INSECTICIDES
0058
RESISTANCE
0085

MOULDS
0051 0054 0156 0174

MUKIBAT SYSTEMS
0046

MYCORRHIZAE
0019 0020 0174

MYCOSES
0006 0034 0036 0067 0068 0069 0070
0071 0084 0167 0174 0183 0203
DISEASE CONTROL
0058 0059 0060

NEMATODES
0075 0076 0077

NIGERIA
0012 0029 0063 0071 0075 0080 0086
0088 0096 0100 0126 0131 0132
MARKETING
0193
PRODUCTION
0193
TRADE
0193

NITROGEN
0007 0014 0018 0019 0020 0021 0023
0025 0026 0028 0033 0049 0050 0068
0107 0174 0183 0196 0197 0198 0199
0202 0203 0204

NUTRITIONAL REQUIREMENTS
0007 0014 0017 0018 0019 0020 0021
0025 0026 0028 0033 0035 0042 0043
0044 0048 0049 0050 0107 0167 0172
0174 0183 0195 0196 0197 0198 0199
0200 0202 0203 0204

OIDIUM
0167 0203

OLIGONYCHUS BIHARENSIS
0098 0174

OLIGONYCHUS PERUVIANUS
0007 0167

PACKAGING
0144 0165

PANAMA
0127 0130
PRODUCTION
0165
TRADE
0165

PAPER INDUSTRY
0143 0144

PAPUA NEW GUINEA
0070

PARTICLE SIZE
0153
CASSAVA STARCH
0003 0140 0144

PATENTS
FOOD PRODUCTS
0137

PEELING
0118 0135 0141 0143 0144 0147 0171

PELLETS
0116 0161 0163 0189
PROCESSING
0171

PEST CONTROL
0007 0022 0034 0038 0058 0059 0060
0072 0079 0082 0083 0085 0093 0098
0168 0172 0174 0182 0195

PEST DAMAGE
0058 0059 008[illegible] 0084 0093 0094

PETIOLES
0033 0090

pH
0011 0023 0034 0048 0118 0122 0157
CASSAVA STARCH
0137 0141 0144 0155 0156 0182
SOIL ANALYSIS
0014 0020 0033 0102 0167

PHENACOCCUS
0080 0093 0096 0097

PHENACOCCUS MANIHOTI
0086 0088 0095 0100
RESISTANCE
0085

PHILIPPINES
0040 0050 0071 0148 0158 0183 0204
MARKETING
0162
PRODUCTION
0055 0162
SOCIO-ECONOMIC ASPECTS
0162

PHOSPHORUS
0007 0012 0014 0018 0019 0020 0021
0023 0025 0026 0028 0033 0049 0050
0068 0107 0174 0183 0196 0197 0198
0199 0202 0203 0204

PHOTOSYNTHESIS
0007

PHYLLOSTICTA
SYMPTOMATOLOGY
0071

PHYSIOLOGY
0007 0008 0017 0018 0019 0033 0058
0064 0101 0131 0132 0174

PLANT GEOGRAPHY
0090 0116 0146 0166 0167

PLANT GROWTH SUBSTANCES
0009 0174

PLANT HEIGHT
0007 0033 0034 0036 0038 0043 0101
0102 0104 0196

PLANT PHYSIOLOGICAL PROCESSES
0007

PLANT REPRODUCTION
0102 0108 0110

PLANT TISSUES
0002 0013 0066
TISSUE CULTURE
0008 0174

PLANTING
0014 0030 0033 0046 0048
AGRICULTURAL EQUIPMENT
0175 0179
COSTS
0022 0107 0172 0175 0181 0182 0183
0195 0203
LABOUR
0175 0181 0203
MECHANIZATION
0031 0175 0179 0184

SPACING
0007 0023 0025 0032 0034 0049 0050
0102 0107 0167 0174 0175 0181 0182
0183 0196 0199 0200 0201 0204
ROOT PRODUCTIVITY
0022 0023 0026 0036 00[illegible] 0045 0049
0050 0102 0107 0167 0174 0182 0199
0200 0201 0204

POLLEN
0004 0105 0110

POLLINATION
0102 0105 0108 0110

POST-HARVEST LOSSES
0160

POTATOES
0113 0186 0187

POULTRY
0121 0123 0126 0129 0174

POWER SOURCES
0176

PRESSING
0117 0118 0147 0165

PRICES
0022 0098 0142 0143 0147 0162 0163
0165 0166 0176 0177 0181 0182 0185
0187 0189 0191 0192 0194 0198 0203

PROCESSING
0030 0114 0124 0136 0142 0145 0146
0148 0156 0166 0178 0183 0193
DRYING
0031 0117 0118 0119 0131 0132 0135
0137 0141 0143 0144 0147 0149 0152
0153 0165 0171 0184
FERMENTATION
0118 0122 0141 0143 0144 0157 0171
0174

GELATINIZATION
0138 0151
GRINDING
0117 0135 0144 0165
PEELING
0118 0135 0141 0143 0144 0147 0171
PRESSING
0117 0118 0147 0165
RASPING
0118 0141 0143 0144 0147 0165 0171
SCREENING
0118 0141 0143 0144 0147 0165 0171
SILTING
0143 0144 0165 0171
WASHING
0118 0122 0135 0141 0143 0144 0147
0165 0171

PROPAGATION
0030 0031 0106 0167

PROPAGATION MATERIALS
0007 0013 0014 0015 0018 0022 0023
0028 0031 0033 0034 0036 0038 0041
0048 0050 0058 0059 0078 0082 0094
0102 0105 0106 0108 0167 0168 0172
0174 0181 0182 0183 0193 0203 0204

PROTEIN CONTENT
0012 0113 0114 0121 0135 0157
LEAVES
0014 0015
ROOTS
0015 0122 0126 0146
STEMS
0015

PROTEIN ENRICHMENT
ECONOMICS
0118
FERMENTATION
0118 0174

PROTEINS
ANALYSIS
0131

PRUNING
0050 0167
DETERIORATION
0057

PSEUDOMONAS
0174
SYMPTOMATOLOGY
0071

QUARANTINE MEASURES
0060

RAINFALL DATA
0007 0024 0027 0033 0034 0036 0048
0049 0058 0059 0060 0078 0102 0167
0182 0183 0196 0203

RASPING
0118 0141 0143 0144 0147 0165 0171

RESISTANCE
0051
DISEASES AND PATHOGENS
0003 0026
INJURIOUS INSECTS
0085 0090 0103

INJURIOUS MITES
0026 0085 0103

ROOT CROPS
0045 0148

ROOT DEVELOPMENT
0174

ROOT PRODUCTIVITY
0018 0020 0022 0023 0026 0036 0042
0043 0045 0049 0050 0060 0072 0073
0083 0098 0102 0103 0104 0197 0109
0147 0167 0174 0182 0197 0198 0199
0200 0201 0202 0204

ROOT SYSTEM
0033

ROOTS
0007 0019 0077 0084 0101 0102 0128
0134
ANALYSIS
0001 0015 0016 0051 0056 0057 0112
0131 0132
BIOCHEMISTRY
0056 0174
DETERIORATION
0051 0052 0053 0054 0055 0056 0057
0116 0146 0174
DRY MATTER
0033 0043 0103 0107 0126
DIETARY VALUE
0116 0126
DRYING
0131 0132 0165 0185
FAT CONTENT
0122 0126
HCN CONTENT
0015 0016 0131 0132
NUTRITIVE VALUE
0122
PACKAGING
0165
STARCH CONTENT
0052 0053 0103
STORAGE
0051 0052 0053 0054 0055 0057 0112
0116 0146 0165 0167 0174 0183 0185
TRADE
0116 0165 0185

ROSELLINIA
0167

ROTATIONAL CROPS
0026 0167
MAIZE
0200

SAISSETIA NIGRA
0183

SEED
0009 0102 0108
GERMINATION
0105

SENEGAL
0076

SHIFTING CULTIVATION
0176

SHOOTS
0050

SILBA PENDULA
0167

SILTING
0143 0144 0165 0171

SMALL-SCALE EQUIPMENT
0141 0144 0148 0173 0174

SMALL-SCALE PROCESSING
0141 0143 0144 0148 0156 0171

SOCIO-ECONOMIC ASPECTS
0147 0162 0168 0169 0171 0172 0173
0175 0176 0178 0180 0185 0198 0203

SOIL AMENDMENTS
0019 0174

SOIL ANALYSIS
0014 0015 0018 0019 0020 0028 0029
0033 0036 0078 0102 0167 0196

SOIL FERTILITY
0023 0181

SOIL IMPOVERISHMENT
0025

SOIL PHYSICAL PROPERTIES
0007 0014 0018 0019 0020 0023 0024
0026 0028 0033 0034 0036 0045 0048
0049 0078 0102 0167 0182 0196

SOIL REQUIREMENTS
0019 0042 0174 0181 0183

SOIL WATER
0007

SOLAR DRYING
0119 0127 0131 0132 0141 0144 0149
0152 0153

SPHACELOMA MANIHOTICOLA
SYMPTOMATOLOGY
0071

STAMENS
0004 0105 0108 0110

STARCH CONTENT
0002 0028 0045 0052 0053 0083 0103
0104 0114 0135 0144

STARCH PRODUCTIVITY
CLIMATIC REQUIREMENTS
0199
CULTIVARS
0045 0104
FERTILIZERS
0199
HARVESTING
0104

STATISTICAL ANALYSIS
0015 0017 0018 0033 0034 0036 0048
0051 0052 0053 0082 0087 0101 0102
0104 0127 0130 0131 0132 0139 0152
0168 0174 0187 0196 0197 0199 0203

STATISTICAL DATA
0101 0152 0187 0203

STEMS
0036 0043 0196
ANALYSIS
0015
HCN CONTENT
0015
PLANT DEVELOPMENT
0007 0033

STOMATA
0005 0007

STORAGE
0008 0036 0051 0052 0053 0054 0055
0057 0112 0116 0118 0141 0144 0146
0147 0165 0167 0174 0182 0183 0185
0203

SUGAR CONTENT
0052 0053

SULPHUR
0033 0174 0183

SURINAM
0080 0096

SWEET CASSAVA
0010 0015 0016 0077 0084 0146 0169
ROOT PRODUCTIVITY
0102
STARCH CONTENT
0002

SWEET POTATOES
0012 0113

SWINE
0121 0123 0127 0176 0184
FATTENING
0130
ROOTS
0122 0128 0131 0132

SYMPTOMATOLOGY
DISEASES AND PATHOGENS
0058 0059 0060 0061 0067 0068 0071
0073

TAIWAN
0071
MARKETING
0176
SOCIO-ECONOMIC ASPECTS
0176
TRADE
0176

TANZANIA
MARKETING
0191
PRODUCTION
0191
TRADE
0191

TAPIOCA MACARONI
0183

TAPIOCAS
0164

DRYING
0171
INDUSTRIALIZATION
0171 0176
LEGAL ASPECTS
0176
NUTRITIVE VALUE
0171
PROCESSING
0171 0183
STORAGE
0183
TRADE
0171 0176
USES
0171 0183

TECHNOLOGY
0172 0173 0178 0185
TECHNOLOGICAL PACKAGE
0055 0143 0181
TECHNOLOGY EVALUATION
0143 0168 0171

TEMPERATURE
0007 0009 0013 0020 0033 0034 0036
0048 0049 0060 0069 0078 0081 0087
0088 0102 0152 0153 0157 0167 0182
0183

TETRANYCHUS CINNABARINUS
0098 0174

TETRANYCHUS NEOCALEDONICUS
0098

TETRANYCHUS URTICAE
0007 0167 0203

TEXTILES
0143 0144

THAILAND
MARKETING
0163 0194
PRODUCTION
0163 0194
TRADE
0163 0194

THIOCYANATES
0132

THRIPS
0007 0167 0174
INSECTICIDES
0079

TISSUE CULTURE
0008 0009 0030 0031 0045 0108 0174

TOGO
0076 0095

TOXICITY
0077 0116 0119 0120 0167 0171 0174

TRADE
0166 0186 0187 0188 0194
CASSAVA CHIPS
0116 0163 0165 0171 0185 0193
CASSAVA FLOUR
0163 0165 0176 0185 0191
CASSAVA MEAL
0163 0165 0185
CASSAVA STARCH
0142 0144 0161 0165 0171 0176 0192
0193
GARI
0171 0193
PELLETS
0116 0161 0163 0171
ROOTS
0116 0165 0185
TAPIOCAS
0171 0176

TRINIDAD AND TOBAGO
0096

VASCULAR STREAKING
0174

VENEZUELA
0001 0002 0003 0004 0005 0117 0129
0145 0150 0151
MARKETING
0147
PRODUCTION
0147
SOCIO-ECONOMIC ASPECTS
0147
TRADE
0186 0187

VISCOSITY
0114
CASSAVA STARCH
0137 0140

VITAMIN A
0115

VITAMIN CONTENT
0035 0115 0167

WASTE UTILIZATION
0126 0136 0163 0183

WASTES
0136 0156

WATER CONTENT
0012 0152
CASSAVA CHIPS
0153
CASSAVA MEAL
0122 0157
GARI
0118
LEAVES
0014
ROOTS
0052 0053 0122

WATER REQUIREMENTS (PLANT)
0007 0167

WATER REQUIREMENTS (PROCESSING)
0144

WEEDING
0007 0023 0026 0027 0033 0034 0036
0068 0107 0167 0168 0172 0179 0182
0183 0185 0200 0204
HOEING
0022

INOCULATION
0026 0061
RESISTANCE
0026
SYMPTOMATOLOGY
0058 0060 0061 0071

WEEDS
0022 0033

XANTHOMONAS CAMPESTRIS PV. CASSAVAE
0063
DISEASE CONTROL
0058 0059 0060
DISEASE TRANSMISSION
0060
SYMPTOMATOLOGY
0058 0059 0060

XANTHOMONAS CAMPESTRIS PV. MANIHOTIS
0062 0064 0065 0066 0167 0183 0203
DISEASE CONTROL
0058 0060
DISEASE TRANSMISSION
0060

YAMS
0012 0075

ZAIRE
0071 0080 0096

ZINC
0012 0017 0018 0020 0048 0183

ZONOCERUS VARIEGATUS
RESISTANCE
0085

SPECIALIZED INFORMATION CENTERS

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Mariano Mejía M., BA, Information Specialist-Tropical Pastures
Lynn Menéndez F., Information Specialist, Editing and Translation
Keyttel Gutiérrez de Prieto, Information Input
Gladys Rodríguez de Ramos, Proofreader
Mabel Vargas de West, MS, Information Specialist-Cassava

CASSAVA PROGRAM

James H. Cock, PhD, Coordinator
Anthony C. Bellotti, PhD, Entomology
Rupert Best, PhD, Utilization (Senior Research Fellow)
Edward Carey, PhD, Plant Breeding (Postdoctoral Fellow)
Clair Hershey, PhD, Plant Breeding
Reinhardt Howeler, PhD, Soils and Plant Nutrition
Carlos Alberto Ibañez, PhD, Economics (stationed in Brasilia, Brazil)
Willem Janssen, Associated Expert
Kazuo Kawano, PhD, Plant Breeding (stationed in Bangkok, Thailand)
J. Carlos Lozano, PhD, Plant Pathology
John K. Lynam, PhD, Economics
Raúl Moreno, PhD, Agronomy
Barry L. Nolt, PhD, Virology (Visiting Scientist)
Steven Romanoff, PhD, Economics (stationed in Quito, Ecuador)
Roberto Ricardo Saez, PhD, Economics (stationed in Mexico City, Mexico)
Luis Roberto Sanint, PhD, Economics
Romildo Albuquerque dos Santos, PhD, Agronomy (Postdoctoral Fellow)
Ewald Sieverding, Dr. Agr., Soils and Plant Nutrition (Visiting Scientist)
Christopher Wheatley, PhD, Utilization (Senior Research Fellow)

- PN-AAU- 178

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(*Manihot esculenta* Crantz)

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Abstracts on Cassava
(*Manihot esculenta* Crantz)

Vol. XII No. 2 August, 1986

CONTENTS

	INTRODUCTION	iii
	COMPONENTS OF AN ABSTRACT	iv
	HOW TO USE THE INDEXES	v
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY AND MORPHOLOGY	2
C00	PLANT PHYSIOLOGY	3
	C01 Plant Development	4
	C02 Cyanogenesis	6
	C03 Chemical Composition, Methodology and Analyses	6
	C04 Plant Nutrition	10
D00	CULTIVATION	10
	D01 Soil, Water, Climate and Fertilization	10
	D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting	14
	D03 Energy Productivity and Yields	19
	D04 Postharvest Studies	20
E00	PLANT PATHOLOGY	21
	E02 Bacterioses	21
	E03 Mycoses	23
	E04 Viroses	24
	E05 Mycoplasmoses	27
	E06 Nematodes	-

F00 PEST CONTROL AND ENTOMOLOGY 27
F01 Injurious Insects and their Control 27
F02 Rodents and other Noxious Animals 32
F03 Injurious Mites and their Control 32

G00 GENETICS AND PLANT BREEDING 33
G01 Breeding, Germplasm, Varieties and Clones, Selection 33
G02 Cytogenetics 39

H00 NUTRITION 39
H01 Cassava Foods and Nutritive Value 39
H02 Nutritive Disorders in Humans 40
H03 Animal Feeding 41
H04 HCN Toxicity and Detoxification 46

I00 PROCESSING, PRODUCTS AND USES 47
I01 Cassava Starch and its Properties 47
I02 Uses, Industrialization, Processing and Storage 50
I03 Industrial Microbiology 56

J00 ECONOMICS AND DEVELOPMENT 57

K00 OTHER ASSOCIATED COMMODITIES 84
K01 Rotational Schemes and Intercropping 84
K02 Descriptive and Comparative Studies 87

Z00 GENERAL -

ABBREVIATIONS AND ACRONYMS 88

AUTHOR INDEX 90

SUBJECT INDEX 98

INTRODUCTION

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide a specialized guide to the world's literature on cassava (*Manihot esculenta* Crantz), disseminating research results and ongoing activities related to the crop.

The abstracts report condensed information from journal articles, booklets, mimeographed reports, theses, manuals and other conventional and nonconventional material, categorized into broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are author and subject indexed to enable more comprehensive consultation.

When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users who request this search service. The full text of every article abstracted by the Documentation Center is also available, through the photocopy service.

CIAT's Documentation Center also publishes journals of analytical abstracts on field beans (*Phaseolus vulgaris* L.) grown under tropical conditions and on tropical pastures. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include: Pages of Contents, Cassava Newsletter, Pastos Tropicales - Boletín Informativo, and Hojas de Fríjol.

COMPONENTS OF AN ABSTRACT

Accesion number (for photocopy requests)

Authors

Sequential number in the journal (for use of indexes)

Year of publication

19527 IKEDIOBI, C.O.; ONYIKE, E. 0145 1982. The use of linamarase in gari production. Process Biochemistry 17(4):2-5. Engl., Sum. Engl., 12 Refs., Illus. [Dept. of Biochemistry, Ahmadu Bello Univ., Zaria, Nigeria]

Original title

Author address

Additional notes

Source

Pages

Language of paper

Language of summary

Cassava. Linamarase. Uses. Gari. Fermentation. Detoxification processes. Enzymes. Nigeria.

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. [AS]

Abstract

Abstractor and/or translator

HOW TO USE THE INDEXES

The numbers listed under each entry in the author and subject indexes correspond to the abstract's sequential number, found above each abstract within the journal.

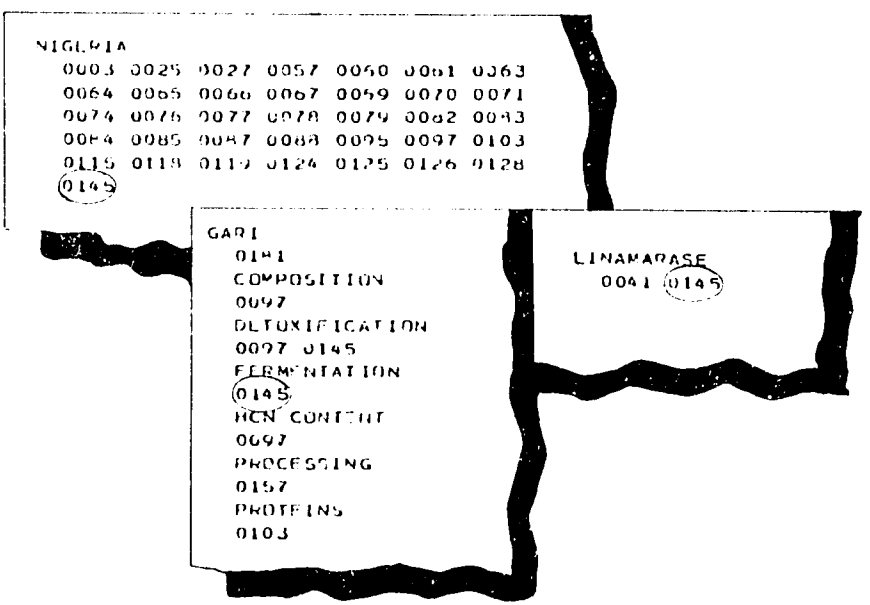
The last issue of the year contains cumulative author and subject indexes for the year.

Author Index

The Author Index can be used to find abstracts when the personal or corporate authors are known. The Author Index, which is alphabetically arranged, lists *all* author and co-author names cited in the publicaction.

Subject Index

The Subject Index presents an alphabetical list of descriptors used in cassava research, many of which are combined with other descriptors, allowing the identification of more specific topics.



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6. UNESCO coupons, available at UNESCO offices all over the world

0206

25253 ALLEM, A.C. 1984. A revision of Manihot section Quinquelobae (Euphorbiaceae). Ph.D. Thesis. Reading, England, University of Reading. v.1,311p. v.2,152p. Engl., Sum. Engl., 708 Refs., Illus.

Cassava. Manihot. Growth. Roots. Stems. Leaves. Inflorescences. Flowers. Fruits. Seed. Pollen. Pollination. Hybrids. Ecology. Taxonomy. Identification. Brazil.

A taxonomic revision of Manihot section Quinquelobae (Euphorbiaceae) is proposed. Of the original 14 species comprising the section, the no. has been reduced to 10. Leaf shape, despite its heavy use in past taxonomic treatments, is a very unreliable character, few species having a truly constant leaf morphology. Of all the fields searched to test their eventual use in taxonomic matters, leaf epidermal-sculpturing pattern proved to be the most rewarding. Not infrequently, this field alone supplied data that led to taxonomic decisions in matters of rank and synonymy. Field activity, enabling the examination of fresh material, revealed that only now are the value of characters of the genus being properly assessed. This is particularly true of fruit sculpturing, a character of basic taxonomic importance, so neglected and overlooked in the past. Cytology revealed little new, with an uniform 2n = 36 holding firm for all of the species of the genus. Palynology revealed a very uniform exine-sculpturing of the pollen grains in all species. Reproductive biology puts forward evidence to indicate geitonogamy as the probable prevailing breeding system of the genus. Evidence is also introduced suggesting that agamospermy and/or pseudogamy might be active in Manihot. The occurrence of a given species is not only dependent on abiotic factors, such as soil, climate and topography, but is also, to a great degree, affected by biotic factors such as pollinator behavior and the breeding system of the plant species. It is made clear that the unit of plant evolution is not the species, but its local breeding population instead. Evidence is advanced, showing ways by which a species can diversify quickly in the tropics, taking advantage of a restriction of gene flow among populations isolated by distance. A classification of the species, though a very conservative one, is given. In it, it is particularly clear that a broad view of the plant species was fully warranted, in the light of the evidence that distinct allopatric populations might be evolving at quite different evolutionary speeds. [AS]

0207

25595 BOSTER, J.S. 1985. Selection for perceptual distinctiveness: evidence from Aguaruna cultivars of Manihot esculenta. Economic Botany 39(3):310-325. Engl., Sum. Engl., 27 Refs. [Dept. of Science & Technology Studies, Rensselaer Polytechnic Inst., Troy, NY 12181, USA]

Cassava. Cultivars. Plant anatomy. Identification. Taxonomy. Manihot esculenta. Sweet cassava. Bitter cassava. Leaves. Petioles. Stems. Branching. Roots. Research. Statistical analysis. Peru.

Evidence that cassava cv. have been selected for combinations of characters that allow them to be perceptually distinguished is presented. This mode of selection is proposed to explain why cv. are so variable in perceptually salient taxonomic characters unrelated to the use or survival of the plant. Published material on cassava and related species is reanalyzed and new evidence from the inventory of cassava cv. maintained by the Aguaruna Jívaro of northern Peru is presented. Three characteristics implied by the

model of selection for perceptual distinctiveness have been identified: high, continuous, and independent variation of nonadaptive taxonomic characters. The inventory of Aguaruna cv. exhibits 2 additional characteristics predicted by the model: taxonomic characters of this local inventory vary as independently and nearly as greatly as those of the species as a whole. Anthropological evidence is presented to demonstrate that Aguaruna interacts with the plants as predicted by the model. The evidence suggests that procedures used by cultivators to identify cv. leave their imprint on the plants; crops show the effect of the cultivator's eye as well as hand. [AS]

0208

24539 CACERES A., L.A. 1985. A mandioca: origem, evolucao e dispersao. (Cassava: origin, evolution, and dispersion). Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 23p. Port., 31 Refs.

Cassava. Manihot. Plant geography. History. Cytogenetics. Genetics. Chromosomes.

A literature review is presented on the origin, domestication, dispersion, cytogenetics, and genetics related to the evolution of cassava. [CIAT]

See also 0237 0366 0370

B00 PLANT ANATOMY AND MORPHOLOGY

0209

25277 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Morphology and development of the cassava plant. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.1-20. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Plant anatomy. Leaves. Stems. Roots. Flowers. Fruits. Seed. Growth. Plant development. Canopy. Root development. Malaysia.

The main advances in research on the morphology and plant development of cassava in Peninsular Malaysia are reported. A botanical description of leaves, stems, roots, flowers, fruits, and seeds is presented with color illustrations of each part. In relation to regeneration, canopy development, root storage and bulking, and 2nd vegetative phase, the growth pattern of the plant over 24 mo. is described. [CIAT]

0210

25732 LOCKARD, R.G.; LOCKARD, J.M.; WOUNUAH, D.D. 1985. A rapid non-destructive method for the estimation of leaf areas in cassava. Annals of Botany 55(1):125-128. Engl., Sum. Engl., 6 Refs., Illus. [Central Agricultural Research Inst., P.O. Box 3929, Monrovia, Liberia]

Cassava. Leaf area. Cultivars. Leaves. Statistical analysis. Liberia.

A rapid and nondestructive method of estimating leaf areas was required for detailed study of new cassava cv. The outlines of leaves were traced in

the field and leaf areas were obtained with a planimeter. Cv. Caricass 2 was chosen for detailed study and 50 leaves of each lobe no. (3-9 lobes/leaf) were measured. The length and width were recorded for all lobes and correlations were made with leaf areas. All lobe lengths and length x width were highly correlated with leaf area. It is therefore necessary to measure the length of only 1 lobe to get an estimate of leaf area. Comparisons of leaves with 5 and 7 lobes from Caricass 1, Caricass 3, and a local cv. showed that these cv. could be measured in the same way and that the regression coefficients of Caricass 2, Caricass 3, and the local cv. were not significantly different. A common regression coefficient could be used to estimate leaf area on all 3 cv. [AS]

See also 0207 0286 0364

C00 PLANT PHYSIOLOGY

0211

25600 COCK, J.H.; PORTO, M.C.M.; EL-SHARKAWY, M.A. 1985. Water use efficiency of cassava. 3. Influence of air humidity and water stress on gas exchange of field grown cassava. Crop Science 25(2):265-272. Engl., Sum. Engl., 23 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Field experiments. Cultivars. Carbon dioxide. Water requirements (plant). Irrigation. Water stress. Photosynthesis. Plant respiration. Transpiration. Leaves. Stomata. Colombia.

Field measurements of gas exchange were made to study the response of field grown cassava to changes in air humidity under well-watered and nonirrigated conditions. Cv. M Col 1684 was used as testing material at CIAT-Palmira and Santander de Quilichao (Colombia). The infrared gas exchange technique was modified to allow for field sampling of leaf CO_2 exchange rates using the syringe injection method at locations far from the lab. There was a remarkable decrease in the leaf photosynthetic rate with decreasing air humidity in both well-watered and nonirrigated plants. Leaf photosynthetic rate was significantly correlated with air vapor pressure difference (VPD) and leaf conductance but was not correlated with leaf water potential at midday and early afternoon. The midday leaf water potential of nonirrigated plants was slightly higher than that of the well-watered plants. Photosynthetic rate of nonirrigated plants was always lower than that of the well-watered ones. Transpiration initially increased with increased leaf to VPD and then sharply declined with further increases in VPD. Leaf water use efficiency decreased in curvilinear pattern with VPD. The results agree with previous reports on lab. controlled expt. Dry root yield and total biomass production of cassava was increased by increasing the RH in the crop canopy by artificial misting. There was 91, 15, and 27% increase in dry root, top, and total DM, resp., after 40 days of misting as compared with the control. These differences in biomass production were neither associated with changes in soil water nor with changes in LAI but rather with enhanced photosynthetic rate/unit leaf area of the misted plants. The leaf photosynthetic rate of cassava decreased with leaf age with a max. rate of 26 micromoles $CO_2/m^2/s$ for young leaves as compared with 13 micromoles $CO_2/m^2/s$ for old leaves lower in the canopy. Photosynthetic saturation irradiance was around 1500 and 800 micromoles/m^2/s for young and old leaves, resp. The modified syringe injection method proved reliable and suitable for handling a large no. of field samples in a short time. Photosynthetic rates of several C_3 and C_4 crop species were similar to reported values obtained with the conventional infrared gas exchange technique. [AS]

0212

25236 KANDA, A.; IMAI, K.; MORIYA, T. 1984. A gas exchange measurement system and its application to rice and cassava leaves. Japanese Journal of Crop Science 53(4):472-478. Engl., Sum. Engl., Jap., 16 Refs., Illus. [Faculty of Agriculture, Univ. of Tokyo, Bunkyo-ku, Tokyo 113, Japan]

Cassava. Leaves. Carbon dioxide. Transpiration. Plant assimilation. Water requirements (plant). Stomata. Japan.

A system for simultaneous measurements of net CO_2 assimilation and transpiration was established. It can precisely regulate the environment inside the assimilation chamber under lab. and field conditions. Gas exchange data were obtained for rice and cassava leaves. When wind velocity was changed from 0.77 to 1.70 m/s, net CO_2 assimilation increased slightly (6% in rice and 7% in cassava) but transpiration increased greatly (70% in rice and 22% in cassava), and consequently water use efficiency decreased. When RH was changed from 32 to 83%, water use efficiency increased because net CO_2 assimilation increased (9% in rice and 8% in cassava) but transpiration decreased (-59% in rice and -43% in cassava). With follow-up regulation, changes in air temp. and humidity were tracked to within $\pm$ 0.2°C and $\pm$ 0.5%, resp. [AS]

See also 0366

C01 Plant Development

0213

25569 AZIZ, Z.A. 1983. Leaf area studies on four varieties of cassava with different leaf forms and branching habits and their relations with yield. MARDI Research Bulletin 11(3):240-247. Engl., Sum. Mal., Engl., 5 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., Serdang, Selangor, Malaysia]

Cassava. Leaves. Cultivars. Leaf area. Branching. Rainfall data. Root productivity. Growth. Malaysia.

Of 4 cassava var. studied at the Malaysian Agricultural Research and Developing Institute (Serdang, Selangor), Black Twig gave the highest root yields. This was attributed to its ability to retain a relatively high LAI for a long period of its growth. Black Twig is unbranched and has normal leaf lobes. A 2nd unbranched var., Peranchis, with narrow leaf lobes, recorded the lowest LAI value. Of the 2 branched var. studied, Melaka gave yields that were intermediate between those of Black Twig and Peranchis, while Buluh gave the lowest yields. It was concluded that branching appears to be associated with low yields. [Plant Breeding Abstracts]

0214

25278 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. The physiological basis of yield in cassava. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.21-31. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Plant physiology. Dry matter. Leaf area. Root productivity. Leaves. Planting. Spacing. Branching. Canopy. Light. Photosynthesis. Malaysia.

The physiological basis of yield in cassava, or capacity for root production, is discussed. This depends on the productivity of DM as a whole by the plant and the distribution of DM in favor of the roots. The DM production, importance of LAI and its components (plant density, leaf size, leaf life, leaf production rate/apex, branching), canopy efficiency (light interception and photosynthetic rate/leaf area unit), distribution of DM, competitive sinks, and HI are analyzed. The DM production largely depends on LAI development, which is related to branching and leaf life, to reach its optimum level and to maintain it in a productive state at this level. As the needs of top growth have to 1st be satisfied before DM passes into root storage, intense branching is clearly undesirable. [CIAT]

0215

25518 GOMEZ, G.; VALDIVIESO, M. 1985. Foliage and root production of field-grown cassava cultivars as affected by plant age. Turrialba 35(1):5-10. Engl., Sum. Engl., Span., 25 Refs., Illus. [Centro Agronómico Tropical de Investigación y Enseñanza, 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Harvesting. Timing. Foliage. Leaves. Petioles. Stems. Roots. Productivity. Root productivity. Dry matter. Costa Rica.

Three cassava cv. (M Col 22, M Col 1684, and the hybrid CM 342-170) were evaluated for foliage (leaves, petioles, and green stems) and root production, as well as stem yield, throughout the period from mo. 6 to 12 of plant age. Foliage yield was affected by climatic conditions and by plant age; it declined progressively in all cv. from mo. 6 to 10 of plant age, during which rainfall decreased and ambient temp. increased. Foliage yield of cv. M Col 1684 was lower than that of the other 2 cv.; at 10 mo. of age, the fresh foliage yield of M Col 1684 was 1.3 t/ha as compared with 4 t/ha for the other 2 cv. Stem yield of M Col 1684 was also the lowest at 6 and 8 mo. of plant age. Root production tended to increase with plant age. Data are presented on the relative proportions of foliage, stem, and root yields in relation to the total fresh plant wt. as well as changes in the DM content of these parts of the plant. [AS]

0216

25237 IMAI, K.; COLEMAN, D.F.; YANAGISAWA, T. 1984. Elevated atmospheric partial pressure of carbon dioxide and dry matter production of cassava (Manihot esculenta Crantz). Japanese Journal of Crop Science 53(4):479-485. Engl., Sum. Engl., Jap., 18 Refs., Illus. [Inst. of Agriculture & Forestry, Univ. of Tsukuba, Sakura-mura, Ibaraki 305, Japan]

Cassava. Cultivation. Temperature. Carbon dioxide. Growth. Dry matter. Leaves. Stomata. Plant assimilation. Transpiration. Japan.

Cassava plants were grown for 2 or 3 mo. in glasshouses at 350 (control) and 700 microbars CO_2, and the growth attributes and gas exchange characteristics were compared. High CO_2 increased total DM production of the control by 54% at 28/21°C (3 mo. growth) and by 150% at 33/26°C (2 mo. growth). The high CO_2 grown plants had bigger leaves but lower top:root ratios. Gas exchange characteristics of both the control and high CO_2 plants were similar at 30 days but the rate of net CO_2 assimilation declined after 55 days of growth at high CO_2. The decline was associated with a decrease in stomatal conductance. Irrespective of the duration of

CO_2-treatments, leaves from the high CO_2 plants had higher water use efficiency than those from the controls. [AS]

See also 0209 0227 0237 0242 0247 0364 0370

CO2 Cyanogenesis

0217

25519 AYANRU, D.K.G.; SHARMA, V.C. 1984. Changes in total cyanide content of tissues from cassava plants infested by mites (Mononychellus tanajoa) and mealybugs (Phenacoccus manihoti). Agriculture, Ecosystems and Environment 12(1):35-46. Engl., Sum. Engl., 29 Refs. [Dept. of Microbiology, Univ. of Benin, PMB 1154, Benin City, Nigeria]

Cassava. Mononychellus tanajoa. Phenacoccus manihoti. Clones. Sweet cassava. Bitter cassava. Leaves. Stems. Roots. Cortex. Plant tissues. Insecticides. Acaricides. Cyanides. HCN content. Linamarase. Nigeria.

The HCN contents of leaf, stem, and root tissues of 6 cassava clones (TMS 4488, 30572, TMS/SA 1001, TMS/U 30395, 41044, and 42046), infested with Mononychellus tanajoa and Phenacoccus manihoti, were determined. All clones except TMS/SA 1001 had a high cyanide content and the control plants were sprayed with monocrotophos. Overall mean total cyanide contents of entire plants, sprayed and unsprayed, were similar; however, individual tissues varied considerably from the whole plant in this respect. [CIAT]

CO3 Chemical Composition, Methodology and Analyses

0218

25768 AJIBOLA, O.O. 1985. Moisture dependence of some electrical and dielectric properties of cassava. Journal of the Science of Food and Agriculture 36(5):359-366. Engl., Sum. Engl., 8 Refs., Illus. [Dept. of Agricultural Engineering, Univ. of Ife, Ile-Ife, Nigeria]

Cassava. Water content. Analysis. Statistical analysis. Nigeria.

The electrical resistance and the 1.0 kHz dielectric properties of cassava were measured at different MC values with the Kiethley digital multimeter and GR1608-A impedance bridge, resp. The resistance increased linearly with decreasing MC while the Napierian logarithm of the alternating current conductivity decreased linearly with decreasing MC. Regression constants were obtained in both cases. The dielectric constant decreased with decreasing MC. [AS]

0219

25761 GOMEZ, G.; VALDIVIESO, M. 1985. Cassava foliage: chemical composition, cyanide content and effect of drying on cyanide elimination. Journal of the Science of Food and Agriculture 36(6):433-441. Engl., Sum. Engl., 31 Refs., Illus.

Cassava. Cultivars. Foliage. Leaves. Petioles. Stems. Drying. Solar drying. Dry matter. Protein content. Fat content. Fibre content. Ash content. Mineral content. Ca. P. Food energy. HCN content. Harvesting. Timing. Colombia.

The chemical composition and cyanide concn. in the foliage of 4 cassava cv. (M Col 113, M Col 22, M Col 1684, and CM 342-170) were evaluated at 4 plant ages (6, 8, 10, and 12 mo.). The effect on cyanide elimination of sun drying on a concrete floor and of oven drying at 60°C was also studied, including some observations on the tannin content of dried foliage. The proximal composition, Ca and P contents, as well as the amino acid composition of dried cassava foliage compared favorably with that of sun-cured lucerne meal. In most cases, foliage from 6- to 12 mo.-old plants contained 25-30% DM, and as dried foliage had 13-23% CP and 16-26% crude fiber. The CP and crude fiber were the 2 chemical constituents which varied the most with plant age. The av. gross energy of dried cassava foliage was 4.12 kcal/kg with a range of 3.90-4.35 kcal/kg. Sun drying eliminated more cyanide than oven drying (82-94% vs. 68-76%, resp.) and in addition, most of the cyanide in sun-dried foliage was free cyanide (62-77%) whereas only 24-36% was found as such in oven-dried foliage. Sun-dried foliage samples had consistently lower tannin content than the corresponding oven-dried samples. [AS]

0220

25262 GOMEZ, G.; VALDIVIESO, M.; NOMA, A.T. 1985. The influence of cultivar and plant age on the chemical composition of field-grown cassava leaves and roots. Qualitas Plantarum Plant Foods for Human Nutrition 20:109-119. Engl., Sum. Engl., 24 Refs., Illus. [Centro Agronómico Tropical de Investigación y Enseñanza, 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Harvesting. Timing. Composition. Dry matter. Protein content. Sugar content. Starch content. Fat content. Amino acids. HCN content. Fibre content. Rainfall data. Temperature. Climatic requirements. Soil physical properties. Colombia.

The chemical composition of low- (M Col 113), intermediate- (M Col 22 and hybrid CM 342-170), and high- (M Col 1684) cyanide-containing cassava cv. at 4 plant ages (6, 8, 10, and 12 mo.) is presented. Information is included on proximal composition, cyanide and amino acid concn. of leaves and root tissues, as well as the starch and sugar concn. of root peel and parenchyma. Local cv. M Col 113 showed lower leaf and root parenchyma DM contents, lower crude fiber and CP levels in root peel, a higher sugar content and lower cyanide concn. in root tissues, than the other 3 cv. Most of the parameters studied were affected by the cv. as well as by plant age. Less variability was observed for all criteria in the root parenchyma than in the leaves and root peel. The S-containing amino acids were low in all tissues analyzed and a high concn. of arginine was found in the root tissue samples. The cyanide concn. of root parenchyma was less variable than that of leaves and root peel; cv. M Col 1684 showed a higher cyanide concn. in the parenchyma (900-1000 mg/kg DM) than the other 3 cv., which ranged from 100 to 200 mg/kg DM. Local cv. M Col 113 was the only one in which the cyanide concn. in leaves was higher than that of the root peel. Hybrid CM 342-170 produced roots with the highest DM and starch concn. [AS]

0221

25299 IZOMKUN-ETIOBHIO, B.O.; UGOCHUKWU, E.N. 1984. Comparison of an alkaline picrate and a pyridine-pyrazolone method for the determination of hydrogen cyanide in cassava and in its products. Journal of the Science of Food and Agriculture 35(1):1-4. Engl., Sum. Engl., 14 Refs. [Dept. of Biochemistry, Univ. of Benin, Benin City, Nigeria]

Cassava. Roots. Gari. Linamarase. HCN content. Cyanides. Analysis. Nigeria.

The HCN in fresh cassava tissues and in processed cassava products was determined by using an alkaline picrate procedure and a pyridine-pyrazolone method which uses Conway vessels. Results obtained for the fresh cassava tissues by the 2 methods were similar. Statistically significant higher values for processed cassava products were obtained with the alkaline picrate procedure which measured both glycosidic and nonglycosidic cyanide. The suggestion is reaffirmed that HCN in processed cassava products may exist in 2 forms: glycosidic and nonglycosidic (entrapped) cyanide. [AS]

0222

25515 KUMAR, A.; SANWAL, G.G. 1984. Starch phosphorylase from tapioca (Manihot utilissima) tuber: isolation and some physico-chemical properties. Indian Journal of Biochemistry & Biophysics 21(4):241-247. Engl., Sum. Engl., 36 Refs., Illus. [Dept. of Biochemistry, Lucknow Univ., Lucknow 226007, India]

Cassava. Cassava starch. Enzymes. Analysis. Biochemistry. India.

Starch phosphorylase from cassava roots was purified to homogeneity as tested by polyacrylamide gel electrophoresis at various pH, gel filtration chromatography, and SDS polyacrylamide gel electrophoresis, using the techniques of adsorption on starch, heat treatment, DEAE-cellulose chromatography, and gel filtration through Sephadex G-200. The enzyme has a mol. wt. of 220,000 ± 10,000 with 2 subunits of identical mol. wt., 110,000 ± 5000, and contains 6 SH- groups/mole of the enzyme protein. The enzyme protein contains 2 moles of pyridoxal 5'-phosphate/mole of the native enzyme. The kinetic data suggest a sequential type of reaction mechanism. The enzyme activity is inhibited by aromatic amino acids, ATP, guanine, and guanosine. [AS]

0223

25765 SANTAMARIA H., E.; CONTRERAS G., J. 1984. Composición química de seis variedades de yuca Manihot esculenta Crantz en distintas etapas de desarrollo. (Chemical composition of six cassava varieties in different growth stages). Agricultura Técnica en México 10(1):3-16. Span., Sum. Span., 19 Refs.

Cassava. Cultivars. Harvesting. Timing. Analysis. HCN content. Starch content. Fibre content. Dry matter. Agronomic characters. Plant anatomy. Organoleptic examination. Mexico.

During 1981 and 1982 at the Cotaxtla Agricultural Expt. Field (Veracruz, Mexico), cassava roots of var. Cubana, Smalling Santa Cruz, Criolla, Señora está en la Mesa, Itú, and Guaxupé were quantitatively and qualitatively analyzed at 4 different plant ages to obtain information on variation of cyanogenic content, DM and starch production, fiber content, and effects of the cyanogenic content on flavor. Chemical analyses demonstrated that the HCN content in fresh root chips indicates the concn. of this component in the parenchyma; likewise, analyses indicated that in some var. this concn. decreased slightly between 11-13 mo. of age. This helps determine methods for eliminating HCN and more convenient periods for harvesting. Estimated production of DM and starch were stable and, in some var., increased with plant age. Fiber content was variable and increased in all the materials according to the crop's development. Amounts of starch and HCN and % of fiber varied with the MC of the roots. Their flavor did not totally relate with the cyanogenic content since it differed depending on plant development. [AS-CIAT]

0224

23719 SUGANUMA, T.; BEPPU, K.; FUJIMOTO, S.; NAGAHAMA, T. 1983. Cassava root phosphorylase contains pyridoxal 5'-phosphate which the leaf enzyme does not. Agricultural and Biological Chemistry 47(12):2961-2963. Engl., 17 Refs., Illus. [Dept. of Agricultural Chemistry, Faculty of Agriculture, Kagoshima Univ., Kagoshima 890, Japan]

Cassava. Enzymes. Roots. Analysis. Biochemistry. Cultivars. Japan.

A study was conducted to try to elucidate whether the phosphorylase from cassava roots was a pyridoxal 5'-phosphate containing enzyme or not. The phosphorylase activities of 8 cassava var. were between 2.2-5.8 units/g fresh wt. After the phosphorylase was purified, the pyridoxal 5'-phosphate content in cassava roots was determined according to the method of Wada and Snell. It was observed that the absorption spectrum of intact phosphorylase was between 240-440 nm; a broad shoulder around 330 nm in addition to the protein absorption peak at 280 nm were seen, as with other enzymes with pyridoxal 5'-phosphate. When phenylhydrazine was added to the perchlorate extract of the enzyme, a distinct peak appeared at 410 nm due to the free pyridoxal 5'-phosphate. Assuming that the subunit mol. wt. of cassava phosphorylase is the same as that of potato, the pyridoxal 5'-phosphate content in the cassava enzyme is calculated to be 0.4 molecule/subunit. The enzyme preparation from roots showed a higher specific activity than the enzyme preparation from leaves by other authors and a very distinct peak at 410 nm due to the pyridoxal 5'-phosphate. [CIAT]

0225

25580 TAKEDA, Y.; SHIRASAKA, K.; HIZUKURI, S. 1984. Examination of the purity and structure of amylose by gel-permeation chromatography. Carbohydrate Research 132(1):83-92. Engl., Sum. Engl., 38 Refs., Illus. [Dept. of Agricultural Chemistry, Faculty of Agriculture, Kagoshima Univ., Korimoto-1, Kagoshima 890, Japan]

Cassava. Cassava starch. Analysis. Japan.

Gel permeation chromatography on TOYOPEARL HW-75F is a sensitive and useful method for examining the purity of amylose specimens. The required recrystallization frequency for preparing amylose free from amylopectin depended on the starch source. The I affinity of chromatographically pure amylose of cassava starch was 20 g/100 g. The pure amylose of cassava starch had a degree of polymerization value of 2660 with 8 chains on the av. [AS (extract)]

0226

25594 VREUGDENHIL, D. 1985. Source-to-sink gradient of potassium in the phloem. Planta 163(2):238-240. Engl., Sum. Engl., 16 Refs., Illus. [Dept. of Plant Physiology, Agricultural Univ., Arboretumlaan 4, NL-6703 BD Wageningen, The Netherlands]

Cassava. Mineral content. K. Stems. Analysis.

The K contents of bark strips of cassava and of phloem exudate of castor bean were analyzed at different regions of the stem. In cassava, a peak in K content was observed near the 1st mature leaf, leveling off both above and below this point. In castor bean, only a downward decreasing gradient was observed. In both plants, the direction of the K gradient coincided with the presumed direction of assimilate flow. [AS]

See also 0261 0287 0299 0319 0349 0370

C04 Plant Nutrition

0227

25763 MANRIQUE, L.A. 1985. Effect of extreme soil acidity conditions on plant growth and yield of cassava. Communications in Soil Science and Plant Analysis 16(9):959-970. Engl., Sum. Engl., 3 Refs., Illus. [Dept. of Agricultural Engineering, Univ. of Hawaii, Honolulu, Hawaii]

Cassava. Cultivars. Leaf area. Soil physical properties. Soil analysis. pH. Al. Plant height. Root productivity. Branching. Timing. Panama.

The differential response of cassava cv. to high levels of KCl-extractable soil Al in a Typic Tropudult of Panama is reported. High levels of soil Al reduced plant height and root yields of most cv., although some genotypes showed good potential to produce acceptable root yields at Al levels above 5 cmol (p^+)/kg. Cv. showed distinctive LAI and leaf area distribution patterns that in some cases appeared to be Al toxicity related. Two possible ways Al might have affected LAI, leaf area distribution, and hence root yields are suggested: (1) impairment of its ability to develop and sustain leaf area, and (2) disturbance of its capacity to distribute and accumulate assimilates by roots. [AS]

0228

25294 SIEVERDING, E.; LEIHNER, D.E. 1984. Effect of herbicides on population dynamics of VA-mycorrhiza with cassava. Angewandte Botanik 58(3-4):283-294. Engl., Sum. Engl., Germ., 13 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Mycorrhizae. Inoculation. Laboratory experiments. Field experiments. Herbicides. Root productivity. Colombia.

One greenhouse and 2 field trials were conducted at CIAT to determine the effect of herbicides on vesicular-arbuscular mycorrhizae in association with cassava. A direct effect on mycorrhizae, as detected in the greenhouse trial, was a mild to intermediate depression of root infection and/or spore production depending on the herbicide used. In field trials, herbicides had an indirect effect in eliminating weeds as mycorrhizal hosts, resulting in a delay in spore population build-up. Cassava growth and root yield were unaffected by herbicidal action on the mycorrhizae. Oxadiazon selectively depressed Glomus spp., thus changing the mycorrhizal species composition. [Review of Plant Pathology]

See also 0230 0246 0359

D00 CULTIVATION

See 0286 0350 0380 0403

D01 Soil, Water, Climate and Fertilization

0229

25260 CADAVID L., L.F.; HOWELER, R.H. 1984. La fertilización de la yuca (Manihot esculenta Crantz) en la región de Mondomo y Pescador, Cauca.

(Cassava fertilization in the Mondomo and Pescador region, Cauca). Suelos Ecuatoriales 14(1):199-207. Span., Sum. Span., 20 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Soil analysis. Fertilizers. N. P. K. Cultivars. Root productivity. Starch productivity. Starch content. Costs. Income. Colombia.

A NPK assay was established in cassava crops in 4 rural communities of Mondomo and in 1 of Pescador (Cauca, Colombia) to determine the response of cassava to several levels of NPK application and to recommend an optimum and economical fertilization for this crop on hillsides and with shifting cultivation patterns. The levels were 0, 50, 100, and 200 kg NPK/ha as urea, triple superphosphate, and KCl, and a constant application of 0.5-1.0 t lime/ha. M Col 113, Barranqueña, CMC-92, Algodona, and Palmirana were planted and harvested 10-15 mo. after planting. There was a positive response to fertilization, a slight response to N applications, and a highly significant response to 50 kg P/ha. With higher levels there was a lower response. Some positive increase in yields was also observed with K applications. An av. of 100 kg N, 50 kg P, and 100 kg K/ha was the optimum economical combination (higher benefits/costs). Even though fertilization had little influence on starch content, this decreased slightly with no K. It is concluded that P is the most limiting element in the region and that a suitable fertilization with the 3 major nutrients is necessary to obtain an optimum economy higher than the regional av. (5 t/ha) and to restore to the soil the nutrients lost through harvest and erosion; a better management of this type of soil is also necessary. [AS-CIAT]

0230

25282 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Fertilizing for maximum yield. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.48-63. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Fertilizers. N. P. K. Cu. Mg. Root productivity. Starch productivity. Mineral deficiencies. Mineral content. Ca. Timing. Malaysia.

Research results on fertilization of cassava in Peninsular Malaysia are summarized. Analyses of leaves, petioles, stems, and roots of a 28 t/ha harvest of cv. Black Twig showed that the crop removes 88, 73, 218, 55, and 27 kg N, P, K, CaO, and MgO, resp., which increase to 126, 105, 312, 78, and 38 kg, resp., when the harvest is of 40 t/ha K is the nutrient most removed by the crop and since Malaysian soils are generally poor in available K, large responses to K fertilization are frequently observed. The importance, deficiency symptoms, and optimum dosage of fertilization with K, N, P, Mg, Cu, and other trace elements are discussed. The suitable time for fertilizer application is at planting in both peat and inorganic soils. [CIAT]

0231

25503 KRUTKUN, T. 1984. [Effects of mercury chloride applied in soil on cassava grown on Map Bon sandy loam soil]. Kasetsart Journal 18(1):24-26. Thai., Sum. Engl., 12 Refs.

Cassava. Cultivation. Growth. Productivity. Thailand.

Application of mercuric chloride at rates above 80 ppm Hg in surface soil reduced the growth and yield of cassava. [AS]

0232

25523 MARTINEZ M., B.; MARTINEZ V., R.; ARCE S., R. 1982. Ensayo de un régimen de riego en la yuca (Manihot esculenta). (Irrigation trial in cassava). Ciencia y Técnica en la Agricultura. Viandas Tropicales, Suplemento Septiembre 1982:83-94. Span., Sum. Span., Engl., 5 Refs., 11lus. [Centro de Mejoramiento de Semillas Agámicas, Ministerio de la Agricultura, Apartado no.6, Santo Domingo, Villa Clara, Cuba]

Cassava. Cultivars. Cultivation. Irrigation. Rainfall data. Temperature. Transpiration. Root productivity. Plant development. Cuba.

The effect of 2 soil moisture levels and 2 growing seasons of cassava were studied on a brown carbonated soil in Santo Domingo, Cuba. A yield of 37.85 t/ha was achieved by applying water at 80% of the field capacity during the 1st growing period (0-60 days) and at 70% field capacity during the 2nd growing period. The total evapotranspiration recorded was 8510 mm, with a daily av. of 27.5 mm. A total of 2328 m^3/ha was applied over 7 irrigations, and a bioclimatic coefficient (K) of 0.42 was obtained. [AS]

0233

23176 NJOKU, B.B.; ARENE, O.B. 1980. The influence of potassium, nitrogen, phosphorus and magnesium fertilization on anthracnose disease and tuber yield of cassava. In Potassium Workshop, Ibadan, Nigeria, 1980. Ibadan, International Institute of Tropical Agriculture. pp.193-198. Engl., 13 Refs., 11lus.

Cassava. Fertilizers. N. P. K. Mg. Cultivars. Colletotrichum. Root productivity. Nigeria.

In Umudike, Nigeria, the improvement of soil fertility to reduce the incidence and severity of anthracnose in cassava was investigated. In a randomized complete block design, 4 nutrients (N, P, K, and Mg) were each tested at 5 levels. Cuttings from cassava cv. 60506, infected with anthracnose, were planted in 6 x 6 m^2 plots in rows 1 m apart. In wk. 22, leaf samples were taken to determine K as well as the incidence and severity of the disease on a 1-5 scale, according to these parameters: wilting, distortion, canker, and die-back. The max. and min. incidences were, resp., of 95 and 52%, the latter in the treatment without N application. Only K had a depressive effect, although not significant, on disease incidence but it significantly reduced disease severity ($P = 0.05$); N increased the incidence and severity ($P = 0.05$), and P and Mg did it moderately. Leaf K concn. and the severity were inversely correlated. When the rates of N, P, and Mg increased there was a tendency for the % of leaf K to decrease. Increasing N rates significantly increased yield. In spite of the high incidence, K reduced the severity by 50%. The possible mechanism by which K difficults the penetration of the disease and how the yield response is due to K as well as to the moderate attack of the disease are indicated. [CIAT]

0234

25524 RODRIGUEZ R., A.; RODRIGUEZ N., A.; RODRIGUEZ M., S. 1982. Observaciones sobre el potencial forrajero de dos clones de yuca (Manihot esculenta). (Observations on the forage potential of two cassava clones). Ciencia y Técnica en la Agricultura. Viandas Tropicales, Suplemento Septiembre 1982:95-107. Span., Sum. Span., Engl., 13 Refs.,

Illus. [Centro de Mejoramiento de Semillas Agámicas, Ministerio de la Agricultura, Apartado no.6, Santo Domingo, Villa Clara, Cuba]

Cassava. Clones. Planting. Spacing. Timing. Harvesting. Composition. Foliage. Forage. Plant height. Productivity. Cuba.

Results from a preliminary study on forage potential of 2 Cuban cassava clones, Pinera and CEMSA 80-99, grown on a brown tropical soil with carbonate differentiation, are reported. Two planting distances, 1.35 x 0.20 m and 0.67 x 0.37 m were used, equivalent to 41,666 and 37,037 plants/ha. The 0.67 x 0.37 m planting distance is recommended for those plantations programmed for more than one cutting and the 1.35 x 0.20 m distance for a single cutting. [AS]

0235

25718 SINTHUPRAMA, S.; TIRAPORN, C. 1986. Improving the productivity of cassava in Thailand. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.277-287. Engl. [Field Crops Research Inst., Dept. of Agriculture, Bangkhen, Bangkok 10900, Thailand]

Cassava. Rainfall data. Soil physical properties. Cultivars. Cultivation. Intercropping. Land preparation. Cuttings. Storage. Planting. Weeding. Hoeing. Harvesting. Xanthomonas campestris pv. manihotis. Cercosporidium henningsii. Tetranychus truncatus. Research. Plant breeding. Germplasm. Timing. Fertilizers. N. P. K. Root productivity. Rotational crops. Herbicides. Thailand.

The situation of cassava in Thailand is described. Cultural practices, climatic and edaphic conditions, cv. used, diseases (Xanthomonas campestris pv. manihotis and Cercosporidium henningsii), and pests (Tetranychus truncatus) are given. The research activities in the areas of plant breeding and agronomy are analyzed, and results are indicated. The future of cassava in the country and the direction of research are discussed. [CIAT]

0236

25254 UNE, M.Y. 1979. Fatores climáticos influenciando a agricultura em Campo Grande. (Climatic factors that influence agriculture in Campo Grande). Revista Brasileira de Geografía 41(2):3-31. Port., Sum. Engl., Fr., 7 Refs., Illus.

Cassava. Climatic requirements. Rainfall data. Cultivation. Brazil.

Rainfall possibilities during the year were studied for the region of Campo Grande (Mato Grosso, Brazil) on the basis of data obtained over a period of 43 yr. The correlations between production and rainfall data, and between the latter and indexes of moisture equilibrium, gave similar results in degrees of intensity below 0.7000. Therefore a very close relationship was not observed between climate and agricultural production. A difference, however, was observed between the 2 types of crops: those strongly influenced by the climate (sugar cane, cassava, maize, and beans) and those less affected (groundnuts, rice, and soybean). [CIAT]

0237

24734 VENEZUELA. MINISTERIO DE AGRICULTURA Y CRIA. 1977. Manual agroeconómico de la yuca. (Agroeconomical manual of cassava). Caracas, Dirección General de Desarrollo Agrícola. Programa Raíces y Tubérculos. 103p. Span., 15 Refs., Illus.

Cassava. Taxonomy. Plant anatomy. Climatic requirements. Rainfall data. Soil physical properties. Land preparation. Ploughing. Cuttings. Propagation. Cultivars. Sweet cassava. Bitter cassava. Planting. Timing. Mechanization. Agricultural equipment. Growth. Plant development. Weeding. Herbicides. Weeds. Erinnyis ello. Chilomina clarkei. Vatiga illudens. Vatiga manihotae. Silba pendula. Carpolonchaea chalybea. Cecidomyiidae. Atta. Aonidomytilus albus. Saissetia nigra. Bemisia. Mononychellus tanajoa. Tetranychus urticae. Oligonychus peruvianus. Xanthomonas campestris pv. manihotis. Sphaceloma manihoticola. Mycoplasmoses. Cercosporidium henningsii. Cercospora caribaea. Cassava common mosaic virus. Oidium. Phytophthora. Sclerotium rolfsii. Rosellinia. Rhizopus nigricans. Fertilizers. Storage. Composition. Uses. Costs. Production. Productivity. Income. Venezuela.

An agroeconomic manual on cassava, compiled by researchers, professors, extension workers, agricultural economists, and industrialists of Venezuela, is presented. The agronomic aspects considered include a botanical description (origin, taxonomy, and morphology), climatic requirements, soils and their preparation, selection and storage of propagation material, rapid propagation system, planting systems, time, and distance, plant development stages, weed control, pests and diseases and their control, earthing up, fertilization, and harvest. The storage, chemical composition, nutritive value, and utilization of cassava are discussed. Also included are production costs, yields, and profitability. [CIAT]

See also 0227 0239 0241 0242 0243 0245 0246 0284 0287 0289 0291 0292 0294 0296 0297 0298 0327 0329 0355 0359 0360 0362 0363 0364 0366 0370 0371 0373 0378 0379 0382 0383 0384 0387 0388 0397 0399 0401 0406 0419 0420 0421 0422 0423 0424

1 2 3

D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting

0238

23437 ABENOJA, F.A.; BATERNA, J.P. 1982. Tillage practices in continuous hillside farming of root crops. Radix 4(2):9-11. Engl., 2 Refs., Illus.

Cassava. Ploughing. Root crops. Cultivars. Sweet potatoes. Taro. Erosion. Root productivity. Philippines.

A trial was carried out in Philippines to (1) identify the min. tillage requirement of 3 root crops, including cassava, grown on hillsides; (2) compare different tillage practices and make recommendations about them. The treatments included zero tillage, min. tillage, strip tillage (25, 50, or 75 cm) and tillage of the whole plot. Soil eroded/treatment was measured. During the 1st 2 cycles of the crop, no apparent response of cassava to the different tillage practices was seen. Root yield was slightly higher in the tilled plots than in the untilled plots. The av. yield in the 2 harvests was approx. 27 t/ha. Soil erosion in the 1st harvest was min. due to the canopy cover at the time of rains and to the rapid water infiltration into the soil of a newly opened forest area. In the 2nd harvest, soil erosion was significantly higher since it rained when the canopy had not yet been established, but the yields remained high. [CIAT]

0239

23496 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1982. Package of practices for cassava. Trivandrum, India. Extension Publication no.1. 6p. Engl.

Cassava. Cultivation. Climatic requirements. Soil physical properties. Planting. Timing. Cultivars. Cuttings. Fertilizers. Manures. N. P. K. Injurious mites. Injurious insects. Cassava African mosaic virus. Insecticides. Acaricides. Disease control. Harvesting. Intercropping. Groundnut. India.

Recommendations for cassava cultivation in India are presented. They include the appropriate climatic and soil requirements, planting time and methods, cv., selection of planting material, planting position of the cuttings, fertilization and manuring, crop protection (mites, scale insects, CAMV), harvesting, and intercropping with groundnut. [CIAT]

0240

25283 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Control of weeds, insect pests and diseases. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.64-68. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Weeding. Herbicides. Injurious insects. Tiracola plagiata. Dasychira. Ectropis bhurmitra. Spodoptera litura. Porthesia scintillans. Chloridea obsoleta. Achaea janata. Insecticides. Cercosporidium henningsii. Phaeoramularia caribaea. Cercospora vicosae. Fomes lignosus. Disease control. Xanthomonas campestris pv. manihotis. Choanephora cucubitarum. Ganoderma pseudoferrum. Sclerotium rolfsii. Sphaerostilbe repens. Glomerella cingulata. Periconia manihoticola. Pestalotiopsis. Malaysia.

Research on weed, pest, and disease control in cassava in Peninsular Malaysia is summarized. For weed control the following preemergence herbicides are recommended: alachlor, 1-3 kg/ha; chloramben, 2-4 kg/ha; diuron, 0.5-1.0 kg/ha; fluometuron, 1-3 kg/ha; oryzalin, 1-2 kg/ha; oxyfluorfen, 0.25-0.75 kg/ha; and trifluralin 0.75-1.50 kg/ha. Serious damage from pest attack rarely occurs in Malaysia although Tiracola plagiata, Dasychira spp., Ectropis bhurmitra, Spodoptera litura, Porthesia scintillans, Chloridea obsoleta, and Achaea janata have been occasionally observed; regular inspections to monitor pest populations are recommended. For the control of diseases caused by Cercospora spp. and Xanthomonas campestris pv. manihotis, the removal and burning of all crop residues and crop rotation are recommended. For the control of Fomes lignosus, besides the aforementioned practices, a regular inspection of the cassava plants, with complete removal of the infected plants and the roots of hosts such as rubber, is recommended. [CIAT]

0241

25281 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Planting for maximum yield. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.41-47. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Soil physical properties. pH. Soil requirements. Land preparation. Planting. Timing. Cuttings. Mineral content. K. Storage. Spacing. Pruning. Intercropping. Malaysia.

Research results of cassava planting for max. yield in Peninsular Malaysia are summarized. The aspects considered are soils and their preparation, appropriate planting time, planting material selection, cutting length and planting position, optimum planting density, pruning of shoots or stems. An alternative to square planting is presented with the double row pattern: 0.73 x 0.73 m spaced 2.00 m apart with 10,000 plants/ha. [CIAT]

0242

25712 COCK, J.H. 1986. The agronomic potential of cassava for the upland areas of tropical Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.203-212. Engl., 9 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Plant development. Water requirements (plant). pH. Soil fertility. Root productivity. Cuttings. Selection. Storage. Planting. Spacing. Soil conservation practices. Erosion. Bacterioses. Mycoses. Injurious mites. Injurious insects. Cultivation systems. Intercropping. Asia.

The development characteristics that make cassava a crop with potential for the upland areas in tropical Asia are discussed as well as the use of improved var., planting methods, conservation of the soil and its fertility, pest and disease control, and the cropping systems that allow increased cassava productivity. [CIAT]

0243

25540 DU PLESSIX, Y.J. 1984. Amelioration de la culture du manioc en Cote d'Ivoire. (Improvement of cassava cultivation in Ivory Coast). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.153-178. Fr., Sum. Fr., Illus.

Cassava. History. Production. Cultivation. Atieke. Gari. Cassava chips. Research. Development. Land preparation. Root productivity. Cultivars. Planting. Timing. Harvesting. Fertilizers. N. P. K. Ca. Mg. Weeds. Weeding. Climatic requirements. Mechanization. Bacterioses. Injurious mites. Mycoses. Viroses. Ivory Coast.

Cassava is the 3rd crop in the Ivory Coast; its production is 1.1 million tons/yr. Results are presented of cassava research carried out by the Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres in collaboration with the Institut de Savanes and the Société de Développement du Palmier a Huile. The use of heavy machinery to limit the risks of erosion, the techniques for propagation by cuttings, planting times, fertilization, and problems related to crop residues are indicated. Also mentioned are the critical periods of cassava for weed invasion and weed control, as well as the phytosanitary problems (bacterioses, mycoses, viroses, and mites). [CIAT]

0244

25550 DU PLESSIX, Y.J. 1984. Le point sur la mécanisation de la culture du manioc en République de Cote d'Ivoire. (Mechanization of cassava

cultivation in Ivory Coast). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.268-271. Fr.

Cassava. Cultivation. Agricultural equipment. Planting. Weeding. Herbicides. Harvesting. Ivory Coast.

The agricultural equipment used in planting, weeding, and harvesting cassava in Ivory Coast is described. [CIAT]

0245

25275 FERGUSON, T.U. 1981. Root crop production on project farms in St. Lucia and St. Vincent. Trinidad, West Indies, Caribbean Agricultural Research and Development Institute. Consultant Report no.9. 114p. Engl., Illus.

Cassava. Root crops. Yams. Sweet potatoes. Cocoyams. Taro. Cultivars. Cultivation. Land preparation. Cuttings. Planting. Spacing. Timing. Fertilizers. Harvesting. Intercropping. Saint Lucia. Saint Vincent.

The agronomic techniques used in the production of root crops on farms participating in a project on small farm multiple cropping in St. Vincent and St. Lucia are briefly described and evaluated. Some recommendations to improve the agronomy of these crops are presented. Since cassava is a relatively secondary crop on the studied farms and the production area is too small to allow an agronomic evaluation to be made, the only recommendation is to evaluate cv. M Col 22 for its possible cultivation on both islands since it has outyielded local cv. in trials in Jamaica, Barbados, Trinidad, and Guyana. An evaluation of 14 farms in St. Vincent and 12 in St. Lucia is presented. [CIAT]

0246

25714 GHOSH, S.P.; NAIR, R.G. 1986. Improving the productivity of cassava in India. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.219-228. Engl. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum-17, Kerala, India]

Cassava. Production. Research. Plant breeding. Germplasm. Cultivars. Cultivation. Planting. Spacing. Cuttings. Fertilizers. N. P. K. Ca. S. Zn. B. Mo. Irrigation. Intercropping. Cassava African mosaic virus. Eutetranychus orientalis. Oligonychus biharensis. Tetranychus cinnabarinus. Tetranychus neocaledonicus. Disease control. Mite control. Aonidomytilus albus. Insect control. Productivity. India.

The prevalent cultivation practices of cassava in India are described and the research activities carried out by the Central Tuber Crops Research Institute to confront the production constraints are presented. Research has focused mainly on the obtainment of high-yielding, disease-resistant var., the development of crop management practices, proper control of pests and diseases, technology transfer, and postharvest technology. Finally, future research directions are presented. [CIAT]

0247

25511 GURITNO, B. 1985. Influence of planting material on plant performance in cassava (Manihot esculenta Crantz). Malang, Indonesia, University of Brawijaya. 178p. Engl., Sum. Engl., Mal., 60 Refs., Illus.

Cassava. Cultivars. Cuttings. Harvesting. Timing. Growth. Plant development. Stems. Shoots. Root development. Productivity. Root productivity. Leaf area. Dry matter. Starch content. Fibre content. Mineral content. N. P. K. Indonesia.

At Bedali exptl. field of Brawijaya U. (Indonesia), 4 field expt., in addition to 4 pot expt. and 2 lab. expt., were conducted to study the influence of planting materials on the performance of cassava plants. The relationship of growth pattern and final root yield to age, region of stem, size, length, diameter, wt., starch, fiber, and nutrient contents of the propagation material was determined. Results showed that the age of the plant from which cuttings were obtained affected DM production, and both root yield and total plant dry wt. were significantly influenced by the region of the stem from which cuttings were obtained. Cuttings from the base of the stem gave a higher yield than cuttings from either the medial (which yielded 6.4% less than basal) or the apical regions (12.7% less). The differences in yield/ha were brought about by differences in no. and wt. of storage roots, but the more important of these 2 components of yield was the size (wt.) of the storage roots. The wt. of roots produced from basal cuttings was 4.1% greater than from medial cuttings and 11.9% greater than from apical cuttings. Av. growth rates of plants showed a similar pattern; growth rates from basal, medial, and apical cuttings were 24.2, 28.0, and 30.8 g/plant/wk., resp. Although stem age did not have a significant effect on yield, the difference between the root yields from basal and apical cuttings was greater for young stems (7 and 9 mo. old) than for older stems (11 and 13 mo. old). With young stems, the apical cuttings gave plants which yielded 15% less than those from basal cuttings. With the older stems the difference was 10%. During initial growth, sprouting of the apical cuttings was quicker than that of the basal cuttings, but the subsequent growth of the basal cuttings was more rapid than that of the apical cuttings. The RGR of the plant organs (roots, new shoots, and new plants) developed from basal cuttings were greater than those from apical cuttings. The nutrient content of the cuttings (mg/cutting) varied with the region of the parent stem. The oldest (lowest) section of the stem had the highest nutrient and starch contents. Storage root yield was positively and linearly related to both N and K contents of the cuttings. Length and diameter of cutting individually influenced yield; however, there was no significant interaction between them. The optimum cutting length was about 25 cm; this length also favored root and storage root growth. On the other hand, for shoot growth, the longer the cutting the greater the rate of growth. The optimum diameter of the cutting was 2.25-2.50 cm. Although cutting length and diameter were related to wt. of cutting, no relationship was found between wt. of cutting and root yield. [AS (extract)]

0248

25568 LOPEZ Z., M.; VAZQUEZ B., E. 1982. Efecto de la longitud del esqueje utilizado como material de plantación, en los rendimientos de yuca (crantz) (Manihot esculenta), variedad Señorita. (Effect of the length of cuttings used as propagation material on the yields of cassava variety Señorita). [Centro Agrícola 9(3):97-112. Span., Sum. Span., Engl., 7 Refs., Illus. [Depto. de Fitotecnia de la Facultad de Ciencias Agrícolas, Univ. Central de las Villas, Santa Clara, Cuba]

Cassava. Cuttings. Growth. Leaf area. Dry matter. Productivity. Stems. Root productivity. Starch content. Plant development. Cuba.

The effect of the length of the cassava cutting on growth, development, and yield of var. Señorita was studied; the lengths considered were 20, 40, 60, and 80 cm. For each exptl. variable, leaf area, DM of the aerial part and

the root, plant height, no. of stems/plant, and production efficiency were determined. The best yield was obtained with the 20-cm-long cuttings. [AS]

0249

25298 VILLAMAYOR JUNIOR, F.G. 1983. Root and stake production of cassava at different populations and subsequent yield evaluation of stakes. Philippine Journal of Crop Science 8(1):23-25. Engl., Sum. Engl., 4 Refs. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127-A, Philippines]

Cassava. Cultivation. Cultivars. Cuttings. Planting. Spacing. Harvesting. Timing. Root productivity. Roots. Harvest index. Stems. Branching. Plant height. Storage. Statistical analysis. Philippines.

Increasing population density of cassava cv. Golden Yellow, planted as stem cuttings corresponding to 13,333, 17,777, 26,666, and 53,333 plants/ha, generally decreased root yield, although not significantly, and increased stake production significantly. Although the diameter of the stake decreased with increasing population, the subsequent evaluation of fresh and stored stakes showed that yield was not affected significantly by the diameter of the stake. [AS]

0250

24721 WARGIONO, J.; BANGUN, P. 1984. Effect of weed control on the yield of cassava at Lampung Red Yellow Padzolic soil. Bogor, Indonesia, Research Institute for Food Crops. 8p. Engl., Sum. Engl., 5 Refs., Illus.

Paper presented at the Weed Science Symposium, Bogor, Indonesia, 1984.

Cassava. Cultivars. Weeds. Weeding. Herbicides. Hoeing. Root productivity. Plant height. Shoots. Indonesia.

The effect of weed control on cassava yield was studied in Imperata cylindrica newly opened area of Sukadana (Lampung, Indonesia), during the 1982-83 wet season. Six levels of herbicides, hand weeding, and unweeded (check) treatments were arranged in a randomized block design. Cassava var. Adira-1 was used with a plant spacing of 100 cm between rows and 60 cm between plants. The max. weed cover (70%) was found in the check plot, which was dominated by I. cylindrica, Barreria alata, Synedrella nodiflora, and Cyperus sp. Cassava yield was not significantly affected by any treatment. Besides hand weeding, the application of 1.5 kg ametryn/ha alone 1 day after planting or followed by 3.0 l glyphosate/ha at 150 days after planting is recommended. [AS]

See also 0228 0235 0237 0289 0291 0292 0294 0298 0338 0356 0360 0362 0363 0364 0366 0370 0371 0373 0378 0379 0382 0383 0384 0385 0387 0388 0397 0399 0401 0406 0419 0420 0421 0422

D03 Energy Productivity and Yields

See 0213 0214 0215 0227 0229 0233 0237 0237 0247 0248 0249 0284 0289 0291 0293 0313 0419 0422

0251

25549 AYERNOR, G.S. 1984. Indigenous technologies for roots and tubers in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.247-267. Engl., 11 Refs., Illus.

Cassava. Root crops. Production. Storage. Post-harvest losses. Processing. Steeping. Cassava flour. Gari. Drying. Foofoo. Africa.

The production of roots and tubers in Africa and some estimated postharvest losses (5-60%) are presented. Cassava and yams are the major crops and they are grown both for subsistence and as cash crops. Some indigenous postharvest storage practices that minimize or prevent food losses in roots and tubers are reviewed. Most of the rural processing technologies are adaptable to modern advanced food processing practices. In fact, the gari process of cassava has been adapted and upgraded in West Africa. Similar attempts can be made to process cyanide-free CF. African institutions with the capabilities in postharvest research and development and related appropriate technological endeavors must play a collective role in a regional effort to minimize postharvest losses through effective storage practices and food transformation processes. [CIAT]

0252

25721 BARRETT, D.M. 1986. Postharvest research priorities for cassava in Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.339-364. Engl., 38 Refs., Illus. [Central Research Inst. for Food Crops, Jl. Panorango 6, P.O. Box 85, Bogor, Indonesia]

Cassava. Harvesting. Peeling. Washing. Solar drying. Drying. Processing. Consumption. Composition. Cassava products. HCN content. Cassava starch. Cassava meal. Cassava chips. Pellets. Ethanol. Protein enrichment. Confectioneries. Asia.

In view of the postharvest losses of cassava (25% or more) and the poor postharvest practices, the research needs on cassava processing in Thailand, Indonesia, Philippines, Malaysia, and India are analyzed on a product basis. Cassava consumption as a food is restricted by the perception of cassava as an inferior food, and by its low protein, mineral, and vitamin contents. Starch and animal feed productions are hampered by the lack of a consistent, dependable supply of raw material, and the quality is often poor due to careless sanitary practices. Hydrolyzed starch products, such as ethanol, SCP, and high fructose syrup, have emerged as areas of great potential for cassava utilization. [CIAT]

0253

25234 COURSEY, D.G. 1983. Tropical root crop work at the Tropical Products Institute. Tropical Root and Tuber Crops Newsletter no.14:20-40. Engl., 104 Refs. [Tropical Development and Research Inst., 56/62 Gray's Inn Road, London WC1X 8LU, England]

Cassava. Dioscorea. Storage. Processing. Cassava flour. Cassava starch. Marketing. Economics. Cyanides. United Kingdom.

Work carried out at the Tropical Development and Research Institute (formerly Tropical Products Institute) on aspects of storage of yams, cassava, and other root crops is reviewed, regarding respiration and dormancy, curing and wound healing, chilling injury, storage pathogens and control, cyanide in cassava, and root processing. [Field Crop Abstracts]

0254

25764 QUEVEDO, M.A.; BAUTISTA, O.K. 1983. Pre-harvest factors affecting vascular streaking and quality of cassava tubers. Annals of Tropical Research 5(3-4):141-153. Engl., Sum. Engl., 15 Refs., Illus.

Cassava. Pruning. Cultivars. Harvesting. Vascular streaking. Starch content. Dry matter. Timing. Roots. Storage. Philippines.

Detopping of cassava plants at different degrees before harvest was undertaken to determine its effect on vascular streaking and root quality during storage. Detopping the plants at 50-100% and stripping of all the leaves substantially delayed vascular streaking of the roots during storage at ambient condition. However, it reduced root DM and starch contents. A positive relationship was observed between severity of rotting and streaking but not between vascular streaking and % rotting. [AS]

See also 0237 0317 0359 0373 0384 0399

E00 PLANT PATHOLOGY

E02 Bacterioses

0255

25583 DANIEL, J.F.; BOHER, B. 1985. Epiphytic phase of *Xanthomonas campestris* pathovar *manihotis* on aerial parts of cassava. Agronomie 5(2):111-115. Engl., Sum. Engl., Fr., 11 Refs., Illus. [Office de la Recherche Scientifique et Outre-Mer, Laboratoire de Phytopathologie, Centre de Recherches de Brazzaville, B.P. 181, Brazzaville, République Populaire du Congo]

Cassava. *Xanthomonas campestris* pv. *manihotis*. Cultivars. Shoots. Leaves. Flowers. Fruits. Field experiments. Analysis. Culture media. Rainfall data. Congo.

Study of the bacterial microflora of the phyllosphere of cassava plants growing in fields previously infected with CBB in Congo demonstrated the epiphytic activity of *Xanthomonas campestris* pv. *manihotis*. An epiphytic phase was found to be a normal part of the disease cycle of CBB. In the rainy season, when disease spread occurs, large no. of the pathogen were present on symptomless leaves, constituting a potential inoculum which could explain the sudden outbreaks and rapid spread of the disease. In the dry season, the no. of the pathogen decreased to undetectable levels, but the presence of *X. campestris* pv. *manihotis* a few weeks before the 1st new symptoms at the beginning of the next rainy season suggested that the pathogen could survive as an epiphyte throughout the dry season. The role of the endophytic population in the 1st step of the epiphytic life of the pathogen was also investigated. The capacity of *X. manihotis* to have an epiphytic phase in its disease cycle contributes to the buildup of primary inoculum and to the establishment of the pathogen in the field, and enhances its survival. [AS]

0256

22991 FUKUDA, C.; ROCHA, B.V. DA; FUKUDA, W.M.G. 1982. Selecac de cultivares e clones de mandioca resistentes a bacteriose (Xanthomonas manihotis, Arthaud-Berthet) Starr. (Selection of cassava cultivars and clones resistant to Xanthomonas manihotis). In Empresa de Pesquisa Agropecuária de Minas Gerais. Projeto mandioca: relatorio 76/79. Belo Horizonte-MG, Brasil. p.90. Port. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cultivars. Clones. Xanthomonas campestris pv. manihotis. Resistance. Selection. Brazil.

In 1978 and 1979, 263 and 569 cassava cv., resp., were evaluated under field conditions in Brazil for their resistance to Xanthomonas campestris pv. manihotis, through natural inoculation. The levels of resistance were evaluated according to symptoms at 4, 6, 9, and 12 mo. after emergence. Of the cv. tested in 1978, 220 (83.3%) were susceptible, 23 (8.7%) fairly susceptible, 19 (7.2%) fairly resistant, and 4 (1.5%) resistant. Of the cv. evaluated in 1979, 406 (71.3%) were susceptible, 85 (14.9%) fairly susceptible, 56 (10.3%) fairly resistant, and 22 (3.8%) resistant. [CIAT]

0257

25300 IKOTUN, T. 1984. The nature and function of the extracellular polysaccharide produced by Xanthomonas campestris pathovar manihotis. Fitopatologia Brasileira 9(3):467-473. Engl., Sum. Engl., Port., 23 Refs., Illus. [Dept. of Agricultural Biology, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Xanthomonas campestris pv. manihotis. Laboratory experiments. Culture media. Isolation. Analysis. Brazil.

Xanthomonas campestris pv. manihotis, the causal organism of CBB, produced in culture a loose extracellular slime, which is a high mol. wt. polysaccharide precipitated with acetone. Acid hydrolysis of a 1% solution of slime in water yielded glucose, mannose, and glucuronic acid on paper chromatograms. Autoclaving solutions of acetone-precipitated slime for 30-90 min drastically decreased its viscosity. Plant toxicity is probably due to a physical blockage of the xylem vessels rather than its effects on plant cell walls or cytoplasm. Absorption in the UV spectrum indicates that the extracellular slime probably protects X. campestris pv. manihotis from radiation and other environmental hazards. Recent studies indicate that the extracellular slime is a virulence factor. [AS]

0258

25727 MAAS, J.L.; FINNEY, M.M.; CIVEROLO, E.L.; SASSER, M. 1985. Association of an unusual strain of Xanthomonas campestris with apple. Phytopathology 75(4):438-445. Engl., Sum. Engl., 21 Refs., Illus. [Fruit Laboratory, Agricultural Research Service, U.S. Dept. of Agriculture, Beltsville, MD 20705, USA]

Cassava. Isolation. Inoculation. Xanthomonas campestris.

A yellow, Gram-negative bacterium was isolated from damaged apple explants in tissue culture. The strains were recovered from inoculated apple explants in tissue culture. Symptoms and bacterial strain characteristics agreed with those originally observed. Based on growth on diagnostic media, conventional biochemical and physiological tests, and fatty acid analyses, the strains represent an unusual form of Xanthomonas campestris.

Greenhouse inoculation tests were negative for pathogenicity to tomato, tobacco, cassava, peach, and grape. The strains of Xanthomonas from apple are apparently pathogenic only in tissue culture; however, they are capable of limited colonization of apple tissue under greenhouse conditions without causing apparent symptoms. These strains probably represent an unusual form of X. campestris. [AS (extract)]

See also 0235 0237 0240 0243 0285 0288 0353 0364 0370 0374 0379 0384 0401

E03 Mycoses

0259

25502 LABERRY S., R.; LOZANO, J.C.; BURITICA, P. 1984. Estudio taxonómico de especies del género Uromyces en yuca (Manihot spp.). (Taxonomic study of Uromyces species on cassava). Fitopatologia Brasileira 9(3):525-536. Span., Sum. Span., Engl., 38 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Uromyces. Uromyces manihotis. Taxonomy. Identification. Colombia.

A taxonomic study indicates that Uromyces manihotis is present in Brazil, Polivia, Colombia, Costa Rica, Cuba, Ecuador, Jamaica, Dominican Republic, Trinidad and Tobago, Venezuela, and Puerto Rico; U. jatrophae in Cuba, Mexico, and Trinidad and Tobago; U. carthagenensis in Argentina and Brazil; and U. manihotis-catingae, U. tolerandus, and U. manihoticola only in Brazil. Only U. manihotis and U. jatrophae have been reported attacking cassava. [AS]

0260

25525 PINO A., J.A.; FUENTES V., E.; HERNANDEZ, E. 1982. Resultados preliminares sobre la influencia de la época de plantación y el desarrollo de la enfermedad superalargamiento (Sphaceloma manihoticola) en el cultivo de la yuca. [Preliminary results of the effect of the planting time on the development of the superelongation disease (Sphaceloma manihoticola) on cassava]. Ciencia y Técnica en la Agricultura. Viandas Tropicales, Suplemento Septiembre 1982:167-175. Span., Sum. Span., Engl., 4 Refs., Illus. [Centro de Mejoramiento de Semillas Agámicas, Ministerio de la Agricultura, Apartado no.6, Santo Domingo, Villa Clara, Cuba]

Cassava. Cultivars. Sphaceloma manihoticola. Resistance. Planting. Timing. Rainfall data. Cuba.

Five cassava planting dates (Feb., March, April, May, and June) were evaluated in relation to the development of the superelongation disease (Sphaceloma manihoticola) at the Centro de Mejoramiento de Semillas Agámicas (Cuba). A randomized block exptl. design was used with susceptible clone Montes de Oca. The infestion % during Aug. for the March, April, May, June, and Feb. planting dates were 67.8, 61.6, 63.1, 55.9, and 32.0%, resp. The positive influence of precipitation on disease development was confirmed. [AS]

See also 0233 0235 0237 0240 0243 0285 0289 0292 0302 0362 0364 0370 0374 0401

0261

25758 AYANRU, D.K.G. 1985. Relations between mosaic disease infections and total cyanide levels in cassava leaves. Tropical Agriculture (Trinidad) 62(4):305-309. Engl., Sum. Engl., 30 Refs., Illus. [Dept. of Microbiology, Univ. of Benin, Benin City, Nigeria]

Cassava. Cultivars. Cassava African mosaic virus. HCN content. Leaves. Bitter cassava. Analysis. Linamarase. Nigeria.

Lamina samples of 4 cassava clones (TMS/GP/B 4107, RP/B 5028, U 42046, and W 4488) infected by CAMV were assessed for total cyanide, 3-5 mo. after field propagation, using an enzymatic assay method. Cyanide contents of leaves of varying ages from paired plants (with and without CAMV symptoms) and plants grouped into classes of symptom severity were compared. Contents varied considerably (ca. 500-2500 mg/kg fresh wt.), and differences between means were significant ($P < 0.01$). Depending on the level of infection and other factors, HCN values increased, decreased, or remained unchanged. The variations are explained on the basis of known effects of plant viruses on host carbohydrate and N metabolism. [AS]

0262

25517 HAMILTON, W.D.O.; STEIN, V.E.; COUTTS, R.H.A.; BUCK, K.W. 1984. Complete nucleotide sequence of the infectious cloned DNA components of tomato golden mosaic virus: potential coding regions and regulatory sequences. European Molecular Biology Organization Journal 3(9):2197-2205. Engl., Sum. Engl., 40 Refs., Illus. [Dept. of Pure & Applied Biology, Imperial College of Science & Technology, London SW7 2BB, England]

Cassava. Cassava African mosaic virus. Analysis. United Kingdom.

Comparison of the nucleotide sequences of the DNA of tomato golden mosaic virus (TGMV) and CAMV revealed a fairly close relationship between TGMV DNA A and CAMV DNA 1 and a comparatively distant relationship between TGMV DNA B and CAMV DNA 2. All the potential coding regions in the TGMV DNA had counterparts in the CAMV DNA suggesting an overall similarity in genome organization, but 6 potential coding regions in the CAMV DNA had no counterparts in the TGMV DNA. The 200-base region common to the 2 DNA of each virus had little sequence homology, except for a highly conserved 33-base sequence potentially capable of forming a stable hairpin structure. [AS]

0263

24027 JAYASINGHE, U.; VELASCO, A.C.; LOZANO, J.C. 1983. Electrophoretic detection of frog skin-infected Manihot esculenta Crantz. Cali, Colombia, Centro Internacional de Agricultura Tropical. 6p. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Paper presented at the Symposium of the International Society for Tropical Root Crops, 6th. Lima, Peru, 1983.

Cassava. Frog skin disease. Symptomatology. Cultivars. Isolation. Analysis. Colombia.

The symptoms of frog skin, a cassava disease of unknown etiology that causes yield losses of up to 100% in susceptible cv., are described. Analyses of partially-purified preparations, obtained from frog

skin-affected M Col 33 cassava plants, by polyacrylamide gel electrophoresis in the presence of SDS (SDS-PAGE) revealed a marked increase in the concn. of a normal host protein (mol. wt. 54.000 daltons) in infected tissue, as compared with disease-free controls. This phenomenon has been consistent in SDS-PAGE analyses of leaf and root extracts of frog skin-affected M Col 33, Secundina, and Quilcace-PR cassava plants, and of leaf extracts of 30 other different cassava genotypes. The electrophoretic method is suitable for the detection of frog skin-affected cassava plants grown under glasshouse and field conditions. [AS (extract)-CIAT]

0264

25240 JOS, J.S.; BAI, K.V.; NAIR, N.G. 1984. Unreported symptoms associated with mosaic disease in cassava. Indian Phytopathology 37(4):696-699. Engl., 4 Refs., Illus. [Central Tuber Crops Research Inst., Trivandrum 695 017, India]

Cassava. Cassava African mosaic virus. Symptomatology. India.

Symptoms caused by CAMD are classified according to severity on a 1-5 scale. Leaf symptoms appearing in plants graded above 3 (severe mosaic) are described in detail. [CIAT]

0265

25731 PACUMBABA, R.P. 1985. Virus-free shoots from cassava stem cuttings infected with cassava latent virus. Plant Disease 69(3):231-232. Engl., Sum. Engl., 16 Refs. [Dept. of Natural Resource & Environmental Studies, Alabama A & M Univ., Normal, AL 35762, USA]

Cassava. Cuttings. Cultivars. Shoots. Cassava African mosaic virus. Zaire.

Cassava stem cuttings infected with CAMV gave rise to shoots that showed CAMV symptoms at emergence, shoots that showed CAMV symptoms 3-5 wk. later, and shoots that remained symptomless after 6 wk. of observation. Symptoms appeared 5-11 days earlier when symptomless shoots were detopped than when they were left intact. Symptomless shoots severed 2 wk. after emergence from CAMV-infected stem cuttings and subsequently detopped did not develop CAMV symptoms. These plants readily developed symptoms of CAMV when colonized with CAMV-laden Bemisia tabaci. Therefore, symptomless shoots were considered free of CAMV and could be used as healthy planting stock. [AS]

0266

25508 ROBERTS, I.M.; ROBINSON, D.J.; HARRISON, B.D. 1984. Serological relationships and genome homologies among geminiviruses. Journal of General Virology 65(10):1723-1730. Engl., Sum. Engl., 24 Refs., Illus. [Scottish Crop Research Inst., Invergowrie, Dundee DD2 5DA, United Kingdom]

Cassava. Cassava African mosaic virus. Electron microscopy. Analysis. United Kingdom.

In immunosorbent electron microscopy tests, strong relationships were detected between 5 whitefly-transmitted geminiviruses: CAMV, BGMV, euphorbia mosaic, squash leaf curl, and tomato golden mosaic. No relationship was detected between any whitefly-transmitted and any leafhopper-transmitted virus. A similar pattern of relationships was found by spot hybridization expt. in which extracts from infected leaves were

tested with probes for CAMV DNA-1 or DNA-2. Imperfect nucleotide sequence homologies were found between CAMV DNA-1, which contains the particle protein gene, and the DNA of 5 other whitefly-transmitted viruses: BGMV, tomato golden mosaic, tobacco leaf curl, tomato leaf curl, and tomato yellow leaf curl, the last 3 of which are not sap-transmissible. Thus, relationships were established between sap-transmissible and sap-nontransmissible geminiviruses. No homologies were detected with a full-length probe for CAMV DNA-2. Extracts from plants infected with 3 leafhopper-transmitted viruses (beet curlytop, maize streak, and wheat dwarf) did not react with probes for CAMV DNA-1 or DNA-2. Because each of the leafhopper-transmitted geminiviruses has a different vector species whereas the whitefly-transmitted geminiviruses all have the same vector, Bemisia tabaci, the genome homologies and antigenic relationships detected among members of the group could be explained if their coat proteins have a key role in transmission by vectors. [AS]

0267

24568 ROBERTSON, I.A.D. 1985. Cassava/whitefly project (part of crop virology project R3177 at the Kenya Agricultural Research Institute); final report 1984. London, England, Overseas Development Administration. 77p. Engl., Illus.

Cassava. Bemisia. Insect biology. Mononychellus tanajoa. Cassava African mosaic virus. Rainfall data. Cultivars. Productivity. Intercropping. Groundnut. Kenya.

The final report of the cassava/whitefly project is presented and the conclusions reached in the 2 yr of trials carried out in Kenya are summarized. The whitefly ecology program, the epidemiology trials, and other observations and trials carried out in 1983-84 are described. It was found that the CAMV vector, Bemisia tabaci, is as common on the north coast as it is on the south coast of the country, but CAMV incidence is markedly less in the north probably due to the lower rainfall in this region. In general, B. tabaci does not seem to be a very efficient vector; unless a susceptible var. is being grown, spread of CAMV in a field of clean cassava in a single season is not very rapid. The incidence of CAMV can readily be reduced by planting clean material and by rogueing infected plants at not less than 3-wk.-intervals. It is recommended to (1) establish sources of clean planting material, (2) evaluate the range of resistance to CAMV in available cv., (3) educate the farmers on the nature of the disease and its results, and (4) establish a system of regular rogueing. Future requirements, in terms of research and extension in different areas, are discussed. A method of preparing pure cultures of B. hancocki from a mixed population of both Bemisia especies is suggested. [CIAT]

0268

24554 ROBERTSON, I.A.D. 1983. Cassava/whitefly project (part of crop virology project R3177). Annual Report 1982-83. London, England, Overseas Development Administration. 34p. Engl., Illus.

Cassava. Bemisia. Cassava African mosaic virus. Vectors. Cultivars. Insect biology. Productivity. Epidemiology. Kenya.

A report is presented on the cassava/whitefly project conducted during 1982-83 in the coastal region of Kenya, where 71 species of host plants of Bemisia tabaci were found. Fifteen whitefly species differing from B. tabaci were identified in wild host plants. In addition to the latter, B. hancocki was found in cassava; this species is not considered to transmit CAMV. Pupae counts in cassava hybrid 5543/156, considered to be resistant

to CAMV, indicated the presence of 2 species at all of the exptl. sites. Results show that even though CAMV incidence is greater in the southern areas, the whitefly population is smaller than in the northern areas and, furthermore, half of the whitefly population belongs to the species B. hancocki. Counts done in different cassava var. suggest that the most resistant to CAMV are probably less attractive to the whiteflies; results also show that var. recently imported from Brazil present resistance to CAMV. The use of sticky traps to study the movement of adult whiteflies and the counts made are described. CAMV incidence was superior in the southern areas within the high rainfall zone. Epidemiological studies indicate that, overall, local var. have more resistance to CAMV than var. recently introduced from Brazil. It was determined that CAMV can cause yield losses of up to 80%. Requirements for a cassava var. adapted to the coastal regions of Kenya and the objectives of the program for 1983-84 are described. [CIAT]

See also 0237 0239 0243 0246 0288 0292 0320 0338 0353 0359 0370 0379

E05 Mycoplasmoses

See 0370

F00 PEST CONTROL AND ENTOMOLOGY

F01 Injurious Insects and their Control

0269

23796 BENNETT, F.D. 1978. Report on a visit to Colombia to collect natural enemies of Phenacoccus spp. November 1977. Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 5p. Engl., 2 Refs.

Cassava. Phenacoccus. Ferrisia virgata. Predators and parasites. Colombia.

The predators and parasites found on Phenacoccus spp. on cassava and Acalypha plants in Colombia are reported. On cassava plants, at CIAT, the parasite species found were Anagyrus, Apoanagyrus, Aenasius, and Prochiloneurus; in addition to Phenacoccus sp., 3 individuals of Ferrisia virgata were collected from cassava. At CIAT Acalypha plants were also heavily infested by Orthezia sp., but there was no evidence of attack by Phenacoccus; occasionally, an individual of the mealybug F. virgata was found. A heavy infestation of Phenacoccus grenadensis was observed on Acalypha plants 10 km from CIAT. A very rich complex of predators and parasites was also observed which included Acerophagus sp., Aenasius sp., Apoanagyrus sp., Anagyrus sp., Prochiloneurus sp., Signophora sp., Thysanus sp., Hyperaspis spp., Ocyptamus sp. nr. stenogaster, Chrysopids, Hemerobiids, and Cecidomyiids. [CIAT]

0270

25235 BRUN, P.G.; MORAES, G.W.G. DE; SOARES, L.A. 1984. Tres espécies novas de Trichogrammatidae parasitóides de lepidópteros desfolhadores da

mandioca e do eucalipto. (Three new species of Trichogrammatidae, parasitoids of lepidopteran cassava and eucalyptus defoliators). Pesquisa Agropecuaria Brasileira 19(7):805-810. Port., Sum. Port., Engl., 21 Refs., Illus. [Inst. de Ciencias Biológicas, Depto. de Bioquímica e Imunología, Univ. Federal de Minas Gerais, Caixa Postal 2486, 30.000 Belo Horizonte-MG, Brasil]

Cassava. Biological control. Predators and parasites. Erinnyis ello. Brazil.

Three new species of Trichogramma from Brazil are described: T. manicobai, T. caiaposi, and T. acacioi. The former 2 parasitize Erinnyis ello eggs (cassava pest), and the latter parasitizes Psorocampa denticulata eggs (eucalyptus pest). The formation of a new group of Trichogramma for T. caiaposi and T. acacioi is proposed. [AS]

0271

25729 LEMA, K.M.; HERREN, H.R. 1985. The influence of constant temperature on population growth rates of the cassava mealybug, Phenacoccus manihoti. Entomologia Experimentalis et Applicata 38(2):165-169. Engl., Sum. Engl., Fr., 11 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Insect biology. Temperature. Cultivars. Growth chamber experiments. Nigeria.

Life table studies were conducted to assess the effect of constant temp. on the rate of population growth of the cassava mealybug, Phenacoccus manihoti. Four temp. between 20.0-30.5°C were tested. An inverse relationship was observed between temp. and most demographic parameters. The intrinsic rate of natural increase (r_m) increased from 0.1 at 20.0°C to 0.2 at 27.0 and 30.5°C. The net reproductive rate varied between 425.3 at 30.5°C and 584.6 at 20.0°C. The mealybug population reached 50% mortality after 37.5, 21.5, 19.0, and 19.0 days, resp., at 20.0, 23.5, 27.0, and 30.5°C. Results indicate that P. manihoti can persist and increase in no. within the range between 20.0-30.5°C. [AS]

0272

25730 LEMA, K.M.; HERREN, H.R. 1985. Release and establishment in Nigeria of Epidinocarsis lopezi, a parasitoid of the cassava mealybug, Phenacoccus manihoti. Entomologia Experimentalis et Applicata 38(2):171-175. Engl., Sum. Engl., Fr., 9 Refs., Illus. [International Inst. of Tropical Agriculture, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Predators and parasites. Biological control. Paraguay. Nigeria.

The encyrtid wasp Epidinocarsis (= Apoanagyrus) lopezi was imported from Paraguay into Nigeria for the biological control of the cassava mealybug, Phenacoccus manihoti. It was mass-reared and released at 4 localities in Nigeria. The parasitoid is now established and it is dispersing throughout cassava growing areas of Nigeria. [AS]

0273

25579 NWANA, I.E. 1984. The dispersal of the variegated grasshopper, Zonocerus variegatus (Linnaeus) (Orthoptera, Acridoidea, Pyrgomorphidae), in open fields and cultivated farms. Insect Science

and its Application 5(4):273-278. Engl., Sum. Engl., 24 Refs., Illus. [Imo State Univ., P.M.B. 2000, Owerri, Nigeria]

Cassava. Zonocerus variegatus. Insect biology. Entomology. Nigeria.

Marked individuals of Zonocerus variegatus were released in batches of 100/developmental cohort at definitive loci in either an open field of mainly Cynodon sp. or a cultivated farm of cassava. The distance and direction of movement of individuals in any given stadium were determined in meters and angular degrees. The mean distances moved by marked Z. variegatus for each day of observation were determined by Clark's root mean square formula. Older cohorts covered more distance during a given period than young cohorts. While the 1st instar nymphs moved significantly less than any other cohort, the differences in the mean daily distances moved by nymphs of the 2nd through the 6th developmental instars in the cassava farm were not statistically significant. For all cohorts, Z. variegatus covered significantly more distances in the open field than in the cultivated farm, suggesting that the availability of food inhibited the rate of dispersal of Z. variegatus. There was no significant difference in the no. of Z. variegatus found on the different aspects of the compass. [AS]

0274

25572 SANTOS, C.D.; RIBEIRO, A.F.; FERREIRA, C.; TERRA, W.R. 1984. The larval midgut of the cassava hornworm (Erinnyis ello): ultrastructure, fluid fluxes and the secretory activity in relation to the organization of digestion. Cell and Tissue Research 237(3):565-574. Engl., Sum. Engl., 29 Refs., Illus. [Depto. de Bioquímica, Inst. de Química, Univ. de Sao Paulo, Caixa Postal 20.780, Sao Paulo, Brasil]

Cassava. Erinnyis ello. Insect biology. Entomology. Analysis. Electron microscopy. Brazil.

Columnar cells of the larval midgut of the cassava hornworm, Erinnyis ello, display microvilli with vesicles pinching off from their tips (anterior and middle midgut) or with a large no. of double membrane spheres budding along their length (posterior midgut). Basal infoldings in columnar cells occur in a parallel array with many openings to the underlying space (posterior midgut) or are less organized with few openings (anterior and middle midgut). Goblet cells have a cavity, which is formed by invagination of the apical membrane and which occupies most of the cell (anterior and middle midgut) or only its upper part (posterior midgut). The infolded apical membrane shows modified microvilli, which sometimes (posterior midgut) or always (anterior and middle midgut) contain mitochondria. The cytoplasmic side of the membrane of the microvilli that contain mitochondria are studded with small particles. The anterior and middle region of the midgut absorbs water, whereas the posterior region secretes it. This results in a countercurrent flux of fluid, which is responsible for the enzyme recovery from undigested food before it is expelled. Intermediary and final digestion of food probably occurs in the columnar cells under the action of plasma membrane-bound and glycocalix-associated enzymes. [AS]

0275

24544 SCHMITT, A.T. 1985. Eficiencia da aplicacao de Baculovirus erinnyis no controle do mandarova da mandioca. (Efficiency of the application of Baculovirus erinnyis in controlling the cassava hornworm). Florianopolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Comunicado Técnico no.88. 9p. Port., 14 Refs.

Cassava. Erinnyis ello. Field experiments. Biological control. Predators and parasites. Brazil.

The effect of 0, 25, 35, and 45 ml of a solution of Baculovirus erinnyis/200 l water/ha on the control of Erinnyis ello in cassava was evaluated. In all the treatments, the presence of larvae with the 1st symptoms of the disease was verified 4 days after application. Symptoms were decoloration, loss of movement, loss of feeding capacity, and presence of deaf larvae. The % of infected larvae for the resp. treatments was 25, 34, 50, and 50%. The existence of infected larvae in the untreated control indicates that the virus has the capacity of dispersion through the wind, the movement of people through the crop, insects, parasites and predators, and other factors. In all the treatments 90% of infected and dead larvae was observed 10 days after the application. The Baculovirus is innocuous to other insects present in the crop. Since all the doses were efficient, further research must be conducted to determine the efficiency of smaller doses. [CIAT]

0276

25239 SCHOONHOVEN, A. VAN 1974. Insetos que atacam a mandioca. (Insects that attack cassava). In Curso Especial de Aperfeicoamento para Pesquisadores de Mandioca, Cali, Colombia, 1974. Trabalhos apresentados. Cali, Centro Internacional de Agricultura Tropical. 7p. Port.

Cassava. Thrips. Mononychellus. Tetranychus. Erinnyis ello. Silba pendula. Bemisia. Vatiga manihotae. Saissetia nigra. Aonidomytilus albus. Cecidomyiidae. Atta. Pest damage. Insect biology. Insect control. Mite control. Biological control. Predators and parasites. Colombia.

The biology, damage, and control of thrips (Frankliniella sp., Corynothrips stenopterus, Caliothrips masculinus), mites (Mononychellus spp., Tetranychus spp.), the cassava hornworm (Erinnyis ello), and shoot flies (Silba pendula) are described. Whiteflies, lace bugs, scale insects, gall midges, and ants are also mentioned. [CIAT]

0277

25295 SULLIVAN, D.J. 1985. Encapsulation and melanization. The mealybug defends itself against a natural enemy—but loses. IITA Research Briefs 6(2):3. Engl., Illus.

Cassava. Phenacoccus. Predators and parasites. Nigeria.

The cassava mealybug has a defense mechanism against its natural enemy Epidinocarsis lopezi. When the female wasp lays its eggs inside the mealybug, the mealybug's blood cells surround or encapsulate the parasitoid's egg or larvae. This is followed by a hardening or blackening of the capsule, called melanization, resulting in suffocation and death. However, it seems that the mealybug's blood cells are not capable of encapsulating several eggs or larvae so one survives to kill the mealybug. [CIAT]

0278

23789 YASEEN, M. 1981. Report of investigations on Phenacoccus manihoti Matile-Ferrero in Paraguay June 23 - July 10, 1981. Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 4p. Engl., 3 Refs.

Cassava. Phenacoccus manihoti. Predators and parasites. Paraguay.

The results of a visit to Paraguay between June 23rd-July 10th of 1981 to observe the behavior of Phenacoccus manihoti and its biological control are summarized. The populations of P. manihoti and its natural enemies were low due to the rainfall. However, the pest was able to survive in adverse situations, by protecting itself in the twisted tips. Among the natural enemies the species found were Chartocerus sp., Prochilonerus sp., Anagyrus sp., Hyperaspis sp., Exochomus sp., Chrysopa sp., and syrphid larvae. [CIAT]

0279

23792 YASEEN, M. 1981. Report on surveys for cassava mealybugs (Phenacoccus spp.) and their natural enemies in South America (January - March 1981). Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 7p. Engl., 5 Refs.

Cassava. Phenacoccus. Phenacoccus manihoti. Phenacoccus grenadensis. Phenacoccus herreni. Predators and parasites. Venezuela. Colombia. Ecuador. Bolivia. Paraguay.

A report is given on the visits in Jan.-March of 1981 to Venezuela, Colombia, Ecuador, Bolivia, and Paraguay to observe the behavior of Phenacoccus spp. and their natural enemies. In Venezuela and Ecuador the pest was not found. In cassava crops in Colombia the species P. grenadensis and P. herreni were detected; the use of Kalodiplosis coccidarum, natural enemy of P. herreni, is being studied. In Bolivia the species P. grenadensis, P. herreni, and P. manihoti were detected. Also the parasites Apoanagyrus lopezi and Acerophagous sp. were found. In Paraguay, P. manihoti was observed as well as the natural enemies Prochiloneurus dactylopii, Apoanagyrus lopezi, Chartocerus sp., Hyperaspis notata, Exochomus sp. nr sallei, Oila v-nigrum, Chrysopa sp., C. sp. reducta, Sympherobius sp., Ocyptamus sp., and Kalodiplosis sp. nov. It is also known that H. notata, Ocyptamus sp., and Chrysopa sp., which have been found in association with P. manihoti in Paraguay, prey on P. herreni in NE South America, indicating that predators of the latter (Hyperaspis sp., Nephus bilucernarius) can be adapted to P. manihoti if they are released in Africa. [CIAT]

0280

23794 YASEEN, M. 1979. Report on a visit to Guyana for the natural enemies of the cassava mealybug Phenacoccus manihoti M. - F. November 4-23, 1979. Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 9p. Engl., 3 Refs.

Cassava. Phenacoccus manihoti. Predators and parasites. Guyana.

In 1979 an unidentified Pteromalid was observed parasitizing Phenacoccus manihoti in Guyana. Other species detected were Aenasius ? vexans, Aenasius phenacocci, Nephus (Scymnobius) sp., Ocyptamus sp., and Hyperaspis sp. Attempts were made to induce A. ? vexans and the unidentified Pteromalid to parasitize related mealybugs, P. grenadensis, or other Phenacoccus spp.; however the results were not successful. Efforts to culture the syrphid Ocyptamus were also unsuccessful. [CIAT]

0281

23790 YASEEN, M. 1977. Survey of cassava mealybugs (Phenacoccus spp.) and their natural enemies in Guyana, Surinam and Brazil - November 1977.

Curepe, Trinidad, West Indies, Commonwealth Institute of Biological Control. 7p. Engl., 4 Refs.

Cassava. Phenacoccus. Phenacoccus manihoti. Ferrisia virgata. Predators and parasites. Guyana. Surinam. Brazil.

For the 1st time Phenacoccus manihoti is reported from Guyana; its presence was also recorded in Brazil but not in Surinam. The natural enemy complex in the 1st 2 countries was similar: Hyperaspis spp., Nephus (Scymnobius) sp., Ocyptamus sp., Aenasius ? vexans, Anagyrus ? pseudococci, Anagyrus sp., Belpyrus insularis, and Prochiloneurus argentinensis. [CIAT]

See also 0237 0239 0240 0246 0267 0268 0288 0289 0353 0364 0370 0374 0379 0380

F02 Rodents and other Noxious Animals

See 0362

F03 Injurious Mites and their Control

0282

24047 BONDAR, G. 1938. Notas entomológicas da Bahia. 3. 1. Sobre um acarino nocivo á mandioca. (Entomological notes of Bahia. 3. 1. On a noxious mite of cassava). Revista de Entomologia 9(3-4):441-445. Port., 11 Refs., Illus.

Cassava. Injurious mites. Insect biology. Identification. Pest damage. Mite control. Brazil.

The damage, control, identification, and biology of a noxious mite of cassava in Bahia, Brazil, are described. The control methods used include (1) the cutting of shoots of affected plants for subsequent burning and (2) the spraying of plants with a nicotine and water solution or S suspended in water. The pest was identified in 1923 in the USA as Tetranychus tanajoa. [CIAT]

0283

25521 EZULIKE, T.O.; ODEBIYI, J.A. 1984. Feeding habit of Amblyseius fustis (Acarina:Phytoseiidae), a predator of the cassava red mite, Oligonychus gossypii (Acarina:Tetranychidae). Biologia Africana 1(2):30-34. Engl., Sum. Engl., Fr., 14 Refs., Illus. [National Root Crops Research Inst., Umudike, Umuahia, Imo State, Nigeria]

Cassava. Olygonichus gossypii. Predators and parasites. Insect biology. Nigeria.

The nymphs and adults of Amblyseius fustis, an important predator on Oligonychus gossypii on cassava in Nigeria, preyed on all stages of the tetranychid in the lab., but the larvae did not feed. When the adults were fed separately on different developmental stages of the prey, the no. of adult prey consumed averaged 89.4 and 81.0 for mated male and female predators, resp., and 69.4 and 59.4 for unmated ones. The corresponding av. for nymphal prey were 131.9, 120.5, 98.8, and 93.1. There was no

significant difference in the longevity of mated and unmated males on all the feeding regimens. [Biocontrol News and Information]

See also 0235 0237 0239 0243 0246 0276 0288 0292 0353 0359 0370 0379 0384 0401

G00 GENETICS AND PLANT BREEDING

G01 Breeding, Germplasm, Varieties and Clones, Selection

0284

25561 BADILLO-FELICIANO, J. 1984. Performance of cassava cultivars in an Oxisol in northwestern Puerto Rico. Journal of Agriculture of the University of Puerto Rico 68(4):375-381. Engl., Sum. Engl., Span., 8 Refs. [Agricultural Experiment Station, Mayaguez Campus, Univ. of Puerto Rico, Río Piedras, Puerto Rico]

Cassava. Cultivars. Root productivity. HCN content. Organoleptic examination. Plant anatomy. Puerto Rico.

Fifty-five cassava cv. were evaluated for 3 consecutive years in a Coto clay (Oxisol) in northwestern Puerto Rico. The highest yielders, averaged over 3 yr, were PI 12902, Jamaica 18, PI 9570, and PI 12903 with 34,345, 29,906, 26,845, and 24,684 kg/ha, resp. With the organoleptic evaluation all but cv. PI 12903 were found to be acceptable. The HCN content among cv. was below the moderately toxic levels (50 ppm). [AS]

0285

25279 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Breeding and selection of cassava. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.32-36. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Plant breeding. Cytology. Pollination. Plant reproduction. Crossbreeding. Germination. Seed. Selection. Root productivity. Starch content. Harvest index. Leaf area. Resistance. Cercosporidium henningsii. Xanthomonas campestris pv. manihotis. Fomes lignosus. Hybridizing. Malaysia.

Breeding and selection methods and criteria of cassava at the Malaysian Agricultural Research and Developing Institute are described. The cytology and breeding system in cassava, pollination techniques (open, semicontrolled, and controlled hand crosses), and seed germination are discussed. Selection criteria of the cassava breeding and selection program for Peninsular Malaysia include root yield/ha, root starch content, HI, leaf area retention, germination, % of cuttings, disease resistance (Cercosporidium henningsii, Fomes lignosus, and Xanthomonas campestris pv. manihotis), HCN content, adaptability, and earliness. The scheme of breeding and selection follows the following sequence: germplasm evaluation for parent var. selection, hybridization, seedling selection, and clonal selection. [CIAT]

0286

25280 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. The important cassava varieties. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.37-40. Engl., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Cultivars. Plant anatomy. Root productivity. Malaysia.

A summarized description of the most important cassava var. grown in Peninsular Malaysia is presented. Among the 44 cv. included, Black Twig and Red Twig stand out regarding starch extraction and chip production, and Medan for multiple food preparations. The new var. C5 was selected from open-pollinated seedlings and its yield of fresh roots 9 mo. after planting is comparable with that of Black Twig, the highest yielding var. harvested at 12 mo. A comparative table of the morphological and agronomic characteristics of Black Twig, Medan, and C5 is presented. A brief historical review is given of these last 3 var. [CIAT]

0287

25599 FERREIRA FILHO, J.R. 1985. Introducao e avaliacao de cultivares de mandioca na Regiao Nordeste da Bahia. (Introduction and evaluation of cassava cultivars in the northeastern region of Bahia). Salvador-BA, Brasil, Empresa de Pesquisa Agropecuária da Bahia. Pesquisa em Andamento no.19. 7p. Port. [Empresa de Pesquisa Agropecuária da Bahia, Caixa Postal 1222, 40.000 Salvador-BA, Brasil]

Cassava. Cultivars. Productivity. Root productivity. Starch content. Soil analysis. Soil physical properties. Selection. Brazil.

In a red yellow podzolic soil with low P content, high K content, and moderate Ca and Mg contents (Bahia, Brazil), 44 cassava cv. from the Centro Nacional de Pesquisa de Mandioca e Fruticultura and from the NE region of Bahia were evaluated. The 10-m-long exptl. plot, with plants spaced 1 m apart, was fertilized with 30 and 80 kg N and P/ha, resp. Four regional cv. were among the 10 cv. producing most roots; cv. Mandioca Italiana produced 43.6 t roots/ha and Mandioca Alagoana, preferred by farmers of the region for its earliness, produced only 11.0 t/ha. In general, the starch content was not too high; regional cv. presented starch contents above 19%. Most of the introduced cv. presented a good root yield potential, indicating that genotypes are available that could substitute the regional var. whenever necessary. [CIAT]

0288

25593 HAHN, S.K. 1983. Roots and tubers improvement: IITA's experience. Courier no.82:61-63. Engl., Illus. [IITA, Root & Tuber Improvement Programme, Ibadan, Nigeria]

Cassava. Cassava programs. Cassava African mosaic virus. Bemisia. Xanthomonas campestris pv. manihotis. Cultivars. Resistance. Phenacoccus manihoti. Mononychellus. Biological control. Predators and parasites. HCN content. Nigeria.

The root and tuber improvement program of the International Institute of Tropical Agriculture (Ibadan, Nigeria) is briefly reviewed. While CAMV was found in Africa as early as 1894, CBB, cassava mealybug, and green spider mites are recent introductions. Their control is sought through resistance

breeding and biological control. Var. with low HCN content have also been obtained through breeding. [Abstracts on Tropical Agriculture]

0289

24566 INSTITUTO NACIONAL DE INVESTIGACIONES AGRICOLAS. MEXICO. 1981. Informe Anual del Programa de Yuca ciclo 1981-1982. Resumen del documento presentado en la evaluación del programa de yuca. (Annual report of the cassava program 1981-82. Summary of the document presented in the evaluation of the cassava program). México, Secretaría de Agricultura y Recursos Hidráulicos. 63p. Span., Illus.

Cassava. Cassava programs. Cultivars. Plant breeding. Sphaceloma manihoticola. Resistance. Thrips. Cercosporidium henningsii. Cercospora vicosae. Selection. Root productivity. Planting. Spacing. Fertilizers. N. P. K. Costs. Statistical analysis. Intercropping. Beans. Weeding. Herbicides. Cuttings. Forage. Erinnyis ello. Simulation models. Defoliation. Insecticides. Mexico.

Research results of the 1981-82 Mexican cassava program are summarized. In plant breeding, the objective was to select pest- and disease-resistant var. with high productivity in the savanna ecosystem and with good agronomic characteristics. A total of 189 materials were assessed and characterized. Of these, 46.6% were resistant to Sphaceloma manihoticola and 65.6% were tolerant to Frankliniella cephalica. Most materials were resistant to Cercospora vicosae and susceptible to Cercosporidium henningsii. Thirty var. selected on the basis of their main characteristics, but especially for having a potential yield over 30 t/ha, are listed. Sabanera, Costeña, Señora está en la Mesa, Cubana T, and Cubana V were outstanding materials in regional trials. In relation to agronomic studies on fertilization and population density, expt. were carried out in La Palma and Las Flores, with var. Sabanera and Costeña both in monoculture as well as intercropped with beans. The optimum economic fertilization rates and population density for both var. were found to be 70-120-75 kg NPK/ha with 12,000 plants/ha for unrestricted capital, and 30-75-55 kg NPK/ha with 10,000 plants/ha for restricted capital. In another expt., a good fertilization and planting material selection were found to guarantee a good yield. The optimum dose to obtain feed forage from var. M Mex 60 was 120-120-65 kg NPK/ha with 95,000 plants/ha, yielding 23 t/ha in 2 cuttings and thus obtaining up to 70 t high protein cassava forage/ha in 1 yr. The evaluation of herbicides for weed control in monoculture showed that the most effective chemicals were fluorodifen (3.0-4.5 l/ha), ametrine (4.0 kg/ha), linuron (1.5-2.0 kg/ha), diuron (3.0 kg/ha), and Herbilaz (3.0 l/ha), with control ranging between 70-85%. In cassava intercropped with beans, the most effective herbicides were prometryn and metribuzin. Thrip population was lower in cassava when intercropped with beans than in monoculture. In La Palma 189 var. were evaluated as well as 144 in Huimanguillo and 105 in Pedregal for their resistance to thrips; 8% was found to be resistant, 68% tolerant, and 24% susceptible. The best insecticides for the control of Erinnyis ello were carbaryl and trichlorfon. [CIAT]

0290

25719 KAWANO, K.; TIRAPORN, C.; SINTHUPRAMA, S.; SOENARJO, R.; LIAN, T.S.; MARISCAL, A.M.; APILAR, E. 1986. CIAT germplasm in Asian cassava research programs. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro International de Agricultura Tropical. pp.289-307. Engl., 17 Refs., Illus. [Field Crops Research Inst., Dept. of Agriculture, Bangkhen, Bangkok, Thailand]

Cassava. Germplasm. Technology. Cultivars. Climatic requirements. Clones. Hybrids. Seed. Cuttings. Apical meristems. Tissue culture. Cassava programs. Research. Plant breeding. Technology transfer. Asia.

CIAT's research activities in Asia are presented, particularly in relation to plant breeding and introduction of improved var. The characteristics of the existent technology, the types of germplasm available for exchange, and the regional programs are described. Likewise, plant breeding objectives in the region and the performance of CIAT's germplasm in evaluations carried out in Thailand, Malaysia, Philippines, and Indonesia are indicated. The importance of on-site selection is highlighted. [CIAT]

0241

25762 LAMEIRA, O.A. 1985. Competicao de cultivares de mandioca em área de mata de Roraima, Brasil. (Competition of cassava cultivars in a forest area of Roraima, Brazil). Pesquisa Agropecuaria Brasileira 20(5):591-594. Port., Sum. Port., Engl., 8 Refs., Illus. [Empresa Brasileira de Pesquisa Agropecuária, Unidade de Execucao de Pesquisa de Ambito Territorial de Boa Vista, Caixa Postal 133, 69.300 Boa Vista-RR, Brasil]

Cassava. Cultivars. Plant anatomy. Root productivity. Productivity. Dry matter. Starch content. Brazil.

From 1983 to 1984, studies were carried out with 16 cassava cv. on red yellow Latosols in a forest area of Bonfim (Roraima, Brazil) to identify cv. of high genetic potential and appropriate characteristics to satisfy local market requirements. The highest root yields were achieved by cv. BGM 018, Pretinha, and EAB 596 with yields of 18.8, 18.5, and 17.2 t/ha, resp. The 1st 2 are suitable for the production of white flour and the latter for the production of yellow flour. Of all the cv. tested, 78% gave higher yields than the local av. (12 t/ha). [AS]

0292

23731 NAYAR, N.M.; NAIR, R.G. 1983. Tuber crops and tuber crops research in India. Kerala, India, Central Tuber Crops Research Institute. Publication no.3. 8p. Engl.

Cassava. Production. Cultivars. Germplasm. Plant breeding. Technological package. Cassava African mosaic virus. Intercropping. Post-harvest technology. Alcohol. Cassava chips. Storage. India.

A general review of the history and main achievements of research on tuber and root crops, including cassava, in India is presented. Research costs are given and a general review is presented on the advances in terms of: the collection, conservation, cataloging, and evaluation of germplasm; var. improvement; development of packages of cultural practices; pests and diseases (CAMV, leaf spot, and mites); intercropping (especially with groundnut); postharvest technology (especially alcohol production and shelf life of cassava chips); extension and training (with emphasis on the Lab. to land program); and intensification of research. In the future, the objectives of the cassava breeding program will be to develop (1) early maturing cv. (5-7 mo.), resistant to drought and with good cooking qualities; (2) high yielding cv. that have a high starch content; (3) cv. resistant to CAMV and mites; and (4) cv. suitable for their use in intercropping systems. [CIAT]

0293

25296 RADHAKRISHNAN, V.V.; GOPAKUMAR, K. 1984. Correlation between yield and its components in tapioca. Indian Journal of Agricultural Sciences 54(11):975-978. Engl., Sum. Engl., 7 Refs. [Extension Training Centre, Mannuthy, Trichur 680 001, India]

Cassava. Germplasm. Clones. Root productivity. Harvest index. Roots. Leaves. Branching. Stems. India.

In 20 diverse cassava clones, a high value for HI was found to be indicative of a correspondingly high root yield; HI was inversely influenced by the no. of leaves which abscised during the 4th mo. after planting. An increase in stem length had a negative influence on yield while an increase in root girth had a positive influence. [AS]

0294

22864 RAMANUJAM, T.; THANKAPPAN, M.; PALANISWAMI, M.S. 1982. High yielding hybrids of cassava for irrigated tracts of Tamil Nadu. In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.25-31. Engl., Illus.

Cassava. Cultivars. Hybrids. Technological package. Cultivation. Land preparation. Cuttings. Planting. Fertilizers. N. P. K. Intercropping. Irrigation. Root productivity. Economics. Income. India.

In the village of Gaj. Patti (Tamil Nadu, India), the yields of high yielding cassava var. (Sree Visakham, Sree Sahya, H226, and H97) in monoculture and in association (groundnut, onion, tomato, brinjal, and Eleusine coracana) were evaluated within the Lab. to Land program. Cultural practices and systems used in the 31 monocropped cassava trials and in the 36 intercropped cassava trials are described. Var. H 226 outyielded all the others with 33.5 t/ha (75% higher than the yield of the local var.). Var. H 97 presented lodging and the lowest yield (av. of 20.25 t/ha). The presence of carotene in Sree Visakham roots affected their acceptance by the factories; this resulted in a low market price, although its yield performance was acceptable (av. of 25.75 t/ha). Based on these yields, farmers preferred H 226 and Sree Sahya. Jan. plantings gave better yields than June plantings. Data are given on farmers' net income when cultivating improved cassava var., the additional income derived from intercropping, and the net benefit when compared with monoculture. Cassava yield reduction due to intercropping was between 3.0-17.2%; brinjal and E. coracana affected yield the most (17.2%), while onion was the one that affected it least (3.0%). [CIAT]

0295

25577 RAMASWAMY, N.; VIJAYAKUMAR, M.; SUNDARARAJAN, S. 1984. Co. 2 tapioca - a high yielding clone. South Indian Horticulture 32(1):43-45. Engl. [Tamil Nadu Agricultural Univ., Coimbatore-641 003, India]

Cassava. Clones. Plant height. Root productivity. Starch content. Starch productivity. HCN content. India.

Cassava var. Co. 2 (tested as MF. 167) is a clonal bulk selected from the Tiruvarur line TV. 1 collected from Thanjavur District (Tamil Nadu, India). The plants are of short duration (8.5-9.0 mo.) and have moderate vigor, a height of 165 cm and medium-sized roots with a creamy-white, nonbitter flesh (when raw and cooked). The roots contain 34.5% starch and the av. yield is 37.65 t/ha. [Plant Breeding Abstracts]

0296

25522 RODRIGUEZ M., S.; GONZALEZ A., A.; PEDRAZA, A. 1982. Resultados de un programa de mejoramiento en yuca (Manihot esculenta) en Cuba. (Results of a cassava improvement program in Cuba). Ciencia y Técnica en la Agricultura. Viandas Tropicales, Suplemento Septiembre 1982:45-59. Span., Sum. Span., Engl., 13 Refs. [Centro de Mejoramiento de Semillas Agámicas, Ministerio de la Agricultura, Apartado no.6, Santo Domingo, Villa Clara, Cuba]

Cassava. Cultivars. Clones. Crossbreeding. Selection. Resistance. Root productivity. Post-harvest losses. Agronomic characters. Xanthomonas campestris pv. manihotis. Carpolonchaea chalybea. Sphaceloma manihoticola. Cuba.

A cassava breeding program was carried out at the Centro de Mejoramiento de Semillas Agámicas (CEMSA) in Santo Domingo, Cuba, on a brown soil with carbonate differentiation. Controlled hybridization work began in 1974 and the comparative clonal survey concluded in 1981; the intermediate stages of the program consisted in row and population density trials. Señorita (check), Pinera, Vegana, Enana Rosada, Yuca de Arroba, Cayo-Bejuco, and Especial were used as parent material. In the comparative clonal survey (1980 and 1981), a randomized block design was used with 4 replications and 7 treatments: clones Señorita, CEMSA 74-725, CEMSA 74-110, CEMSA 74-119, CEMSA 74-3280, CEMSA 74-2180, CEMSA 74-6295, and CEMSA 74-6329; during the 1st year clones CEMSA 74-725, CEMSA 74-110, CEMSA 74-6329, and Señorita did not show significant differences in root yield. In the 2nd year, CEMSA 74-725 yielded more than Señorita and the other clones. [AS-CIAT]

0297

25715 SOENARJO, R.; NUGROHO, J.H. 1986. Improving the productivity of cassava in Indonesia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.229-239. Engl., 8 Refs., Illus. [Central Research Inst. for Food Crops, Jl. Merdeka 99, Bogor, Indonesia]

Cassava. Production. Tetranychus. Xanthomonas campestris pv. manihotis. Cercosporidium henningsii. Cercospora caribaea. Fomes lignosus. Pseudomonas. Prices. Research. Cultivars. Resistance. Selection. Fertilizers. Productivity. Harvest index. Soil physical properties. Indonesia.

In Indonesia cassava is the 3rd most important crop after rice and maize. Its production, constraints, research, and results are discussed. The main research activities have been in the areas of plant breeding and agronomy (fertilizers). [CIAT]

0298

25713 XIONG, L.; WEITE, Z.; XUECHENG, T. 1986. Improving the productivity of cassava in China. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.213-218. Engl. [South China Academy of Tropical Crops, Hainan Island, Guangdong Province, People's Republic of China]

Cassava. Research. Cultivars. Plant breeding. Cuttings. Planting. Spacing. Fertilizers. N. P. K. Root productivity. Dry matter. Starch content. HCN content. Intercropping. Development. China.

The research activities carried out by the Tropical Crops Cultivation Research Institute, China, are presented: plant breeding and selection of improved var., cultural practices (cuttings, planting, fertilizers), var. trials, and intercropping. Data on yield, DM, and starch and HCN contents are included. Production constraints are discussed and the future research directions are indicated. [CIAT]

See also 0207 0208 0235 0246 0359 0360 0364 0366 0373 0378 0382 0387 0388 0397 0399

G02 Cytogenetics

See 0208 0285

H00 NUTRITION

H01 Cassava Foods and Nutritive Value

0299

25513 CONSTANT, J.L.; KOCHELEFF, P.; CARTERON, B.; PERRIN, J.; BEDERE, C.; KABONDO, P. 1984. Distribution géographique des aflatoxines dans l'alimentation humaine au Burundi. (Geographical distribution of aflatoxins in human nutrition in Burundi). Sciences des Aliments 4(2):305-315. Fr., Sum. Fr., Engl., 20 Refs., Illus. [Université du Burundi, Faculté de Médecine, B.P. 1020, Bujumbura, Burundi]

Cassava. Aflatoxin. Analysis. Statistical analysis. Aspergillus. Burundi.

Aflatoxin contamination of food in rural Burundi was studied. It seemed to occur only in areas of low alt., the foods most adversely affected being peanuts, cassava, and maize, containing max. of 202, 325, and 148 micrograms toxin/kg, resp. [AS]

0300

25505 JOAO, W. DA S.J.; ELIAS, L.G.; BRESSANI, R. 1984. Valor nutritivo de dietas elaboradas a base de tubérculos y leguminosas consumidas en tres proporciones diferentes. (Nutritive value of diets based on tubers and legumes taken in three different proportions). Archivos Latinoamericanos de Nutrición 34(2):315-320. Span., Sum. Span., Engl., 9 Refs., Illus. [Univ. Federal do Pará, Belém-PA, Brasil]

Cassava. Cassava flour. Cowpea. Nutritive value. Composition. Water content. Fat content. Fibre content. Protein content. Ash content. Carbohydrate content. Methionine. Guatemala.

Groups of 8 Wistar rats 21 days old were given ad libitum diets with a mixture of cassava and cowpea meals making up about 90% of the diet in the proportions 87:13, 70:30, and 50:50, all without or with 0.21% met. Protein was best utilized when the meals were in the ratio 50:50. The met. supplement had no effect when added to the 87:13 diet but when added to the 70:30 and 50:50 diets there was an increase in wt. gain. The % of utilizable protein increased as the % of cowpea meal in the diet increased. [Nutrition Abstracts and Reviews]

0301

25548 MAZUMBA, J. 1984. Cassava processing workshop - production and processing in Zambia. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.243-244. Engl.

Cassava. Cassava chips. Storage. Cassava meal. Composition. Zambia.

The situation of cassava in Zambia is presented. It is mainly grown as a subsistence crop. Once harvested, cassava is washed, peeled, and cut into chips that are sun-dried. These are then stored and when they are going to be consumed, they are macerated to obtain CM. It is recommended to improve the technology used to give cassava a better use. [CIAT]

0302

25288 OYENIRAN, J.O. 1981. Mould development in gari during storage in polythene and hessian bags. In Nigerian Stored Products Research Institute. Federal Ministry of Science and Technology. Annual Report for 1978-79. Ibadan. Technical Report no.11. pp.93-99. Engl., Sum. Engl., 4 Refs.

Cassava. Gari. Storage. Water content. Moulds. Nigeria.

The storage of white and yellow gari in polyethylene and hessian bags was compared at 2 levels of MC, the market level of 18.6% for white and 18.1% for yellow gari. The storage lasted 2 mo. The initial MC of the gari which was purchased from the markets was high enough to support mold infection. This infection was aggravated when such gari was stored in polyethylene bags because the MC increased appreciably. The samples in the hessian bag maintained reduced moisture and so moldiness did not increase as much as the samples stored in the polyethylene bags. Gari samples stored in polyethylene bags at lower MC did not change in appearance and level of mold contamination during storage. The samples in hessian bags increased in MC slightly, being affected almost directly by the prevailing RH of the storage atm. Ten mold species were isolated. Aspergillus chevalieri and Mucor pusillus were the dominant species at the commencement of storage but Aspergillus flavus, A. niger, and Syncephalastrum racemosum became more abundant during storage at the high moisture levels. In the samples stored at lower MC, Aspergillus candidus, A. melleus, and Penicillium citrinum were sparsely distributed. [AS]

See also								
	0251	0252	0284	0318	0320	0326	0328	0331
	0333	0334	0335	0336	0338	0340	0341	0342
	0347	0349	0352	0353	0361	0366	0368	0372
	0374	0377	0379	0380	0381	0383	0385	0386
	0387	0388	0389	0394	0396	0403	0404	0407
	0408	0410	0411	0412	0413	0416		

H02 Nutritive Disorders in Humans

0303

25574 LIENER, I.E. 1984. Natural toxins in plant foods. Nutrition and Health 3(1-2):113-114. Engl., Sum. Engl., 13 Refs. [Dept. of Biochemistry, Univ. of Minnesota, College of Biological Sciences, St. Paul, MN 55108, USA]

Cassava. Cyanogenic glucosides. Toxicity. USA.

Certain substances present in some plants, namely, soybean and cassava, that can produce adverse physiological effects in human beings are briefly discussed. The preparation and cooking methods that have been utilized to deal with the problem are mentioned. [AS]

See also 0338

H03 Animal Feeding

0304

24055 AUMAITRE, A. 1972. Le manioc convient-il aux porcs? (Cassava, is it suitable for pigs?). La Revue de l'Elevage 27:83,85,87. Fr., Illus.

Cassava. Animal nutrition. Swine. Piglets. Composition. Digestibility. France.

The chemical composition of cassava is presented and discussed, and the need to complement its use in animal nutrition with N sources is indicated. Its use in swine nutrition is recommended as a cereal substitute considering its digestibility, positive effect on animal growth, and low price. However, it should be used moderately because of its toxicity. [CIAT]

0305

25244 BALDIZAN, A.; DIXON, R.; PARRA, O. DE; PARRA, R. 1982. Efecto de la adición de harina de yuca a una dieta de heno (Cenchrus ciliaris) sobre la digestibilidad de la materia seca y pared celular en ovejas y chiguires. (Effect of addition of cassava meal to a diet of Cenchrus ciliaris hay on dry matter and cell wall digestibility in sheep and capybaras). In Instituto de Producción Animal. Venezuela. Informe Anual 1982. Maracay, Universidad Central de Venezuela. pp.27-28. Span. [Inst. de Producción Animal, Univ. Central de Venezuela, Maracay, Venezuela]

Cassava. Animal nutrition. Cassava meal. Forage crops. Sheep. Capybaras. Digestibility. Venezuela.

Three sheep and 3 capybaras were fed Cenchrus ciliaris hay with the addition of 1% minerals, 15% CM + 1% minerals or 30% CM + 1% minerals. In sheep, addition of CM increased DM digestibility from 48.7 to 52.4% but reduced cell wall digestibility from 53.6 to 46.0%; in capybaras, cell wall digestibility did not increase (50.7 and 52.0%) but DM digestibility increased from 44.6 to 56.6%. [Nutrition Abstracts and Reviews]

0306

24708 CALEFFI, A.; BROCCAIOLI, A. 1982. La farina di manioca nell'ingrasso dei suini. (Cassava flour for fattening pigs). Mantova Agricola e Zootecnica 32(19):1-2. Ital.

Cassava. Animal feeding. Swine. Cassava meal. Fattening. Water content. Fat content. Protein content. Ash content. Fiber content. Feed constituents. Italy.

Three groups of pigs, of 17 animals each, received resp. a diet of maize (A) or with 30 (B) or 15% CM (C); the diets were not isoproteid. The wt.

gain/day, the food conversion indexes, and the linoleic acid contents were 0.649, 0.605, and 0.625 g; 4.336, 4.697, and 4.440; and 12.45, 9.77, and 10.71%, resp. The use of cassava is recommended as long as its price, in relation to that of maize, is 25% lower. [CIAT]

0307

25598 COSTA, J.B.; SILVA, V.G. DA; RODRIGUES, F. DE M.; SILVA, U.R. DA 1985. Efeito da uréia associada a mistura mineral e do feno de mandioca sobre o ganho de peso de novilhos. (The effect of urea associated with a mineral mixture and of cassava forage on the weight gain of steers). Salvador-BA, Brasil, Empresa de Pesquisa Agropecuária da Bahia. Pesquisa em Andamento no.21. 4p. Port. [Empresa de Pesquisa Agropecuária da Bahia, Caixa Postal 1222, 40.000 Salvador-BA, Brasil]

Cassava. Forage. Feed constituents. Minerals. Beef cattle. Brazil.

The preliminary results of an expt., projected for 3 yr and carried out at the Itaberaba Exptl. Station (Bahia, Brazil), are presented; it intends to evaluate the effect of urea supplementation to the mineral mixture and of cassava forage on the wt. gain of steers. The animals were kept under a grazing regime during the dry season. A completely randomized exptl. design with 3 treatments and 10 animals/treatment was used. The treatments were pasture (Digitaria decumbens) + mineral mixture (control), T1; pasture + urea/mineral mixture (50 + 50%), T2; and pasture + cassava forage + mineral mixture, T3. This 1st exptl. period lasted 112 days. The av. wt. gain/day was -1.3, 0.7, and 20.0 kg for T1, T2, and T3, resp. The superiority of the cassava forage supplement in daily wt. gain is evident. [CIAT]

0308

25230 KHAJARERN, S.; KHAJARERN, J.M. 1984. Aspecto económico y aceptación pública de raciones basadas en yuca en Tailandia. (The economics and public acceptance of cassava-based rations in Thailand). Producción Animal Tropical 9(2):138-150. Span., Sum. Span., 38 Refs. [Faculty of Agriculture, Khon Kaen Univ., Khon Kaen, Thailand]

Cassava. Animal nutrition. Nutritive value. Cassava chips. Pellets. Economics. Thailand.

Market prices of important feedstuffs and biological responses from 15 feeding trials including some 3320 broilers, 1600 replacement birds, 768 layers, and 182 growing-finishing pigs are analyzed to evaluate the economic feasibility of cassava-based feeds for Thailand. Cassava could replace cereals only when its price was lower than 50% of the cereal price. In the EEC such substitution was possible when the cassava/maize price quotient was lower than 75%. Public acceptance of cassava-based feeds in Thailand is still low since cassava has been uneconomic to use and there have been wide fluctuations in the market price and irregular supplies of root products. Stiff competition among feedmillers has prevented them from using cassava products in their compound feeds. [AS-Nutrition Abstracts and Reviews]

0309

25520 LAW, A.T. 1984. Nutritional study of jelawat, Leptobarbus hoevenii (Bleeker), fed on pelleted feed. Aquaculture 41(3):227-233. Engl., Sum. Engl., 11 Refs., 11lus. [Faculty of Fisheries & Marine Science, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia]

Cassava. Pellets. Feed constituents. Animal nutrition. Fish. Uses. Malaysia.

The digestion coefficients of the nutrients in the ingredients used in formulating the diet (Malaysian Agricultural Research and Developing Institute-37%) for the culturing of jelawat were evaluated. Cr_2O_3 was used as an internal marker for the evaluation of digestibility. Jelawat digested 100% of the protein, fat, carbohydrate, and gross energy in fish meal, but only 69.50% protein, 60.70% fat, 73.82% carbohydrate, and 59.30% gross energy in SBM. This fish digested copra cake meal, an agricultural by-product in Malaysia, better than SBM; the values were 75.39% protein, 98.36% fat, 50.03% carbohydrate, and 73.21% gross energy. Digestibility of maize, rice bran, and cassava was poor in this fish. There were no significant differences in the digestibility of DM, protein, fat, carbohydrate, ash, and gross energy of the reference diet in jelawat specimens whose total length was more than 12 cm; in fish less than 12 cm, digestibility was significantly lower. [AS]

0310

24090 MANER, J.H.; BUITRAGO, J.; PORTELA, R.; JIMENEZ, I. 1978. La yuca en la alimentación de cerdos. (Cassava in swine feeding). Palmira, Instituto Colombiano Agropecuario. Centro Internacional de Agricultura Tropical. 115p. Span., Illus.

Cassava. Cultivars. Composition. Water content. Protein content. Fibre content. Fat content. Ash content. Mineral content. HCN content. Toxicity. Detoxification. Harvesting. Storage. Roots. Silage. Swine. Animal nutrition. Cassava meal. Fresh products. Feed constituents. Leaves. Forage. Colombia.

A literature review on swine feeding with cassava, and the results of 16 expt. with fresh, dry, or ensiled cassava to feed growing and finishing pigs or in-pig or suckling sows, are presented. In 6 expt. with growing and finishing pigs fed fresh cassava, it was observed that groups receiving a max. consumption of 4.0-4.5 kg fresh cassava/animal/day with controlled amounts of a protein supplement grew slower than those fed with a maize-based control diet and than those fed fresh cassava + supplement ad libitum; this latter group consumed more protein supplement to partially meet its daily energy needs since the daily ration of fresh chopped cassava was not enough to meet them. Cassava palatability was improved in diets supplemented with sugar or molasses. Supplements with protein levels of only 20% rendered adequate yields in terms of wt. increase and feed conversion, and avoided protein overconsumption observed in previous expt. In expt. 7, 8, 9, and 10, also with growing and finishing pigs but fed with dry cassava and CM, it was observed that the progressive reduction in wt. increase was associated with increasing levels of CM substituting maize in the ration. A slight favorable response was obtained when adding 0.1% met. to the CM and soybean cake-based diets. In expt. 11, 12, and 13 (ensiled cassava fed to growing and finishing pigs), it was observed that the inclusion of stems and foliage into the silage reduced diet acceptability by the animals; animals fed ensiled cassava and protein supplement increased wt. at the same rate as pigs fed maize-based diets and protein supplement. Consumption of ensiled cassava was less than that of fresh cassava. A more active HCN detoxification mechanism was observed in pigs fed with ensiled cassava. In expt. 14 with fresh cassava supplied to in-pig sows, good results were obtained. In expt. 15 (fresh cassava and CM supplied to suckling sows) it was found that litters from sows consuming fresh cassava were less numerous but with increased individual wt. and the av. wt. of litters at weaning were higher. However, total litter wt. at weaning indicated that there were no considerable differences in the overall performance of sows between all 3 treatments. In expt. 16 (ensiled cassava fed to suckling sows), it was found that sow and litter performance was adequate at any lactation stage when fed with ensiled cassava. [CIAT]

0311

25725 McALLAN, A.B.; GRIFFITH, E.S. 1984. Evaluation of detergent extraction procedures for characterising carbohydrate components in ruminant feeds and digesta. Journal of the Science of Food and Agriculture 35(8):869-877. Engl., Sum. Engl., 28 Refs. [National Inst. for Research in Dairying, Shinfield, Reading RG2 9AT, England]

Cassava. Feed constituents. Feeds and feeding. Animal nutrition. Cattle. Composition. Analysis. Metabolism. Sugar content. Fibre content. Protein content. United Kingdom.

Steers fitted with simple rumen and abomasal cannulas were given isoenergetic diets of approx. equal amounts of untreated barley straw and concentrates (flaked maize + cassava) alone (BSA) or with urea (BSU) or fishmeal (BSF). Similar diets were also given in which the barley straw had been treated with NaOH (BSA, BSAU, and BSAF, resp.). The diets were given in a 6 x 6 Latin square design. Feed components and abomasal digesta samples were analyzed for neutral (NDF) and acid (ADF) detergent fibers and for monosaccharide constituents of structural polysaccharides. Hemicellulose contents were estimated as the sum of xylose + arabinose and by the difference between ash-free NDF and ash-free ADF (NDF-ADF). Cellulose was estimated as beta-linked glucose and by the difference between ash-free ADF and lignin (ADF-L). ^{103}Ruthenium and polyethylene glycol were given as flow markers, and flows (g/24 h) at the abomasum of carbohydrate components estimated in these ways were calculated. Approx. 98% (by wt.) of the cellulose found in original feed and digesta samples was recovered in both NDF and ADF. Recoveries of hemicellulose in NDF from untreated straw, treated straw, and abomasal digesta were approx. 92, 48, and 50%, resp. The ADF fraction of feeds and digesta contained 3-6 and 10-17% of the N and xylose, resp., present in the original samples. Mouth to abomasum digestibilities of hemicellulose (NDF-ADF) for diets BS, BSU, BSF, BSA, BSAU, and BSAF were 35, 62, 67, 29, 61, and 76%, resp. Corresponding values for cellulose were 37, 34, 50, 45, 48, and 63%, resp. The use of NDF-ADF and ADF-L as measures of hemicellulose and cellulose contents, resp., of feeds and digesta, and the digestibility of these carbohydrate fractions between mouth and abomasum of steers are discussed. [AS]

0312

25297 MELO, J.F.; VIANA, J. DE A.C.; MOREIRA, H.A.; MELLO, R.P. DE 1983. Farelo de arroz e mandioca (raiz dessecada e feno) como suplementos de dieta básica de cana-de-acucar + uréia para novilhas leiteiras. [Rice bran and cassava (dried roots and hay) as supplements to a basic diet of sugar cane + urea for dairy heifers]. Arquivo Brasileiro de Medicina Veterinária e Zootecnia 35(6):871-886. Port., Sum. Port., Engl., Fr., Span., 32 Refs.

Cassava. Dairy cattle. Cassava meal. Feed constituents. Composition. Dry matter. Ash content. Protein content. Fibre content. Food energy. Metabolism. Brazil.

The potential of using sugar cane combined with urea:ammonium sulphate (9:1) and minerals, supplemented with different energy levels (rice bran, cassava roots with or without hay), as feed for dairy heifers during the dry season was evaluated. Twenty-four Holstein x Zebu heifers, with mean initial wt. and age of 240 kg and 21 mo., resp., were used. The completely randomized design included the following 3 treatments: A, sugar cane + urea:ammonium sulphate + rice bran; B, sugar cane + urea:ammonium sulphate + cassava roots; C, sugar cane + urea:ammonium sulphate + cassava roots + hay. Mean daily wt. gains/heifer during the exptl. period were 0.588,

0.415, and 0.278 kg, resp., for treatments A, B, and C. Treatment A differed significantly ($P < 0.05$) from B and C. However, no significant differences were observed between B and C. Total mean DM intakes (heifer/day) were 6.9, 6.5, and 6.2 kg, resp., and no significant differences were observed among the treatments. [AS]

0313

25597 MOORE, C.P.; COCK, J.H. 1985. Cassava forage silage as a feed source for Zebu calves in the tropics. Tropical Agriculture (Trinidad) 62(2):142-144. Engl., Sum. Engl., 15 Refs. [International Mineral & Chemical Corporation, Box 207, Terre Haute, IN 47808, USA]

Cassava. Forage. Silage. Calves. Composition. Dry matter. Protein content. Fat content. Fibre content. Ash content. Feeds and feeding. Colombia.

Five-mo.-old Zebu calves were fed for 112 days either (1) cassava forage silage alone, (2) silage + 0.50 kg dried cassava chips, or (3) silage + 0.50 kg dried cassava chips + 0.25 kg cottonseed meal. Body wt. gains, feed efficiency, and protein utilization were significantly low for animals on the pure cassava forage diet. The addition of dried cassava chips to the silage diet improved growth rate (59%) and feed efficiency (34%) over that of the base diet (1). The addition of cottonseed meal to the diet did not improve animal performance, suggesting that energy was more limiting than protein in the pure silage diet. Based on 2 harvests during a 210-day period, the annual production of cassava forage/ha was calculated to be 75.50 t of fresh forage (14 t DM/ha) and 3.48 t of protein (N x 6.25). [AS]

0314

24543 MORENO, E.A.H. 1982. Mandioca, potencial energético na alimentacao do suíno. (Cassava, energetic potential for swine feeding). Londrina-PR, Brasil, Fundacao Instituto Agronomico do Paraná. Circular no.27. 53p. Port., Sum. Port., 121 Refs., Illus

Cassava. Swine. Animal nutrition. Fresh products. Cassava meal. Silage. Forage. Proteins. Food energy. Brazil.

A literature review on the use of cassava in swine nutrition is presented. The geographical distribution and production of cassava, its utilization, chemical composition, and methods to reduce its toxicity are reviewed. The use of fresh cassava and CM for feeding pigs during their growing, finishing, pregnancy, lactation, and preinitiation periods is also reviewed. The use of cassava silage during the growing, finishing, and lactation periods, and of the cassava forage and SCP during the growing and finishing periods are also discussed. It is concluded that fresh cassava, CM, or cassava silage are excellent energy sources that, if used properly, can partially or totally substitute maize or other cereals in rations for pigs, without eliminating the possibility of having, in the future, an excellent protein source produced from cassava energy. [CIAT]

0315

25265 PAPADOPOULOS, G.; ZIRAS, E.; KALAISSAKIS, P. 1983. [Replacement of cereals by tapioca in rations of fattening pigs]. Bulletin of the Hellenic Veterinary Medical Society 34(1):22-31. Greek, Sum. Engl., 10 Refs.

Cassava. Animal nutrition. Swine. Fattening. Feeds and feeding. Greece.

Forty-four Large White x Landrace hybrid pigs (av. initial wt. 22 kg) were divided into 7 groups and fed ad libitum with rations consisting of maize, barley, cassava, SBM, fish meal, and wheat bran. During the prefattening period the rations contained 13.1-13.4 MJ digestible energy/kg, 16.2-16.5% CP, and 0, 20, and 40% cassava. In the final fattening period, however, the rations contained 12.8-13.6 MJ digestible energy/kg, 13.0-13.6% CP, and 0, 20, 40, and 60% cassava. Partial replacement of cereals by cassava reduced the linoleic acid content of the rations, which was added to 1.00%, except for 1 group where the linoleic acid content of the ration was 0.45%. Results suggest that cassava given to fattening pigs up to 40 and 60% during the prefattening and final fattening periods, resp., did not significantly affect the av. daily live wt. gain nor improved the feed conversion coefficient for $P < 0.05$. Carcass characteristics were not affected and during the replacement of cereals by cassava to the above proportions, the addition of linoleic acid to the ration was not necessary. For the use of cassava to be economical under current Greek conditions, its price should be less than 80% that of cereals. [AS]

0316

25509 RAVINDRAN, V.; RAJAGURU, A.S.B. 1985. Nutrient contents of some unconventional poultry feeds. Indian Journal of Animal Sciences 55(1):58-61. Engl., Sum. Engl., 21 Refs. [Univ. of Peradeniya, Peradeniya, Sri Lanka]

Cassava. Poultry. Feeds and feeding. Leaves. Cassava meal. Composition. Protein content. Fat content. Fibre content. Ash content. HCN content. Food energy. India.

The nutrient and N-corrected ME contents of 10 nonconventional poultry feed ingredients were determined. The chromic oxide indicator method was employed to assay the ME values. The ME contents for undetoxified and detoxified cassava root meal were 3197 and 3805 kcal/kg, resp. This difference suggested that HCN interfers with the utilization of energy by poultry. The ME content of CLM was 1870 kcal/kg. [AS]

See also 0219 0234 0252 0317 0330 0353 0357 0358 0365 0366 0368 0371 0373 0381 0383 0384 0387 0388 0390 0392 0395 0403 0404 0407 0408 0409 0414 0416

H04 HCN Toxicity and Detoxification

0317

25261 GOMEZ, G.; VALDIVIESO, M. 1985. Effects of drying temperature and loading rates on cyanide elimination from cassava whole-root chips. Journal of Food Technology 20:375-382. Engl., Sum. Engl., 24 Refs. [Centro Agronómico Tropical de Investigación y Enseñanza, 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Cassava chips. Drying. Dry matter. Cyanides. HCN content. Detoxification processes. Statistical analysis. Costa Rica.

The effects of 3 oven drying temp. (60, 70, and 80°C), each at 3 loading rates (10, 15, and 20 kg/m^2), on cyanide elimination from cassava whole root chips were evaluated. Roots of 2 cassava cv., one with high (M Col 1684) and the other with intermediate (M Col 22) cyanide contents, were

used. A total of 27 drying expt. with chips of M Col 1684 and 18 with M Col 22 were evaluated in 2 factorial expt.: 3 x 3 x 3 (temp. x loading x replicate) and 3 x 3 x 2, resp. Under these conditions the main factor determining cyanide elimination was the loading rate rather than the drying temp. As the loading rate increased from 10 to 20 kg/m^2, the total and bound cyanide contents of dried chips decreased as a result of the higher cyanide losses. This effect was statistically significant only with the chips of M Col 1684 but the same trend was observed with M Col 22. Artificial drying at the temp. and loadings assayed allowed total cyanide losses of 81 and 69% for chips of cv. M Col 22 and M Col 1684, resp. The residual cyanide content of dried chips of cv. M Col 1684 was 3 times the max. permissible level set by the EEC for HCN in cassava products to be used as animal feeds. These exptl. results are compared with previously published data on cyanide elimination. [AS]

See also 0316 0342

100 PROCESSING, PRODUCTS AND USES

101 Cassava Starch and Its Properties

0318

25557 BARTSCH, W. 1984. Development of the industrial processing of cassava roots to starch, gari and alcohol. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.391-398. Engl.

Cassava. Cassava starch. Processing. Industrial machinery. Development. Uses. Gari. Tapiocas. Ethanol. Africa.

The advantages of the recommended machinery to obtain a higher yield and consume less water in the processing of starch are discussed. The uses of cassava starch and the economic feasibility of its use in the production of tapioca are indicated. Likewise, starch production from cassava chips is mentioned. Finally, gari processing and ethanol production from cassava are discussed. [CIAT]

0319

25760 CEREDA, M.P.; LIMA, U. DE A. 1985. Aspectos sobre a fermentacao da fécula de mandioca. 3. Determinacao dos ácidos organicos. (Aspects on cassava starch fermentation. 3. Organic acids determination). Turrialba 35(1):19-24. Port., Sum. Engl., Port., 25 Refs.

Cassava. Cassava starch. Fermentation. Analysis. Composition. Industrial microbiology. Brazil.

The actual conditions of the fermented cassava starch industries were surveyed in the lab. under simiar conditions to those used in commercial production. Six organic acids were determined by a silicic acid column chromatography method in samples of both commercial and lab.-fermented cassava starch: propionic, butiric, acetic, formic, succinic, and lactic in highly varied quantities. [AS]

0320

25541 ODERA, F.P.; MBINGA, M.J. 1984. Cassava processing in Kenya. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.179-185. Engl.

Cassava. Cultivars. Socio-economic aspects. Cassava African mosaic virus. Processing. Cassava starch. Factories. Production. Uses. Cassava leaves (vegetable). Cassava chips. Cassava flour. Development. Kenya.

The situation of cassava in Kenya is presented. Production systems, var. grown, and production constraints (CAMV) are indicated. The industrial processing of cassava, whose main product is starch, is described and its uses and production (7200 t/yr) are mentioned. Cassava leaves are cooked with other legumes, and the roots are consumed raw, boiled, grilled, or fried depending on the dish that is prepared, or they are processed into chips or flour. Finally, other industrial alternatives for cassava (animal feeds, ethanol) are presented. [CIAT]

0321

25726 PIZZINATTO, A.; CAMPOS, S.D. DA S. DE 1984. Correlacao entre viscosidades do viscosímetro Epprecht e do viscógrafo Brabender determinadas em suspensao de amido de mandioca. (Viscosity correlation between the Epprecht viscosimeter and the Brabender viscograph using suspensions of cassava starch). Boletim do Instituto de Tecnologia de Alimentos 21(4):527-536. Port., Sum. Port., Engl., 10 Refs.

Cassava. Cassava starch. Viscosity. pH. Analysis. Statistical analysis. Brazil.

The possibility of substituting the Brabender viscograph (slow method) by the Epprecht viscosimeter TVB model (rapid method) to determine the viscosity of cassava starch was determined. The correlation coefficient between the viscosity results obtained with the Brabender viscograph with samples at the point of the curve corresponding to 50°C in the cooling stage, and those obtained in the Epprecht viscosimeter for the same samples under the same conditions, was established using the rank correlation method. The correlation coefficient rho = 0.78 obtained does not indicate whether the Epprecht viscosimeter can substitute the Brabender viscograph, although it can be used as long as standards for specific points on the processing line are established. [AS]

0322

25504 QUEZADA L., O.; BELLO, R.A. 1984. Factibilidad de empleo de diferentes agentes adhesivos para el desarrollo de productos a base de carne deshuesada de pescado. (Feasibility of using different binding agents for the development of products based on deboned fish flesh). Archivos Latinoamericanos de Nutrición 34(1):169-188. Span., Sum. Span., Engl., 23 Refs., Illus. [Facultad de Ciencias de la Univ. Central de Venezuela, Apartado Postal 47097, Caracas 1041 A, Venezuela]

Cassava. Cassava starch. Food products. Uses. Venezuela.

Preparations of fish flesh and binding agents were investigated, with emphasis on the rheological and hydration properties. Starches and precooked maize and cassava flours were used as binding agents. Flours presented a high binding capacity, even at low concn. (10-15%); however, at higher concn. this property tended to be counteracted by the water

absorption capacity. Application of thermal gelatinizing treatments was required when crude starch was used. As far as color is concerned, the observed changes depended both on the type of binder used and on its concn. The flesh-binding texture depends on the viscosity developed by the starchy product. [AS]

0323

25582 SONI, P.L.; SHARMA, H.W.; DOBHAL, N.P.; BISEN, S.S.; SRIVASTAVA, H.C.; GHARIA, M.M. 1985. The starches of Dioscorea ballophylla and Amorphophallus campanulatus: comparison with tapioca starch. Stärke 37(1):6-9. Engl., Sum. Engl., Germ., 13 Refs., Illus. [Forest Research Inst. & Colleges, Dehra Dun 248006, India]

Cassava. Starch crops. Cassava starch. Analysis. Composition. Protein content. Ash content. Fat content. Viscosity. Gelatinization. Electron microscopy. Particle size. India.

Starches from the tubers of Dioscorea ballophylla and corms of Amorphophallus campanulatus were isolated and purified. Scanning electron microscopy of these starches exhibits eliptical and spherical or irregular shapes, resp., while the shape of cassava is spherical. Water-binding capacity of A. campanulatus starch is very high in comparison with D. ballophylla and cassava starches but the amylose content is significantly less. Gelatinization temp. of both these starches is the same but is higher when compared with cassava starch; swelling power and solubilities are less. Paste viscosity characteristics show high peak viscosity for A. campanulatus in comparison with D. ballophylla and cassava starch. [AS]

0324

25567 SWINKELS, J.J.M. 1985. Composition and properties of commercial native starches. Stärke 37(1):1-5. Engl., Sum. Engl., Germ., 21 Refs., Illus. [Avebe B.A., Kl. Nieboerweg 12, 9607 PN Foxhol, Holland]

Cassava. Cassava starch. Potatoes. Maize. Production. Particle size. Water content. Fat content. Protein content. Ash content. Gelatinization. Viscosity.

The physicochemical properties of starches depend upon the botanical source from which they are isolated. Important differences between potato, maize, wheat, cassava, and waxy maize starch are reviewed. Special attention is given to production and applications, composition and properties of the starch granules, amylose and amylopectin, gelatinization characteristics, and the properties of starch pastes and starch films. [AS]

0325

25566 TREGUBOV, N.N.; PAVLOVSKAYA, O.E. 1984. [Cassava starch—a promising material for the manufacture of food concentrates]. Sakharnaya Promyshlennost no.3:52-54. Russ., 4 Refs., Illus.

Cassava. Cassava starch. Food products. Uses. Viscosity. Water content.

Use of extruded cassava starch for food concentrates that do not require boiling, such as puddings and desserts, is discussed, with particular reference to the effect of various conditions (extrusion, MC, temp., intensity of mechanical action) on the degree of starch breakdown and the

changes in the properties (solubility, viscosity, water-binding capacity) of the extruded product. [Food Science and Technology Abstracts]

See also 0225 0252 0330 0332 0343 0344 0349 0353 0364 0365 0366 0371 0374 0376 0381 0383 0389 0390 0394 0398 0400 0401 0402 0407 0414 0416

I02 Uses, Industrialization, Processing and Storage

0326

25561 ADJORLOLO, S.K. 1984. Industrial processing equipment. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.429-441. Engl., Sum. Engl., Illus.

Cassava. Gari. Processing. Technology. Cassava flour. Industrial machinery. Cortex. Animal nutrition. Africa.

The traditional processing of CF and gari in Africa, and the equipment for their industrial processing as well as that for yam are discussed. The necessary materials for the construction of the slicing machine, driers, hammer mill, and gari frying machine are indicated. Illustrations are included as well as the approximate quantity of industrial equipment that 20 African countries would need to process cassava, yam, and other tubers and roots. [CIAT]

0327

25728 AGBIM, N.N. 1985. Potentials of cassava peels as a soil amendment: 2. Field evaluation. Journal of Environmental Quality 14(3):411-415. Engl., Sum. Engl., 7 Refs., Illus.

Cassava. Cortex. Uses. Soil amendments. Soil analysis. N. P. K. Ca. Mg. Mineral content. Colocasia esculenta. Fallowing. Nigeria.

The effect of cassava peels (CP), applied in different proportions with poultry droppings (PD), on the growth of Colocasia esculenta was evaluated in the field over a 4-yr period, which included 1 yr of fallow. The treatments 100-0, 75-25, 50-50, 25-75, and 0-100% CP-PD were each applied at the rates of 0, 10, 25, and 50 t/ha. At 10 t/ha the CP-PD mixtures increased yield by 559, 328, and 311%, resp., for the 1979, 1980, and 1982 croppings, thus emphasizing the value of the amendment. Significant increases in yield ($P < 0.01$) were obtained each year for each increment in rate. The mean yields of 2.20, 5.09, and 2.40 t/ha, resp., for 1979, 1980, and 1982 demonstrate the residual benefit from these wastes after their incorporation into the soil. After 2 yr, treatment had no sustained effect on residual soil N. Residual (extractable) soil P increased from 11 mg/kg with 100% CP to 89 mg/kg with 75% CP-25% PD, thus showing the relatively low and high potentials, resp., of CP and PD for increasing soil P. Since the availability of PD is considerably less than CP, a 75% CP-25% PD mixture at 25 t/ha was deemed appropriate for most efficient utilization of the wastes. At 10 t CP/ha, total yield over 3 yr was also increased by 139%. With treatments containing PD, the corresponding yield increases were in the range 275-568%. Thus, while CP was a good soil amendment, there was need to incorporate PD with it to maximize yield. [AS]

0328

25536 ANIMBO, H.H. 1984. Procédé de transformation industrielle du manioc de bouche et de ses derivés au Gabon. (Process of the industrial transformation of edible cassava and its products in Gabon). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.129-133. Fr.

Cassava. Processing. Washing. Peeling. Fermentation. Steeping. Rasping. Cassava pastes. Boiling. Storage. Protein enrichment. Gabon.

The industrial process of the traditional transformation of cassava into cassava sticks in Gabon, including the enrichment with lipids and proteins and the improved sanitary conditions, is described in detail. [CIAT]

0329

25596 ASIEGBU, J.E. 1984. Organic manure substrates and their effect on early weed incidence, earthworm activities, and microbial population. Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin 22(4):371-376. Engl., Sum. Engl., Germ., Russ., Fr., Span., 6 Refs. [Dept. of Crop Science, Faculty of Agriculture, Univ. of Nigeria, Nsukka, Anambra State, Nigeria]

Cassava. Dung. Cortex. Soil analysis. Weeds. Uses. Nigeria.

In a loamy Nigerian Ultisol, the effect of cow dung, goat dung, poultry droppings, and composted cassava peel at an application rate of 10 t/ha (dry basis) on early weed incidence, earthworm activities, and microbial population was studied. The highest early weed cover was obtained with cow dung. There is a varying enhancement of earthworm activity by the different substrates, obviously due to differences in the N content and the influence on the soil pH. NPK fertilization as minerals markedly decreases the pH and affects earthworm activities and the population density of fungi and bacteria. The effective utilization of mineral fertilizers requires supplementation by organic manures. [AS]

0330

25287 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Processing and uses. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no.PTM-02-83. pp.85-92. Engl. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Processing. Cassava starch. Washing. Rasping. Screening. Silting. Drying. Grinding. Tapiocas. Gelatinization. Cassava chips. Pellets. Uses. Malaysia.

Aspects of cassava processing and utilization in Peninsular Malaysia are summarized. Most of the roots produced are processed into starch and starch products, including sago, tapioca pearls, and flakes. Of the total production of roots, approx. 10% is assigned to the manufacture of cassava chips for the animal feed industry. The processing operations used in rural factories for the extraction of starch are described. Likewise, the processing for obtaining sago, tapioca pearls, flakes, chips, and pellets is briefly mentioned. The utilization of different cassava products (roots, leaves, stems, chips, CF, CM, starch, and modified starches) is summarized. [CIAT]

0331

25560 CROIX-MARIE, F. 1984. Technologies and products adapted to new markets. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.425-427. Engl.

Cassava. Cassava flour. Processing. Mechanization. Development. Industrialization. Technology. Production. Labor. Power sources. Congo.

The changes and improvements that have been made to the traditional technology of CF and foofoo processing in Congo, over a 3-yr period, to satisfy new markets and mechanize the process are discussed. [CIAT]

0332

25551 GRIFFON, D. 1984. Savoir traditionnel et hydrolyse enzymatique du manioc. (Traditional know-how and enzymatic hydrolysis of cassava). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.273-290. Fr., Sum. Fr., 2 Refs.

Cassava. Cassava starch. Processing. Cassava products. Enzymes. Hydrolysis. Africa.

Cassava starch and its uses, and the native technologies for the transformation of cassava are reviewed. Two traditional techniques related to the hydrolysis of starchy substrates are also discussed. [CIAT]

0333

25555 HEYS, G. 1984. Commercial considerations in the processing of cassava to gari at Texagri-Nigeria. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.349-365. Engl.

Cassava. Gari. Processing. Factories. Peeling. Rasping. Fermentation. Pressing. Gelatinization. Grinding. Packaging. Industrialization. Industrial machinery. Development. Power sources. Water requirements (processing). Labor. Production. Prices. Costs. Marketing. Economics. Nigeria.

The commercial processing for the conversion of cassava into gari, undertaken by the Texagru company (Nigeria) is described in detail. The water requirements, energy sources, and labor required are discussed and the improvements that have been made in the Newell Dunford factory are analyzed. Production costs, prices and marketing, gari production and the repercussions that the cereals imports might have on the future of the factory are presented. [CIAT]

0334

25554 KAPUTO, M.T.; CHAIWE, K.D. 1984. Use of fermented cassava flour in composite flour for preparation of bread and biscuits. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.341-347. Engl., 2 Refs., Illus.

Cassava. Wheat flour. Composite flours. Breads. Bakery products. Uses. Beverages. Cassava meal. Processing. Fermentation. Washing. Peeling. Solar drying. Screening. Water content. Statistical analysis. Maps. Zambia.

Cassava is grown in large quantities in Zambia and it is consumed as a major starch component of the diet, as a snack, or for brewing local beers. The traditional production process of CM is presented. To substitute cassava for wheat at levels higher than 15% in biscuit and bread recipes and therefore reduce wheat imports, work was undertaken by the National Council for Scientific Research of Zambia. When fermented CF was added to wheat flour at 5, 10, 15, 20, and 25% levels, only bread containing 10% fermented CF could be made and compared in flavor with the control without changing either the recipe or the processing conditions. Biscuits were prepared with the incorporation of up to 60% fermented CF to wheat flour. The statistical analysis of the sensory evaluation showed that incorporation of up to 40% fermented CF did not affect either the flavor or the texture of the biscuits significantly. More work is being carried out to have quality control and product promotion. A map showing the distribution of staple crops in Zambia is included. [CIAT]

0335

25552 LARTEY, B.L. 1984. Improved small processing machines for making gari in Ghana. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.291-314. Engl., Sum. Engl., 12 Refs., Illus.

Cassava. Gari. Processing. Peeling. Washing. Rasping. Pressing. Fermentation. Screening. Drying. Packaging. Storage. Small-scale equipment. Small-scale processing. Development. Ghana.

The traditional operations involved in making gari are discussed as well as the time-consuming, inefficient, wasteful, and uneconomical related steps. A no. of improved small processing equipment and machines which are in use or can be used in Ghana for making gari and for processing cassava in general are presented and reviewed. Illustrations are included. [CIAT]

0336

25565 MOFOR, E.N. 1984. Transformation des tubercules de manioc - expérience du Cameroun. (Transformation of cassava tubers—Cameroon's experience). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.497-510. Fr., Illus.

Cassava. Production. Processing. Cassava pastes. Gari. Small-scale processing. Mechanization. Rasping. Development. Cameroon.

The 2 traditional methods for the transformation of cassava (pastes and gari) in Cameroon are indicated, and the specifications and operation of a mechanical rasper, developed to improve the quality of processed cassava, are described in detail. [CIAT]

0337

25545 MSABAHA, M.A.M.; SEMESI, V.M.D. 1984. Roots and tubers in Tanzania. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.209-212. Engl., 4 Refs.

Cassava. Production. Cultivars. Sweet cassava. Bitter cassava. Cassava products. Processing. Cassava chips. Cassava flour. Prices. Research. Tanzania.

The situation of cassava in Tanzania is presented. Production, var. used, utilization, processing, prices, and research in progress are mentioned. [CIAT]

0338

25544 MUENDANE, C.; SERRA, A.D.P. 1984. Production et transformation du manioc au Mozambique. (Production and transformation of cassava in Mozambique). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.197-208. Fr., 9 Refs., Illus.

Cassava. Cassava flour. Production. Cultivation. Cultivation systems. Rotational crops. Cultivars. Sweet cassava. Bitter cassava. Toxicology. Human health. Processing. Aflatoxin. Prices. Mozambique.

The situation of cassava, the food crop that occupies the largest surface area in Mozambique, is presented. The processes for the production of fine and grilled flour, ways in which cassava is consumed, are briefly described. The cultivation systems and var. used are indicated; the drought has forced the bitter var. Gurué to be used, a fact that has reflected in an increased incidence of spastic paraparesis. Data on production are given, and the need to improve the sanitary conditions of cassava processing and to find improved var. resistant to CAMV is highlighted. [CIAT]

0339

25570 NZELIBE, F.K.; GUGNANI, H.C. 1984. Use of locally available plant materials for mycological media. Mykosen 27(10):519-526. Engl., Sum. Engl., Germ., 10 Refs., Illus. [Mycology Laboratory Univ. of Nigeria Teaching Hospital, Enugu, Nigeria]

Cassava. Culture media. Laboratory experiments. Research. Uses. Industrial microbiology. Nigeria.

Local plant materials such as papaya, yam, cocoyam, white sweet potato, cassava, and avocado were evaluated for their efficacy as principal ingredients for preparation of media for culture of medically significant as well as some common saprophytic fungi. Sweet potato dextrose agar was found to be better than all other natural media for the growth of dermatophytes but characteristic pigmentation was not readily visible on the reverse side of the medium. Cassava dextrose agar supported good growth and sporulation of dermatophytes. [AS-extract]

0340

25535 NZIEFFE, A. 1984. Colloque sur la transformation du manioc - République Populaire du Congo. (Colloquy on cassava transformation—People's Republic of the Congo). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.119-128. Fr.

Cassava. Economics. Socio-economic aspects. Cultivation. Industrialization. Foofoo. Chickwangue. Processing. Steeping. Peeling. Screening. Boiling. Drying. Congo.

Cassava, the most important food crop in Congo, especially in the low income groups, is grown both at the small-scale and industrial levels. The main products of cassava are foofoo and chickwangue; their production processes at the small-scale and industrial levels are described in detail. The peeling of roots is the main bottleneck due to the high labor cost; however, an efficient method for mechanical peeling has been used with good results. [CIAT]

0341

25553 OLYMPIO, H.K. 1984. Premiers resultats obtenus par les essais pour la mise en place d'une unite semi-artisanale de fabrication de gari. [First results obtained with the trials for the establishment of a small-scale unit for the elaboration (by artisans) of gari]. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.315-329. Fr., Illus.

Cassava. Gari. Processing. Small-scale processing. Peeling. Washing. Fermentation. Pressing. Screening. Drying. Small-scale equipment. Development. Africa.

The traditional operations involved in making gari in Africa are discussed as well as the equipment that has been tested to mechanize the processing. Illustrations are included. [CIAT]

0342

25556 ONYEKWERE, O.O.; KOLEOSO, O.A. 1984. Industrial processing of cassava products—the Federal Institute of Industrial Research experience. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.367-388. Engl., 21 Refs., Illus.

Cassava. Gari. Foofoo. Cassava flour. Processing. Composition. Laboratory experiments. Industrial microbiology. Fermentation. Gelatinization. Drying. Peeling. Factories. Development. Small-scale processing. Mechanization. Waste utilization. Toxicity. Marketing. Costs. Nigeria.

The traditional cassava products in West Africa, especially in Nigeria (gari, lafun, foofoo), are presented and the traditional processing of gari (fermentation, gelatinization, and drying) is discussed. Also presented are the improvements in the mechanization of the process made at the small-scale industrial level; these include the equipment for rasping, pressing, and frying. The mechanized processing at the industrial level, which main problem has been the improvement of the peelers, is described in detail. The preliminary test made for the functioning of a gari factory with a daily production of 1 t is presented. Marketing problems are indicated as well as the possibilities of expanding the gari factories by processing foofoo and the research needs in the processing of the latter (required var., pulp obtainment, and drying). Finally, the toxicity of cassava and its elimination during processing are discussed. [CIAT]

0343

25581 PEREZ, M.; GONZALEZ, F.; CASTAÑEDA, I.; LUJAN, M.; FERNANDEZ, R. 1983. Reproducción de Bacillus thuringiensis variedad dendrolimus comparando en tres medios líquidos el polvo de yuca y el de boniato como fuente de carbohidratos. (Reproduction of Bacillus thuringiensis

variety dendrolimus comparing powdered cassava and sweet potato as sources of carbohydrate, in three liquid media). Ciencia y Técnica en la Agricultura. Protección de Plantas 6(4):21-30. Span., Sum. Span., Engl., 5 Refs., Illus. [Unidad de Lucha Biológica, Inst. de Investigaciones de Sanidad Vegetal, Ministerio de la Agricultura, La Habana, Cuba]

Cassava. Sweet potatoes. Culture media. Uses. Cuba.

Bacillus thuringiensis var. dendrolimus was grown on media made up of nutrients produced locally in Cuba, which are sources of C and N, and are very inexpensive, such as sweet potato, cassava starch, and yeasts. On these media, the bacterium grew, sporulated, and produced the asporal body or crystal. The speed of sporangium sporulation and lysis was analyzed as well as the spore concn. after 24 and 48 h. The virulence tests on larvae of Mocis latipes were satisfactory. [AS]

0344

25558 ROEGE, W. 1984. The use of separators and decanters in the cassava starch industry. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.399-405. Engl.

Cassava. Cassava starch. Industrial machinery. Processing.

The operation, capacity, and construction of decanters and separators employed in the cassava starch industry are described in detail. [CIAT]

See also 0219 0237 0252 0253 0286 0292 0301 0302 0318 0320 0325 0345 0346 0347 0349 0352 0353 0358 0364 0365 0366 0368 0370 0371 0373 0379 0380 0383 0384 0385 0386 0387 0388 0390 0394 0395 0398 0399 0401 0403 0404 0405 0406 0407 0408 0409 0410 0413 0414 0415 0416

103 Industrial Microbiology

0345

25576 MUKO, M.A. DE; PARK, Y.K.; CARIOCA, J.O.B. 1984. Producao de etanol a partir de farinha de babacu, através da fermentacao alcoólica nao convencional. (Production of ethanol from babassu starch by a nonconventional fermentation method). Revista de Microbiologia 15(4):266-271. Port., Sum. Port., Engl., 9 Refs., Illus. [Faculdade de Engenharia de Alimentos e Agrícola UNICAMP, Caixa Postal 6121, 13.100 Campinas-SP, Brasil]

Cassava. Cassava starch. Enzymes. Fermentation. Ethanol. Industrial microbiology. Brazil.

Babassu, maize, cassava, and rice starches were fermented by the nonconventional fermentation method, which consists of saccharification and fermentation of starch simultaneously (1-step process) without cooking. Productivity of ethanol from rice starch was higher than the other starches used. The lowest productivity of ethanol was obtained from babassu starch. The ethanol yield from cassava starch was 91%. [AS]

0346

25575 RHEE, S.K.; LEE, G.M.; HAN, Y.T.; YUSOF, Z.A.M.; HAN, M.H.; LEE, K.J. 1984. Ethanol production from cassava and sago starch using Zymomonas mobilis. Biotechnology Letters 6(9):615-620. Engl., Sum. Engl., 9 Refs., Illus. [Division of Biotechnology, Korea Advanced Inst. of Science & Technology, P.O. Box 131, Dongdaemun, Seoul, Korea]

Cassava. Cassava starch. Sago. Industrial microbiology. Ethanol. Production. Malaysia.

Cassava and sago starches were evaluated for their feasibilities as substrates for ethanol production using Zymomonas mobilis ZM4 strain. Before fermentation, the starch materials were pretreated employing 2 commercial enzymes, Termamyl (thermostable alpha-amylase) and amyloglucosidase. Using 2 microliters of Termamyl/g and 4 microliters amyloglucosidase/g, effective conversion of cassava and sago starches into glucose was found with substrate concn. up to 30% (wt./vol.) dry substances. A fermentation study performed using these starch hydrolysates as substrates resulted in ethanol yield at an av. of 0.48 g/g by Z. mobilis ZM4. [AS]

See also 0252 0342 0403

J00 ECONOMICS AND DEVELOPMENT

0347

24730 ACOSTA, W.O. 1984. Diagnóstico socioeconómico de la producción y comercialización del casabe en los distritos Bolívar y Bruzual del Estado Anzoátegui. (Socioeconomic diagnosis of casabe production and commercialization in the Bolivar and Bruzual districts of the state of Anzoátegui). Tesis Ing.Agr. Jusepín, Venezuela, Universidad de Oriente. 58p. Span., 24 Refs., Illus.

Cassava. Casave. Socio-economic aspects. Production. Marketing. Cultivars. Prices. Processing. Peeling. Washing. Rasping. Pressing. Screening. Drying. Costs. Income. Venezuela.

A socioeconomic survey on casave production and commercialization in Bolivar and Bruzual (Anzoátegui, Venezuela) was conducted to identify and determine the casave production units, define the geographic distribution of producers and learn about their social problems, learn about the processes involved in casave production, and determine the costs and net income levels obtained in casave production units. The av. daily no. of cassava sacks processed were 10 and 6 for Bolivar and Bruzual, resp. Casave production involves the following steps: peeling, washing, grating, pressing, screening, spreading, and drying. Costs and labor involved in each step are analyzed. In Bolivar and Bruzual, 15 and 215 casave cakes/100 kg cassava roots are produced, resp.; the av. diameter is 80 and 23 cm, resp. The main casave markets are Barcelona, Puerto La Cruz, El Tigre, Bergantin, Naricual, and Sabana de Uchire. Production costs and income data are given. It is recommended to implement policies to improve public services and social conditions of producers, study the possibility of improving casave production techniques, start a cooperative system, and train producers on how to keep production records. [CIAT]

0348

25529 AGOSTINI, B.; GREENFIELD, J.N. 1984. Production and trade of cassava in the world. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.41-42. Engl.

Cassava. Production. Marketing. Trade. Economics. Uses. Asia. Africa. Latin America.

The cassava world market in 1983 is reviewed. There was a sharp decline in the vol. of trade (25%), mainly due to the agreements between the EEC and its main suppliers (Thailand, Indonesia, and China) to reduce their imports; this also reduced the use of cassava for animal feed. World cassava production also fell by 2%, the reason being drought in Africa and Latin America; this decline in output in both continents led to a drop in the use of cassava for human nutrition and an increase in cereal import requirements. The industrial utilization of cassava, however, expanded slightly in developing countries where increasing quantities were processed into alcohol (Brazil, Republic of Korea, and Thailand) and into starch (Indonesia), while it declined in USA and Japan. [CIAT]

0349

25703 AHMAD, K.U. 1986. Cassava in the agricultural economy of Bangladesh. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.51-57. Engl., 14 Refs. [Bangladesh Agricultural Research Council, Farm Gate, New Airport Road, Dhaka 15, Bangladesh]

Cassava. History. Production. Cultivars. Dry matter. Ash content. Protein content. Starch content. Ascorbic acid. Vitamin A. Research. Development. Consumption. Costs. Income. Bangladesh.

The history and situation of cassava in Bangladesh are presented. It is a secondary crop, used mostly as a vegetable. The results of some var. trials carried out by the Bangladesh Agricultural Research Institute are presented, and production costs are compared with those of rice, wheat, potato, and sweet potato. Finally, the possible uses that could be given to cassava, especially starch, in this country are discussed. [CIAT]

0350

25722 ANANTHARAMAN, M.; RAMANATHAN, S. 1986. Extending new cassava technology—the Lab-to-Land program in southern India. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.365-372. Engl., 6 Refs.

Cassava. Socio-economic aspects. Research. Cassava programs. Development. Economics. Hybrids. Cultivation. Technology. Technology transfer. Productivity. Income. India.

The Lab. to Land program developed by the Indian Council of Agricultural Research (India), which helps in the transfer of technology to the farmers' fields and identifies the problems associated with this transfer, is described. The program of the Central Tuber Crops Research Institute, one of the centers for the Lab. to Land program implementation, is analyzed in detail; it had 2 phases in Kerala and Tamil Nadu. The economic and social

profile of the farmers, the socioeconomic impact of the program, the benefits and changes of behavior are indicated. [CIAT]

0351

25542 ANDERSON, M.; DAVIS, M. 1984. The agricultural industry and the Liberian economy. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.187-192. Engl.

Cassava. Production. Productivity. Development. Economics. Liberia.

The situation of cassava in Liberia is presented, and its importance (2nd crop after rice) and the need to industrialize its production on behalf of the country's economy are discussed. [CIAT]

0352

25537 ANIMBO, H.H.; ISSEMBRE, T. 1984. Montage d'unité de transformation du manioc au Gabon - exemple d'une réalisation pratique. (The installation of a cassava transformation unit in Gabon—example of a practical accomplishment). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.135-138. Fr., Illus.

Cassava. Processing. Small-scale processing. Small-scale equipment. Costs. Gabon.

The required equipment and costs for the installation of 2 cassava transformation units at the rural level, in Gabon, are described. The units would have a capacity to produce 1000 cassava sticks/day. Illustrations are included. [CIAT]

0353

25272 ATKINSON, D.R.; WHOLEY, D.J.; JARMAN, T.R.W.; TURNBULL, J. 1983. A factory concept for integrated cassava processing operations: the cassava processing concept. Vienna, United Nations Industrial Development Organization. UNIDO/IO.534. 134p. Engl., Sum. Engl., Illus.

Cassava. Processing. Industrialization. Development. Uses. Food products. Cassava products. Cultivation. Climatic requirements. Temperature. Rainfall data. Fertilizers. Cultivation systems. Production. Costs. Prices. Mechanization. Distribution. Cassava chips. Cassava starch. Water requirements (processing). Wastes. Cassava leaves (vegetable). Storage. Glucose. Dextrins. Alcohol. Irrigation. Labor. Injurious insects. Injurious mites. Bacterioses. Viroses. Zambia.

A project to elaborate and evaluate the concept of setting up cassava processing factories in any country able to support its growth was established, Zambia being chosen for testing the concept. This modern integrated cassava processing factory concept is outlined, as a guidance in the setting-up and operation of such factories. The following topics are dealt with: markets, agronomic requirements of the cassava crop, procurement of cassava, process design, outline of a factory, and financial evaluation. [CIAT]

0354

25759 BLAIN, D. 1985. A farming system for women: the case of cassava production in Zaire. Ceres 18(3):43-46. Engl., 8 Refs., Illus.

Cassava. Socio-economic aspects. Cultivation. Development. Zaire.

A report is given on a UNDP-funded project implemented by FAO during 1979-83 in the subregions of Kwango-Kwilu, Zaire, in which food crop production plays a key role in the strategies for supplying the capital Kinshasa, 400-700 km away. The project, which was a large-scale investigation of the biological, technical, and socioeconomic problems hampering agricultural and rural development in this huge region, revealed the need to concentrate on the women and their main crop, cassava, production of which had continued to decline every year over 23 yr, from an av. of 12.0 to 5.5 t/ha/yr. It recommends farming systems research as one of the very few, if not the only methodological approach, to take account of the conflicting needs that arise as a result of rural women in developing countries being obliged to fill so many roles. [World Agricultural Economics and Rural Sociology Abstracts]

0355

25241 BLOM, P.S. 1984. Agricultural development in the Western Province of Zambia, with special reference to rice cultivation. Netherlands Journal of Agricultural Science 32(3):167-174. Engl., Sum. Engl., 4 Refs. [Dept. of Agricultural Research, Royal Tropical Inst., Mauritskade 63, 1092 AD Amsterdam, Netherlands]

Cassava. Socio-economic aspects. Climatic requirements. Rainfall data. Temperature. Soil physical properties. Cultivation. Zambia.

Traditional subsistence agriculture in the Western Province, one of the less developed regions of Zambia, is described. Main constraints to agricultural development are discussed. Cassava and millet are grown on upland soils and maize and sorghum on the lower slopes of depressions (dambos); rice is sometimes grown as a cash crop on the lower slopes. Agricultural development in the Western Province requires long-term planning, adaptive research with a farming systems approach, and adequate marketing and credit facilities. [AS (extract)]

0356

24741 BORREN, C. 1983. Competition of cassava production on a small scale with sorghum on a larger scale as a future source of calories in animal feed. Netherlands, Wageningen Agricultural University. 11p. Engl.

Cassava. Sorghums. Socio-economic aspects. Cultivation. Costs. Prices. Production. Colombia.

A preliminary description is given of the project initiated in April, 1983, in Colombia to study production competition of cassava on a small scale with sorghum on a larger scale as a future source of calories in animal feed. Competition might occur due to different profitabilities at the farm level, but competition can also exist due to the marketing factors (land, labor, machinery, credit, administration). Farmer characteristics, general crop management, and the history of a sample of 20 farmers are discussed, and hypotheses are presented regarding the way the aforementioned factors can affect profitability and therefore, competition between the 2 crops. [CIAT]

0357

24555 BOURDON, J.P. 1979. Quelques données a propos du manioc débats recents. (Some data on cassava; recent discussions). Rungis, France, Institut National de la Recherche Agronomique. 74p. Fr., 5 Refs.

Cassava. Production. Economics. Trade. Productivity. Animal nutrition. Swine. Prices. France.

Tables with statistics on agricultural production, cassava exports, and countries importing cassava from Thailand and Indonesia, the 2 main cassava exporting countries, are presented. Data are also given on cassava production and yields in the main cassava producing countries, origin of imported cassava and countries that use it, as well as the recent evolution of gross importations of cassava and different agroindustrial by-products by EEC member countries. Finally, articles for discussion are provided; these reflect the different opinions of the interested parties, i.e., Association Générale de Producteurs de Blé et autres Céréales, Syndicat National des Industries de l'Alimentation Animale, and the Ministry of Agriculture of France, particularly regarding the implications on the French economy. Addresses of the main companies related to cassava commercialization and of the institutions involved in cassava research are given. [CIAT]

0358

25559 BREDEL, P.M. 1984. Les programmes nationaux de manioc en Amerique Latine. (National cassava programs in Latin America). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.407-424. Fr., Illus.

Cassava. Development. Cassava programs. Composite flours. Cassava flour. Wheat flour. Bakery products. Industrialization. Cultivars. Alcohol. Animal nutrition. Composition. Cassava meal. Swine. Poultry. Cattle. Cassava chips. Food energy. Foliage. Protein content. Amino acids. Peru. Brazil.

The program carried out in the forest zone of Peru in 1979 to promote the cultivation of cassava, its industrialization, and the utilization of CF in composite flours to reduce wheat imports is described. The agronomic and industrial feasibility is presented. Also described is the alcohol program in Brazil. A brief summary on the use of cassava in swine, poultry, and dairy cattle feeding is given, highlighting the chemical composition of the plant. Finally, the advantages and disadvantages of the use of cassava products are presented. [CIAT]

0359

23043 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1984. Research highlights 1983. Trivandrum, India. 13p. Engl.

Cassava. Cassava programs. Plant breeding. Cuttings. Storage. Germination. Nutritional requirements. Intercropping. Dry matter. Harvest index. Pruning. Cultivars. Root productivity. Cyanogenesis. Cassava African mosaic virus. Injurious mites. Post-harvest technology. HCN content. Industrial microbiology. Cassava starch. Modified starches. Mycorrhiza. Research. Development. India.

Advances in research on root and tuber crops, including cassava, at the Central Tuber Crops Research Institute, India, during 1983 are summarized. Field tolerance to CAMV was found in 12 cassava lines backcrossed to

Manihot glaziovii; 4 were promising regarding yield, starch content (30-31%), DM (36-38%), and cooking quality. When homozygosis increased due to repeated self-pollination, a reduction was observed in the deleterious effect on the formation of fruits and seed and on seed germination. Crosses between tetraploid and diploid cassava produced few triploid plants (2n = 54). Dominance of the normal green leaf over the variegated leaf was confirmed. Concerning agronomic practices, the storage of stems for 15 days improved the germination of planted cuttings (96%). Stems stored in vertical/inverted position germinated better as compared with those stored horizontally. Planting of the basal portion resulted in max. establishment. The no. of shoots/cutting was greater when the stems were thicker. In acid lateritic soils with a high P content, 25 kg P/ha were sufficient to maintain optimum cassava yields. Symptoms of Mg deficiency associated with a high dose of K (100 kg/ha) were observed in acid lateritic soils with low pH and low basic level. The snap bean cv. Contender was the best for association with cassava. A significative positive correlation was observed between total biomass yield at 4 and 6 mo. and final yield. In comparison with normal yields of a 10-mo. crop, yields doubled and even tripled by pruning the stems 30 cm off the ground during the dry period and by ratooning up to 16 mo. after planting. HCN in cassava roots was positively correlated with HCN in leaves. CAMV was mechanically transmitted from the cassava cv. Kalikalan to Nicotiana benthamiana and N. glutinosa, but not from cassava to cassava or from Nicotiana spp. to cassava. The presence of twin particles in the semipurified preparation of Kalikalan leaves infected with CAMV was reconfirmed. Material highly resistant to mites was found in introduced cassava collections; the economic threshold for mites was found to be 10% leaf infestation and the economic damage threshold 25%. Dimethoate (0.05%) applied monthly was very effective in reducing mite damage. Cyanogenic glucosides in cassava varied depending on the processing method. Studies indicated the possibility of using Rhizopus oryzae to disintoxicate cassava-based food formulations from cyanogenic glucosides. Results of production of SCP, modification of cassava starch, and properties of starch are also presented. Inoculation of vesicular-arbuscular mycorrhizae in cassava stimulated the accumulation of Cu, Zn, and P in the leaf tissue. Other results related to agricultural statistics, the program Lab. to Land-phase 2, and other activities (training and workshops) are summarized. [CIAT]

0360

22860 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1982. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. 58p. Engl., Illus.

Cassava. Hybrids. Productivity. Intercropping. Groundnut. Socio-economic aspects. Cultivation. Land preparation. Cuttings. Planting. Timing. Fertilizers. N. P. K. Manures. Economics. Technology transfer. India.

The activities of transferring knowledge and technology from the research labs to the farms in India, during the 1st phase (1979-82) of the Lab to Land program, are summarized. Areas related to the replanting of degenerated cassava stocks using improved clones and cassava/groundnut intercropping are included. The impact of this program in the field was measured on the basis of the adoption of the mentioned technologies by the farmers (200 families), their acceptance, and the dissemination of new techniques by the farmers themselves. Such positive impact was not only observed among the farmers adopting the technologies but also within the socioeconomic system of the involved villages. Individual papers are recorded in this publication under the following consecutive no.: 0294, 0378, 0397, and 0421. [CIAT]

0361

24567 CENTRO DE PESQUISAS E DESENVOLVIMENTO. BRASIL. 1978. Módulo de mandioca. Relatorio de andamento. (Cassava module. Progress report). Bahia, Brasil, Programa de Tecnología Agroindustrial. 87p. Port., 7 Refs., Illus.

Cassava. Development. Socio-economic aspects. Timing. Production. Costs. Industrialization. Maps. Climatic requirements. Marketing. Cassava meal. Brazil.

A progress report is presented on the project for the establishment of a cassava agroindustrial module in Bahia, Brazil. The project is defined in terms of its philosophy, structure, details by area of influence, and operational chronogram of the module. A socioeconomic characterization of the low profitability producer communities in the region is included for the future selection of the area and the communities that will be part of the agroindustrial module. Likewise, the physical and socioeconomic bases for the definition of such area and of the communities are presented. Maps localizing the municipalities and a description of the production systems and costs are presented. [CIAT]

0362

25285 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Farmers' cultural practices in Perak and Kedah. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no. PTM-02-83. pp.73-78. Engl. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Planting. Timing. Land preparation. Fertilizers. Weeding. Herbicides. Pruning. Cultivation systems. Rotational crops. Diseases and pathogens. Noxious animals. Harvesting. Root productivity. Marketing. Socio-economic aspects. Costs. Income. Malaysia.

The cultural practices used by cassava producers in Perak and Kedah (Peninsular Malaysia) are described. Planting time, land preparation, fertilizer practices, weed control, pruning, replanting, cropping systems, diseases and pests, harvesting, and marketing are discussed as well as some problems faced by the producers (lodging, drought, labor shortage, erosion, fluctuating prices). Easy maintenance is the main reason why farmers grow cassava; other reasons are the convenience of the land for cassava that assures a crop yield, profitability, flexibility in harvesting time, accessibility to market, availability of subsidies, and use of idle land. Costs of production and returns on investment in both localities are presented. [CIAT]

0363

25284 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. Harvesting and estimation of costs and returns. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no. PTM-02-83. pp.69-72. Engl. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Cultivars. Harvesting. Timing. Mechanization. Production. Costs. Labor. Fertilizers. Herbicides. Income. Malaysia.

The optimum time to harvest, manual harvesting, and problems of mechanical harvesting of cassava in Peninsular Malaysia are discussed, with estimates of production costs and net returns on investment. In the case of cv. Black Twig, it should be harvested between 12-14 mo. since delay in its harvest decreases root starch content, thus increasing the cost of starch extraction and reducing the price paid. The cost of root production varies with the management, time, and location. The maintenance of soil fertility incurs the highest cost, except at one location where transportation is the factor that contributes the most. A table on the % return on investment that would be obtained for a range of yields (15-50 t/ha) and prices of roots at a fixed production cost is presented. [CIAT]

0364

25276 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T.S.; LAN, G.S.; PIANG, L.N. 1983. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no. PTM-02-83. 105p. Engl., 60 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Plant anatomy. Plant development. Leaf area. Dry matter. Plant breeding. Selection. Pollination. Cultivars. Planting. Cuttings. Spacing. Pruning. Fertilizers. N. P. K. Mg. Cu. Weeding. Herbicides. Tiracola plagiata. Dasychira. Ectropis bhurmitra. Spodoptera litura. Porthesia scintillans. Chloridea obsoleta. Achaea janata. Cercosporidium henningsii. Phaeoramularia caribaea. Cercospora vicosae. Fomes lignosus. Xanthomonas campestris pv. manihotis. Choanephora cucubitarum. Ganoderma pseudoferrum. Sclerotium rolfsii. Sphaerostilbe repens. Glomerella cingulata. Harvesting. Costs. Income. Marketing. Cassava starch. Cassava chips. Trade. Consumption. Processing. Malaysia.

A compilation of some of the results of research on cassava for over a decade in Peninsular Malaysia is presented. Included are aspects related to plant morphology and development, physiology of yield in cassava, breeding and selection, var., planting methods and fertilization for max. yield, control of weeds, pests, and diseases, harvesting and estimates of costs and benefits, cultural practices of the farmers in Perak and Kedah, cassava production and markets, processing and uses. Individual papers are registered in this publication under the following consecutive no.: 0209, 0214, 0230, 0240, 0241, 0285, 0286, 0330, 0362, 0363, and 0365. [CIAT]

0365

25286 CHAN, S.K.; HUSSEIN, K.M.; LIAN, T. .; LAN, G.S.; PIANG, L.N. 1983. Tapioca production and market outlets. In _____. A special report on cassava in Peninsular Malaysia, with particular reference to production techniques. Kuala Lumpur, Malaysian Agricultural Research and Developing Institute. Report no. PTM-02-83. pp.79-84. Engl. [Malaysian Agricultural Research & Developing Inst., P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Cultivation systems. Intercropping. Rotational crops. Production. Marketing. Cassava chips. Tapiocas. Cassava starch. Cassava flour. Glucose. Uses. Trade. Consumption. Malaysia.

Different aspects of the production and markets of cassava in Peninsular Malaysia are presented. Data on its cultivated area during the period 1964-30 are presented, as well as the production of roots and derivatives (flour, tapioca pearls, flakes, chips, and starch). Also included are export figures and estimations of potential local demand (present and

future demand). Flakes and chips are used in the animal feed industry; starch, flour, and tapioca pearls are used in the textile and food industries and in laundries, among others, and for the manufacture of glucose. The largest consumers of starch in Malaysia are the manufacturers of monosodium glutamate. [CIAT]

0366

24542 CURSO NACIONAL EL CULTIVO DE LA YUCA Y SUS USOS ALTERNATIVOS, 1er., QUITO, ECUADOR, 1985. Informe de trabajos. (Proceedings). In Montaldo, A. Cultivo e industrialización de la yuca y papa en Ecuador: Informe de consultoría. Quito, Ecuador, Instituto Interamericano de Cooperación para la Agricultura. pp.19-38. Span., Illus.

Cassava. Cultivation. Processing. Economics. Uses. Development. Ecuador.

The no. of hours, subjects, and lecturers are given for the 1st course for professionals, technicians, industrialists, and persons related to cassava cultivation in Ecuador; the course was called "Cassava cultivation and its alternate uses" and took place in Quito, July 22-25, 1985. Twenty-eight people participated in the theoretical-practical course. The questionnaire on cassava problems in Ecuador that the participants to the course answered and the answers given by the Ministry of Agriculture and Cattle Husbandry are included. [CIAT]

0367

25266 DEBFS, C. 1985. How Thailand is selling food to the industrial world. Business Week. August 12:41. Engl., Illus.

Cassava. Cultivation. Trade. Development. Economics. Thailand.

The agricultural situation, rural development, economy, and commercialization of agricultural products in Thailand are briefly described. Cassava exports increased from 0.5 to 7.8 million MT in 1982. In 1984 these exports increased 31%, but profits were only 6%. During the last decade the area cultivated has increased 37% and although improved cultural practices have been applied, the total increase in production has only been 10%. Therefore, the government is trying to maintain the growth of the food sector at a faster rate than the population increase, and is establishing policies that coordinate exports and production. [CIAT]

0368

25539 DRAME, M.M.; ISSE, F.A. 1984. Transformation du manioc et des autres tubercules et racines en Guinée. (Transformation of cassava and other tuber and roots in Guinea). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.147-152. Fr.

Cassava. Cultivars. Gari. Tapiocas. Cassava flour. Cassava starch. Processing. Guinea.

The projects in Guinea for the development of agroindustrial processing, mainly of cassava and potato, and to a lesser extent of sweet potato, taro, and yam, are presented. [CIAT]

0369

25516 ECKEBIL, J.P. 1983. Cameroon: recent examples of areas of priority in research. Courier no.82:86-88. Engl., Illus.

Cassava. Production. Research. Cameroon.

The emphasis of agricultural research in Cameroon was shifted from cash to food crops with the 5th Development Plan. The position in the national economy of the major food crops (maize, sorghum, rice, cassava, sweet potatoes, yams, soybean, cowpea, fruits, and to a lesser degree, vegetables) is described as well as the problems related to their development and the goals to be achieved by research workers. Work is supported by soil research, and it is argued that farming systems research should receive greater attention. [Abstracts on Tropical Agriculture]

0370

24548 ENRIQUEZ T., J. 1985. Plan operativo para 1985 de la Provincia de Napo. Normas técnicas del cultivo. (1985 operational plan for the Napo Province. Technical norms of the crop). Ecuador, Programa Tubérculos y Raíces; proyecto yuca. 40p. Span.

Cassava. Production. Cultivation. Cultivars. Hybrids. Development. Economics. Planting. Timing. Spacing. Fertilizers. N. P. K. Weeding. Thrips. Mononychellus tanajoa. Mononychellus megressori. Tetranychus urticae. Oligonychus. Phenacoccus. Erinnyis ello. Predators and parasites. Silba pendula. Carpolonchaea chalybea. Anastrepha pickeli. Anastrepha manihoti. Aleyrodidae. Bemisia. Trialeurodes variabilis. Vatiga manihotae. Saissetia miranda. Hemiberlesia diffinis. Aonidomytilus albus. Cecidomyiidae. Agrotis ipsilon. Xanthomonas campestris pv. manihotis. Cassava common mosaic virus. Mycoplasmoses. Cercosporidium henningsii. Cercospora caribaea. Cercospora vicosae. Oidium. Cassava superelongation. Glomerella. Uromyces manihotis. Phytophthora. Fomes lignosus. Rosellinia. Sclerotium rolfsii. Insect control. Mite control. Insecticides. Acaricides. Growth. Pruning. Root productivity. Cuttings. Roots. Storage. Rotational crops. Uses. Composition. Feeds and feeding. Costs. Ecuador.

The cassava planting program for the Napo Province, Ecuador, in 1985 and the technical norms for cultivation are presented. The strategies and course of action to fulfill the plan, the goals for the year in relation to planting surface and harvesting, production and yield, production needs, cassava var. grown in the region and in the country, and exptl. var. tested in the region are described. The plan for credit and financing of inputs (seeds, fertilizers, and pesticides) is presented. A taxonomic and botanical description of cassava, the appropriate ecological conditions for its cultivation, and specific recommendations on pests, diseases, and weeds are presented. The conservation of roots and cuttings, crop rotation, and uses of cassava, besides compositional analyses, are discussed. Data on production costs are included. [CIAT]

0371

25704 FATAO, L.; XIONG, L.; XUECHENG, T. 1986. Cassava in the agricultural economy of China. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.59-63. Engl. [South China Academy of Tropical Crops, Hainan Island, Guangdong Province, People's Republic of China]

Cassava. Ecosystems. Production. Cassava chips. Cassava starch. Income. Cultivation systems. Intercropping. Planting. Spacing. Ploughing. Harvesting. Timing. Development. China.

The situation of cassava in China is presented. Three agroclimatic zones in which cassava is cultivated (largest production, expansion, and var.

trials) are described. Yields are low (8.2 t/ha) due to poor management. Produced cassava is processed into chips or starch, which are exported. Research has been focused on the improvement of crop management practices to increase productivity. The best results have been obtained with intercropping, planting distances, tillage, and harvest times. The problems that exist for the future development of cassava in the country are (1) lack of improved var., (2) soil erosion, (3) inadequate processing and use, (4) lack of technical assistance and systematic planning, and (5) poor storage of cuttings. Possible solutions to these constraints and the future perspectives for the development of cassava are discussed. [CIAT]

0372

24556 FUNDACION PARA EL DESARROLLO INDUSTRIAL Y AGRICOLA DEL QUINDIO. 1975. Estudio de localización de una planta de harina de yuca panificable en la región del Quindío. (Location study of a cassava flour plant for bakery purposes in the Quindio region). Armenia. 17p. Span.

Cassava. Cassava flour. Development. Economics. Production. Water requirements (processing). Costs. Processing. Colombia.

A location study of a CF plant for bakery purposes in the Quindio region, Colombia, with a capacity of processing 1800 t fresh cassava/yr (600 t flour), is presented. The highly productive cassava regions located between the southwestern section of Quindio and northern Valle (Caicedonia, Quimbaya, Armenia, Montenegro, and La Tebaida) are described as well as several economic and infrastructure aspects that allow the optimum region for the location of the plant to be determined. It was concluded that the processing plant should be located in La Tebaida because of the available energy, aqueduct capacity, available telephone services, available incentives (tax exemption), road and railroad infrastructure, and proximity to the airport, to the wholesale provision market, and to the city of Armenia. [CIAT]

0373

25723 GAPASIN, D.P.; LOPEZ, E.L. 1986. Planning cassava development: the Philippine national research and development program for cassava. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.373-385. Engl., 5 Refs., Illus. [Philippine Council for Agriculture & Resources Research & Development, Los Baños, Laguna, Philippines]

Cassava. Cassava programs. Research. Development. Processing. Cassava chips. Post-harvest technology. Plant breeding. Cultivation systems. Cultivation. Socio-economic aspects. Philippines.

The systematic approach used in agricultural research and development programs in the Philippines is described. In relation to cassava, priorities and goals of the national development are discussed and the research activities are analyzed. Finally, the strategy for the implementation of the program (research network, international agencies, and budget) is presented. [CIAT]

0374

25706 GURITNO, B.; SITOMPUL, S.M. 1986. Cassava in the agricultural of Indonesia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.73-88. Engl., 11 Refs., Illus. [Centre for Root Crops Research, Faculty of Agriculture, Brawijaya Univ., Jl. May. Jen. Haryono 163, Malang, Indonesia]

Cassava. Production. Tetranychus urticae. Oidium. Xanthomonas campestris pv. manihotis. Intercropping. Costs. Income. Trade. Uses. Gaplek. Cassava starch. Consumption. Prices. Research. Development. Indonesia.

The situation of cassava in Indonesia is presented; it is the most important upland crop after maize, with an av. yield of 9.7 t/ha. The production, including costs, and its perspectives are discussed. Trade, uses, and consumption of cassava (fresh, gaplek, starch) are analyzed. Finally, research needs (var. trials, cultivation systems, extension services) and the impact that research has had in the country are presented. [CIAT]

0375

25264 INSTITUTO INTERAMERICANO DE COOPERACION PARA LA AGRICULTURA. 1983. Proyecto para el grupo campesino "Angel del Limón", El Triunfo, Choluteca. (Project for the peasant group "Angel del Limón", El Triunfo, Choluteca). Tegucigalpa, Honduras, Convenio IICA-INA-Consuplane. Unidad de Formulación de Proyectos. 13p. Span., Sum. Span.

Cassava. Socio-economic aspects. Economics. Income. Costs. Development. Honduras.

The project proposed to benefit the peasant group "Angel del Limón", beneficiary of the land reform, in the dept. of Choluteca, Honduras, is presented. It is intended to improve the income level of the group through the alternating cultivation of maize, Johnson grass, sorghum, cassava, and sesame. [CIAT]

0376

24086 JANSSEN, W.; DE JONG, G. 1980. Cassava and cassava starch; the production, processing and marketing of cassava and sour cassava starch in Mondomo, Colombia. Cali, Colombia, Centro Internacional de Agricultura Tropical. 177p. Engl., 23 Refs., Illus.

Cassava. Cultivation. Cultivars. Cultivation systems. Fallowing. Timing. Land preparation. Costs. Economics. Planting. Spacing. Weeding. Insecticides. Fertilizers. Harvesting. Prices. Intercropping. Erosion. Maize. Banana-plantains. Marketing. Cassava roots (vegetable). Cassava starch. Factories. Starch content. Distribution. Processing. Washing. Peeling. Rasping. Screening. Silting. Fermentation. Drying. Packaging. Water requirements (processing). Waste utilization. Consumption. Storage. Bakery products. Colombia.

To study the relationships between the cassava crop and its marketing and the potential marketing channels for cassava starch, the Mondomo area in Colombia was chosen due to the presence of CIAT field trials in the region. Surveys were conducted at the farm, small-scale rasping industry, middleman, and wholesaler-retailer levels. The agricultural economy is dominated by a limited no. of crop alternatives. The starch production process is described and the economic situation of the small-scale rasping industries is analyzed. A description of the middleman, product, storage, risk absorption, transportation, credit, quality control and classification, communication, and profitability is given. The end user is also considered. A general analysis is included of the marketing channel of sour starch coming from the vecinity of Santander de Quilichao, where approx. 4200-4800 ha of cassava (5000 t of starch/yr) are grown. The breeding programs should focus on the selection of var. tolerant to low fertility soils and with high starch yields/ha, the relationship between fertilizer use and starch content should be investigated and studies to solve the erosion problems related to the cultivation of cassava are

required. Of the costs involved in the small-scale rasping industries, 80% corresponds to the raw material. [CIAT]

0377

25708 JAYAWARDENA, S.D.G. 1986. Cassava in the agricultural economy of Sri Lanka. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.115-129. Engl. 5 Refs., Illus. [Central Agricultural Research Centre, Gannoruwa, Peradeniya, Sri Lanka]

Cassava. Production. Intercropping. Prices. Costs. Research. Fresh products. Development. Sri Lanka.

The situation of cassava in Sri Lanka is presented; it is a secondary crop, grown in association with other crops (coconut, pineapple), and mainly consumed fresh. Production data for the 1972-80 period are included. The production areas are described and production costs and constraints are analyzed, in addition to discussing areas of research. The uses, the potential for the production and utilization of cassava, and the implications that government policies may have on research are discussed. [CIAT]

0378

22861 JOS, J.S. 1982. High-lights of Lab to Land Programme (Phase 1). In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.1-17. Engl., Illus.

Cassava. Hybrids. Intercropping. Groundnut. Socio-economic aspects. Soil analysis. Cultivation. Fertilizers. Pest control. Economics. Income. Root productivity. Technological package. Technology transfer. Technology evaluation. India.

The methodology and outstanding results of the Lab. to Land program are described. This program was carried out among 200 families in 4 villages of the Trivandrum, Kanyakumari, and Salem districts, India, during 1979-80. The 2 main technologies transferred during this program consisted in the replacement of degenerated cassava stocks with improved clones (Sree Sahya and Sree Visakham) and cassava/groundnut intercropping. The prevailing type of agriculture before adoption, soil fertility status of the landholdings of the families involved, and agricultural practices in the villages are described. Additional income derived from using both technologies independently is shown; their potential to favor the income in all villages is thus indicated. In general, the increase in income due to the use of these technologies was more than 65% during the 1st yr. Selected results achieved with particular farmers concerning increases in cassava yield and income in the 4 villages are presented. Another impact of the program was the generation of employment, both in crop production as well as in the transformation of fresh roots into cassava chips. Training programs, field days, radio programs, and pamphlet publication, contributing to the general strategy of the program, are described. [CIAT]

0379

25532 LAME, B. 1984. Mission FAO sur le manioc en République Populaire du Benin: la culture et sa transformation. (FAO mission on cassava in Benin: the crop and its transformation). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa,

Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.87-93. Fr.

Cassava. Cultivation. Production. Cassava African mosaic virus. Xanthomonas campestris pv. manihotis. Phenacoccus manihoti. Ferrisia virgata. Mononychellus tanajoa. Tetranychus cinnabarinus. Cultivars. Processing. Drying. Steeping. Rasping. Cassava chips. Cassava flour. Gari. Tapiocas. Industrialization. Benin.

The cassava situation in Benin is presented. Of the root and tuberous crops and cereals grown in the country, cassava is the one grown the most; both its leaves and roots are used for human and animal consumption. The cropping systems are indicated, production data between 1970-81 are given, and some of the problems that have caused the fluctuations in the production (CAMV, Xanthomonas campestris pv. manihotis, Phenacoccus manihoti, Ferrisia virgata, Mononychellus tanajoa, and Tetranychus cinnabarinus) are mentioned. In 1982-83 a campaign was started to plant improved var. (TMS 30001 and TMS 30211) introduced from Nigeria and the Ivory Coast. It is suggested to gather all the available information in order to create a fact sheet on the crop that covers land preparation, weed control, fertilization, and mechanical harvest. Finally, the cassava transformation techniques, which basically involve drying, rasping, and steeping, are presented; the main products are lafun, gari, cassava chips, and tapioca. The need for industrializing the transformation and cultivation processes is highlighted. [CIAT]

0380

25538 LARTEY, B.L. 1984. Country profile. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.139-146. Engl.

Cassava. Economics. Root crops. Cultivars. Production. Cultivation. Zonocerus variegatus. Roots. Storage. Gari. Tapiocas. Cassava starch. Cassava chips. Dried roots. Small-scale processing. Research. Ghana.

Basic data on Ghana's economy and agriculture are given. The main root crops are cassava, yams, cocoyams, and sweet potatoes, cassava being produced and utilized the most. A brief account of cassava cultivation is presented; the most common var. are Gari, Queen, Williams, and Ankra. The methods used to store the roots are indicated. The most important products are gari, tapioca, starch, konkonte, and cassava chips; processing is mostly done in the rural communities. Research is being carried out on root storage and the development of cassava processing machines. [CIAT]

0381

25767 LIAN, T.S.; WELSCH, D.E. 1986. Cassava in the agricultural economy of Malaysia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.89-114. Engl., 19 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., G.P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Production. Prices. Economics. Costs. Cultivation. Cultivation systems. Cassava starch. Cassava chips. Fresh products. Waste utilization. Feeds and feeding. Trade. Consumption. Food products. Uses. Animal nutrition. Development. Malaysia.

The situation of cassava in Malaysia is presented. Its production (1960-81) and costs (1983) are discussed. Uses, marketing, trade, and potential use of cassava products (fresh, starch, chips, sweeteners) are analyzed, and data on prices, production, exports, and imports (1970-81) are included. Finally, the future supply of cassava in relation to policies for its development is analyzed. [CIAT]

0382

25716 LIAN, T.S.; CHAN, S.K. 1986. Improving the productivity of cassava in Peninsular Malaysia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.241-259. Engl., 11 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., G.P.O. 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Soil physical properties. Climatic requirements. Temperature. Rainfall data. Cultivars. Land preparation. Planting. Spacing. Cuttings. Fertilizers. N. P. K. Mg. Weeding. Herbicides. Harvesting. Timing. Root productivity. Fomes lignosus. Tiracola plagiata. Socio-economic aspects. Research. Plant breeding. Mechanization. Cultivation. Cultivation systems. Malaysia.

The situation of cassava in Malaysia is presented and the production systems and zones (soils, temp., rainfall) in which it is grown are discussed. The technical, socioeconomic, and managerial constraints of cassava productivity are analyzed. The research objectives of the Malaysian Agricultural Research and Developing Institute's cassava program are (1) to increase the productivity of cassava in smallholdings and in plantation-scale cultivation through the breeding and selection of improved var. and the development of appropriate production technologies and (2) to improve postharvest processing and storage technology and to develop new end uses for cassava. The strategies and directions of research proposed are analyzed and results of research are presented. Finally, the assessment of yield gap and production potential are discussed. [CIAT]

0383

25711 LYNAM, J.K. 1986. A comparative analysis of cassava production and utilization in tropical Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.171-195. Engl., 18 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Production. Uses. Cultivation systems. Labor. Costs. Productivity. Consumption. Economics. Feeds and feeding. Trade. Marketing. Prices. Fresh products. Cassava starch. Cassava chips. Pellets. Gaplek. Asia.

Within an economic context (costs, prices, labor, policies), the diversities and similarities of cassava production and utilization systems in tropical Asia (India, Indonesia, Malaysia, Philippines, and Thailand) are compared and analyzed. Based on this analysis, the potential of the crop in the region is discussed. [CIAT]

0384

25717 MARISCAL, A.M. 1986. Improving the productivity of cassava in the Philippines. In Regional Workshop on Cassava in Asia, its Potential and

Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.261-276. Engl., 14 Refs. [Philippine Root Crops Research & Training Center, 8 Lourdes Street, Pasay City 3129, Philippines]

Cassava. Production. Socio-economic aspects. Costs. Prices. Technology. Post-harvest losses. Research. Technological package. Cultivars. Cultivation systems. Intercropping. Rotational crops. Fertilizers. Cuttings. Xanthomonas campestris pv. manihotis. Tetranychus urticae. Tetranychus kansawai. Roots. Storage. Cassava chips. Food products. Animal nutrition. Philippines.

The cultivated area, yield, production, and potential of cassava in the Philippines are presented. The main production constraints are analyzed, namely, socioeconomic aspects, infertile areas, inappropriate technology, and postharvest and processing problems. The projects and research activities of the Philippine Root Crop Research and Training Center, the U. of Philippines, and the Bureau of Plant Industry of the Ministry of Agriculture are discussed. These have been oriented toward the development of improved var., agronomy, and the National Feed Root Crops Program. Research results are indicated. [CIAT]

0385

25527 MICHE, J.C. 1984. FAO mission on the harvesting, processing and use of cassava in Thailand and in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.15-32. Engl., Sum. Engl.

Cassava. Production. Cultivars. Processing. Cassava chips. Pellets. Cassava starch. Marketing. Trade. Research. Development. Ethanol. Atieke. Cultivation. Mechanization. Gari. Uses. Cassava flour. Foofoo. Thailand. Ghana. Togo. Cameroon. Congo. Ivory Coast.

Information on problems existing in the cassava sector in Thailand and Ivory Coast, Ghana, Togo, Cameroon, and Congo is given. Problems related to production, utilization, processing, marketing, research, and development of cassava products in Thailand are reviewed. In Ivory Coast, there is an agroindustrial complex for the processing of dry atieke and CF. The mechanization problems of the industrial cultivation and harvesting of cassava seem to have been resolved. The problems of small material for mechanized cassava processing in Ghana and Togo are discussed; these are attributed to the shortage of cassava during that time of the year due to drought, bushfires, and diseases. Shortage of cassava was also observed in Cameroon; however, traditional food products (gari and cassava sticks) are being processed on a semi-industrial level. A comprehensive description is given on the foofoo flour production plant in Mantsoumba, Congo, which has a production capacity of 400 kg flour/h. Finally, conclusions and recommendations are given. [AS]

0386

25528 MICHE, J.C. 1984. Potential improvements of cassava processing technologies in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.33-40. Engl., Sum. Engl.

Cassava. Processing. Development. Foofoo. Gari. Small-scale processing. Industrialization. Africa.

The possibilities of improving the traditional technologies of cassava processing, at the village and industrial levels, in Africa, are discussed and analyzed. Some recommendations are given. [CIAT]

0387

24541 MONTALDO, A. 1985. Cultivo e industrialización de yuca. (Cultivation and industrialization of cassava). In _____. Cultivo e industrialización de la yuca y papa en Ecuador; informe de consultoría. Quito, Ecuador, Instituto Interamericano de Cooperación para la Agricultura. pp.1-18. Span., 16 Refs. [Facultad de Agronomía, Univ. Central de Venezuela, Apartado 97, Maracay 2101 A, Venezuela]

Cassava. Production. Productivity. Food energy. Development. Cultivation. Cultivars. Plant breeding. Uses. Composition. Ecuador.

Information is given on cassava cultivation in Ecuador where it is considered to be one of the crops to be included in a crop diversification plan to substitute cereal imports in the country. Cassava is compared with cereals and other root crops in terms of production parameters and nutritive value. Information related to the use of CF in animal feed and the utilization of by-products for human consumption is discussed. The possibilities of crop expansion in the country are analyzed and suggestions are presented for improving its cultivation. It is suggested that new technologies, products, and uses should be developed to increase cassava production and utilization; a national trials network on agronomic problems should be established and the development of the Ecuatorian cassava industry should be supported. Training should be offered in agricultural, nutritional, and industrial research, and a close link should be maintained between producers, researchers, salesmen, businessmen, and extension agents. Four strategies are recommended to accomplish the aforementioned objectives: breeding, agronomic improvement, processing technology, and diversification of end uses. Organizations participating in the plan, required germplasm materials, and priorities are listed. [CIAT]

0388

24540 MONTALDO, A. 1985. Cultivo e industrialización de la yuca y papa en Ecuador; informe de consultoría. (Cultivation and industrialization of cassava and potato in Ecuador; consultancy report). Quito, Ecuador, Instituto Interamericano de Cooperación para la Agricultura. 40p. Span., 16 Refs., Illus. [Facultad de Agronomía, Univ. Central de Venezuela, Apartado 97, Maracay 2101 A, Venezuela]

Cassava. Production. Productivity. Food energy. Development. Cultivars. Cultivation. Plant breeding. Composition. Ecuador.

A report on the cultivation and industrialization of cassava in Ecuador is presented. Aspects related to the possibilities of expansion of cassava cultivation, suggestions for the improvement of the crop, germplasm, organizations involved, and priorities to undertake the proposed plan are dealt with. The 1st national course on cassava cultivation and its alternate uses is described. A questionnaire given to the course participants and the answers given by the Ministry of Agriculture and Cattle Husbandry of Ecuador are annexed. The papers on the cultivation and industrialization of cassava presented during the course are registered in this publication under the following consecutive no.: 0366 and 0387. [CIAT]

0389

25534 N'BONGUE, R.; BAYOGO, A.J. 1984. Transformation du manioc et autres tubercules et racines en République Centrafricaine. (Transformation of cassava and other tubers and roots in the Central African Republic). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.113-118. Fr.

Cassava. Yams. Potatoes. Sweet potatoes. Cultivation. Root productivity. Injurious mites. Injurious insects. Cassava African mosaic virus. Bacterioses. Cassava chips. Cassava flour. Processing. Steeping. Industrialization. Development. Costs. Central African Republic.

The situation of the cassava, yam, sweet potato, and potato crops in the Central African Republic is presented. Cassava is the most important food crop (50-60% of the calorie intake); it is grown alone or in association with an av. yield of 7 t/ha, although the improved var. produce up to 35 t/ha. The production is affected by CAMV, mealybugs, mites, and bacterioses. The different cassava products are (1) "cossettes" or chips that are steeped to be softened and then converted into small balls that are dried on the ground; (2) chikouang or steeped roots molded into canes (10-15 x 2-5 cm) and cooked in boiling water; (3) Ngou-Kassa or a cassava, yam, and sweet potato soup; and (4) CF from the steeped chips. The project proposed by the government for the industrialization of cassava is described. [CIAT]

0390

25710 NELSON, G.C. 1986. An analysis of the international market potential for dried cassava and cassava starch. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.153-169. Engl., Sum. Engl., 4 Refs. [Agricultural Development Council, Inc. IRRI/Econ., P.O. Box 933, Manila, Philippines]

Cassava. Cassava starch. Trade. Consumption. Feeds and feeding. Feed constituents. Prices. Costs. Dried roots. Marketing.

The situation of cassava in Thailand is presented and its production, costs, cultivation, and processing are analyzed. The main products (pellets, chips, and starch) and their consumption, marketing, prices, and trade are discussed; likewise, related data are included. The dependence that the Thai cassava industry has on the EEC countries, Japan, and USA is highlighted. Alternatives to reduce this dependency are presented. [CIAT]

0391

25571 NINAN, K.N. 1984. Labour use in agriculture. Case studies of tapioca and paddy. Economic and Political Weekly 19(52-53):A-199-A-204. Engl., Sum. Engl., 11 Refs.

Cassava. Labor. Land preparation. Planting. Weeding. Fertilizers. Harvesting. Distribution. Productivity. Economics. India.

Various issues related to labor use in agriculture are discussed, with specific emphasis on cassava and paddy production, using farm level data relating to Kerala (India). In particular, the relationship between labor use on one hand and yields, farm size, and crop operations on the other, is examined. The question of labor productivity in agriculture is also discussed. [World Agricultural Economics and Rural Sociology Abstracts]

0392

25531 NYANIN, O.O. 1984. Economic feasibility of cassava in compound animal feeds in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.51-55. Engl., 3 Refs.

Cassava. Animal nutrition. Feeds and feeding. Economics. Costs. Prices. Africa.

The use of cassava in animal feeding is briefly reviewed and an economic analysis of the feasibility of cassava replacement for maize in compound feeds in Africa is made. The potential exists, but only country-specific feasibility studies with updated relevant data can truly ascertain the feasibility since the availability and prices of cassava, other cereal substitutes, and major protein sources vary from one country to the other. [CIAT]

0393

25530 NYANIN, O.O. 1984. Some economic aspects of industrial processing of cassava. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.43-50. Engl.

Cassava. Processing. Gari. Costs. Prices. Economics. Nigeria.

An economic analysis of the viability of industrial processing of cassava in Africa is made, based on the industrial processing of gari employed in Nigeria. It is concluded that the financial viability of industrial processing of cassava would depend mainly on 3 endogenous variables: (1) the operational efficiency of the plant which is constrained by production factor costs and the cost of the factory; (2) the production efficiency of the equipment; and (3) the capacity at which the plant is operated. [CIAT]

0394

25547 OLYMPIO, H.K.; ALOGBLETO, K. 1984. Apercu sur la production et les utilisations des plantes a tubercules au Togo. (Survey on the production and utilization of tuber crops in Togo). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.235-242. Fr., Illus.

Cassava. Production. Cassava starch. Tapiocas. Cassava flour. Gari. Small-scale processing. Marketing. Prices. Togo.

The situation of cassava, yam, sweet potato, potato, and taro in Togo is presented. The most important crops are cassava and yam; their production, processing, and marketing are indicated. Cassava is consumed fresh or it is processed into starch, tapiocas, flour, or gari. [CIAT]

0395

24036 OSPINA, B.; BEST, R.; GOMEZ, G. 1983. Natural drying of cassava for animal feed: the establishment of small agro-industries on the Atlantic Coast of Colombia. Cali, Colombia, Centro Internacional de Agricultura Tropical. 17p. Engl., Sum. Engl., 13 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Paper presented at the Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983.

Cassava. Cassava programs. Development. Solar drying. Technology. Production. Processing. Marketing. Economics. Colombia.

The ongoing cooperative project between the Colombian Integrated Rural Development Program (DRI), the Canadian International Development Agency, and CIAT is described. Its objective is to establish small-scale cassava natural drying plants on the Atlantic Coast of Colombia. The project initiated with the setting up of a pilot drying plant in collaboration with a group of 15 farmers. In 1981 the plant operated on an exptl. basis in order to collect data on drying performance under the conditions prevailing on the Atlantic Coast and to ascertain the acceptability of the product by the animal feed industry. In 1982 the plant was operated on a semi-commercial basis to collect accurate production cost figures and to demonstrate the economic feasibility of replicating the process in other areas of the region in 1983. From the experience obtained it was concluded that for the successful establishment of drying plants, the following conditions should be met: (a) the selection of a processing technology that may be easily controlled and managed by the farmers themselves, (b) the integration of crop production, processing, and marketing activities, and (c) the provision of institutional support in terms of technical assistance, training, and credit facilities. [AS]

0396

25291 PACHICO, D.H. 1984. Nutritional objectives in agricultural research. The case of CIAT. In Pinstrup-Andersen, P.; Berg, A.; Forman, M., eds. International agricultural research and human nutrition. Washington, D.C., International Food Policy Research Institute. pp.25-40. Engl., Sum. Engl., 62 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Development. Phaseolus vulgaris. Human nutrition. Socio-economic aspects. Technology. Economics. Colombia.

The research strategies of CIAT's commodities, particularly cassava and beans, to meet CIAT's mandate, are analyzed in depth from the nutritional point of view. Collaborative research with other institutes should be given high priority. [CIAT]

0397

22862 RAJENDRAN, P.G.; NAIR, R.B. 1982. Popularising high yielding cassava hybrids—technology 1. In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.18-22. Engl., Illus.

Cassava. Hybrids. Technological package. Cultivation. Land preparation. Cuttings. Selection. Fertilizers. N. P. K. Manures. Harvesting. Root productivity. Income. India.

Results are presented on yield and income obtained with the transfer of technology related to the planting of high-yielding cassava hybrids (Sree Visakham and Sree Sahya) as substitutes of the traditional var. Cultural practices (land preparation, selection of planting material, planting method and time, fertilizers and manures, harvest) under which these hybrids can yield up to 45.0 t/ha are described. Although traditional var. can yield 8.0-12.0 t/ha, the new hybrids allowed yields between 23.5-30.0 t/ha to be obtained, which resulted in increased income. [CIAT]

0398

25543 RAVELOMANANTSOA, J.; RAKOTONANAHARY, J.P. 1984. Situation actuelle de la production et la transformation du manioc et autres tubercules a Madagascar. (Current situation of the production and transformation of cassava and other tubers in Madagascar). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.193-196. Fr.

Cassava. Production. Productivity. Processing. Cassava starch. Cassava flour. Tapiocas. Prices. Marketing. Trade. Madagascar.

The situation of cassava and potato in Madagascar is presented. Data on production and productivity of fresh and processed cassava (starch, tapioca) as well as on market and trade prices are given. [CIAT]

0399

25701 REGIONAL WORKSHOP ON CASSAVA IN ASIA, ITS POTENTIAL AND RESEARCH DEVELOPMENT NEEDS, BANGKOK, THAILAND, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. 442p. Engl., 234 Refs., Illus.

Cassava. Economics. Marketing. Production. Trade. Productivity. Germplasm. Research. Post-harvest technology. Technology. Development. Uses. Asia.

In June 1984, a regional workshop on cassava was held in Bangkok, Thailand. The objectives of the workshop were to describe and assess (1) cassava's market potential in tropical Asia, (2) new technology as the basis for increased cassava production, and (3) cassava research and development needs. Individual country reports presented discuss cassava's role in the country's agricultural economy and/or the improvement of cassava productivity. Papers presented are recorded individually in this publication under the following consecutive no.: 0235, 0242, 0246, 0252, 0290, 0297, 0298, 0349, 0350, 0371, 0373, 0374, 0377, 0381, 0382, 0383, 0384, 0390, 0401, 0405, 0406, 0410, and 0414. [CIAT]

0400

22988 REIS, A.J. DOS; FERREIRA, L.D. 1982. Levantamento técnico e economico da producao e comercializacao da mandioca nos municípios de Conceicao dos Ouros e Cachoeira de Minas, na Zona da Mata de Minas Gerais. (Technical and economic survey of cassava production and commercialization in the municipalities of Conceicao dos Ouros and Cachoeira de Minas, in the Zona da Mata of Minas Gerais). In Empresa de Pesquisa Agropecuária de Minas Gerais. Projeto mandioca: relatorio 76/79. Belo Horizonte-MG, Brasil. pp.19-20. Port. [Escola Superior de Agricultura de Lavras, Caixa Postal 37, 37.200 Lavras-MG, Brasil]

Cassava. Economics. Production. Costs. Cassava starch. Marketing. Brazil.

The results of a technical and economic survey on cassava production and commercialization in Conceicao dos Ouros and Cachoeira de Minas (Minas Gerais, Brazil) among 71 cassava producers and 17 starch factories for the 1977 harvest are briefly discussed. Agricultural practices used corresponded to a great extent to the recommended production techniques. Land contributed the most (73.06%) to the total fixed cost, and labor (42.93%) to the total variable cost. Av. costs were confirmed to decrease as the area planted increased, indicating scale economies at the farmer level. The raw material for the starch factories was provided by the surveyed and neighboring municipalities. Approx. 20% of the cassava roots

were purchased in the state of Sao Paulo. Bitter starch was produced in the main factories and was completed by the minor ones. Sweet starch was imported to mix with the bitter starch. The gross margin of commercialization was positive for both municipalities but was less in Cachoeira de Minas. [CIAT]

0401

25720 ROCHE, F.C. 1986. Cassava-based farming systems in tropical Asia: research issues and development needs. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.313-337. Engl., 29 Refs., Illus. [Agricultural Development Council, Brawijaya Univ., Jl. May. Jen. Haryono 163, Malang, Indonesia]

Cassava. Production. Root productivity. Socio-economic aspects. Economics. Labor. Cultivation. Cultivars. Cuttings. Storage. Tetranychus urticae. Oidium. Xanthomonas campestris pv. manihotis. Weeding. Nutritional requirements. Fertilizers. N. P. K. Prices. Costs. Intercropping. Development. Wastes. Erosion. Indonesia. Asia.

The technical and economic constraints to greater cassava productivity in Asia, particularly in Indonesia, are discussed. The improved cassava cultivation practices that would be needed to increase yields, the program requirements, and the necessary economic incentives for the adoption of such techniques are analyzed as well as the secondary effects of a larger production of cassava (soil erosion and water pollution from starch production). Finally, the future agroeconomic research on cassava in the region is discussed. [CIAT]

0402

23776 RODRIGUEZ, F. 1983. Desarrollo de tecnologías apropiadas para el procesamiento de yuca en las áreas rurales colombianas. (Development of proper technologies for cassava processing in the rural areas of Colombia). In Seminario Avanzado de Tecnología de Alimentos, 4o., Bogotá, Colombia, 1983. Anales. Bogotá, Instituto de Investigaciones Tecnológicas. Serie Reuniones Científicas. pp.422-425. Span.

Cassava. Processing. Socio-economic aspects. Cassava starch. Industrialization. Development. Colombia.

The general context in which the technological development of the Colombian agricultural sector has taken place is described to explain, as an example, the industrialization possibilities of cassava that exist in the Andean and coastal regions. Some alternatives that have been studied to improve the cassava industrialization process are outlined. [CIAT]

0403

25533 SAKUBU, J. 1984. Point sur les plantes a racines et tubercules amylacées au Burundi. (Starchy root and tuberous plants in Burundi). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.95-111. Fr.

Cassava. Root crops. Production. Post-harvest losses. Productivity. Human nutrition. Processing. Cassava chips. Cassava flour. Cassava pastes. Economics. Research. Cultivars. Fermentation. Protein enrichment. Burundi.

The situation of root and tuber crops in Burundi is presented. Their production, yield, postharvest losses, prices, and nutritive contribution to human nutrition (30, 11, and 9% of the calories, protein, and fat intake, resp.) are discussed in relation to cereals, legumes, oilseeds, bananas, and others. Cassava technology is analyzed, and the processes for the production of chips, flour, and pastes are described. Research priorities regarding cassava and sweet potato are indicated and the project for the protein enrichment of cassava and its use in human and animal nutrition is presented. [CIAT]

0404

25563 SARIKAPHUTI, Y. 1984. Subsidiary food crop (cassava) in Thailand. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.447-467. Engl.

Cassava. Production. Consumption. Cultivars. Sweet cassava. Bitter cassava. Animal nutrition. Human nutrition. Cassava starch. Cassava flour. Cassava chips. Pellets. Alcohol. Development. Marketing. Trade. Prices. Thailand.

The situation of cassava in Thailand is presented. Although it is not the largest cassava producer in the world, it ranks 1st in terms of quantity exported. Data on production, supply and demand, var. used, and the production of flour, starch, chips, and pellets are given. A project for the production of alcohol is presented and the government policies to overcome production, marketing, and trade constraints are indicated. [CIAT]

0405

25702 SARMA, J.S.; PAULINO, L.A. 1986. Trends in the production and use of cassava and other selected food crops in tropical Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.17-41. Engl., Illus. [International Food Policy Research Inst., 1776 Massachusetts Avenue N.W., Washington D.C. 20036,0, USA]

Cassava. Production. Root crops. Cereals. Uses. Trade. Consumption. Asia.

Data on production and use of cassava, other root and tuber crops, and food grains in tropical Asia, covering the period 1961-82, are presented and discussed; global figures are also given. Based on these data the future of cassava in the region is analyzed. [CIAT]

0406

25724 SINGH, R.B. 1986. Past performance and future prospects of cassava production in Asia and the Pacific region. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.387-409. Engl., Sum. Engl. [Food & Agricultural Organization, Regional Office for Asia & the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand]

Cassava. Production. Root productivity. Productivity. Economics. Development. Uses. Consumption. Fertilizers. Costs. Cultivation systems. Asia.

The production, productivity, and area planted to cassava in 26 countries of the Asian Pacific region for 1973-83 are analyzed. This region accounts

for about 38% of the cassava produced in the world. Regional production increased at a high annual growth rate of 7.4% during this period, against a zero growth rate in the rest of the world. About 70% of the production increase was attributed to increase in area and the remaining 30% to increase in yield. The rate of growth of cassava production has, however, decelerated in recent years. Market restrictions, inadequate price and institutional support, low productivity under rainfed conditions, narrow germplasm base, lack of high-yielding, stress-tolerant, and widely-adapted var., inadequate application and inefficient management of fertilizers and water, and lack of appropriate technology for low-input conditions are the major production constraints. Besides being an important staple food, especially in marginal areas, cassava could emerge as a major feed source to meet rapidly expanding animal production in the region. However, this will depend to a large extent on the price competitiveness of cassava with coarse grains. Increased productivity and reduced unit costs of production are the most viable approaches to increase the competitiveness of cassava. Starch, sweeteners, gasohol, and SCP are other products of cassava. But, as yet, commercial production of these items, except starch, is not quite economical. Hence, additional research is called for to diversify the utilization of cassava roots. Furthermore, cassava-related economic, agricultural, and nutritional policies should be kept under continuing review to get the best out of this remarkable root crop. [AS]

0407

25546 SMITH, K. 1984. Thailand country report on cassava. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.213-234. Engl., Illus.

Cassava. Sweet cassava. Bitter cassava. Cultivars. Production. Processing. Cassava chips. Pellets. Small-scale processing. Industrialization. Tapiocas. Cassava starch. MSG. Prices. Marketing. Socio-economic aspects. Economics. Research. Development. Thailand.

The situation of cassava in Thailand is presented. It is the 2nd most important economic crop after rice, and it has had an enormous socioeconomic and political impact on the country. Most of the cassava is processed into pellets, cassava chips, starch, and monosodium glutamate. The pellets and chips are all exported; of the starch, 60% is exported and 40% is used for domestic consumption. Although most of the var. used are bitter, since the roots are all processed, there are some sweet var. such as Ha Na Tee and Yod Daeng that are grown on small scale for human consumption. Data on production of fresh and processed cassava, exports and imports, prices and consumption are given. The institutes and universities carrying out research on cassava processing and utilization in order to diversify the market and uses of cassava are mentioned as well as the projects they are executing. [CIAT]

0408

25274 STEGHART, P.B.; WHOLEY, D.W. 1984. A factory concept for integrated cassava processing operations: supporting and background information on the production of cassava chips. Vienna, United Nations Industrial Development Organization. UNIDO/IO/R.123. v.2,124p. Engl., 233 Refs., Illus.

Cassava. Cassava chips. Pellets. Production. Harvesting. Agricultural equipment. Roots. Peeling. Distribution. Storage. Mechanization. Solar

drying. Economics. Costs. Caplek. Toxicity. Animal nutrition. Human nutrition. Thailand. Indonesia.

A project to define the requirements for high quality cassava chips and to recommend the best means to achieve their production and supply is presented. The current production practices of chips and pellets are reviewed in relation to harvesting, root preparation, root transportation and storage, procedures for the elaboration of chips (manual and large-scale mechanical production techniques), small- and large-scale chip drying techniques (natural drying), pellet elaboration from chips, and quality standards and their control. Economic aspects of chip and pellet production are discussed for the cases of Thailand and Indonesia. [CIAT]

0409

25273 STEGHART, P.B.; WHOLEY, D.W. 1984. A factory concept for integrated cassava processing operations: the raw material cassava chips; production systems, quality criteria and techno-economic factors. Vienna, United Nations Industrial Development Organization. UNIDO/IO.582. v.1,137p. Engl., Sum. Engl., 233 Refs.

Cassava. Production. Uses. Toxicity. Nutritive value. Trade. Processing. Economics. Socio-economic aspects. Cassava chips. Distribution. Storage. Factories. Development. Industrialization. Drying. Solar drying. Water content. Starch content. Fibre content. Ash content. Pellets.

A project is presented to define the requirements for high-quality, dry cassava chips and for a factory producing food for human consumption and other products, and to recommend the best practical means of achieving chip production and supply. The background for cassava development, the technical and economic factors, case studies, and economic feasibility of the production systems are discussed in detail. Recommended techniques for chip production, agricultural considerations, postharvest operations, small- and large-scale chip production and drying methods, and management and storage of chips are described. Quality considerations and standards for cassava chips in terms of size and form, chemical composition, contamination with microbes and other materials, HCN toxicity, and external physical characteristics are discussed. The relation between the quality of the chips and the processed product is analyzed and results are presented of the lab. analysis of chip samples obtained in SE Asia. [CIAT]

0410

25705 SUBRAMANIAN, S.R. 1986. Cassava in the agricultural economy of India. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.65-72. Engl., 6 Refs. [Centre for Agricultural & Rural Development Studies, Tamil Nadu Agricultural Univ., Coimbatore 641003, India]

Cassava. Production. Statistical data. Productivity. Marketing. Costs. Prices. Income. Tapioca pearls. Cassava starch. Waste utilization. Cattle. Feeds and feeding. Labor. Irrigation. Cassava chips. India.

The situation of cassava in India is presented. The area planted to cassava represents only 0.2% of the cropped area of the country and it is located mostly in the southern states, Kerala and Tamil Nadu. Production, marketing, processing, and labor are analyzed and the integration of the stages of production and processing is suggested. Data on production, cultivated area, and yield (1967-82) in the country and the aforementioned states are included; also presented are production costs for 1979. [CIAT]

0411

24419 SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA. BRASIL. 1983. Avaliacao da safra de mandioca. (Evaluation of cassava production). In _____. Avaliacao da safra 1981/1982 de arroz, milho, feijao, mandioca cultivados na regiao norte. Belém-PA, Brasil, Departamento de Setores Produtivos. pp.51-63. Port., Illus.

Cassava. Production. Costs. Productivity. Brazil.

After the analysis of preceding crop cycles, the 1981-82 cassava crop cycle in the northern region of Brazil (Rodonia, Acre, Pará, Amazonas, Amapá, and Roraima) is analyzed. The northern region accounted for 13.7% of the national cassava production in the 1981-82 harvest. The main producers in the region were the states of Pará and Amazonas (77%). The highest yield in the region (17,397 kg/ha) was obtained in the state of Rodonia. The production, yield, harvested area, main producing municipalities, climatic conditions, demand for mechanized services, labor, production costs, markets, and farinha production for each state are analyzed. The perspectives for the 1982-83 harvest in the region are presented. [CIAT]

0412

24416 SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA. BRASIL. 1982. Avaliacao da safra da mandioca. (Evaluation of cassava production). In _____. Avaliacao da safra 1980/81 de arroz, feijao, mandioca e milho, cultivados na regiao norte. Belém-PA, Brasil, Departamento de Setores Produtivos. pp.57-83. Port., Illus.

Cassava. Production. Costs. Productivity. Brazil.

After the analysis of preceding crop cycles, the 1980-81 cassava crop cycle in the northern region of Brazil (Rodonia, Acre, Pará, Amazonas, Amapá, and Roraima) is analyzed. The northern region accounted for 12.2% of the national cassava production in the harvest of that year. The main producers in the region were the states of Pará (49.4%), Amazonas (27.3%), and Rodonia (12.9%). The production, yield harvested area, main producing municipalities, climatic conditions, demand for mechanized services, labor, production costs, markets, and farinha production for each state are analyzed. The perspectives for the 1981-82 harvest are presented. [CIAT]

0413

25562 TCHIENGUE, E. 1984. Transformation industrielle ou artisanale du manioc et autres tubercules au Cameroun. [Industrial or small-scale (by artisans) transformation of cassava and other tubers in Cameroon]. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.445-446. Fr.

Cassava. Processing. Small-scale processing. Prices. Cameroon.

The processing of cassava in Cameroon is presented. Most of the processing is undertaken by small artisans. The Centre National d'Etudes et d'Expérimentation du Machinisme Agricole and the Centre d'Assistance aux Petites et Moyennes Entreprises are working on the study and design of adapted machines. [CIAT]

0414

25709 TITAPIWATANAKUN, B. 1986. Cassava in the agricultural economy of Thailand. In Regional Workshop on Cassava in Asia, its Potential and

Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.131-151. Engl., Sum. Engl., 20 Refs., Illus. [Dept. of Agricultural Economics, Faculty of Economics & Business Administration, Kasetsart Univ., Bangkhen, Bangkok 9, Thailand]

Cassava. Production. Productivity. Processing. Cassava chips. Cassava starch. Pellets. Costs. Marketing. Consumption. Uses. Food products. MSG. Textiles. Paper industry. Trade. Prices. Thailand.

The international market of cassava starch and dried cassava for animal feed is presented. Cassava starch trade is analyzed within the context of local starch production, its exports, imports, and consumption in USA, Japan, Taiwan, and EEC countries. Dried cassava for animal feed in the international market is discussed considering the demand for meat and other animal products, the no. of animals being fed commercial mixed rations, and the price of cassava relative to other feed ingredients. [CIAT]

0415

25766 UGWU, B.O. 1985. The problem of inadequate supply of raw cassava for industrial cassava processing: a case study of the Nigerian Root Crops Production Company, Enugu, Nigeria. Agricultural Systems 18(3):155-170. Engl., Sum. Engl., 17 Refs. [National Root Crops Research Inst., Umudike, Umuahia, Nigeria]

Cassava. Economics. Production. Prices. Distribution. Labor. Phenacoccus. Mononychellus. Development. Processing. Nigeria.

The reasons supporting the establishment of the Nigerian Root Crops Production Company in Enugu are given. The Company cannot operate at full capacity because of a shortage of cassava roots for processing. The factors responsible for the inadequate supply of raw cassava to the Company are identified and solutions are proposed. In order to spread the benefits of this project to small-scale farmers, as well as to minimize the cassava root supply problem, it is suggested that the Company organize these farmers as outgrowers and encourage them to supply at least 50% of its root requirements, through technical advice and the supply of improved cassava cuttings and by helping them to obtain production credit. [AS]

0416

25526 WORKSHOP ON PROCESSING TECHNOLOGIES FOR CASSAVA AND OTHER TROPICAL ROOTS AND TUBERS IN AFRICA, ABIDJAN, IVORY COAST, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,82p. v.2,pp.83-510. Engl., Fr., Illus.

Cassava. Processing. Industrialization. Technology. Economics. Trade. Uses. Animal nutrition. Cultivation. Gari. Composite flours. Bakery products. Cassava starch. Alcohol. Africa.

A workshop was held on the technologies of processing cassava and other tropical roots and tubers in Africa. The objectives were (1) to bring together and disseminate recently acquired knowledge and experience in storage and in small-scale mechanized and industrial processing of cassava and other African tropical roots and tubers, as well as to ascertain the economic profitability of these processing techniques; (2) to define appropriate technologies for the industrial production of local culinary preparations in order to obtain easier-to-use products; (3) to define the needs for transfer of technology at the village or industrial level; (4) to study the use of tuber/root flour and starch in composite flours for bakery

purposes. The papers presented at this workshop are recorded individually in this publication under the following consecutive no.: 0243, 0244, 0251, 0301, 0318, 0320, 0326, 0328, 0331, 0332, 0333, 0334, 0335, 0336, 0337, 0338, 0340, 0341, 0342, 0344, 0348, 0351, 0352, 0358, 0368, 0379, 0380, 0385, 0386, 0389, 0392, 0393, 0394, 0398, 0403, 0404, 0407, 0413, and 0418. [CIAT]

0417

25573 WRIGHT, M. 1984. Tapioca—solutions to pressing problems. Bangkok Bank Monthly Review 25(11):450-455. Engl., Illus.

Cassava. Production. Trade. Marketing. Prices. Economics. Cassava chips. Pellets. Cassava flour. Development. Thailand.

In 1978 cassava pellets overtook rice to become Thailand's highest foreign exchange earner with total cassava exports (pellets, flour, chips) reaching an estimated 6.03 MT in 1984. Thailand is the largest exporter of cassava with the highest proportion going to EEC countries. France is badly affected by the import of cassava, a relatively cheap animal feed, into the EEC and has used its influence to restrict cassava imports. In 1982 Thailand and the EEC set import quotas of approx. 5 MT/yr with an import duty of 6%. Future Thai policies should emphasize the importance of improved quality, storage facilities should be constructed to allow farmers and manufacturers to minimize losses, new export markets should be found, and substitute crops should be identified. [World Agricultural Economics and Rural Sociology Abstracts]

0418

25564 YEO, G. 1984. Le plan manioc et le projet agro-industriel de Toumodi. (The cassava plan and the agroindustrial project of Toumodi). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.469-484. Fr.

Cassava. Production. Development. Cassava programs. Cultivation. Economics. Uses. Mechanization. Processing. Ivory Coast.

The cassava plan and agroindustrial project of Toumodi, Ivory Coast, are presented and discussed. The basic objectives of both are the improvement of cassava cultivation and the establishment of an agricultural unit for its processing, thus normalizing the demand and stabilizing the price. Their execution, difficulties, efforts, achievements, and research carried out are analyzed. [CIAT]

See also 0229 0235 0243 0251 0294 0297 0308 0320 0326 0331 0334 0337 0338 0340 0342 0421 0423

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0419

25757 ASHOKAN, P.K.; NAIR, R.V.; SUDHAKARA, K. 1985. Studies on cassava-legume intercropping systems for the Oxisols of Kerala State, India.

Tropical Agriculture (Trinidad) 62(4):313-318. Engl., Sum. Engl., 9 Refs., Illus. [College of Horticulture, P.O. Vellanikkara 680 654, Trichur, Kerala, India]

Cassava. Intercropping. Cultivars. Beans. Legume crops. Root productivity. Productivity. Agronomic characters. Soil analysis. N. P. K. Costs. Economics. Rainfall data. Weeding. India.

A field expt. was conducted at Kerala Agricultural Univ., India, to compare the performance of 5 legumes (cowpea, groundnut, mung bean, urd bean, and soybean) intercropped with cassava. Results of 3 yr showed that cowpea may be the most remunerative intercrop for cassava in similar high rainfall Oxisols (laterite soils) of the humid tropics. The yields of cassava in monoculture and mixed culture were similar. The cost of weeding could be reduced by approx. 50% by growing cowpea as an intercrop with cassava. OM depletion was slow in intercropped plots. Total N, available P and K contents were higher in intercropped plots. The height, no. of leaves, and root no. and DM content of cassava plants were not significantly influenced by the intercrops. [AS]

0420

23773 LEDUC, B. 1980. Culture de manioc sur les tests binomes. (Cassava cultivation in the binomial tests). In _____ Liaison recherche. Developpement IDESSA/ARSO; recherche de systemes stables de cultures vivrieres dans le Sud-Ouest. Résultats de la campagne 1979. Abidjan, Cote d'Ivoire, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. pp.17,68-90,143-145,183. Fr., 7 Refs.

Cassava. Cultivars. Cultivation. Cultivation systems. Maize. Rice. Root productivity. Soil conservation practices. Ivory Coast.

Several soil protection trials with different cultivation systems, which included cassava var. CB, were carried out in 1978-79 in SW Ivory Coast in the Zagne, San Pedro, and Tabou regions. Cassava did not have a repressive effect on rice. Var. CB was not very appreciated by the farmers; they prefer the local var. Bonoua. The av. cassava yields in trials with rice, maize, and other crops for the Zagne, San Pedro, and Tabou regions were 4.35, 22.57, and 13.30 t/ha, resp. [CIAT]

0421

22863 MOHANKUMAR, C.R. 1982. Intercropping cassava with groundnut. In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.23-24. Engl., Illus.

Cassava. Intercropping. Groundnut. Cultivation. Fertilizers. N. P. K. Productivity. Income. India.

The methodology and results are given of cassava/groundnut intercropping in Kerala, India, under the Lab. to Land program, which was carried out during 1979-82 in the villages of Karippur, Manappuram, Munchirai, and Gaj. Patti. Yields of cassava hybrids Sree Visakham and Sree Sahya over the 4 sites were between 22.94-27.98 t/ha, with an av. of 25.56 t/ha, and groundnut yield was between 440-817 kg/ha, with an av. of 617 kg/ha; this allowed increases in the av. income and a 50% increase in labor. The introduction of legumes to the cropping system also contributed to maintain soil productivity. [CIAT]

0422

25215 RAO, M.R.; MORGADO, L.B. 1985. Consorciacao com a cultura da mandioca no Nordeste do Brasil; resultados atuais e perspectivas para futuras pesquisas. (Intercropping with cassava in northeastern Brazil; current results and perspectives for future research). Petrolina-PE, Brasil, Empresa Brasileira de Pesquisa Agropecuária, Centro de Pesquisa Agropecuária do Trópico Semi-Arido, Documentos no.32, 22p. Port., Sum. Port., Engl., 12 Refs., Illus. [Centro de Pesquisa Agropecuária do Trópico Semi-Arido, Caixa Postal 23, 56.300 Petrolina-PE, Brasil]

Cassava. Cultivation systems. Intercropping. Planting. Spacing. Fertilizers. N. P. K. Harvesting. Timing. Maize. Bean. Cowpea. Brazil.

The traditional planting systems and some exptl. results are reviewed along with the perspectives for improving cassava-based intercropping systems. Cassava is intercropped mainly with maize, beans, or cowpea, individually or together. The intercropping advantage for this crop in different systems varied from 80 to 100%, compared with sole cropping. Cassava planted in double rows (2.00 x 0.60 x 0.60 m) improved the yield of intercrops but no study tested whether this effect would be obtained in single rows with larger spacing. Future studies should include (a) identification of compatible genotypes for intercropping; (b) definition of levels and methods of fertilizer application, especially in good rainfall regions; (c) effect of intercropping on pest and disease incidence; (d) identification of alternative intercrops (soybean, groundnut, sunflower, and sorghum); (e) possibility of intercropping cassava harvested at 12 mo.; and (f) comparison of different alternative planting systems under different practices and soil management. [AS]

0423

25506 WADE, M.K.; SANCHEZ, P.A. 1984. Productive potential of an annual intercropping scheme in the Amazon. Field Crops Research 9(3-4):253-263. Engl., Sum. Engl., 18 Refs., Illus. [North Carolina State Univ., Dept. of Soil Science, Tropical Soils Research Program, P.O. Box 7619, Raleigh, NC 27695, USA]

Cassava. Intercropping. Cultivars. Cowpea. Soybeans. Maize. Rice. Groundnut. Planting. Spacing. Timing. Fertilizers. N. Economics. Income. Production. Energy productivity. Protein content. Peru.

A multiple cropping system, modeled after the local traditional planting scheme, was the basis for an expt. conducted on a Typic Paleudult near Yurimaguas, Peru. The system utilized intercropping and relay planting to produce 4 and 5 crops/yr in 2 consecutive years. The effect of 1-, 2-, and 3-m row spacing of the tall component crops (maize and cassava var. Huallagina), interplanted with short-statured companion crops (soybeans and cowpea) in the 1st yr and upland rice, peanuts, and cowpeas in the 2nd yr was quantified. Monoculture checks were grown simultaneously with each of the intercrop components. The effect of various N rates on the productivity of each cropping pattern was also studied. As the row spacing widened, maize and cassava yields decreased, while yields of the short companion crops increased. The 1 m intercropping pattern was 30% more efficient in producing crop yields than the corresponding monocultures, as measured by the area-time equivalency ratio (ATER = 1.3). This treatment also produced income and calories at a rate equal to or higher than monoculture rotations or the individual monoculture checks. The 2- and 3-m intercrops produced income, calories, and protein at rates similar to the monocultures, and had ATER values near unity. Only maize (in both years) and soybeans (in the 1st yr, non-nodulated) responded to N applications;

ATER values were not affected by these rates. The rate of production of income, calories, and protein by the intercropping systems increased with additions of N in the 1st year but not in the 2nd. A multiple cropping system such as used in this expt. (with 1-m row spacing) would be equally or more productive biologically, economically, and nutritionally than the corresponding monocultures, and may provide other benefits such as greater income stability, reduced weed pressure, and reduced susceptibility to soil erosion. [AS]

0424

23068 XAVIER, J.J.B.N.; NOGUEIRA, O.L.; SA SOBRINHO, A.F. DE 1982. Mandioca em rotacao com culturas de ciclo curto (milho x feijao caupi). [Cassava in rotation with short-cycle crops (maize x cowpea)]. Manaus-AM, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual de Manaus. Pesquisa em Andamento no.35. 2p. Port. [Unidade de Execucao de Pesquisa de Ambito Estadual de Manaus, Caixa Postal 455, 69.000 Manaus-AM, Brasil]

Cassava. Cultivation systems. Rotational crops. Maize. Cowpea. Brazil.

To study the convenience of rotational crops under the physical and chemical conditions of the soil (Manaus, Brazil), the following treatments were evaluated: fertilized maize + fertilized bean + cassava, fertilized maize + fertilized bean + fertilized cassava, fertilized cassava + cassava, cassava + cassava. The harvesting of maize and bean gave yields of 2467 and 717 kg/ha, resp., and cassava presented an optimum growth. [CIAT]

See also 0235 0239 0241 0242 0245 0246 0289 0292 0294 0298 0338 0360 0370 0371 0374 0377 0378 0382 0383 0384 0399 0401

K02 Descriptive and Comparative Studies

See 0207

ABBREVIATIONS AND ACRONYMS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxigen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CAMD	Cassava African mosaic disease
CMV	Cassava African mosaic virus
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
COD	Chemical oxigen demand
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
EP	Preliminary Trials, CIAT
expt.	Experiment(s)
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
hp	Horsepower
IAA	Indoleacetic acid
IBA	Indolebutyric acid
IBYAN	International Bean Yield and Adaptation Nursery, CIAT
Illus.	Illustrated
in.	Inches
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilocalorie(s)
kg	Kilogram(s)
kJ	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio

LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	Alpha-naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
p.	Page
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pp.	Pages
pphm	Parts per hundred million
PPI	Pre planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGR	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
rpm	Revolutions per minute
Russ.	Russian
s	Second
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Species
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with N-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VEF	Bean Team Nursery, CIAT
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
vs.	Versus
W	West, watt
wk.	Week
WP	Wettable powder
wt.	Weight
yr	Year(s)
/	Per
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus

AUTHOR INDEX

ABENOJA, E.A.
0238

ACOSTA, W.D.
0347

ADJUPOLO, S.K.
0326

AGBIM, N.N.
0327

AGOSTINI, R.
0348

AHMAD, K.U.
0349

AJIBOLA, O.O.
0218

ALLEM, A.C.
0206

ALOSPETO, K.
0394

ANANTHARAMAN, M.
0350

ANDERSON, V.
0351

ANIMBO, A.H.
0323 0352

APILAR, E.
0290

ARCE, S.J. R.
0232

ARENE, O.O.
0233

ASHOKAN, P.K.
0417

ASTEGBO, J.E.
0329

ATKINSON, D.R.
0353

AUMAITRE, A.
0304

AYANRU, D.K.S.
0217 0261

AYERMOR, G.S.
0251

AZIZ, Z.A.
0213

BADILLO-FELICIANO, J.
0284

BAI, K.V.
0264

BALDIZAN, A.
0305

BANGUN, P.
0250

BARRETT, D.M.
0252

BARTSCH, W.
0318

BATERNA, J.P.
0238

BAUTISTA, O.K.
0254

BAYOGO, A.J.
0389

BEDERE, C.
0297

BELLO, R.W.
0322

BENNETT, F.D.
0269

BEPPU, K.
0224

BEST, R.
0395

BISEN, S.S.
0323

BLAIN, D.
0354

BLOM, P.S.
0355

BOHER, B.
0253

BONDAR, G.
0282

BORREN, C.
0356

BOSTER, J.S.
0207

BOURDON, J.P.
0357

BREFEL, P.M.
0358

BRESSANI, R.
0300

BRICCAIDLI, A.
0306

BRUN, P.G.
0273

BUCK, K.W.
0262

BUITRAGO, J.
0310

BURITICA, P.
0257

CACERES A., L.A.
0208

CADAVID L., L.F.
0227

CALLEFI, A.
0306

CAMPOS, S.D. DA S. DE
0321

CANIOCA, J.O.D.
0345

CARTERON, J.
0297

CASTANEDA, I.
0343

CENTRAL TUBER CROPS RESEARCH INSTITUTE
0237 0357 0360

CENTRO DE PESQUISAS E DESENVOLVIMENTO, BRASIL
0361

CEPEDA, M.P.
0317

CHALKE, K.D.
0334

CHAN, S.K.
0207 0214 0230 0240 0241 0265 0286 0310 0362 0363 0364 0365 0367

CISSE, F.M.
0368

CLEFEJEU, J.L.
0258

COCK, J.H.
0211 0242 0313

COLEMAN, D.F.
0210

CONSTANT, J.L.
0297

CONTRERAS G., J.
0223

COSTA, J.G.
0307

COURSEY, D.G.
0253

COUTTS, P.H.A.
0262

CROIX-MARIE, F.
0331

CURSO NACIONAL EL CULTIVO DE YUCA Y SUS USOS ALTERNATIVOS, 1er., QUITO, ECUADOR
0366

DANIEL, J.F.
0255

DAVIS, A.
0351

DE JONG, G.
0370

DERES, C.
0367

DIXON, R.
0303

DUBHAL, N.P.
0323

DIAME, M.M.
0368

DU PLESSIX, Y.J.
0243 0244

ECKEBIL, J.P.
0307

EL-SHARKAWY, M.A.
0211

ELIAS, L.G.
0300

ENRIQUEZ T., J.
0370

EZULIKE, T.O.
0283

FATAR, L.
0371

FERGUSON, T.U.
0243

FERNANDES, R.
0343

FERREIRA FILHO, J.R.
0287

FERREIRA, C.
0274

FERREIRA, L.D.
0400

FINDEY, M.M.
0258

FUENTES V., F.
0260

FUJIMOTO, S.
0224

FUKUDA, C.
0256

FUKUDA, M.M.S.
0256

FUNDACION PARA EL DESARROLLO INDUSTRIA Y AGRICOLA DEL QUINDIO
0372

GARASIN, S.P.
0373

GHARIA, M.M.
0323

GHOSH, S.P.
0246

GOMEZ, S.
0215 0219 0220 0317 0375

GONZALEZ A., A.
0296

GONZALEZ, F.
0343

GOPAKUMAR, K.
0293

GREENFIELD, J.N.
0348

GRIFFITH, S.S.
0311

GRIFFON, D.
0332

GUGNANI, H.C.
0337

GURITAO, G.
0247 0374

HAHN, S.K.
0280

HAMILTON, M.D.D.
0262

HAN, M.H.
0346

HAN, Y.T.
0346

HARRISON, B.D.
0266

HERNANDEZ, L.
0260

HERREN, H.R.
0271 0272

HEYS, G.
0333

HIZUKURI, S.
0225

HOMELLER, R.H.
0227

HOSSEIN, K.M.
0207 0214 0230 0240 0241 0255 0296 0330 0362 0363 0364 0365

IKOTUN, T.
0257

IMAI, K.
0212 0218

INSTITUTO INTERAMERICANO DE COOPERACION PARA LA AGRICULTURA
0375

INSTITUTO NACIONAL DE INVESTIGACIONES AGRICOLAS, MEXICO
0289

ISSEMORE, T.
0352

IZOMKON-EKIOBHIO, B.O.
0221

JANSSEN, A.
0376

JARMAN, T.R.A.
0353

JAYASINGHE, U.
0263

JAYAWARDENA, S.D.G.
0377

JIMENEZ, I.
0310

JUAO, M. DA S.J.
0380

JUG, J.J.
0264 0371

KARUNDO, P.
0297

KALAITSAKIS, P.
0313

KANDA, A.
0212

KAPUTU, V.T.
0334

KAWANO, K.
0290

KHAJAREKN, J.M.
0308

KHAJAREKN, S.
0308

KOCHELEFF, P.
0297

KULEDJO, J.A.
0342

KRUTKON, T.
0231

KUMAR, A.
0222

LABERRY S., T.
0259

LAMI, B.
0379

LAMEIRA, O.A.
0291

LAN, G.S.
0207 0214 0230 0240 0241 0285 0286
0320 0362 0363 0364 0365

LARTEY, R.L.
0335 0380

LAW, A.T.
0307

LEDUC, G.
0420

LEE, G.R.
0343

LEE, K.J.
0340

LEITNER, D.E.
0228

LEMA, K.M.
0271 0272

LIAN, T.S.
0207 0214 0230 0240 0241 0285 0286
0290 0350 0362 0363 0364 0365 0381
0382

LIENEN, I.E.
0393

LIMA, O. DE A.
0314

LOCKARD, J.M.
0210

LOCKARD, R.G.
0210

LOPEZ Z., M.
0243

LOPEZ, L.L.
0373

LOZANO, J.C.
0259 0263

LUJAN, M.
0343

LYNAM, J.K.
0383

MAAS, J.L.
0258

MANER, J.H.
0310

MANRIQUE, L.A.
0227

MARISCAL, A.A.
0290 0384

MARTINEZ H., B.
0232

MARTINEZ V., R.
0232

MAZUMBA, J.
0301

MBINGA, M.J.
0320

MCALLAN, A.B.
0311

MELLO, R.P. DE
0312

MELO, J.F.
0312

MICHE, J.C.
0383 0386

MUFUR, L.N.
0336

MUHANKUMAR, S.R.
0421

MONTALDO, A.
0387 0388

MOORE, C.P.
0313

MORAES, G.W.G. DE
0270

MOREIRA, M.A.
0312

MORENO, E.A.M.
0314

MORGADO, L.O.
0422

MORIYA, T.
0212

MSABAHA, M.A.M.
0337

MUENDANE, C.
0338

MURO, M.A. DE
0345

N'BONGUE, R.
0389

NAGAHAMA, T.
0234

NAIR, M.G.
0264

NAIR, R.B.
0397

NAIR, R.G.
0246 0292

NAIR, R.V.
0419

NAYAR, M.M.
0292

NELSON, G.C.
0390

NINAN, K.N.
0391

NJOKU, O.U.
0235

NOGUEIRA, O.L.
0424

NUMA, A.T.
0220

NUGROHO, J.M.
0297

NWANA, I.E.
0273

NYANIN, O.O.
0392 0393

NZELIDE, F.K.
0339

NZIEFFE, A.
0340

ODEBIYI, J.A.
0283

ODERA, F.P.
0320

OLYMPIO, H.K.
0341 0394

ONYEKWERE, O.O.
0342

OSPINA, B.
0395

OYENIRAN, J.O.
0302

PACHICO, O.M.
0396

PACUMBABA, R.P.
0265

PALANISWAMI, M.S.
0294

PAPADOPOULOS, G.
0315

PARK, Y.K.
0345

PARKA, O. DE
0305

PARKA, M.
0305

PAULINO, L.A.
0405

PAVLOVSKAYA, O.E.
0315

PEDRAZA, A.
0295

PEREZ, M.
0343

PERKIN, J.
0297

PIANO, L.N.
0209 0214 0230 0240 0241 0285 0286
0330 0362 0363 0364 0365

PINO A., J.A.
0270

PIZZINATTO, A.
0321

PORTELA, R.
0310

PORTO, M.C.M.
0211

QUEVEDO, M.A.
0254

QUIZADA L., D.
0322

RADHAKRISHNAN, V.V.
0293

RAJAGURU, A.S.D.
0316

RAJENDRAN, P.G.
0397

RAKOTONANAHARY, J.P.
0398

RAMANATHAN, I.
0350

RAMANUJAM, T.
0294

RAMASWAMY, N.
0295

RAO, M.R.
0422

RAVELOMANANTSOA, J.
0393

RAVINDRAN, V.
0316

REGIONAL WORKSHOP ON CASSAVA IN ASIA, ITS POTENTIAL AND RESEARCH DEVELOPMENT NEEDS, BANGKOK, THAILAND
0399

REIS, A.J. DOS
0400

RHEE, S.K.
0345

RIBEIRO, A.F.
0274

ROBERTS, I.M.
0260

ROBERTSON, I.A.D.
0267 0268

ROBINSON, D.J.
0266

ROCHA, B.V. DA
0256

ROCHE, P.C.
0401

RODRIGUES, F. DE M.
0307

RODRIGUEZ M., S.
0234 0290

RODRIGUEZ N., A.
0234

RODRIGUEZ P., A.
0234

RODRIGUEZ, F.
0402

ROSCO, A.
0344

SA SOUZINHO, A.F. DE
0424

SAKURU, J.
0403

SANCHEZ, P.A.
0423

SANTAMARIA M., E.
0273

SANTOS, C.V.
0274

SANWAL, G.G.
0222

SARIKAPHUTI, Y.
0404

SARMA, J.S.
0405

SASSER, M.
0258

SCHMITT, A.T.
0275

SCHOONHOVEN, A. VAN
0276

SEMESI, V.M.K.
0337

SERRA, A.D.P.
0338

SHARMA, H.K.
0323

SHARMA, V.C.
0217

SHIKASAKA, K.
0225

SIEVERDING, E.
0223

SILVA, O.R. DA
0307

SILVA, V.G. DA
0307

[illegible]
0405

SINTHUPRAMA, S.
0235 0290

SITOMPUL, S.A.
0374

SMITH, R.
0407

SOARES, L.A.
0270

SOENARJO, R.
0293 0297

SONI, S.L.
0323

SRIVASTAVA, A.C.
0323

STEGHART, P.H.
0408 0409

STEIN, V.E.
0262

SUBRAMANIAN, S.R.
0410

SUDHAKARA, K.
0417

SUGANUMA, T.
0224

SULLIVAN, D.J.
0277

SUNDARARAJAN, S.
0295

SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA, BRASIL
0411 0412

SWINKELS, J.J.M.
0324

TAKEDA, Y.
0325

TCHIENGUE, F.
0411

TERRA, W.R.
0274

THANKAPPAN, R.
0294

THAPORN, C.
0235 0290

TITAPIWATANAKUN, B.
0414

TRESOROV, N.N.
0329

TURNBULL, J.
0351

UGOCHUKWU, E.N.
0321

UKWU, J.U.
0415

UNU, M.Y.
0336

VALDIVIESO, M.
0215 0219 0220 0317

VAZQUEZ, J. E.
0249

VELASCO, A.C.
0263

VENEZUELA, MINISTERIO DE AGRICULTURA Y CRIA
0237

VIANA, J. DE A.C.
0312

VIJAYAKUMAR, M.
0295

VILLAMAYOR JUNIOR, F.G.
0247

VREUGDENHIL, D.
0278

WADE, M.K.
0423

WARGIONO, J.
0290

WEITE, Z.
0298

WELSCH, D.F.
0391

WHOLEY, D.J.
0353

WHOLEY, D.W.
0408 0409

WORKSHOP ON PROCESSING TECHNOLOGIES FOR CASSAVA AND OTHER TROPICAL ROOTS AND TUBERS IN AFRICA, ABIDJAN, IVORY COAST
0416

WOUNDAH, B.U.
0210

WRIGHT, M.
0417

XAVIER, J.J.P.N.
0424

XIONG, L.
0293 0371

XUECHENG, T.
0293 0371

YANAGISAWA, T.
0216

YASEEN, M.
0278 0279 0280 0281

YEO, W.
0418

YUSUF, Z.A.M.
0346

ZIRAS, L.
0315

Subject Index

ACARICIDES
0217 0237 0370

AFLATOXINS
0293 0334

AGRICULTURAL EQUIPMENT
COSTS
0237 0408
HARVESTING
0244 0409
LAND PREPARATION
0237
PLANTING
0237 0244

ALCOHOL
0358
FERMENTATION
0345
PROCESSING
0252 0311 0345 0353 0385 0416
PRODUCTION
0292 0346 0353 0385 0404
USES
0252 0272 0318 0345 0346 0353 0385
0404 0416

ALEYRODIDAE
0237 0267 0268 0269 0370

ALUMINUM
0227

AMINO ACIDS
0220 0100
DIETARY VALUE
0358

ANASTREPHA AYANIENSIS
INSECTICIDES
0370

ANASTREPHA PICKELI
INSECTICIDES
0370

ANTIBIOTICS ALIUS
0237
INSECT CONTROL
0240 0270
INSECTICIDES
0370

APICAL MERISTEMS
TISSUE CULTURE
0290

ASCORBIC ACID
0347

ASH CONTENT
0217 0100 0306 0310 0312 0313 0316
0323 0324 0347 0409

ASPERGILLUS
0293

ATTA
0237
INSECT CONTROL
0270

BACTERIOSES
0235 0237 0242 0243 0255 0257 0258
0353 0374 0379 0384 0389 0401
DISEASE CONTROL
0240
RESISTANCE
0256 0355 0288 0296 0297

BAKERY PRODUCTS
0370
CASSAVA FLOUR
0358
COMPOSITE FLOURS
0334 0359 0416
WHEAT FLOUR
0334 0359

BANANA-PLANTAINS
0370

BEMISIA
0237 0267 0268
INSECT CONTROL
0270
INSECTICIDES
0370
RESISTANCE
0280

BEVERAGES
0334

BIOCHEMISTRY
0222 0224

BIOLOGICAL CONTROL
BACTERIOSES
0280
INJURIOUS INSECTS
0269 0270 0272 0275 0276 0278 0279
0280 0281 0370
INJURIOUS MITES
0270 0281 0280 0370
MYCOSES
0370
VIROSES
0280 0370

BITTER CASSAVA
0267 0217 0237 0261 0317 0338 0404
0407

BOLIVIA
0279

BOILING
0320 0140

BORON
0246

MANCHIOS
0207 0213 0214 0227 0249 0291

MANIOC
0233 0235 0257 0270 0274 0275 0281
0282 0287 0291 0307 0312 0314 0319
0321 0345 0358 0423 0424
MARKETING
0361 0409
PRODUCTION
0361 0407 0411 0417
SOCIO-ECONOMIC ASPECTS
0361

MANGO
0334

CALCIUM
0216 0245 0327
DEFICIENCIES
0230
SOIL PRODUCTIVITY
0230 0241

CALVES
0313

CAMEROON
0413
MARKETING
0395
PRODUCTION
0336 0369 0395
TRADE
0395

CANDY
0207 0214

CARBOHYDRATE CONTENT
0229 0231 0295 0300 0311 0353 0365

CARBON DIOXIDE
0211 0212 0216

CARIBBEAN
0231 0235 0245 0248 0250 0280 0281
0284 0296 0343

CARPOLONCHAEA CHALYBEA
0237
INSECTICIDES
0370
RESISTANCE
0295

CASAVE
0347

CASSAVA AFRICAN MOSAIC VIRUS
0261 0262 0265 0267 0267 0292 0326
0357 0371 0379
DISEASE CONTROL
0237 0249
ENTOMOLOGY
0268
RESISTANCE
0295
SYMPTOMATOLOGY
0264

CASSAVA BREAD
0347

CASSAVA CHIPS
0243 0304 0371
CATTLE
0351 0410
CONSUMPTION
0252 0364 0365 0381 0383 0404 0414
COSTS
0353 0364 0381 0383 0384 0389 0405
0410 0414
DETOXIFICATION PROCESSES
0317
DRYING
0252 0317 0330 0379 0416 0409
HCN CONTENT
0252 0317
INDUSTRIALIZATION
0320 0351 0358 0379 0399 0407 0409
MARKETING
0364 0365 0383 0385 0404 0407 0410
0414 0417
PRICES
0357 0363 0381 0383 0384 0404 0407
0410 0414 0417
PROCESSING
0252 0317 0320 0330 0337 0351 0364
0373 0379 0380 0385 0399 0403 0407
0409 0414
SOLAR DRYING
0252 0404 0409
STORAGE
0292 0301 0314 0408 0409
INSECTS
0353 0358
SWINE
0355
TRADE
0354 0365 0381 0383 0385 0404 0409
0414 0417

CASSAVA COMMON MOSAIC VIRUS
0237 0370

CASSAVA FLOUR
COMPOSITION
0300 0342 0358 0365
CONSUMPTION
0365 0404
COSTS
0342 0347 0372 0399
DRYING
0251 0342 0347 0379
INDUSTRIAL MACHINERY
0372
INDUSTRIAL MICROBIOLOGY
0342
INDUSTRIALIZATION
0320 0326 0331 0342 0355 0379 0399
MARKETING
0255 0342 0347 0365 0375 0374 0398
0404 0417
NUTRITIVE VALUE
0300
PRICES
0337 0338 0347 0374 0398 0404 0417
PROCESSING
0251 0261 0320 0326 0331 0337 0351
0342 0347 0358 0372 0374 0385 0399
0404 0407 0409
PRODUCTION
0251 0320 0331 0337 0338 0347 0365
0372 0373 0385 0394 0398 0403 0404
0417

PROTEIN CONTENT
0303 0358
STORAGE
0251 0253
SWINE
0353
TRADE
0365 0385 0396 0404 0417
WATER CONTENT
0303

CASSAVA LEAVES (VEGETABLE)
0320
COMPOSITION
0353

CASSAVA MEAL
0243
BOILING
0321 0340
COMPOSITION
0252 0301 0306 0310 0312 0316 0334
0342 0350
CONSUMPTION
0252
DIGESTIBILITY
0305
DRYING
0251 0252 0334 0340 0342
FACTORIES
0342
FATTENING
0305
INDUSTRIALIZATION
0340 0342 0353 0361 0376
PELLETS
0252 0305
PROCESSING
0251 0252 0320 0334 0336 0340 0342
0385 0386 0403
STORAGE
0251 0301 0310 0328
SWINE
0336 0110 0314 0351
TRADE
0353

CASSAVA PASTES
0243 0251 0320 0335 0340 0342 0385
0386 0401

CASSAVA PRODUCTS
0390
FRESH PRODUCTS
0310 0314 0377 0381
CASSAVA LEAVES (VEGETABLE)
0320 0351
CASSAVA ROOTS (VEGETABLE)
0376
CASAVE
0347
CASSAVA BREAD
0347
CASSAVA CHIPS
0243 0252 0272 0301 0308 0317
0320 0330 0337 0351 0356 0364
0365 0371 0373 0377 0390 0391
0393 0394 0395 0397 0403 0404
0407 0409 0407 0410 0414 0417
CASSAVA FLOUR
0251 0251 0320 0320 0326 0331
0337 0339 0342 0347 0353 0365
0368 0372 0373 0375 0389 0394
0396 0401 0404 0417

CASSAVA MEAL
0243 0251 0252 0301 0305 0306
0310 0312 0314 0316 0321 0334
0336 0340 0342 0351 0361 0365
0386 0403
CASSAVA STARCH
0222 0245 0252 0251 0316 0319
0320 0321 0322 0323 0324 0325
0330 0332 0344 0348 0353 0360
0364 0365 0366 0371 0374 0375
0379 0380 0391 0393 0395 0390
0394 0398 0400 0402 0404 0407
0410 0414 0416
FUD-FUM
0251 0340 0342 0355 0366
GAPLEK
0374 0383 0406
GARI
0243 0251 0316 0326 0330 0347
0368 0377 0380 0385 0396 0394
0416
PELLETS
0252 0308 0330 0383 0385 0404
0407 0403 0407 0414 0417
TAPIOCAS
0316 0330 0365 0383 0377 0380
0394 0403 0407 0410

CASSAVA PROGRAMS
0283 0330 0375 0419
ANIMAL NUTRITION
0358
GERMPLASM
0290
HUMAN NUTRITION
0396
PLANT BREEDING
0287 0290 0359 0371

CASSAVA STARCH
0371
ALCOHOL
0252 0319 0345 0346 0353 0365 0404
0416
ANALYSIS
0222 0245 0319 0321 0373
CONSUMPTION
0252 0354 0365 0374 0376 0381 0383
0390 0404 0414
COSTS
0353 0364 0374 0376 0381 0381 0390
0403 0413 0414
DEXTRINS
0353
DRYING
0254 0330 0376 0379
ENZYMES
0222 0332 0345
FACTORIES
0320 0379
FERMENTATION
0319 0345 0376
GELATINIZATION
0323 0324 0330
GLUCOSE
0353 0365
HYDROLYSIS
0332
INDUSTRIAL MICROBIOLOGY
0319 0345 0346 0354
INDUSTRIAL STARCHES
0414

INDUSTRIALIZATION
0316 0320 0334 0353 0376 0379 0402
0407 0416
MARKETING
0253 0364 0365 0376 0383 0385 0390
0394 0399 0400 0404 0407 0410 0414
PACKAGING
0378
PARTICLE SIZE
0323 0324
PRICES
0353 0374 0376 0381 0383 0390 0394
0398 0404 0407 0410 0414
PROCESSING
0252 0253 0318 0320 0323 0324 0330
0332 0344 0345 0353 0354 0359 0376
0377 0380 0385 0394 0398 0402 0407
0414 0416
STORAGE
0253 0353 0357 0376 0380
TEXTILES
0414
TRADE
0364 0365 0374 0381 0383 0385 0390
0398 0404 0414 0416
USES
0252 0318 0320 0322 0325 0330 0345
0346 0353 0365 0366 0374 0379 0380
0381 0383 0385 0390 0394 0404 0407
0410 0414 0416
VISCOSITY
0321 0323 0324 0325
WATER REQUIREMENTS (PROCESSING)
0353 0376

CASSAVA ROOTS (VEGETABLE)
COMPOSITION
0376

CATTLE
0311 0354 0410
BEEF CATTLE
0307
DAIRY CATTLE
0312

CECIDOMYIIDAE
0237 0278 0370

CENTRAL AFRICAN REPUBLIC
0399

CERCOSPORA CARIBEA
0237 0370
RESISTANCE
0297

CERCOSPORIDIUM HENNINGSII
0236 0237 0364 0370
DISEASE CONTROL
0240
RESISTANCE
0297 0298 0297

CERCOSPORA VICOSAE
0364 0370
DISEASE CONTROL
0240
RESISTANCE
0297

CEREALS
0324 0356 0376 0405 0410 0423 0423
0424

CHICKANGUE
0340

CHRONOSOLES
0208

CLIMATIC REQUIREMENTS
0220 0236 0237 0271 0280 0353 0355
0361
GROWTH
0216 0237
PRODUCTIVITY
0214 0232 0237 0243 0312

CLONES
0217 0234 0256 0270 0293 0295
AGRONOMIC CHARACTERS
0296

COCOYAMS
0293

COLOMBIA
0211 0219 0220 0228 0229 0253 0263
0267 0276 0277 0310 0313
MARKETING
0376 0378
PRODUCTION
0353 0372 0395
SOCIO-ECONOMIC ASPECTS
0356 0376 0402

COMPOSITE FLOURS
0334 0358 0416

COMPOSITION
0213 0220 0223 0229 0230 0234 0237
0241 0244 0245 0257 0288 0291 0296
0298 0302 0304 0311 0313 0347 0362
0367 0388 0409 0423
CASSAVA FLOUR
0300 0342 0358 0365
CASSAVA MEAL
0252 0301 0306 0310 0312 0316 0334
0342 0358
CASSAVA STARCH
0252 0313 0323 0324 0326 0351 0357
0364 0365 0376
LEAVES
0214 0215 0216 0217 0219 0261 0310
0316
ROOTS
0215 0217 0221 0254 0310 0372
STEMS
0215 0217 0219 0226 0247 0248
TABLES
0365

CONFECTIONERIES
0256

CONGO
0255
MARKETING
0385
PRODUCTION
0371 0385
SOCIO-ECONOMIC ASPECTS
0340
TRADE
0385

COPPER
0230 0304

CORTEX
COMPOSITION
0217
HCN CONTENT
0217
USES
0326 0327 0329

COSTA RICA
0215 0317

CROSSBREEDING
0285 0295

CUBA
0232 0234 0248 0260 0296 0343

CULTIVARS
0215 0211 0219 0220 0224 0237 0239
0245 0254 0255 0256 0260 0261 0263
0265 0267 0268 0271 0285 0317 0320
0337 0338 0347 0349 0358 0363 0368
0376 0379 0380 0384 0385 0387 0386
0403 0404 0407 0423
AGRONOMIC CHARACTERS
0223 0296 0419
GERMPLASM
0235 0246 0290 0292
IDENTIFICATION
0207
ROOT PRODUCTIVITY
0213 0215 0227 0228 0229 0232 0233
0235 0238 0243 0247 0249 0250 0254
0286 0287 0289 0291 0294 0296 0298
0359 0370 0382 0401 0419 0420
SELECTION
0256 0287 0289 0296 0297 0364
STARCH PRODUCTIVITY
0227
TOXICITY
0310

CULTIVATION SYSTEMS
0353 0373 0381 0382 0383 0406 0420
FALLOWING
0376
INTER-CROPPING
0235 0239 0241 0242 0245 0246 0267
0289 0292 0294 0298 0359 0360 0365
0371 0374 0376 0377 0378 0384 0401
0419 0421 0422 0423
ROTATIONAL CROPS
0235 0358 0362 0365 0370 0384 0424

CULTURE MEDIA
0255 0257 0337 0343

CUTTINGS
0239 0265 0290 0360
GERMINATION
0359
PROPAGATION
0237
ROOT PRODUCTIVITY
0235 0242 0247 0248 0249 0250 0294
SPACING
0241 0243 0245 0246 0249 0289 0296
0364 0370 0382
STORAGE
0235 0237 0241 0242 0249 0359 0370
0384 0401
0290 0359 0370 0382 0377 0401

CYANIDES
0217 0321 0253
DETOXIFICATION
0317

CYANOGENESIS
0357

CYANOGENIC GLYCOSIDES
0303

CYTOGENETICS
0286 0288

CYTOLOGY
0285

DETOXIFICATION
0310 0317

DEVELOPMENTAL STAGES
BRANCHING
0207 0213 0214 0249 0293
GERMINATION
0285 0359
ROOT DEVELOPMENT
0207 0247

DEXTRINS
0353

DIGESTIBILITY
0304
CASSAVA MEAL
0305

DIOSCOREA
0253

DISEASE CONTROL
BACTERIOSES
0240
MYCOSES
0240
VIRUSES
0239 0246

DOMESTIC ANIMALS
0304 0305 0306 0307 0310 0311 0312
0314 0315 0316 0357 0358 0410

DRIED POTS
0243 0252 0292 0301 0308 0317 0320
0330 0337 0358 0371 0373 0374 0379
0380 0381 0384 0389 0401 0403
DISTRIBUTION
0353 0404 0407
MARKETING
0364 0365 0383 0385 0390 0404 0407
0410 0414 0417

DRYING
0217 0335 0340 0341
CASSAVA CHIPS
0252 0317 0330 0379 0408 0409
CASSAVA FLOUR
0251 0342 0347 0379
CASSAVA STARCH
0252 0330 0376 0379
PELLETS
0252 0330 0408 0409
TAPIOCAS
0330 0379

WATER CONTENT
0334 0409

ECOLOGY
0206 0371

ECOSYSTEMS
0371

ECUADOR
0279 0369 0370 0387 0398

ENERGY PRODUCTIVITY
0423

ENTOMOLOGY
0267 0268 0271 0273 0274 0282 0283

EPIDEMIOLOGY
0268

ERINNYIS ELLO
0237 0270 0274 0275
INSECT CONTROL
0275
INSECTICIDES
0274 0277
RESISTANCE
0279

ETHANOL
0252 0311 0345 0346 0385

EUTETRANYCHUS ORIENTALIS
INSECT CONTROL
0246

FACTORIES
CASSAVA CHIPS
0326 0403
CASSAVA FLOUR
0326 0331 0342
CASSAVA STARCH
0320 0376
GARI
0333 0342
PELLETS
0409

FALLOWING
0327 0376

FATTENING
SWINE
0306 0315

FEED CONSTITUENTS
0306 0307 0309 0310 0311 0312 0396

FEEDS AND FEEDING
0234 0252 0299 0306 0307 0308 0309
0310 0311 0312 0313 0314 0315 0316
0330 0379 0381 0383 0385 0391 0392
0403 0404 0407 0408 0410 0414 0417

FERMENTATION
0317 0331 0334 0335 0341 0342 0345
0376
PROTEIN ENRICHMENT
0320 0403

FERMENTED PRODUCTS
0252 0342 0348 0345 0346 0351 0385
0404 0416

FLOWERS
0206 0207 0255

FOLIAGE
0209 0214 0215 0217 0358
FORAGE
0234

FOMES LIGNOSUS
0364 0370 0382
DISEASE CONTROL
0240
RESISTANCE
0285 0297

FOOD ENERGY
0217 0312 0314 0316 0356 0387 0398

FOOD PRODUCTS
0221 0241 0251 0252 0312 0318 0322
0325 0326 0328 0333 0334 0335 0336
0341 0342 0353 0354 0358 0375 0376
0380 0381 0384 0385 0386 0391 0394
0403 0407 0414 0416

FUN-FUN
COMPOSITION
0342
PROCESSING
0251 0340 0342 0345 0386

FURAGE
0234 0301 0307 0310 0313 0314

FRUITS
0206 0207 0255

GABON
0325 0327

GARDEN
PRODUCTION
0374 0383 0408
TRADE
0374 0383
USES
0374 0383 0406

GARI
COMPOSITION
0221 0302 0342
FACTORIES
0333 0342
FERMENTATION
0333 0335 0341 0342
HCN CONTENT
0221
INDUSTRIAL MACHINERY
0315 0321 0333
MECHANIZATION
0243 0356 0342 0385
PACKAGING
0335 0336
PROCESSING
0251 0311 0325 0331 0335 0336 0361
0342 0356 0372 0380 0385 0386 0393
0394 0416
STORAGE
0251 0302 0335 0360

GELATINIZATION
0323 0324 0330 0331 0342

GENETICS
0200

GERMINATION
CUTTINGS
0359
SEED
0293

GERMPLASM
0235 0246 0290 0292 0293 0399

GHANA
0330
MARKETING
0359
PRODUCTION
0380 0384
TRADE
0385

GLOMERELLA CINGULATA
0364
DISEASE CONTROL
0240

GLUCOSE
0353 0369

GRINDING
0330 0331

GROWTH
0206 0207 0213 0216 0231 0237 0247
0288 0379

GROWTH-CHAMBER EXPERIMENTS
0271

GUATEMALA
0390

GUINEA
0363

GUYANA
0285 0381

HARVEST INDEX
0244 0255 0293 0297 0354

HARVESTING
0252 0310 0364 0381 0397
AGRICULTURAL EQUIPMENT
0244 0304
TIMING
0215 0219 0220 0223 0234 0235 0239
0243 0245 0247 0249 0254 0302 0363
0371 0376 0382 0422

HCN CONTENT
0220 0221 0284 0287 0295 0298
CASSAVA CHIPS
0252 0317
CASSAVA MEAL
0252 0310 0316
CASSAVA STARCH
0252 0359
CORTICA
0217
LEAVES
0217 0219 0261 0310 0316

ROOTS
0217 0221 0310
STEMS
0217 0219

HERBICIDES
0228 0234 0237 0240 0244 0253 0289
0362 0363 0364 0382

HUMAN NUTRITION
0300 0345 0403 0404 0408 0409

HYBRIDS
0200 0293
PRODUCTIVITY
0294 0350 0360 0370 0378 0397
ROOT PRODUCTIVITY
0294 0370 0378 0397
SELECTION
0397

HYDROLYSIS
CASSAVA STARCH
0332

INCOME
0227 0237 0294 0347 0349 0350 0352
0363 0364 0371 0373 0375 0378 0397
0410 0421 0423

INDIA
0272 0234 0264 0294 0295 0314 0323
0359 0361 0377 0419 0421
GERMPLASM
0246 0292 0293
MARKETING
0419
PRODUCTION
0246 0292 0410
SOCIO-ECONOMIC ASPECTS
0350 0360 0376

INDONESIA
0247 0359
PRODUCTION
0297 0374 0401 0408
SOCIO-ECONOMIC ASPECTS
0401
TRADE
0374

INDUSTRIAL MACHINERY
0315 0328 0333 0344

INDUSTRIAL STARCHES
0414

INFLORESCENCES
0208 0209 0255

INJURIOUS INSECTS
0237 0240 0242 0269 0277 0351 0364
0382 0383 0415
ANASTREPHA MANIHOTI
0370
ANASTREPHA PICKELI
0370
AONIDOMYTILUS ALDUS
0237 0246 0276 0370
ATTA
0237 0275
TERMISIA
0237 0274 0288 0378

CARPOLONCHAEA CHALYBEA
0237 0296 0370
ERIONYTS ELLO
0237 0270 0274 0275 0276 0289 0370
PHENACOCCUS MANIHOTI
0217 0271 0272 0278 0279 0280 0281
0283 0370
SILIA PENDULA
0237 0276 0370
TRIALEURODES VARIABILIS
0370
ZONOCERUS VARIEGATUS
0273 0380

INJURIOUS SITES
0235 0239 0242 0243 0276 0282 0283
0283 0297 0353 0359 0389 0415
MONONYCHELLUS TANAJOA
0217 0237 0267 0370 0379
OLYGONYCHUS PERUVIANUS
0237
TETRANYCHUS CINNABARINUS
0246 0379
TETRANYCHUS URTICAE
0237 0370 0374 0384 0401

INOCULATION
0228
DISEASES AND PATHOGENS
0258

INSECT BIOLOGY
0267 0256 0271 0273 0274 0276 0282
0285

INSECTICIDES
0217 0239 0240 0269 0370 0376

INTER-CROPPING
0235 0241 0242 0245 0292 0294 0298
0359 0363 0371 0374 0377 0384 0401
BANANA-PLANTAINS
0376
BEANS
0287 0419 0422
COWPEA
0422 0423
GROUNDNUT
0237 0267 0360 0371 0421 0423
LEGUME CROPS
0287 0419 0422 0423
MAIZE
0376 0422 0423
RICE
0423
SOYBEANS
0423
SWEET-POTATOES
0245
TARO
0245
YAMS
0245

IRRIGATION
0211 0232 0246 0294 0353 0419

ISOLATION
DISEASES AND PATHOGENS
0257 0258 0263

IVORY COAST
0244 0420

MARKETING
0385
PRODUCTION
0243 0385 0418
TRADE
0385

KENYA
0267 0268
PRODUCTION
0320
SOCIO-ECONOMIC ASPECTS
0320

HONDURAS
0375

LABOUR
0383 0401 0410
HARVESTING
0363 0391
PLANTING
0391
PROCESSING
0331 0353 0415

LAND PREPARATION
0241 0245 0360 0375 0391
AGRICULTURAL EQUIPMENT
0237
MECHANIZATION
0237 0243 0382
ROOT PRODUCTIVITY
0235 0243 0294 0362 0392 0397

LATIN AMERICA
MARKETING
0346
PRODUCTION
0346
TRADE
0346

LEAF AREA
0210 0213 0214 0227 0247 0248 0285
0364

LEAVES
0205 0207 0209 0210 0211 0212 0213
0214 0215 0216 0273
ANALYSIS
0255 0261
ANIMAL NUTRITION
0310
HCN CONTENT
0217 0219 0261 0310 0316
MINERAL CONTENT
0219 0310
PROTEIN CONTENT
0219 0310 0316

LIGHT
0214

LINAMARASE
0217 0221 0261

MADAGASCAR
MARKETING
0395

MAGNESIUM
0327 0364

ROOT PRODUCTIVITY
0230 0233 0243 0382
PRODUCTION
0398
TRADE
0398

MALAYSIA
0209 0213 0214 0230 0240 0241 0285
0296 0307 0330
MARKETING
0362 0364 0365
PRODUCTION
0345 0363 0365 0381
SOCIO-ECONOMIC ASPECTS
0362 0382
TRADE
0364 0365 0381

MANURES
0237 0360 0397
OCHO
0329

MARKETING
0345 0362 0375 0399 0405
CASSAVA CHIPS
0364 0365 0383 0385 0404 0407 0410
0414 0417
CASSAVA FLOUR
0253 0342 0347 0365 0375 0374 0396
0404 0417
CASSAVA MEAL
0342 0361 0385
CASSAVA STARCH
0253 0364 0365 0376 0383 0385 0390
0394 0391 0400 0404 0407 0410 0414
GARI
0333 0342 0385 0394
PELLETS
0253 0365 0404 0407 0414 0417
TAPIOCAS
0365 0394 0398 0407 0410

MECHANIZATION
HARVESTING
0243 0361 0382 0408
PLANTING
0237 0243 0382
PROCESSING
0331 0336 0342 0353 0375 0414

METHIONINE
0300

MEXICO
0233 0259

MINERAL DEFICIENCIES
0230

MINERALS
0217 0229 0227 0229 0230 0233 0235
0237 0241 0243 0246 0247 0249 0294
0293 0307 0327 0364 0370 0382 0397
0401 0417 0421 0422

MITE CONTROL
0240 0275 0282
ACARICIDES
0217 0237 0370

MODIFIED STARCHES
0397

MOLYBDENUM
0246

MONONYCHELLUS TANAJOA
0237 0267 0374
INSECTICIDES
0217 0370

MOULDS
0302

MSG
0407 0414

MYCOPLASMOSES
0237 0370

MYCORRHIZAE
0228 0357

MYCOSES
0233 0235 0237 0242 0243 0259 0294
0364 0370 0374 0382 0401
DISEASE CONTROL
0240
RESISTANCE
0260 0265 0269 0276 0277

NIGERIA
0217 0218 0221 0233 0261 0271 0272
0273 0277 0283 0288 0302 0327 0329
0339 0393
MARKETING
0333 0342
PRODUCTION
0333 0415

NITROGEN
0227 0233 0235 0239 0243 0246 0247
0289 0294 0298 0327 0350 0364 0370
0382 0397 0401 0419 0421 0422 0423

NUTRITIONAL REQUIREMENTS
0227 0230 0233 0235 0237 0239 0243
0245 0246 0249 0294 0297 0293 0329
0353 0357 0360 0362 0363 0364 0370
0373 0384 0391 0397 0401 0406 0421
0422 0423

OIDIUM
0237 0370 0374 0401

OLIGONYCHUS TIHAPENSIS
INSECT CONTROL
0240

OLIGONYCHUS PERUVIANUS
0237

ORGANOLEPTIC EXAMINATION
0223 0284

PACKAGING
0333 0335 0376

PANAMA
0227

PAPER INDUSTRY
0414

PARTICLE SIZE
CASSAVA STARCH
0323 0324

PEELING
0252 0128 0333 0334 0335 0340 0341
0342 0347 0376 0408

PELLETS
0303 0307 0393 0404 0406 0417
PROCESSING
0252 0330 0345 0407 0409 0414

PERU
0207 0359
PRODUCTION
0423

PEST CONTROL
0217 0237 0240 0246 0276 0282 0289
0370 0376 0378

PEST DAMAGE
0276 0282
DEFOLIATION
0289

PETIOLES
0207 0215 0219

PH
0241 0242
CASSAVA STARCH
0321
SOIL ANALYSIS
0277

PHENACOCCUS
0269 0277 0279 0281 0370 0415

PHENACOCCUS MANIHOTI
0271 0272 0278 0279 0280 0281 0379
INSECTICIDES
0217
RESISTANCE
0280

PHILIPPINES
0233 0243 0254
PRODUCTION
0384
SOCIO-ECONOMIC ASPECTS
0373 0384

PHOSPHORUS
0219 0229 0230 0233 0235 0239 0243
0246 0247 0294 0294 0298 0327 0366
0364 0370 0382 0397 0419 0421 0422

PHOTOSYNTHESIS
0211 0214

PHYSIOLOGY
0209 0207 0213 0214 0216 0231 0232
0237 0242 0247 0248 0364 0170

PIGLETS
0304

PLANT ASSIMILATION
0212 0215

PLANT GEOGRAPHY
0206

PLANT HEIGHT
0227 0233 0249 0250 0275

PLANT PHYSIOLOGICAL PROCESSES
0211 0212 0214 0216 0232

PLANT REPRODUCTION
0206 0235

PLANT RESPIRATION
0211

PLANT TISSUES
0217
TISSUE CULTURE
0290

PLANTING
0239 0360 0360
AGRICULTURAL EQUIPMENT
0237 0244
COSTS
0237 0269 0362 0364 0370 0376
LABOUR
0391
MECHANIZATION
0237 0243 0382
ROOT PRODUCTIVITY
0214 0235 0242 0243 0249 0289 0294
0298 0362 0370 0382
SPACING
0214 0234 0241 0242 0245 0246 0249
0289 0291 0364 0370 0371 0376 0382
0422 0423

PLOUGHING
0237 0239 0371

POLLEN
0206

POLLINATION
0206 0235 0364

POST-HARVEST LOSSES
0231 0376 0384 0403

POTATOES
0324 0169

POULTRY
0315 0158

POWER SOURCES
0331 0333

PRESSING
0333 0335 0341 0347

PRICES
0297 0333 0337 0338 0347 0353 0356
0357 0374 0376 0377 0381 0383 0384
0390 0392 0393 0394 0398 0401 0404
0407 0410 0413 0414 0415 0417

PROCESSING
0253 0318 0323 0326 0331 0332 0337
0338 0344 0352 0353 0364 0365 0366
0372 0373 0380 0385 0386 0393 0394
0395 0398 0402 0407 0413 0414 0415
0416 0418
BOILING
0323 0140
DRYING
0251 0252 0317 0330 0334 0335 0340
0341 0342 0347 0376 0379 0409

FERMENTATION
0328 0333 0334 0335 0341 0342 0345
0376 0403
GELATINIZATION
0323 0324 0330 0333 0342
GRINDING
0330 0331
PEELING
0252 0324 0333 0334 0335 0340 0341
0342 0347 0376
PRESSING
0333 0335 0341 0347
RASPING
0328 0330 0333 0335 0336 0347 0376
0379
SCREENING
0330 0334 0335 0340 0341 0347 0376
SILTING
0330 0376
STEEPING
0251 0328 0340 0379 0389
WASHING
0252 0324 0330 0334 0335 0341 0347
0376

PROPAGATION
0237

PROPAGATION MATERIALS
0206 0209 0235 0237 0239 0241 0242
0245 0246 0247 0248 0249 0265 0285
0289 0290 0294 0298 0359 0360 0364
0376 0382 0384 0397 0401

PROTEIN CONTENT
0220 0300 0306 0311 0312 0313 0323
0324 0349 0353 0423
LEAVES
0217 0310 0316
ROOTS
0310
STEMS
0219

PROTEIN ENRICHMENT
ECONOMICS
0252 0403
FERMENTATION
0328 0403

PROTEINS
DIETARY VALUE
0314

PRUNING
0241 0254 0359 0362 0364 0370

PSEUDOMONAS
RESISTANCE
0297

PUERTO RICO
0284

RAINFALL DATA
0215 0220 0232 0235 0236 0237 0255
0266 0267 0353 0355 0362 0419

RASPING
0328 0330 0333 0335 0336 0347 0376
0379

RESISTANCE
DISEASES AND PATHOGENS
0256 0260 0285 0288 0289 0295
INJURIOUS INSECTS
0268 0289 0296
INJURIOUS MITES
0289 0297

ROOT CROPS
0238 0245 0251 0360 0403 0405

ROOT DEVELOPMENT
0207 0247

ROOT PRODUCTIVITY
0213 0214 0215 0227 0228 0229 0230
0232 0233 0235 0238 0242 0243 0247
0248 0249 0250 0284 0285 0286 0287
0289 0291 0293 0294 0295 0296 0298
0357 0362 0370 0378 0382 0389 0397
0401 0406 0419 0420

ROOTS
0206 0207 0209 0293 0326 0327 0329
ANALYSIS
0221 0224
BIOCHEMISTRY
0224
DRY MATTER
0215 0254
DRYING
0403
FAT CONTENT
0310
HCN CONTENT
0217 0221 0310
SILAGE
0310
STARCH CONTENT
0254
STORAGE
0247 0254 0310 0370 0310 0384 0406

ROSELLINIA
0237 0370

ROTATIONAL CROPS
0235 0353 0362 0365 0370 0384
MAIZE
0424

SAISSETIA MIGRA
0237
INSECT CONTROL
0270

SCLEROTIUM ROLFSII
0237 0364 0370
DISEASE CONTROL
0240

SEED
0206 0209 0290
COMPOSITION
0285
GERMINATION
0290

SHEEP
0305

SHOOTS
0247 0250 0255 0265

SILAGE
0310 0313 0314

SILBA PENDULA
0237
INSECT CONTROL
0276
INSECTICIDES
0370

SILTING
0330 0376

SMALL-SCALE EQUIPMENT
0335 0341 0352

SMALL-SCALE PROCESSING
0335 0336 0341 0342 0352 0380 0386
0394 0407 0413

SOCIO-ECONOMIC ASPECTS
0320 0340 0347 0350 0354 0355 0356
0360 0361 0362 0373 0375 0378 0382
0384 0395 0401 0402 0407 0409

SOIL AMENDMENTS
0327

SOIL ANALYSIS
0227 0229 0237 0327 0329 0379 0419

SOIL FERTILITY
0242

SOIL PHYSICAL PROPERTIES
0220 0227 0235 0237 0239 0241 0287
0297 0365 0382

SOIL REQUIREMENTS
0241 0242 0327

SOLAR DRYING
0219 0252 0334 0395 0408 0409

SOYBEANS
0423

SPHACELOMA MANIHOTICOLA
0237 0370
RESISTANCE
0260 0289 0296

SRI LANKA
PRODUCTION
0377

STARCH CONTENT
0220 0223 0229 0247 0248 0254 0285
0287 0291 0295 0299 0349 0376 0409

STARCH PRODUCTIVITY
0295
CULTIVARS
0229
FERTILIZERS
0229 0230
TIMING
0230

STATISTICAL ANALYSIS
0207 0210 0218 0249 0249 0297 0317
0321 0334

STATISTICAL DATA
0410

STEEPING
0251 0328 0340 0379 0389

STEMS
0207 0215 0249 0293
ANALYSIS
0226
HCN CONTENT
0217 0219
PLANT DEVELOPMENT
0206 0207 0247 0248

STOMATA
0211 0212 0216

STORAGE
0235 0237 0241 0242 0249 0251 0253
0254 0292 0301 0302 0310 0323 0335
0353 0359 0370 0376 0390 0394 0401
0408 0409

SULPHUR
0246

SURINAM
0281

SWEET CASSAVA
0207 0217 0237 0337 0338 0404 0407

SWEET POTATOES
0238 0245 0343 0369

SWINE
0304 0314 0357 0358
FATTENING
0306 0315
LEAVES
0310
ROOTS
0310

SYMPTOMATOLOGY
DISEASES AND PATHOGENS
0263 0264

TAIWAN
0298
PRODUCTION
0371

TANZANIA
PRODUCTION
0337

TAPIOCA PEARLS
0410

TAPIOCAS
CONSUMPTION
0365
DRYING
0330 0379
INDUSTRIAL MACHINERY
0313
INDUSTRIALIZATION
0310 0370 0407
PROCESSING
0313 0330 0358 0379 0380 0394 0398
0407

STORAGE
0390
TRADE
0365 0390
USES
0315 0330 0365 0368 0379 0380 0394
0407 0410

TAXONOMY
0206 0207 0237 0359

TECHNOLOGY
0290 0320 0331 0350 0395 0396 0399
0416
TECHNOLOGICAL PACKAGE
0292 0294 0378 0384 0397
TECHNOLOGY EVALUATION
0375

TEMPERATURE
0216 0220 0232 0271 0353 0355 0382

TETRANYCHUS CINNABARINUS
0379
INSECT CONTROL
0245

TETRANYCHUS MEDCALFORNICUS
INSECT CONTROL
0246

TETRANYCHUS URTICAE
0237 0374 0394 0401
INSECTICIDES
0370

TEXTILES
0414

THAILAND
0231 0361
GERMPLASM
0235
MARKETING
0385 0404 0407 0414 0417
PRODUCTION
0385 0404 0407 0408 0414 0417
SOCIO-ECONOMIC ASPECTS
0407
TRADE
0367 0385 0404 0414 0417

THRIPS
INSECT CONTROL
0275
INSECTICIDES
0289 0370
RESISTANCE
0267

TISSUE CULTURE
0296

TOGO
MARKETING
0385 0394
PRODUCTION
0385 0394
TRADE
0385

TOXICITY
0305 0310 0342 0409 0417

TOXICOLOGY
0335

TRADE
0348 0367 0367 0379 0405
CASSAVA CHIPS
0364 0365 0381 0383 0385 0404 0409
0414 0417
CASSAVA FLOUR
0365 0385 0395 0404 0417
CASSAVA MEAL
0385
CASSAVA STARCH
0364 0365 0374 0381 0383 0385 0390
0393 0404 0414 0416
GARI
0385 0416
PELLETS
0383 0385 0404 0409 0414 0417
TAPIOCAS
0365 0390

TRIALEURODES VAPORARIUM
0370

TROMYCES MANIHOTIS
0267 0370

VASCULAR STREAKING
0254

VENEZUELA
0279 0305 0322
MARKETING
0347
PRODUCTION
0237 0347
SOCIO-ECONOMIC ASPECTS
0347

VISCOSITY
CASSAVA STARCH
0321 0323 0324 0325

VITAMIN A
0349

VITAMIN CONTENT
0349

WASTE UTILIZATION
0342 0376 0391 0410

WASTES
0353 0361

WATER CONTENT
0213
CASSAVA CHIPS
0409
CASSAVA FLOUR
0300
CASSAVA MEAL
0300 0310 0334
CASSAVA STARCH
0324 0325
GARI
0302
LEAVES
0310
ROOTS
0310

WATER REQUIREMENTS(PLANT)
0211 0212 0242

WATER REQUIREMENTS(PROCESSING)
0335 0353 0372 0376

WEEDING
0223 0237 0240 0243 0244 0289 0362
0363 0364 0370 0376 0392 0391 0401
0419
HOEING
0235 0250

WEEDS
0237 0243 0250 0329

XANTHOMONAS CAMPESTRIS PV. MANIHOTIS
0235 0237 0255 0257 0364 0370 0374
0377 0384 0401

DISEASE CONTROL
0240
RESISTANCE
0256 0285 0288 0296 0297

YAMS
0245 0389

ZAIRE
0265
SOCIO-ECONOMIC ASPECTS
0354

ZINC
0246

ZONOCERUS VARIEGATUS
0273 0380

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CASSAVA PROGRAM

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Rupert Best, PhD, Utilization (Senior Research Fellow)
Edward Carey, PhD, Plant Breeding (Postdoctoral Fellow)
Mabrouk El-Sharkawy, PhD, Physiology (Senior Research Fellow)
Clair Hershey, PhD, Plant Breeding (sabbatical leave)
Reinhardt Howeler, PhD, Soils and Plant Nutrition
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Ewald Sieverding, Dr. Agr., Soils and Plant Nutrition (Visiting Scientist)
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(*Manihot esculenta* Crantz)

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Information and conclusions reported herein do not necessarily reflect the position of any of the aforementioned entities.

Abstracts on Cassava
(*Manihot esculenta* Crantz)

Vol. XII No. 3 December, 1986

CONTENTS

	INTRODUCTION	iii
	COMPONENTS OF AN ABSTRACT	iv
	HOW TO USE THE INDEXES	v
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY AND MORPHOLOGY	-
C00	PLANT PHYSIOLOGY	2
	C01 Plant Development	4
	C02 Cyanogenesis	10
	C03 Chemical Composition, Methodology and Analyses	11
	C04 Plant Nutrition	13
D00	CULTIVATION	18
	D01 Soil, Water, Climate and Fertilization	18
	D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting	21
	D03 Energy Productivity and Yields	28
	D04 Postharvest Studies	29
E00	PLANT PATHOLOGY	31
	E02 Bacterioses	32
	E03 Mycoses	34
	E04 Viroses	35
	E05 Mycoplasmoses	39
	E06 Nematodes	39
F00	PEST CONTROL AND ENTOMOLOGY	40
	F01 Injurious Insects and their Control	40

F02 Rodents and other Noxious Animals -
F03 Injurious Mites and their Control 47

G00 GENETICS AND PLANT BREEDING 51
G01 Breeding, Germplasm, Varieties and Clones, Selection 51
G02 Cytogenetics 60

H00 NUTRITION 62
H01 Cassava Foods and Nutritive Value 62
H02 Nutritive Disorders in Humans 65
H03 Animal Feeding 68
H04 HCN Toxicity and Detoxification 72

I00 PROCESSING, PRODUCTS AND USES 73
I01 Cassava Starch and its Properties 73
I02 Uses, Industrialization, Processing and Storage 74
I03 Industrial Microbiology 78

J00 ECONOMICS AND DEVELOPMENT 80

K00 OTHER ASSOCIATED COMMODITIES 95
K01 Rotational Schemes and Intercropping 95
K02 Descriptive and Comparative Studies 97

Z00 GENERAL -

ABBREVIATIONS AND ACRONYMS 99

CUMULATIVE AUTHOR INDEX 101

CUMULATIVE SUBJECT INDEX 123

INTRODUCTION

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide a specialized guide to the world's literature on cassava (*Manihot esculenta* Crantz), disseminating research results and ongoing activities related to the crop.

The abstracts report condensed information from journal articles, booklets, mimeographed reports, theses, manuals and other conventional and nonconventional material, categorized into broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are author and subject indexed to enable more comprehensive consultation.

When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users who request this search service. The full text of every article abstracted by the Documentation Center is also available, through the photocopy service.

CIAT's Documentation Center also publishes journals of analytical abstracts on field beans (*Phaseolus vulgaris* L.) grown under tropical conditions and on tropical pastures. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include: Pages of Contents, Cassava Newsletter, Pastos Tropicales - Boletín Informativo, and Hojas de Fríjol.

COMPONENTS OF AN ABSTRACT

Accesion number (for photocopy requests)

Authors

Sequential number in the journal (for use of indexes)

Year of publication

19527 IKEDIOBI, C.O.; ONYIKE, E. 0145 1982. The use of linamarase in gari production. Process Biochemistry 17(4):2-5. Engl., Sum. Engl., 12 Refs., Il s. [Dept. of Biochemistry, Ahmadu Bello Univ., Zaria, Nigeria]

Original title

Author address

Additional notes

Source

Pages

Language of paper

Language of summary

Cassava. Linamarase. Uses. Gari. Fermentation. Detoxification processes. Enzymes. Nigeria.

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. [AS]

Abstract

Abstractor and/or translator

HOW TO USE THE INDEXES

The numbers listed under each entry in the author and subject indexes correspond to the abstract's sequential number, found above each abstract within the journal.

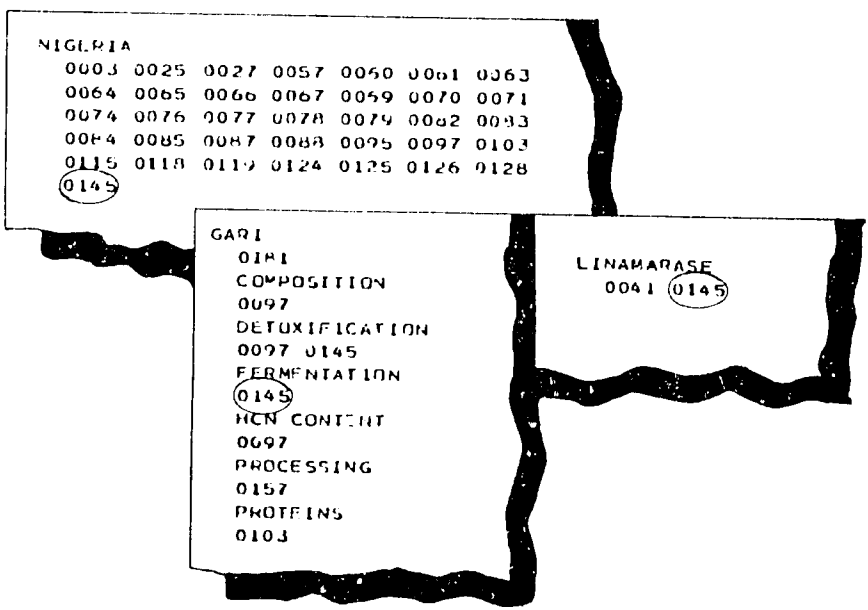
The last issue of the year contains cumulative author and subject indexes for the year.

Author Index

The Author Index can be used to find abstracts when the personal or corporate authors are known. The Author Index, which is alphabetically arranged, lists *all* author and co-author names cited in the publicaction.

Subject Index

The Subject Index presents an alphabetical list of descriptors used in cassava research, many of which are combined with other descriptors, allowing the identification of more specific topics.



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A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0425

25578 SNEEP, J.W.; DE ROON, A.C. 1984. Euphorbiaceae. Uitgaven van de Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen 0(113):231-285. Engl.

Cassava; Manihot; Plant anatomy; Identification; Manihot glaziovii; Manihot esculenta; Manihot carthagenensis; Plant geography.

A botanical description of the Euphorbiaceae family is presented and taxonomic keys for the identification of the genera are given. Likewise, the genera Euphorbia, Pedilanthus, Phyllanthus, Margaritaria, Tragia, Dalechampia, Croton, Argythamnia, Cnidoscolus, Ricinus, Jatropha, Manihot, Acalypha, Bernardia, Adelia, Hippomane, and Hura are described in detail. Some species are also described, giving common names and place of origin. Of the genus Manihot, the species M. esculenta, M. glaziovii, and M. carthagenensis are described. (CIAT)

0426

25268 SPATH, C.D. 1973. Plant domestication: the case of Manihot esculenta. Journal of the Steward Anthropological Society 5(1):45-69. Engl., Sum. Engl., 34 Refs., Illus.

Cassava; History; Processing; Plant geography; Manihot; Sweet cassava; Bitter cassava; Propagation; Peru.

The problem of cassava domestication is analyzed. The archaeological evidence available for the origins of cassava in South America, particularly that from Peru, is outlined. The plant is discussed in terms of its morphology, habitat, growing conditions, and yield. The possible implications of the relationships between the propagation systems of the plant and its domestication are analyzed. Domestication and cultural intensification are emphasized. (CIAT) See also 0561 0594 0632

0427

24746 EL-SHARKAWY, M.A.; COCK, J.H. 1985. The humidity factor in stomatal control and its effect on crop productivity. Cali, Colombia, Centro Internacional de Agricultura Tropical. 12p. Engl., Sum. Engl., 25 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Water requirements (plant); Stomata; Carbon dioxide; Photosynthesis; Cultivars; Leaves; Colombia.

Recent studies in the lab. on the response of cassava to water stress demonstrated that plants grown in pots or in the field, with and without soil water stress, were very sensitive to changes in atmospheric humidity. Both CO2 uptake rate and H2O loss decreased greatly as VPD increased. This decrease in gas exchange rate was associated with a reduction in leaf conductance in the absence of changes in leaf water potential. The strong stomatal response to changes in VPD may be of particular importance to perennial crops, such as cassava, that may have to endure a long period of drought. Under these conditions, and in the absence of stomatal response to humidity, both photosynthesis and transpiration will continue at relatively high rates until available soil water is depleted and leaf water potential drops to the level required to induce stomatal closure, at which time both photosynthesis and transpiration will approach zero. In such case, most of the transpirational loss will occur during periods of high VPD and low photosynthesis:transpiration ratio, resulting in a low DM accumulation/unit water transpired. On the other hand, with a direct stomatal response to changes in air humidity, available soil water will be depleted slowly, as most of the transpirational loss will occur during periods of the day when VPD is low and water use efficiency is highest. With a prolonged period of limited soil water, the greater water use efficiency will lead to a greater total accumulation of photosynthate over the stress period. Thus, the direct stomatal mechanism is beneficial for those crops that experience long period of drought. However, with nonlimiting soil water conditions or only short periods of soil water stress, optimizing water use efficiency would not be as important as maximizing photosynthesis and consequently crop productivity. Under these conditions nonsensitive stomata would be advantageous. An hypothesis is presented which relates stomatal sensitivity to stomatal density and is discussed in the light of selection methods for var. with optimum productivity under differing conditions of air humidity and soil water availability. (AS)

0428

25592 EL-SHARKAWY M.A.; COCK, J.H.; HERNANDEZ, A. DEL P. 1985. Stomatal response to air humidity and its relation to stomatal density in a wide range of warm climate species. Photosynthesis Research 7:137-149. Engl., Sum. Engl., 41 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Stomata; Cultivars; Photosynthesis; Water requirements (plant); Transpiration; Colombia.

The gas exchange of 19 widely different warm climate species (including cassava) was observed at different leaf to air VPD. In all species stomata tended to close as VPD increased resulting in a decrease in net photosynthesis. The absolute reduction in leaf conductance/unit increase in VPD was greatest in those species which had a large leaf conductance at low VPDs. This would be expected even if stomata of all species were equally sensitive. However, the percentage reduction in net photosynthesis (used as a measure of the relative sensitivity of stomata of the different species) was also closely related to the maximal conductance at low VPD. Cassava had

the highest reduction in apparent photosynthetic rate and leaf conductance (85 and 86 per cent, resp.). Similarly the relative sensitivity of stomata to changes in VPD was closely related to the weighted stomatal density or "crowding index". The hypothesis is presented that stomatal closure at different VPDs is related to peristomatal evaporation coupled with a high resistance between the epidermis and the mesophyll and low resistance between the stomatal apparatus and the epidermal cells. This hypothesis is consistent with the greater relative sensitivity of stomata on leaves with a high crowding index. The results and the hypothesis are discussed in the light of selection for optimal productivity under differing conditions of RH and soil water availability, by observation of stomatal density and distribution on the 2 sides of the leaf. (AS)

0429

26178 HOZYO, Y.; MEGAWATI, M.; WARGIONO, J. 1984. Plant production and potential productivity of cassava (Manihot esculenta Crantz). Bogor, Indonesia, Central Research Institute for Food Crops. Contributions no.73. 20p. Engl., Sum. Engl., Indon., 7 Refs., Illus. (Central Research Inst. for Food Crops, Jalan Merdeka 99, Bogor, Indonesia)

Cassava; Cultivars; Leaves; Leaf area; Light; Plant physiology; Dry matter; Roots; Plant height; Growth; Indonesia.

Plant production and potential productivity of cassava were investigated during the 1981 and 1982 growing seasons at Cikeumeuh exptl. farm of Bogor Research Institute for Food Crops (Indonesia). DM production and tuberous root growth were measured and indices of plant production were analyzed. The CGR and NAR had high values in the active thickening and maturation growth stages. The orientation adjustment of the leaf blade was observed. This movement adjusted the reception of incident solar radiation throughout the day. Variations in the angle were described by the inclination, subinclination, and direction angles. The potential productivity of cassava was analyzed using grafts combining scion and stock of 2 cv. and 1 local var. The potential productivity of the tuberous root was found to be independent of scion character. However, the scion was a secondary influence of root thickening if the stock was of a late root thickening type. (AS)

0430

26368 MELIS, R.J.M.; VAN STADEN, J. 1985. Tuberization in cassava (Manihot esculenta): cytokinin and abscisic acid activity in tuberous roots. Journal of Plant Physiology 118(4):357-366. Engl., Sum. Engl., 26 Refs., Illus. (Plant Development Research Unit, Dept. of Botany, Univ. of Natal, Pietermaritzburg 3200, Republic of South Africa)

Cassava; Plant growth substances; Roots; Analysis; South Africa.

The nature and distribution of cytokinins and ABA in tuberous roots of cassava were studied. Trans-ribosylzeatin, dihydrozeatin, and trans-zeatin were tentatively identified as the major cytokinins in tuberous root extracts. Cytokinin activity was concentrated in the meristematic region of the secondary xylem and in the phloem. This suggests a role for cytokinins in the regulation of meristematic activity, which is responsible for the growth of the tuberous roots. Some cytokinin activity, which coeluted with cytokinin glucosides, was found in extracts from the phloem. Inhibitor activity, which was tentatively identified as cis-ABA, was present in tuberous root extracts. The activity of this hormone did not vary greatly between the different tissues analyzed. (AS)

0431

25585 BARRIOS, J.R. 1984. Contribución al estudio del vigor y del desarrollo inicial de las estacas de yuca (Manihot esculenta Crantz). (Contribution to the vigor and initial development of cassava cuttings). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:15-54. Span., Sum. Span., 42 Refs., Illus. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Cuttings; Germination; Timing; Dry matter; Roots; Leaves; Shoots; Leaf area; Brazil.

An expt. was conducted in the Escuela Superior de Agricultura Luiz de Queiroz (Piracicaba, Brazil) to determine the performance of 2 cassava cv. in relation to vigor and initial development when planted in sand propagators. During 2 periods, cuttings 5, 10, 15, and 20 cm long were used to evaluate the following variables: budding percentage; rate of emergence; total, aerial part, and root DM wt.; mean DM wt. of leaves and shoot stems; and mean and total leaf areas. Results show that cutting vigor during initial development is directly related to cutting size, within the limits studied. (AS-CIAT)

0432

25774 BELTRAN, J.; NARVAEZ, J.; REYES, R.; ROCA, W.M. 1984. Efecto de la concentración de nitrógeno, citoquininas, carbon activado y del volumen del recipiente sobre el crecimiento y viabilidad de los cultivos. (Effect of the nitrogen concentration, cytokinins, activated carbon, and the volume of the container on crop growth and viability). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.128-134. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; Plant growth substances; Growth; Leaves; Tissue culture; Colombia.

The effect of N, BAP, ABA, activated carbon, and the size of the container on the growth, development, and viability of cassava cv. M Col 22 and M Col 1467 cultivated in vitro was studied. Forty micromoles of total N in the medium allowed reduced growth and an acceptable viability of the material to be maintained. At low BAP concn. and high saccharose concn., or vice versa, at high BAP concn. and low saccharose concn., there is a high rate of viability. Growth was not accelerated by 2.5 milligrams ABA/liter. Viability was greater in the material cultivated in a medium with activated carbon and in larger containers. The use of activated carbon and larger containers also reduced leaf fall. (CIAT)

0433

25770 CORAL, J.C.; MAFFLA, G.; ROA, J.C.; ROCA, W.M. 1984. Efecto del cultivo de meristemos sobre el vigor y rendimiento de dos variedades de yuca Manihot esculenta Crantz. (Effect of meristem culture on the vigor and yield of two cassava varieties). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.176-182. Span.

Cassava; Cultivars; Apical meristems; Productivity; Cuttings; Leaves; Branching; Colombia.

The effect of meristem culture on the yield and vigor of cassava cv. Llanera and CMC-40 was studied. In both cv. an increase in root and propagation material productivity was observed. Llanera plants propagated through meristem culture showed an enlargement of the leaf lobes and a thicker mesophyll. The possible reasons for these changes are discussed. (CIAT)

0434

26337 INDIRA, P.; RAMANUJAM, T. 1979. Screening of varieties for salt and drought tolerance in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.70-72. Engl.

Cassava; Cultivars; Salinity; Germination; Cuttings; Fertilizers; N; P; K; Water requirements (plant); Timing; India.

Cuttings of var. H-165, H-226, H-97, and M-4 were planted in pots containing 1000, 2000, and 3000 ppm NaCl to select cassava var. tolerant to salinity; their germination was observed. Ten replications were made for each var. In pots containing 1000 ppm NaCl, only 66.6 percent of H-97 survived; in the remaining var. the percentage of survival was of 16.6. At 2000 ppm only H-97 survived (17.0 percent) and at 3000 ppm none of the var. survived. Based on selection by K:Na ratio, 14 var. were planted in pots with the recommended NPK dose and 1000 ppm NaCl. After 1 mo., leaf samples were taken to analyze K and Na contents. Var. Ce 22, S-1315, H-398, H-648, H-226, and H-1253 were tolerant to salinity; H-165, H-97 (2), H-1687, H-1423, H-97, and H-207 were moderately tolerant, and M-4 and H-2304 susceptible. The same 14 var. were used in the study on tolerance to drought. Artificial drought was induced by reducing the soil MC to 50 percent of the original level and the relative water contents of the var. were determined at the 7th, 8th, and 9th mo. Var. S-1315, H-165, H-226, H-97, H-648, Ce 22, and H-207 were tolerant to drought. (CIAT)

0435

26358 MABANZA, J.; RODRIGUEZ, A.V. 1986. Le bouturage in vitro du manioc. (In vitro cassava propagation by cuttings). Brazzaville, République Populaire du Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 4p. Fr., 8 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Republique Populaire du Congo)

Cassava; Clones; Tissue culture; Plant growth substances; Rooting; Culture media; Congo.

The in vitro performance of 2 local clones and 1 from the International Institute of Tropical Agriculture was studied using different plant growth substances. The results demonstrated that cassava clones grown in vitro differ in their performance depending on the culture medium used and that it is useful to grow certain clones in a shoot growth culture medium for 10 days and then transfer them to a whole-plant growth culture medium. (CIAT)

0436

25586 MANTILLA, J.E. 1984. Propagación de yuca (Manihot esculenta Crantz). Alternativa para incrementar la tasa de multiplicación. (Cassava propagation. Alternative to increase the multiplication rate). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:55-72. Span., Sum. Span., 6 Refs., Illus. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Cuttings; Propagation; Shoots; Germination; Timing; Plant height; Root productivity; Venezuela.

Cuttings of cassava cv. UCV 2112 (20 and 5 cm long) were planted directly in the field to increase cassava propagation material. From short cuttings emergence percentage at 30 days was 84.3 and 98.4 percent for 5- and 20-cm-long cuttings, resp. The no. of useful stems/plant for use as propagation material was 2.1 and 3.4 for the 5- and 20-cm-long cuttings, resp. Yield of commercial roots/plant was 0.93 and 1.75 kg for the 5- and 20-cm-long cuttings, resp. The 20-cm-long cuttings were found to perform better; however, when propagation material is scarce for seedbeds, it is feasible to triplicate the planting area by using 5-cm-long cuttings with the same amount of cassava stems and to increase the multiplication rate up to 2.1 times with respect to that of 20-cm-long cuttings, in identical management conditions (upland planting). (AS-CIAT)

0437

25587 MIRELES, M.; PAEZ DE CASARES, J. 1984. Inducción de "roseta" en yuca (Manihot esculenta Crantz) para la propagación múltiple de la planta in vitro. (Induction of rosette in cassava for in vitro multiple propagation of the plant). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:73-81. Span., Sum. Span., 13 Refs., Illus.

Cassava; Cultivars; Tissue culture; Apical meristems; Culture media; Plant growth substances; Venezuela.

The induction of rosette in the system of multiple propagation from different sized apical meristems of cassava cv. UCV-2578 from the germplasm bank of the U. Central of Venezuela was studied using various levels of NAA and BAP. A solid Murashige and Skoog medium was used with variations in the organic components. The crops were incubated at 25 more or less 2 degrees Celsius, 2000 lux, and 16 h of light. The induction of the rosette occurred in the 7th wk. Larger apexes gave the best response in formation of rosettes and among these, the combination of NAA-BAP had a synergistic effect, presenting the highest percentage of apex induction and the greatest rosette vigor. Treatments that included the highest doses of BAP showed a reduction in apex size and those with the highest NAA dose produced granular brown-colored callures and had not become organogenic by the end of the expt. (AS-CIAT)

0438

26348 NAIR, N.G. 1979. Development of disease free genetic stock. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.99-106. Engl.

Cassava; Tissue culture; Apical meristems; Temperature; Plant growth substances; Plant tissues; Cultivars; India.

The effect of 4 plant growth regulators on the morphogenesis of cassava meristem tips was studied. BAP was the best for morphogenesis, followed by zeatin and kinetin. To study the effect of growth regulators on the induction of morphogenesis from internodal segments of cassava, diseased plants of var. M-4 and Kalikalan were used as sources of the internodes. No morphogenesis was observed. Over 100 meristems each from heat-treated and nontreated diseased (CAMV) cassava meristems were cultured. In both cases regenerated plants remained symptom-free up to the potting stage. (CIAT)

0439

25773 NARVAEZ, J.; BELTRAN, J.; REYES, R.; ROCA, W.M. 1984. Efecto de la iluminación y la temperatura sobre el crecimiento y la viabilidad de los cultivos. (Effect of the illumination and temperature on crop growth and viability). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.135-140. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; Illumination; Temperature; Storage; Colombia.

The effect of light (0, 50, and 500 lux) and low temp. (10, 15, and 20 degrees Celsius) on cassava var. M.Col 22 grown in vitro was studied. The best treatment was that consisting of 20 degrees Celsius during the day and 10 degrees Celsius during the night and 500 lux since the no. of green leaves was highest and the viability of the axillary buds and tips was close to 100 percent. (CIAT)

0440

25688 PAEZ DE CASARES, J. 1984. Brotes foliares in vitro y su producción a partir de ápices caulinares para la micropropagación de la yuca (Manihot esculenta Crantz). 1. Efecto del agar. (Leaf shoots in vitro and their production from cauline tips for cassava micropropagation. 1. The effect of agar). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:83-99. Span., Sum. Span., 21 Refs., Illus. (Univ. Central de Venezuela, Laboratorio de Cultivo de Tejidos, Inst. de Agronomía, Facultad de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Apical meristems; Tissue culture; Culture media; Venezuela.

To produce leaf shoots, and then multiply them in vitro by means of microcuttings, of cassava cv. Tempranita (short cycle) and Cubana (intermediate cycle), 1-mm-long apexes were placed in a solid medium containing basic Murashige and Skoog salts with the organic constituents saccharose, thiamine-HCl, inositol, BAP, NAA, and GA. Four commercial brands of agar were tested: Oxoid (Oxoid Limited), Phytagar (GIBCO), Bacto (DIFCO), and Purificado (DIFCO), in 0.3 and 0.4 percent concn. Implanted material was placed under white cold light (2000 lux) for 16 h/day at 24 more or less 2 degrees Celsius and 50-75 percent RH. Shoot height was highly significative for cv. Tempranita after the 3rd wk.; at the 6th wk., shoots of both cv. were apt for cutting, leaving an axillary bud or terminal, and induced to root. Using the Purificado agar resulted in the best shoot height in both cv.; but, at the same time, this agar resulted in 2 adverse effects: a large no. of roots in cv. Cubana (less in cv. Tempranita) and callus of greater diameter in both cv. In addition, this agar is the most expensive of all used. Shoot formation was acceptable using Phytagar; shoot height did not reach that obtained with Purificado, but callus of smaller diameter and a small no. of roots were found in cv. Cubana, which generally shows a larger no. of roots. Therefore, this agar could be used at 0.4 percent since favorable responses are obtained in both cv. (AS-CIAT)

0441

26376 RAMANUJAM, T. 1985. Leaf density profile and efficiency in partitioning dry matter among high and low yielding cultivars of cassava (Manihot esculenta Crantz). Field Crops Research 10(4):291-303. Engl., Sum. Engl., 28 Refs., Illus. (Central Tuber Crops Research Inst., Trivandrum 695 017, Kerala, India)

Cassava; Cultivars; Plant development; Canopy; Leaves; Leaf area; Growth; Dry matter; Roots; Shoots; India.

The LAD and efficiency in partitioning DM for root growth were studied using cassava cv. M4, H 165, H 1423, H 2304, Ce 22, and Ci 590 which differ in their yielding ability. Low yielding cv. (M4, Ci 590, H 1423, and Ce 22) maintained either suboptimum (over 2) or supraoptimum (less than 4) levels of LAI during the major growth period and this adversely affected their light utilization efficiency. Negative correlation was shown between LAD and light transmission ratio. For better light interception and utilization, a LAI of 2.5-3.5 was optimum. Cv. difference in DM partitioning for root growth was noticed, ranging from 0.3 to 0.7/g DM. Cv. Ci 590 was most efficient (70 percent harvest efficiency) in utilizing DM for storage root growth. The leaf density profile suggested that Ci 590 productivity could be raised by increasing plant density. DM distribution between shoot and root was linearly related with total biomass. The HI was more or less constant after the 4th mo., with the onset of root bulking, to final harvest. (AS)

0442

26335 RAMANUJAM, T. 1979. Effect of growth regulators on cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.59-60. Engl.

Cassava; Plant growth substances; Cultivars; Root productivity; Plant height; Leaves; Roots; India.

The effect of 3 growth regulators on the productivity of 3 cassava var. (M-4, H-2304, and H-1687) was studied for 2 yr. Throughout the study none of the regulators affected the yield of the var. (CIAT)

0443

26334 RAMANUJAM, T.; INDIRA, P. 1979. Physiology of growth and development in cassava genotypes. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.40-58. Engl.

Cassava; Cultivars; Leaves; Leaf area; Canopy; Plant height; Root productivity; Plant development; Dry matter; Roots; Stems; Harvest index; Growth; Pruning; N; India.

Three expt. were carried out to study the physiology of growth and development of cassava var. In the 1st, the physiological variations, canopy growth, LAI, HI, DM distribution, CGR, and root productivity were evaluated using cassava var. M-4, H-165, H-2304, H-97, Ce 161, Ci 288, H-1423, Ci 167, Ci 590, and Ce 22. The mean LAI of the 10 var. ranged from 1.26 to 3.75. Plant height and stem girth did not have any relationship with root yield; however, stem girth was related to total DM production. In the 2nd, the nonbranching var. H-1687, H-2304, and M-4 were used to study the effect of topping at the 2nd, 3rd, and 4th mo. of growth on LAI. Plant height did not differ notably except when the topping took place at the 2nd mo. Except for var. M-4, the root no. was not affected by the topping. In the 3rd expt., LAI was studied in relation to N nutrition in var. H-2304. No significant changes in plant height were observed among treatments when the dose of N was larger than 100 kg/ha. The LAI was highly influenced by N up to 150 kg/ha. The CGR was very high at 250 kg N/ha in relation to the control. The root yield and no. increased significantly with N application, but above 150 kg/ha no effect was observed. (CIAT)

0444

25769 REYES, R.; ROCA, W.M. 1984. El cultivo de embriones in vitro como herramienta para la conservación e intercambio de especies silvestres de Manihot. (In vitro embryo culture as a tool for the conservation and exchange of wild Manihot species). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.301-306. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Manihot; Tissue culture; Culture media; pH; Colombia.

The work carried out at CIAT with embryo cultures for the conservation and exchange of wild Manihot species is described. Results indicate that the wild seeds require a pretreatment for their development, which consists in subjecting the seeds to 60 degrees Celsius for 20 days; the pH of the Murashige medium must be 5.5 and the saccharose concn. of 4 percent. (CIAT)

0445

25743 ROCA, W.M.; SZABADOS, L.; NARVAEZ, J.; BELTRAN, J.; REYES, R.; MAFLA, G.; ROA, J. 1985. Cassava tissue culture. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.173-204. Engl., Sum. Engl., 49 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Tissue culture; Apical meristems; Plant development; Rooting; Growth; Culture media; Germplasm; Morphogenesis; Temperature; Storage; Colombia.

Meristem and shoot tip culture techniques that have been utilized only in the last decade, mainly as a means for ridding selected cassava var. of viruses, are described in detail. More recently, the use of these techniques has been extended to the maintenance and international exchange of cassava germplasm. The future of cassava cryogenic storage is promising. Min. growth storage is now a viable method for maintaining large collections in small spaces free of pest and disease risks. International movement of in vitro cassava provides a valuable safeguard for minimizing the dangers of pest and disease dissemination. The embryo, cell, callus, protoplast, and anther culture methods are briefly discussed. (AS) See also 0462 0478 0509 0548 0556 0565 0616 0617 0623 0634 0651

0446

23944 MULINDABYUMA, J.M. 1983. Composition chimique de la patate douce et du manioc. (Chemical composition of sweet potato and cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et séiection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.107-118. Fr., Illus.

Cassava; HCN content; Cultivars; Sweet cassava; Bitter cassava; Rwanda.

Data related to the HCN content in fresh cassava, the HCN concn. in the steeping water, the ratios of the HCN concn. in the var. grown in Rubona and Karama (Rwanda), and the correlation between the solubility vs. humidity ratios at both sites are presented. The relationship between the starch and water contents of the sweet var. studied is also presented. Only the definition of the lethal dose and the resp. assessment of the min. HCN content determine the difference between sweet and bitter cassava. Indications of the performance of cassava var. can be obtained on the basis of the ecosystems and of the physical, chemical, and technical treatments to which they are submitted. (CIAT)

C03 CHEMICAL COMPOSITION, METHODOLOGY AND ANALYSES

0447

26134 HOLLOWAY, W.D.; MONRO, J.A.; GURNSEY, J.C.; POMARE, E.W.; STAGE, N.H. 1985. Dietary fiber and other constituents of some Tongan foods. Journal of Food Science 50(6):1756-1757. Engl., Sum. Engl., 15 Refs. (Applied Biochemistry Division, Dept. of Scientific & Industrial Research, Palmerston North, New Zealand)

Cassava; Water content; Food energy; Protein content; Fat content; Sugar content Starch content; Ash content; Fibre content; Tonga.

Components of dietary fiber (soluble nonstarch polysaccharide, pectin, hemicellulose, cellulose, and lignin), water, energy, protein, lipids, and starch were measured in banana, breadfruit, cassava, coconut, mango, pawpaw, plantain, sweet potato, taro, and Pacific yam, all from Tonga. Tongan foods were generally higher in dietary fiber than New Zealand foods, consistent with the hypothesis that dietary fiber is an important factor contributing to a lower incidence of certain gastrointestinal disorders in Tonga than in New Zealand. Cassava total dietary fiber content was 13.4 percent. (AS)

0448

26303 MAMAT, E.; RAGAB, M.H.H. 1971. Rapid determination of starch in tapioca tubers for control purposes. Serdang, Selangor, Food Technology Research and Development Centre of Malaysia. Report no.49. 21p. Engl., Illus.

Cassava; Starch content; Analysis; Malaysia.

Three methods to rapidly determine the starch content of cassava roots are described in detail, namely, the specific gravity, the iodine, and the anthrone methods. (CIAT)

0449

21456 PALAFOX, A.L. 1982. Animal sciences. In Guam Agricultural Experiment Station. Annual Report 1982. Mangilao, Guam, University of Guam. College of Agriculture and Life Sciences. pp.55-57. Engl., Sum. Engl., Illus.

Cassava; Cultivars; Composition; Ash content; Mineral content; Ca; P; K; Na; Mg; Cu; Fe; Mn; Zn; Leaves; Petioles; Roots; USA.

In Guam, 6 cassava cv. were evaluated to determine and differentiate their potential for human and animal nutrition. The growth and the color of stems, petioles, leaves, and roots were observed and data were taken on the no., wt., diameter, and circumference of roots; the chemical composition of leaves and petioles was also studied. The ash content varied between 6.35-7.04 percent for the leaves and between 9.25-11.15 percent for the petioles. With the exception of Mg, Cu, and Fe, the mineral content was higher in the petioles than in the leaves. Cv. GAB 2 produced the heaviest root and cv. PAL 1 the lightest (5.59 and 2.94 kg, resp.). In general, the cv. that produced the heaviest roots also produced the heaviest stems and leaves. (CIAT)

0450

26193 TELES, F.F.F.; OLIVEIRA, J.S.; SILVEIRA, A.J.; BATISTA, C.M. 1985. Fatty acids, carbohydrates and crude protein in twenty cassava cultivars (Manihot esculenta Crantz). Journal of the American Oil Chemists' Society 62(4):706-708. Engl., Sum. Engl., 10 Refs. (Depto. de Química, Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil)

Cassava; Cultivars; Fat content; Protein content; Carbohydrate content; Analysis; Brazil.

Twenty cassava cv. were analyzed for fatty acids, nonstructural carbohydrates, and CP contents. The main constituent fatty acids were myristic, palmitic, stearic, oleic, linoleic, and linolenic. Trace amounts of lauric, myristoleic, and palmitoleic acids were detected. Saturated acids ranged from 26.58 to 58.05 percent. Acid-digestible carbohydrates ranged from 11.82 to 40.70 percent of the green matter. Reducing and nonreducing soluble oligosaccharides were also determined. CP ranged from 1.39 to 4.70 percent of the DM. Linear regression analyses were made, but no significant correlations were found. Some possible genetic relationships are proposed for certain cv. (AS) See also 0446 0487 0495 0509 0633 0636 0651

0451

26341 BALAGOPAL, C.; POTTY, V.P. 1979. Plant microbe-interrelationship in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.79-80. Engl.

Cassava; N; Rhizobium; Inoculation; Growth; India.

The influence of cassava leaf shedding on the ammonification and nitrification process in a laterite soil was studied; the nitrification rate was constant after 105 days of incubation. The inoculation of Azotobacter did not have any effect on the growth of cassava nor were there significant differences among treatments. (CIAT)

0452

25792 BURCKHARDT, E.A.; HOWELER, R.H. 1985. Efecto de la inoculación de cepas de micorriza sobre el crecimiento de la yuca en varios suelos naturales en el invernadero. (Effect of the inoculation of mycorrhizal strains on the growth of cassava in several natural soils in the greenhouse). In Sieverding, E.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.140-153. Span., Sum. Span., 5 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Inoculation; Soil physical properties; Cultivars; Erosion; Growth; Fertilizers; P; Colombia.

A series of trials were conducted to evaluate the response of cassava to inoculation with mycorrhizal strains under various levels of P fertilization, in different natural soils and in eroded soils of cassava-growing regions in Colombia. Only strains C-1-1 (Glomus manihotis) and C-10 (Entrophospora colombiana) resulted in significative responses in the soils used. The remaining strains had a response similar to the av. of native strains. When inoculating cassava with strain C-1-1 and applying 3 doses of P in 6 natural soils, a response to P fertilization was observed only at the 100 kg/ha level. The effect of inoculation was measured with various strains in 10 natural soils, and only in the soils of Carimagua (Reserva and Alegría) a highly significant response was obtained due to the low efficiency of native mycorrhizae and to the low fertility of these 2 soils. (AS-CIAT)

0453

25791 HOWELER, R.H. 1985. Aspectos prácticos de la investigación de micorrizas vesículo-arbusculares demostrados en el cultivo de la yuca. (Practical aspects of the research on vesicular-arbuscular mycorrhizae, demonstrated in cassava). In Sieverding, E.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.44-61. Span., Sum. Span., 2 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Inoculation; Soil physical properties; Soil analysis; Cultivars; pH; Fertilizers; P; N; K; Soil fertility; Dry matter; Field experiments; Laboratory experiments; Colombia.

Results of trials on field inoculation of cassava with vesicular-arbuscular mycorrhizal strains in Carimagua and Mondomo (Colombia) were registered. Some strains such as C-1-1 (Glomus manihotis) were found to be adapted to various edaphoclimatic conditions, while others can be more specific to

certain conditions. In greenhouse trials it was confirmed that some vesicular-arbuscular mycorrhizal strains present differences in their tolerance to soil acidity and fertility, as well as to the levels of N and K fertilization. In greenhouse trials some important factors were also determined for the production of vesicular-arbuscular mycorrhizal inoculum to obtain effective sources of inoculum. These trials sought to find a more efficient and practical method for sterilizing the soil and selecting the substrate and the host plant. Finally, there is an explanation on how to handle infected rootlets, if they are to be utilized as sources of vesicular-arbuscular mycorrhizal inoculum in cassava. (AS-CIAT)

0454

25744 HOWELER, R.H. 1985. Mineral nutrition and fertilization of cassava. A review of recent research. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.249-320. Engl., Sum. Engl., 66 Refs., Illus.

Cassava; Soil physical properties; N; P; K; S; Ca; Mg; Nutrient uptake; Mineral deficiencies; Soil analysis; Plant tissues; Mineral content; pH; Al; Zn; Mn; Salinity; Fertilizers; Manures; Timing; Colombia.

Recent research on mineral nutrition and fertilization of cassava is reviewed. Cassava grows relatively well on acid and infertile soils; however, for high yields the crop requires high levels of fertilization, especially K, which is removed in large quantities with each root harvest. In many acid infertile soils it is recommended to apply a small amount of dolomitic lime (or calcitic lime with MgO) to supply Ca and Mg as nutrients. Initially P is often the most limiting element, but after a few years the level of P application can be reduced while that of K should be increased to prevent soil K exhaustion. Although the plant has large amounts of N in both tops and roots, much of this is returned to the soil in fallen leaves and is recycled. Except in very sandy and low OM soils there is a lower response to application of N than of P or K. Of the minor elements, Zn is the most important; it can be supplied cheaply as a cutting treatment in 2-4 percent $ZnSO_4.7H_2O$ solution. In general it is recommended to apply rather insoluble fertilizers or soil amendments broadcast and incorporated preplanting, while highly soluble sources are best band applied near the cutting all at time of planting or split applied at planting and 2-3 mo. later in sandy soils. (AS)

0455

25512 JONAS, J. 1984. Panama installs cassava experiment. Benchmark Sites News 8(3-4):5,8. Engl.

Cassava; Research; Cultivars; Al; Agricultural lime; Leaf area; Root productivity; Branching; Panama.

As part of a cooperative research effort with International Benchmark Sites Network for Agrotechnology Transfer, the Instituto de Investigación Agropecuaria de Panamá established 2 cassava expt. in May 1984, in a Typic Tropudult of Ocu in the Province of Veraguas. One expt. was designed to study the differential response of cassava cv. to Al toxicity and the other to observe the response of cassava to increasing application rates of lime. Preliminary results of the 1st expt. showed a range of branching habits that appeared to be var. in character; data indicated that root yield performance is not associated with dominance of a particular branching habit. Also, no clear relationship was found between LAI and root yield. In general, the results indicate the existence of local genotypes with the potential to produce relatively high yields under high Al content and low pH conditions. (CIAT)

0456

26333 MOHANKUMAR, B.; NAIR, P.G.; POTTY, V.P. 1979. Effect of sulphur containing fertil'zers on the yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.39-40. Engl.

Cassava; Cultivars; Fertilizers; S; Soil analysis; Root productivity; Starch content; HCN content; India.

The effect of several fertilizers with or without S on the yield and quality of cassava was studied in a randomized block design with 9 treatments and 4 replications. The soluble S content of the soil increased with the application of different levels of the S-containing fertilizers, but it decreased with the age of the crop. In general, the S-containing fertilizers produced a higher cassava root yield. The root starch content also increased with the application of S-containing fertilizers, but the HCN content decreased. (CIAT)

0457

26331 MOHANKUMAR, B.; MAINI, S.B. 1979. Influence of molybdenum and nitrogen on the yield and quality of cassava in acid laterite soil. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.35-36. Engl.

Cassava; Cultivars; Mo; N; Soil physical properties; Root productivity; HCN content; Starch content; Dry matter; India.

The effect of Mo and N on the yield and quality of cassava grown in an acid laterite soil was studied in a randomized block expt. with 16 treatment combinations and 3 replications. Increasing application rates of N significantly increased root yield but there was not a significant increase in yield due to Mo application. HCN content also increased as the level of N increased, but with increasing levels of Mo it decreased slightly. None of the treatments affected the starch and DM contents or the cooking quality of the roots. (CIAT)

0458

26330 NAIR, G.M.; PRABHAKAR, M. 1979. Effect of nitrogen and potash on tuber yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.33-34. Engl.

Cassava; N; K; Cultivars; Fertilizers; Dung; P; Root productivity; Dry matter; HCN content; India.

The effect of N and K on cassava root yield and quality was studied using 4 cassava var. (H-165, H-2304, H-1687, and M-4) and 10 NK combinations (50-50, 50-100, 50-150, 75-75, 75-150, 75-225, 100-100, 100-150, 100-200, and 100-250) in a split plot design. The FYM and P were applied in a uniform basal dose of 12.5 t and 75 kg/ha, resp. Var. H-2304 was superior to the other var. in root yield. The NK fertilizer combination of 100-100 was significantly superior to the combinations 50-50, 50-100, 50-150, 75-75, and 75-150, but not to the others. The influence of N was more pronounced regarding root production than that of K. Var. H-2304 also showed the highest root DM content (35.0 percent) and var. H-165 the lowest (26.5 percent). The fertilizers did not have any effect on root DM and HCN contents. The HCN content was significantly higher in var. H-165 and lower in var. H-1687 and M-4. The N:K ratio recommended as optimum for good yield and root quality is 100:100. (CIAT)

0459

25793 SIEVERDING, E.: CADAVID, L.F.; GALVEZ A., L. 1985. Ecología de la micorriza vesículo-arbuscular en yuca y el efecto de algunas prácticas agronómicas incluyendo la inoculación de campo sobre ella y la producción de yuca. (Ecology of the vesicular-arbuscular mycorrhiza in cassava and the effect of some agronomic practices, including field inoculation, on cassava and its production). In _____.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.194-208. Span., Sum. Span., 10 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Cultivars; Mulching; Temperature; Rainfall data; Inoculation; Root productivity; Colombia.

In a field trial in an Inceptisol (Quilichao, Colombia), rootlet infection of 2 cassava cv. was recorded during 1 yr, as well as the no. of spores of the vesicular-arbuscular mycorrhizae population. The effect that stubble mulching and field inoculation with Glomus manihotis had on the population of vesicular-arbuscular mycorrhizae was also determined. Overall, the infection of cassava roots was greater during rainy periods than in periods with less rainfall. Stubble mulching reduced infection, especially of M Ven 77, during the 1st half of the year. Infection increased 6 mo. after planting due to field inoculation with G. manihotis. The max. no. of spores was found 9 mo. after planting, thereafter decreasing until harvest; the no. of spores was always higher for cv. M Ven 77 than for M Col 638. The optimum no. of vesicular-arbuscular mycorrhizae spores was reached more rapidly (after 6 mo. of growth) in the stubble mulching treatment; these data also correspond to the field inoculation treatment. Without stubble mulching M Col 638 yields were lower than those of M Ven 77. Stubble increased yields significatively and both cv. yielded the same with mulching. Field inoculation increased yields, though not significatively; however, the C.V. of yield decreased due to inoculation. (AS-CIAT)

0460

25745 SIEVERDING, E.; HOWELER, R.H. 1985. Function of vesicular-arbuscular mycorrhiza for cassava growth. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.321-339. Engl., 16 Refs., Illus.

Cassava; Mycorrhizae; Growth; P; Nutritional requirements; Nutrient uptake; Inoculation; Colombia.

The symbiosis mycorrhiza/plant root, the distribution and function of vesicular-arbuscular mycorrhizal (VAM) fungi, and the importance of these in the nutrient uptake by the plant are described. The dependence of cassava on the VAM fungi is analyzed; the obtainment of inoculum sources and methods of field inoculation are described in detail. In relation to their function, the VAM fungi Glomus manihotis and Entrophospora colombiana have demonstrated to be more efficient than the native mycorrhizal populations. The collection, isolation, and maintenance of VAM fungal isolates, the screening procedures in the greenhouse (efficiency in P uptake and ability to compete with native mycorrhiza), and the transfer of technology are discussed. (CIAT)

0461

26379 SIEVERDING, E.; HOWELER, R.H. 1985. Influence of species of VA mycorrhizal fungi on cassava yield response to phosphorus fertilization. Plant and Soil 88(2):213-221. Engl., Sum. Engl., 22 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Cultivars; Field experiments; Laboratory experiments; Fertilizers; P; Colombia.

At 3 different sites with acid soils in Colombia, field trials with cassava were monitored for frequency of vesicular-arbuscular mycorrhiza. Increasing levels of P from 0 to 200 kg/ha had been applied. The fields differed in the composition of species of vesicular-arbuscular mycorrhizal fungi. At all sites, infection of the roots by the total mycorrhizal population decreased with increasing P fertilization, but at 2 sites the relative frequency and activity of 1 species, Glomus manihotis, increased with increasing P applications. This species was only present at 2 sites, and only in these sites a cassava yield response to up to 200 kg P was found. The differential activity of fungal species was confirmed in greenhouse trials, where Entrophospora colombiana was found to be most effective at 50 kg P and G. manihotis at 200 kg P. (AS) See also 0443 0464 0466 0617 0623

D00 CULTIVATION

See 0543

D01 SOIL, WATER, CLIMATE AND FERTILIZATION

0462

25208 AZEVEDO, J.N. DE 1985. Adubacao mineral radicular e foliar comparadas na cultura da mandioca (Manihot esculenta Crantz). (Comparison between root and leaf mineral fertilization in cassava). Tese Mestrado. Areia-PB, Brazil, Universidade Federal da Paraiba. 97p. Port., Sum. Port., Engl., 63 Refs., Illus.

Cassava; Climatic requirements; Temperature; Rainfall data; Soil physical properties; Land preparation; Agricultural lime; Planting; Spacing; Cultivars; Soil analysis; Fertilizers; N; P; K; Leaves; Roots; Dry matter; Starch content; Root productivity; Productivity; Plant height; Harvest index; Mineral content; Statistical analysis; Economics; Costs; Income; Brazil.

Comparative studies of the effects of the chemical fertilization of the roots and leaves of cassava were carried out on a medium textured dystrophic Latossol in Areia (Paraiba, Brazil) in 1983-84. A randomized block design in a 2(3) + 1 factorial arrangement was used with 9 treatments and 5 replications. Root fertilization rates were 50 kg N + 80 kg P + 40 kg K/ha, the N being applied in 2 periods and the other nutrients at planting. Foliar fertilization was applied at 60, 120, 210, and 270 days after the germination of the cuttings. Harvesting took place 12 mo. after planting. The parameters evaluated were wt. of roots and aerial parts, root DM content, stem diameter, plant height, starch content, root diameter and length, and HI. Root production was 16.32 and 9.80 t/ha for the root- and leaf-fertilized plants, resp. The root-applied P significantly influenced all the parameters studied except wt. of the fresh leaves and HI. Leaf-applied N enhanced the production of fresh leaves, although not significantly. K presented a positive and significant interaction with P for: root yield; root DM; total canopy, stem, and fresh leaf DM contents; plant height; and leaf K and P contents at 120 and 270 days, resp., after total germination of cuttings. N showed a positive and significant interaction with P for the production of fresh leaves and with the K for stem diameter and leaf P content at 60 and 270 days after the germination of the cuttings. In relation to the economic analysis, the most profitable treatment was that in which N was applied to the leaves and P and K to the roots. (AS)

0463

24732 BENVENUTI, G.; CRUZ, L.; CEDEÑO, J.; BARCIA, O.; VILLAVICENCIO, A.; TOAPANTA, C.; VALDIVIA, V. 1976. El cultivo de la yuca: instrucciones prácticas. (The cultivation of cassava: practical instructions). Portoviejo, Ecuador, Ministerio de Agricultura y Ganadería. Programa de Tubérculos y Raíces. Proyecto FAO-ECU/71/522. Serie Cultivos no.5. 18p. Span., Illus.

Cassava; Cultivation; Soil physical properties; Soil analysis; Land preparation; Cultivars; Cuttings; Selection; Planting; Spacing; Timing; Fertilizers; Water requirements (plant); Weeding; Herbicides; Insecticides; Disease control; Harvesting; Root productivity; Storage; Rotational crops; Ecuador.

A practical manual with recommendations for the successful cultivation of cassava is presented. The recommended practices emphasize land selection and its proper preparation, soil analysis, planting of good cassava var.,

and the utilization of selected cuttings. Instructions are given for the planting of cuttings in vertical, slanted, or horizontal position, spacing and planting time, and adequate fertilization. Plant water requirements, manual and chemical weed control, chemical pest control and cultural disease control, pruning, yields, preservation of roots and cuttings, and the need of crop rotation (especially with legumes, maize, sesame, cotton, and others) are indicated. (CIAT)

0464

25259 HOWELER, R.H.; CADAVID, L.F. 1984. Prácticas de conservación de suelos para producción de yuca en ladera. (Soil conservation practices for the production of cassava on hillsides). Suelos Ecuatoriales 14(1):303-310. Span., 5 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; P; Nutritional requirements; Agricultural lime; Land preparation; Fertilizers; N; K; Dung; Erosion; Colombia.

To identify cultural practices that permit the cultivation of cassava on hillsides without causing damage to the soil, the results of research on cassava in the Mondomo region (Cauca, Colombia) regarding adapted cv., adequate fertilization, methods of soil preparation, and erosion control practices are presented. Among 21 cassava cv., planted in plots with 0 and 150 kg of P/ha, the best yields were obtained with P application and the cv. M Col 113, CMC 40, and CMC 92 (37.4, 26.4, and 34.3 t/ha, resp.). It was confirmed that once the soil is eroded, it is difficult to recover its productivity through fertilization since not only the nutrients of the vegetal cover are lost but also the water retention capacity, the good structure, and a large proportion of the mycorrhizae population. The fertilization recommended for the soils in the region consists of 100 kg N, 50 kg P, and 100 kg K/ha. Among 7 soil preparation treatments and cultivation practices in Agua Blanca, the least soil losses due to erosion and the highest yields (13.2 and 17.6 t/ha) were obtained (1) soil preparation with oxen, double cassava rows alternated with 1 m of Brachiaria and (2) without preparation and planting with a pick ax at 80 x 80 cm, with the application of lime and fertilizers. On hillsides, to improve the yields/ha it is required to have good fertilization, use adapted var. with good yield potential, select healthy and thick cuttings, control ants and white grubs, and have a good weed control. To better control the runoff, it is recommended to prepare the land and plant the crop in contour, plant strips of live grass barriers, cover the soil with maize or sugarcane mulch, and intercrop cassava with fast growing crops. (CIAT)

0465

24584 JACKSON, G.; BREEN, J. 1985. Cassava. In _____. Collecting, describing and evaluating root crops. Suva, Fiji, Food and Agriculture Organization of the United Nations. RAS/83/001. Field Document no.8. pp.6,8-11,38-46,59,61-62,64-68,80-84,91-95. Engl., 32 Refs., Illus. (Plant Protection Project, United National Development Program, Private Mail Bag, Suva, Fiji)

Cassava; Cultivation; Planting; Spacing; Fertilizers; Insecticides; Acaricides; Harvesting; Plant anatomy; Agronomic characters; Propagation; Cuttings; Amblypelta; Unaspis citri; Tetranychus; Cercosporidium henningsii; Cassava African mosaic virus; Selection; Oceania.

Recommendations on the cultivation (planting, fertilizers, weeding, pest control, harvesting) and rapid propagation techniques of cassava, sweet potato, yam, and edible aroids in the South Pacific are given. A list of descriptors for the identification of cassava is also presented as well as the evaluation guidelines. (CIAT)

0466

26332 MOHANKUMAR, B.; NAIR, P.G. 1979. Effect of level and frequency of lime application on the yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.36-39. Engl.

Cassava; Agricultural lime; Cultivars; pH; Soil analysis; P; Ca; Root productivity; Starch content; HCN content; Mineral content; K; Economics; India.

The effect of lime application on the yield and quality of cassava grown in a laterite soil was studied in a randomized block expt. with 15 treatments and 3 replications. Soil pH and exchangeable Ca content progressively increased as the level of lime increased. Lime application had a beneficial effect on the increase of available P, although the effect was not too pronounced due to the high initial P status of the soil. The root productivity and starch and P contents also increased with lime application, but the different levels of lime did not influence root HCN or K contents. (CIAT)

0467

23936 WILFRID, J. 1983. Influence des facteurs écologiques dans la croissance et le rendement de la patate douce (Ipomea batatas poi ·) et du manioc (Manihot esculenta Crantz). (Influence of ecological factors on the growth and yield of sweet potato and cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.28-36. Fr.

Cassava; Climatic requirements; Temperature; Rainfall data; Photoperiod; Soil requirements; pH; Nutritional requirements; Soil conservation practices; Rwanda.

The climatic (temp., photoperiod, alt., rainfall) and edaphic (soil pH) requirements of cassava in Rwanda are described. Soil preservation is discussed. (CIAT) See also 0434 0453 0454 0455 0456 0457 0458 0459 0470 0475 0477 0487 0490 0548 0549 0556 0610 0611 0616 0617 0620 0622 0623 0627 0630 0632 0633 0640 0643 0644 0646 0650 0653

0468

26180 COCK, J.H. 1986. Cassava production. In _____., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.17-22. Engl., 1 Ref. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Production; Cuttings; Growth; Plant development; Root productivity; Ecosystems; Propagation; Cultivation; Uses; Colombia.

The worldwide importance of cassava and its uses are mentioned, and the growth and development of cassava propagated through cuttings are described as well as the cultivation systems used for cassava production. (CIAT)

0469

25742 COCK, J.H. 1985. Rapid propagation techniques for cassava. In _____.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.165-171. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Propagation; Cuttings; Shoots; Growth-chamber experiments; Rooting; Leaves; Petioles; Temperature; Colombia.

Two techniques for rapid propagation of cassava developed at CIAT, multiple production of shoots and propagation of axillary buds, are described. The 1st requires the use of lignified cuttings, from which the shoots are removed to be rooted; each shoot consists of a node, an internode, an axillary bud, and a leaf. The 2nd uses unlignified material as propagules. Leaves with their axillary bud and a small portion of stem tissue are cut from healthy mother plants; the leaf lobes are cut so that the leaf forms a rosette. (CIAT)

0470

25270 FRESCO, L.; MUAKA, T.; N'TEN ANGIUNG, S.; PEETERS, L. 1983. Le manioc: variétés et techniques culturales; résultats des essais réalisés a Kingungi, Mosambo et Lobo (Bandundu). (Cassava: varieties and cultivation techniques; results of the trials carried out in Kingungi, Mosambo, and Lobo (Bandundu)). Zaire-Afrique no.176:355-362. Fr.

Cassava; Cultivars; Cultivation; Root productivity; Zaire.

A trial was conducted in 3 localities (Lobo, Mosambo, Kingungi) in Zaire to study 6 var. from the Programme National Manioc, 2 local var., 2 cultivation techniques (planting on ridges with or without burning and with or without green manure), and the planting site. Yields depended on the agroecological environment and the cultivation techniques, and varied from 1 to more than 20 t/ha according to the var. and the trial plot. After 12 mo. most of the var. show an av. superior to the one obtained traditionally as long as (1) planting is done at the beginning of the rainy season in fields left under fallow for several years; (2) healthy 20-25 cm cuttings, a plant density of 10,000 plants/ha, and contour ridges are used; and (3) weeding is practiced regularly. (CIAT)

0471

26179 GLOBAL WORKSHOP ON ROOT AND TUBER CROPS PROPAGATION, CALI, COLOMBIA. 1983. Proceedings of a Regional Workshop. Cock, J.H., ed. Cali, Centro Internacional de Agricultura Tropical. 240p. Engl., 192 Refs., Illus.

Cassava; Cuttings; Propagation; Production; Uses; Cultivars; Timing; Fertilizers; N; P; K; Storage; Mycoses; Injurious insects; Injurious mites; Viroses; Disease control; Insecticides; Colombia.

Papers presented at the Global Workshop on Root and Tuber Crops Propagation, held in Cali, Colombia, were related to seed or planting material of the following crops: potato, cassava, sweet potato, yam, and cocoyam. Aspects covered were production systems, seed production, physiology and sanitary problems, rapid propagation techniques, and storage. The papers related with cassava are recorded individually in this publication under the following consecutive no.: 0468, 0472, 0476, 0477, 0478, 0479, 0481, 0483, 0484, 0486, and 0511 (CIAT)

0472

26188 GONZALEZ L., V.W. 1986. Production of cassava planting material in Mexico. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.193-196. Engl., 6 Refs.

Cassava; Cuttings; Cassava programs; Cultivars; Propagation; Mexico.

The propagation project of the cassava research program in Mexico is described. The multiplication is based on the 2-node cutting method, and the main var. used are Costeña and Sabanera. It is important to note that in Mexico, at present, no standards exist for the certification of cassava planting material, and as a result, phytosanitary control is only exercised when the cuttings are handed over to the farmers. (CIAT)

0473

26160 INDUSTRIA DE POLVILHO TRADICAO. BRASIL. s.f.. Conheca a cortadeira de ramas Tradicao. (Get to know the traditional stem cutter). Jaboti-PR, Brasil. 1p. Port., Illus.

Cassava; Stems; Cuttings; Agricultural equipment; Mechanization; Brazil.

The advantages of a cassava stem cutter for the uniform production of cuttings are indicated and a photo is included. Also included are the addresses where additional information can be obtained. (CIAT)

0474

26322 KAMALAM, P. 1979. Development of disease free genetic stocks. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.17-18. Engl.

Cassava; Cuttings; Propagation; Root productivity; Cultivars; India.

Single-node and 2-node cuttings of cassava cv. H-2304, together with control cuttings (20 cm long), were planted directly in the field with 4 replications at 2 different spacings (90 and 45 cm) for each treatment. The harvest took place at 9 mo. in 1978 and at 14 mo. in 1979. The 2-node and the control cuttings, spaced at 45 cm, gave significantly superior yields than the other treatments in both years. (CIAT)

0475

24583 KRAMER, M. 1981. La siembra de la yuca: impresiones recogidas de la literatura, y propuesta de una investigación de campo en La Sierra. (Cassava cultivation: concepts collected from the literature, and a proposal for field research in La Sierra). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 17p. Span., 16 Refs.,

Illus. (Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana)

Cassava; Production; Bitter cassava; Erosion; Planting; Cuttings; Soil conservation practices; Intercropping; Dominican Republic.

Based on a literature review, the planting conditions of cassava (cuttings, position, depth), possibilities to control erosion, and a proposal of field research in La Sierra (Dominican Republic) are presented. (CIAT)

0476

26181 LEIHNER, D.E. 1986. Current practices in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.41-45. Engl., 7 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Selection; Colombia.

The current practices (selection, cutting, preparation, and handling before planting) used for the production of cassava cuttings are reviewed, and the aspects that require improvement are discussed. It is suggested to use healthy, mature cuttings of the proper length, nondamaging cutting practices, and chemical protection. (CIAT)

0477

26182 LEIHNER, D.E. 1986. Physiological problems in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.57-72. Engl., 4 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Cultivars; Timing; Harvesting; Dry matter; Starch content; Roots; Root productivity; Germination; Plant tissues; Planting; Spacing; Fertilizers; N; P; K; Colombia.

The influence of the genotype, the age of the plant and plant tissue, the planting density, and NPK fertilization on the production of cassava planting material is reviewed. Cv. differ widely in their ability to produce planting material; this ability is greatly influenced by the distribution of top growth among parts useful and those not useful for cutting production. The ratio of suitable stem material to total top dry wt. is particularly high in cv. with a late branching and erect growth habit. Cutting production increases with plant age, reaching an optimum in some cases and continuing to increase in others. Besides plant age, the age of tissue within the plant seems to have an influence on the performance of the cuttings in a subsequent crop. Cuttings coming from the lower and middle portion of the primary stems (older tissue) are normally thick and have large carbohydrate reserves. This leads to fast sprouting and vigorous early growth. Cuttings from younger tissue sprout more slowly, but they produce higher commercial and total root yields. It is feasible to use higher than normal planting densities if an increased cutting production in limited space is desired. Plant nutrition interacts with genotypic characteristics in modifying growth habit; therefore, good natural soil fertility or a modest fertilization on poor soils should be adequate to optimize cutting production. (CIAT)

0478

26185 LEIHNER, D.E. 1986. Storage and regeneration of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops

Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional ce Agricultura Tropical. pp.131-138. Engl., 6 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Storage; Water content; Phenacoccus; Fusarium; Diplodia; Glomerella; Curvularia; Aspergillus; Germination; Colombia.

The factors related to cassava cutting deterioration during storage were identified, and the control of such factors through appropriate cutting management is discussed. The water loss and viability, the insects and fungi that infest the cuttings during storage, and the effect of long-term storage on germination are analyzed. Expt. in which stored cassava cuttings were soaked in water or in a nutrient solution to improve germination vigor are described. The best results were obtained when the cuttings were soaked for 240 min, either in water or in the nutrient solution. In the latter case, the root yield was higher than that obtained with fresh cuttings. (CIAT)

0479

26183 LOZANO, J.C.; BELLOTTI, A.; VARGAS, O. 1986. Sanitary problems in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.74-85. Engl., 26 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Storage; Glomerella cingulata; Fusarium; Diplodia; Rosellinia; Sclerotium rolfsii; Mononychellus; Thrips; Neosilba perezi; Carpolonchaea chalybea; Anastrepha manihoti; Anastrepha pickeli; Erwinia carotovora; Phenacoccus; Armillariella; Aonidomytilus albus; Saissetia nigra; Chilomina clarkei; Lagochirus; Coelosternus; Lepturges; Euleeriops manihoti; Agrotis ipsilon; Phyllophaga; Leucopholis rorida; Insecticides; Colombia.

The pathogens (fungi, viruses, and mycoplasmas) and pests (insects and mites) that can attack cassava planting material before harvest, during storage, and after planting are presented. The pathological problems that occur, if proper sanitary measures (clean propagation material, clean rooting media, and clean tools) are not taken, are discussed. Finally control measures are detailed. (CIAT)

0480

23939 MULINDANGABO, J. 1983. Diverses méthodes de propagation du manioc. (Several methods for the propagation of cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rutona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.52-59. Fr.

Cassava; Propagation; Cuttings; Seed; Cultivars; Rwanda.

The methods of sexual (seeds) and vegetative (cuttings) propagation of cassava used in Rwanda are described. For sexual propagation, the form of preparation of the seedbeds, the planting of the seeds and their germination, and the factors that determine the spacing are described in detail. The need of a perfect hygiene for normal development is made evident. In relation to propagation by cuttings, the preparation of the planting material, the ways of planting the cuttings depending on the climate and soil, and the rapid multiplication technique of cassava, which consists in obtaining a high no. of individuals from 2-node cuttings coming from just 1 adult plant, are described. The use of cuttings from the apex, and green and terminal parts of the plant is also described in detail.

(CIAT)

0481

26187 NAIR, G.M.; PRABHAKAR, M.; NAIR, N.G.; GHOSH, S.P. 1986. Production of cassava planting material in India. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.187-192. Engl., 6 Refs.

Cassava; Cuttings; Timing; Propagation; Tissue culture; Apical meristems; India.

The different means that exist in India to propagate cassava are described as well as the rapid propagation techniques that have been developed. The factors affecting the cutting quality (age, thickness, length, viability, and mechanical damage of the cutting) are discussed. Finally, the disease elimination through tissue culture, the problems that limit the multiplication and distribution of planting material, and the strategies for increasing planting material production are analyzed. (CIAT)

0482

23938 NEZEHOSE, J.B. 1983. Multiplication et diffusion du manioc et de la patate douce au Rwanda. (Multiplication and dissemination of cassava and sweet potato in Rwanda). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.48-51. Fr.

Cassava; Production; Root productivity; Cultivars; Statistical data; Cuttings; Propagation; Rwanda.

The 1980 statistics related to cassava in Rwanda are given. In the Kigoma commune, bitter cassava var. Eala 07 and sweet cassava var. Bukarasa, Maguruyinkware, and Mulundi were multiplied at Bumbogo I (20.0 ha) and Bumbogo II (13.5 ha), allowing 1,675,000 cuttings to be available for an area of 167.5 ha. The potential needs of the crop are 454,890,000 cuttings or 9098.0 ha under multiplication. The problems related to the multiplication and diffusion of cassava, among them the lack of knowledge of cassava utilization, CAMV, use of infested cuttings, and insufficient assistance to the farmer, are discussed. (CIAT)

0483

26189 OKEKE, J.E.; OKOLI, O.O.; UTOH, N.O. 1986. Production of cassava planting material in Nigeria. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.197-204. Engl., 7 Refs.

Cassava; Cuttings; Cassava programs; Propagation; Pruning; Cultivars; Nigeria.

The methods that have been used to increase cassava cutting production in Nigeria are described in detail. They include pruning and spacing, node no. and planting position, and the use of rapid multiplication techniques. The multiplication and distribution of planting material are also analyzed. (CIAT)

0484

26190 PANDEY, S.J. 1986. Production of cassava planting material in Zaire. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop.

Cali, Centro Internacional de Agricultura Tropical. pp.205-216. Engl., Illus.

Cassava; Cuttings; Cassava programs; Propagation; Storage; Cultivars; Cassava African mosaic virus; Colletotrichum manihotis; Zaire.

The climatic, edaphic, and agronomic conditions of Zaire are described. The cassava research program is discussed and the work that has been carried out in relation to the age, length, and storage of cuttings is described in detail. Work on the effect of CAMV on germination and growth of cuttings and on the elimination of anthracnose through the selection of clean and healthy planting material has also been undertaken. Finally, the multiplication and distribution of clones are discussed. (CIAT)

0485

25589 QUINTERO, F. 1984. Comportamiento de dos cultivares de yuca en cinco épocas de cosecha. (Performance of two cassava cultivars in five harvesting times). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:101-109. Span., Sum. Span., 7 Refs. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Facultad de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Harvesting; Timing; Dry matter; Starch content; Root productivity; Venezuela.

When the field performance of 2 cassava cv. (UCV-2221 and UCV-2078) was studied over 5 harvests (6, 8, 10, 12, and 14 mo.) in the U. Central of Venezuela, highly significant differences were obtained among treatments (cv. and harvest times). Fresh root yields were highest for both cv. at 10, 12, and 14 mo. with 11.21, 15.08, and 19.77 t/ha, resp., for cv. UCV-2221 and 15.16, 13.66, and 20.48 t/ha, resp., for cv. UCV-2078. UCV-2221 presented the max. starch value (80.2 percent) at 12 mo. and its lowest values (70.7 and 72.2 percent) at 6 and 14 mo., resp. UCV-2078 had its max. starch percentage (86.2) at 12 mo. and the lowest (75.5 and 75.2) at 8 and 14 mo., resp. (AS-CIAT)

0486

26186 RODRIGUEZ N., A. 1986. Production of cassava planting material in Cuba. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.181-185. Engl., 4 Refs.

Cassava; Cuttings; Cassava programs; Propagation; Cultivars; Xanthomonas campestris pv. manihotis; Resistance; Cuba.

The objectives of the production program for cassava planting material in Cuba are to (1) promote the rapid adoption of superior clones for human consumption and resistant or tolerant to both Xanthomonas campestris pv. manihotis and Sphaceloma manihoticola; (2) propagate material that is acceptably free from cutting-transmitted diseases and pests; (3) obtain vigorous cuttings that guarantee high germination levels, so that the amount of replanting is kept to a min.; and (4) establish a base for subsequent yield increase through the use of clones with superior quality and high yield potential. The 4 phases or categories (breeder's seed, basic seed, registered seed, and certified seed) through which a var. must pass before cuttings can be considered suitable for release as certified seed are described, as well as the available commercial and precommercial clones. The impact of basic seed production of the research program is highlighted.

(CIAT) See also 0431 0436 0463 0464 0465 0487 0489 0548 0556 0610 0611 0613 0616 0617 0620 0622 0623 0627 0632 0633 0636 0640 0643 0644 0646 0653

D03 ENERGY PRODUCTIVITY AND YIELDS

0487

23739 ASHOKAN, P.K.; POTTY, N.N.; NAIR, R.V. 1983. A note on the optimum stage of harvest in cassava. South Indian Horticulture 31(1):47-48. Engl. (College of Horticulture, P.O. Vellanikara 680 634, Trichur, Kerala, India)

Cassava; Cultivars; Harvesting; Timing; Root productivity; India.

In 1978-79, at the Coconut Research Station, India, a randomized block design expt. with 6 replications was undertaken to determine the optimum age for harvesting cassava var. M4. Harvesting took place at 7, 8, 9, and 10 mo. after planting. The specific gravity of the roots at all ages indicated a high DM content. (CIAT)

0488

26197 KALMBACHER, R.S.; MARTIN, F.G.; MISLEVY, P. 1985. Fermentation substrate and forage from south Florida cropping sequences. Biomass 7(1):1-11. Engl., Sum. Engl., 20 Refs. (Ona Agricultural Research Center, Ona, FL 33865, USA)

Cassava; Cultivars; Root productivity; Energy productivity; USA.

Maize, sorghum, sweet potato, Jerusalem artichoke, and cassava were grown as alcohol biomass crops in various sequences in 1981 and 1982, on a sandy, siliceous, hyperthermic, typic Haplaquod soil. Herbage yield and yield of nonfermentable by-products were measured as potential cattle feed. Grain produced from maize followed by sorghum averaged 11.4 t/ha and was greater (P less than 0.05) than other grain crop sequences. Highest (P less than 0.05) root yields were from sweet potato (5.1 t/ha) in 1981 and cassava (5.3 t/ha) in 1982. Total nonstructural carbohydrate was greatest for maize/sorghum (6.0 t/ha) and maize/sweet potato (6.8 t/ha) sequences. Sweet potato and cassava crops were hindered by high rainfall and poorly drained soil. Cropping sequences including maize and sorghum produced more cattle feed, and they can be expected to produce more alcohol biomass with fewer cultural problems, on south-central Florida (USA) flatwoods soils. (AS)

0489

24551 MONTAGNER, W. 1983. Rendimento de raizes de mandioca em funcao de espacamento e densidade populacional. (Cassava root yield in function of the spacing and population density). In Reuniao Técnica Anual de Culturas Energéticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronômicas. pp.143-145. Port. (Inst. de Pesquisas Agronômicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Cultivars; Planting; Spacing; Root productivity; Brazil.

At the phytotechnical exptl. station of Taquari, Brazil, a trial was carried out to determine the optimum plant spacing in terms of productivity for cassava cv. L7. A randomized block exptl. design was used with 6 treatments (8333, 10,000, 10,416, 12,500, 13,888, and 16,600 plants/ha) and 4 replications. The highest yield (28.44 t/ha) was obtained with the highest density. The statistical analysis did not indicate any significant differences among the different treatments. No optimum density can be recommended since the results obtained are completely opposed to the ones obtained in previous trials. (CIAT)

D04 POSTHARVEST STUDIES

0491

26338 BALAGOPALAN, C.; POTTY, V.P.; PADMAJA, G. 1979. Improvement of preservation technology for cassava tubers and chips. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.72. Engl.

Cassava; Cultivars; Roots; Storage; India.

During 48 days roots of cassava var. H-2304, H-165, H-226, H-1687, and M-4 were stored in humid (40-45 percent) sawdust; the percentage of damage was recorded on a weekly basis. The results demonstrate that intact cassava can be stored for a prolonged time as long as the storage aeration and humidity are controlled. Storage did not affect root cooking quality. (CIAT)

0492

24550 MONTAGNER, W. 1983. Porcentagem de mudas de mandioca vivas em funcao de diversos métodos de hibernacao. (Percentage of live cassava cuttings in function of different hibernation methods). In Reuniao Técnica Anual de Culturas Energéticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronómicas. pp.140-142. Port. (Inst. de Pesquisas Agronómicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Cuttings; Cultivars; Storage; Germination; Brazil.

At the phytotechnical exptl. station of Taquari, Brazil, several storage methods of cassava cuttings were studied. Under the shade of trees, the stems were left horizontally on the ground, alone or covered with rice straw, or in vertical position alone or covered with straw. Without shade, the stems were left on the ground covered with earth or straw, or in a ditch and covered with straw. The highest percentage of cuttings that survived the winter (44.4 percent) was obtained with the unshaded treatment of stems left on the ground and covered with earth and the lowest (10.0 percent), with stems under shade left on the ground and covered with straw. (CIAT)

0493

25507 TANIGUCHI, T.; DATA, E.S.; BURDEN, O.J.; URITANI, I.; GORGONIO, M.; UMERES, E. 1984. The appearance of antifungal activity in cassava root tissues in response to physiological and microbial deteriorations. Annals of the Phytopathological Society of Japan 50(2):286-288. Engl., 8 Refs., Illus. (Faculty of Agriculture, Nagoya Univ., Nagoya, 464, Japan)

Cassava; Roots; Deterioration; Moulds; Analysis; Japan.

The production of antifungal substances in cassava root tissues showing physiological deterioration and microbial rotting is elucidated. Cassava root tissues, either with physiological deterioration or inoculated with Pythium sp. and Botryodiplodia theobromae, were extracted with ethanol and the extracts were run in TLC. The antifungal activity was detected by spraying the plates with a spore suspension of Alternaria alternata. Results indicate that cassava produces antifungal materials in response to physiological and microbial deterioration. (CIAT)

0494

21869 WHEATLEY, C.; GOMEZ, G. 1985. Evaluation of some quality characteristics in cassava storage roots. Qualitas Plantarum Plant Foods for Human Nutrition 35:121-129. Engl., Sum. Engl., 14 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Roots; Cultivars; Harvesting; Timing; Dry matter; Sugar content; Starch content; Organoleptic examination; Palatability; Deterioration; Colombia.

The susceptibility to physiological deterioration and the hardness (penetration) of fresh peeled cassava roots, as well as the cooking time, taste, and texture of cooked roots of 4 (1 local and 3 promising) cv. at 4 plant ages (6, 8, 10, and 12 mo.) were evaluated. Var. or cv., plant age, and their interactions significantly affected all these parameters. Roots produced by the local cv. (M Col 113) had lower DM contents and susceptibility to physiological deterioration, a longer cooking time, and higher penetration measurements than the promising cv. Physiological deterioration and penetration values tended to decrease; cooking time increased with plant age. The variation in correlation coefficients between quality and chemical parameters among the different cv. was substantial, with no correlation being significant in all 4 cv. The exptl. results demonstrate the great variability among cassava cv. in the root quality factors. (AS)

0495

21129 WHEATLEY, C.; COCK, J. 1985. Methods of aflatoxin analysis-with particular reference to cassava samples. International Journal of Epidemiology 14(1):185. Engl., 8 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Aflatoxins; Analysis; Colombia.

In a letter to the editor the existent methods for the analysis of aflatoxins are discussed. The interference of scopoletin, a nontoxic coumarin involved in the physiological deterioration of cassava, in the aflatoxin analysis is indicated. Both compounds have similar characteristics under UV light and TLC. A simple method of distinguishing between the 2 has been developed; the fluorescent extract is exposed to I vapor, which eliminates the fluorescence of the scopoletin without affecting that of the aflatoxin. Experience in Colombia has demonstrated that blue UV fluorescence in both fresh and processed cassava is invariably due to scopoletin. While the presence of some aflatoxin would not be unexpected, the high mean concn. reported (460 ppb) probably exaggerate the risk of cassava consumption. (CIAT)

0496

25754 WHEATLEY, C.C. 1985. Storage of cassava roots for human consumption. In Cock, J.H.; Reves, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.673-684. Engl., 12 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Roots; Deterioration; Storage; Post-harvest technology; Harvesting; Packaging; Distribution; Dry matter; Starch content; Sugar content; Colombia.

The physiological principles for storing cassava roots are discussed and storage techniques in straw and earth silos and in wooden boxes with moist sawdust are briefly described. A detailed description is given of the methodology for storing roots in polyethylene bags: harvest, root selection, treatment, packing, storage, and transportation. The methodology designed to evaluate postharvest losses, the parameters to be considered for estimating the quality of stored roots, and the potential of this storage technology are presented. (CIAT) See also 0617

0497

23089 SINGH, K.G. 1983. Plant quarantine development in the ASEAN and threats by pests. In _____ ed. Exotic plant quarantine pests & procedures for introduction of plant materials. Serdang, Selangor, Malaysia, Asean Plant Quarantine Centre and Training Institute. pp.283-302. Engl., 7 Refs., Illus.

Cassava; Quarantine measures; Phaeolus manihoti; Xanthomonas campestris pv. cassavae; Cassava African mosaic virus; Cassava mosaic virus; Cassava brown streak virus; Cassava latent virus; Mycoplasmoses; Frog skin disease; Thrips; Mononychellus tanajoa; Oligonychus peruvianus; Asia.

The regional cooperation, area covered, legislation, and establishment of the Plant Quarantine Centre and Training Institute of the countries belonging to the Association of South-East Asia Nations (ASEAN) are discussed. Main pests and diseases of the most important crops in the region, among them cassava, that have not yet been introduced into the region or that have a restricted distribution are listed. Maps are also included. (CIAT)

0498

26164 DIANESE, J.C. 1985. Atividade pectolítica das patovares de Xanthomonas campestris que afetam a mandioca. (Pectolytic activity of Xanthomonas campestris pathovars that affect cassava). Revista de Microbiología 16(3):195-202. Port., Sum. Port., Engl., 24 Refs., Illus. (Depto. de Biologia Vegetal, Univ. de Brasilia, Caixa Postal 153081, 70.910 Brasilia-DF, Brasil)

Cassava; Xanthomonas campestris pv. cassavae; Xanthomonas campestris pv. manihotis; Culture media; Analysis; Biochemistry; Brazil.

Xanthomonas campestris pv. cassavae from Africa (Xca) and Colombia (Xcc) and X. campestris pv. manihotis (Xcm), all 3 pathogenic to cassava, were compared with X. campestris pv. campestris (Xc) isolate NRRL-B1459A, based on their ability to produce enzymes which degrade pectic substances. Xc showed high polygalacturonic acid-transeliminase and pectinesterase activities. These enzymes induced leakage of electrolytes, maceration, and cell death on tissues of potato tubers. Xcc followed a similar pattern; however, Xca and Xcm had low enzymatic activities upon pectic substrates and were unable to cause maceration and cell death on potato tubers. Xcm presented polygalacturonase activity limited to the 1st 22 h of incubation at 30 degrees Celsius. (AS)

0499

25749 LOZANO, C. 1985. Bacterial leaf spot of cassava. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.510-511. Engl. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Xanthomonas campestris pv. cassavae; Agrobacterium tumefasciens; Pseudomonas; Mycoplasmoses; Symptomatology; Disease control; Biochemistry; Colombia.

The cassava diseases caused by Xanthomonas campestris pv. cassavae, Agrobacterium tumefasciens, and Pseudomonas solanacearum and their control are briefly described. The symptoms produced by the causal agent of the witches' broom disease and its control are also presented. (CIAT)

0500

25591 MARCANO, M.; TRUJILLO, G.; LUCIANI, J. 1984. Propagación del añublo bacteriano (AB) mediante esquejes de material de yuca (Manihot esculenta Crantz) resistente y susceptible a la enfermedad en las condiciones ambientales del Estado Aragua. (Propagation of bacterial blight through cassava cuttings, resistant and susceptible to the disease, under the environmental conditions of the state of Aragua).. In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:171-185. Span., Sum. Span., 15 Refs., Illus.

Cassava; Cultivars; Cuttings; Xanthomonas campestris pv. manihotis; Isolation; Symptomatology; Resistance; Venezuela.

Propagation of Xanthomonas campestris pv. manihotis was studied using cuttings of cassava plants having different degrees of resistance and previously attacked by the pathogen. The bacteria X. campestris pv. manihotis was found to translocate along the stems of material from CBB-susceptible clon UCV 2386; therefore, propagation material from these plants is contaminated with the disease, resulting in a high percentage of

diseased plants. Susceptible cassava plants attacked by CBB must not be used as propagation material. Resistant clon UCV 2339 showed that the pathogen is restricted to the zone visibly attacked and does not translocate to the rest of the plant, allowing bacteria-free material to be obtained from resistant material previously attacked by the pathogen. (AS-CIAT) See also 0465 0503 0507 0543 0549 0611 0617 0622 0632 0633 0636 0643 0646

E03 MYCOSES

0501

26347 CHACKO, C.I. 1979. Interrelationship, pathogenicity, and integrated control of Cercospora spp. of cassava and groundnut in an intercropping system. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.95-99. Engl.

Cassava; Groundnut; Intercropping; Cercosporidium henningsii; Isolation; Laboratory experiments; Research; India.

Cercosporidium henningsii and Cercospora personata were isolated into pure culture from diseased tissues of intercropped cassava and groundnut, resp. The growth and sporulation of the fungal isolates in culture were studied, and the effect of carbendazim, methylbenzimidazole carbonate, benomyl, and thiophanate on the inhibition of growth, spore germination, and sporulation of these isolates was assessed. The spore germination was more sensitive to inhibition by these chemicals than the growth of the 2 fungi, the sporulation being the least sensitive to the chemicals tested. (CIAT)

0502

25751 LOZANO, C. 1985. Fungal diseases. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.527-555. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Leaves; Cercosporidium henningsii; Symptomatology; Disease control; Phaeoramularia manihotis; Cercospora vicosae; Phoma; Oidium; Sphaceloma manihoticola; Isolation; Analysis; Plant growth substances; Resistance; Inoculation; Glomerella manihotis; Gloeosporium manihotis; Cuttings; Botryodiplodia theobromae; Roots; Phytophthora drechsleri; Rosellinia; Diplodia; Sclerotium rolfsii; Fomes lignosus; Fusarium; Colombia.

Symptoms, dissemination, and control of fungal diseases affecting cassava leaves, stems, and roots are presented. Among the former are those caused by Cercosporidium henningsii, Phaeoramularia manihotis, Cercospora vicosae, Phoma spp., and Oidium manihotis. The taxonomy, sexual reproduction, host range, and physiology of Sphaceloma manihoticola, causal agent of the superelongation disease, are summarized as well as the resistance of some cassava cv. Among the diseases that affect the quality of cassava cuttings are those caused by Glomerella manihotis and Gloeosporium manihotis. Stem rot is caused by Glomerella manihotis, Botryodiplodia theobromae, and an unidentified basidiomycete; causal agents of root rot are Phytophthora drechsleri, Pythium spp., Rosellinia necatrix, Armillariella mellea, Rigidoporus lignosus, Diplodia manihotis, Fomes lignosus, and Sclerotium rolfsii. (CIAT) See also 0471 0479 0484 0503 0507 0549 0558 0611 0617 0622 0632 0646

E04 VIROSES

0503

23941 BIRANDANO, B. 1983. Maladies du manioc et de la patate douce. (Diseases of cassava and sweet potato). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.91-95. Fr.

Cassava; Cassava African mosaic virus; Vectors; Bemisia; Xanthomonas campestris pv. cassavae; Disease control; Resistance; Cercosporidium henningsii; Phaeoramularia manihotis; Phoma; Colletotrichum manihotis; Rwanda.

The characteristics of CAMV and its means of propagation (Bemisia sp.) are described. The losses it causes in cassava vary between 20-90 percent. Control measures include the use of healthy cuttings and resistant var., and the systematic elimination of diseased plants. Bacteriosis, one of the most severe diseases of cassava, is transmitted in Rwanda by Xanthomonas campestris pv. cassavae. The ecosystems of the pathogen, means of transmission, and way of contamination are described. As control measures, cuttings from healthy plants must be used and crop residues burnt to thus avoid the conservation of the inoculum from one season to the next. Results of a trial for resistance to bacterioses, carried out by the International Institute of Tropical Agriculture, confirmed the resistance of 7 varieties to X. campestris pv. cassavae. Cercosporidium henningsii, Phaeoramularia manihotis, Phoma, Colletotrichum manihotis, and root rots also attack cassava in Rwanda but without causing severe damage. (CIAT)

0504

26343 EDISON, S.; BIRADAR, R.S. 1979. Cassava mosaic: (a) estimation of crop loss due to the disease in cultivator's field. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.87. Engl.

Cassava; Cassava African mosaic virus; Pest damage; India.

In the Trivandrum district, India, a survey was started to determine the damage caused by CAMV, but due to the lack of a permission from the authorities of the Department of Agriculture it could not be continued. (CIAT)

0505

26344 EDISON, S. 1979. Cassava mosaic: (c) survey for the population of whitefly and spread of the mosaic disease. In Central Tuber Crops Resarch Institute. Annual progress report 1978-1979. Trivandrum, India. pp.87-91. Engl.

Cassava; Cassava African mosaic virus; Vectors; Bemisia; Cultivars; India.

In Kerala, India, an expt. was established to locate areas where the population of whiteflies could be the min. so that a disease-free seed multiplication program could be arranged in these areas. Ten centers were selected to conduct the study. The Ambalavayal and Nileswar centers harbored the lowest populations of the insect vector. (CIAT)

0506

26345 EDISON, S. 1979. Cassava mosaic: (e) diagnosis of mosaic disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.91. Engl.

Cassava; Cassava African mosaic virus; Cultivars; India.

A long-term project was prepared to systematically study CAMV and help with an early diagnosis of the disease symptoms. Attempts to transmit the disease through sap failed. A collection of the diseased plants collected from the Trivandrum, Alleppey, and Kanyakumari districts (India) is being maintained at the Central Tuber Crops Research Institute for further studies. (CIAT)

0507

25752 LOZANO, J.C.; NOLT, B. 1985. Cassava quarantine. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.595-615. Engl., 76 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Quarantine measures; Cuttings; Seed; Colletotrichum; Phoma; Diplodia; Xanthomonas campestris pv. manihotis; Mycoplasmoses; Anastrepha manihoti; Anastrepha pickeli; Viroses; Cassava African mosaic virus; Cassava common mosaic virus; Cassava brown streak virus; Cassava vein mosaic virus; Frog skin disease; Cassava Caribbean mosaic virus; Cassava latent virus; Mononychellus tanajoa; Phenacoccus manihoti; Aonidomytilus albus; Tetranychus cinnabarinus; Thrips; Saissetia nigra; Phenacoccus herreni; Colombia.

Cassava pest and disease complexes are described, along with quarantine problems. Pathogens and pests disseminated through botanical seed or through vegetative planting material are presented. Pathogens disseminated through botanical seed are divided into those that infest and those that infect the seed. Pathogens disseminated through vegetative planting material are divided into localized and systemic pathogens; the latter include fungal, bacterial, viral, and mycoplasma-like pathogens. The most important pests disseminated via vegetative planting material are Mononychellus tanajoa, Frankliniella williamsi, Aonidomytilus albus, Saissetia spp., Phenacoccus manihoti, and P. herreni. Sanitary measures required to minimize the risks of disseminating pathogens and pests through propagative material are reviewed. (CIAT)

0508

25771 MAFFLA, G.; ROA, J.C.; ROCA, W.M. 1984. Erradicación de la enfermedad cuero de sapo de la yuca Manihot esculenta, por medio del cultivo de meristemos. Efecto de la termoterapia, y del tamaño del explante sobre la tasa de saneamiento. (Elimination of the frog skin disease from cassava through meristem culture. Effect of the heat therapy and the size of the explant on the rate of cleaning). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.171-175. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Frog skin disease; Symptomatology; Cultivars; Temperature; Analysis; Tissue culture; Apical meristems; Grafting; Disease control; Cuttings; Illumination; Photoperiod; Colombia.

The frog skin disease, produced by a virus, and the techniques used for the cleaning of cassava clones affected, are described. To verify the cleaning of the material obtained through meristem culture, heat therapy was used and transmission tests through grafting and tests for detecting the disease through electrophoresis were done. The clean material underwent another cycle to confirm the cleaning; to date the material has gone through 8 cycles. The best results were obtained with small explants. (CIAT)

0509

26349 NAIR, N.G.; MALATHI, V.G. 1979. Determination of yield loss and biochemical changes due to cassava mosaic and development of diagnostic test for identification of the disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.107-109. Engl.

Cassava; Cultivars; Harvesting; Timing; Leaves; Plant height; HCN content; Carbohydrate content; Protein content; India.

The effect of disease severity caused by CAMV on plant growth parameters was studied on var. H-97, H-226, H-1687, H-2304, and M-4. At 4 mo. after planting, the total no. of leaves produced, no. of leaves retained, and plant height were assessed. The percentage of reduction in all the 3 characters was max. in H-97. The changes in leaf HCN, total carbohydrate, and protein contents were also determined. Statistically significant differences in the levels of constituents between healthy and diseased plants were observed only in var. H-97 and H-2304. In the former, there was an increase in both HCN and total carbohydrates concn. and a decrease in the protein levels. In the latter, while the levels of total carbohydrates increased, the protein and HCN levels decreased. (CIAT)

0510

25750 NOLT, B. 1985. Cassava virology. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.517-527. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cassava African mosaic virus; Vectors; Disease control; Analysis; Cassava brown streak virus; Symptomatology; Cassava common mosaic virus; Cassava vein mosaic virus; Cassava latent virus; Cassava Caribbean mosaic virus; Frog skin disease; Cassava symptomless virus; Colombia.

The morphology, symptoms produced, dissemination, and control of the cassava African mosaic, cassava brown streak, cassava common mosaic, cassava vein mosaic, latent, symptomless, and Caribbean mosaic viruses are described; information on the frog skin disease is also given. The available methods for virus detection in cassava are presented. (CIAT)

0511

26184 SCHILDE-RENTSCHLER, L.; ROCA, W.M. 1986. Virus elimination in potato and cassava. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.89-95. Engl., 17 Refs. (Centro Internacional de la Papa, Apartado 169, Lima, Perú)

Cassava; Viroses; Tissue culture; Apical meristems; Disease control; Peru; Colombia.

The following techniques used for the elimination of viruses in potato and cassava are presented: meristem culture, thermotherapy, and chemotherapy. The effectiveness of routine procedures is discussed as well as the importance of testing plants regenerated from meristem culture. (CIAT)

0512

26346 SHANTA, P. 1979. Cassava mosaic-symptomatology of the disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.92-95. Engl.

Cassava; Cassava African mosaic virus; Cultivars; Symptomatology; Stems;

India.

Five cassava var. (M-4, H-226, H-2304, H-1687, and Kalikalan) were used to study the symptomatology of CAMV and to standardize an indexing system to assess, codify, and quantify the intensity of the disease. There was a high correlation between the calculated index and the actual one observed. Considerable variation in disease severity among var. was noticed. M-4 had the lowest index value and Kalikalan the highest. By culturing serially numbered nodes cut individually from an infected stem, it was seen that not all nodes from a systemically diseased stem were infected. Taking advantage of the information on the irregular distribution pattern of the pathogen in infected stems, the possibility of building up disease-free stocks of highly diseased local var. was demonstrated, and a disease-free stock of Kalikalan is maintained in the field. (CIAT)

0513

26194 TOWNSEND, R.; STANLEY, J.; CURSON, S.J.; SHORT, M.N. 1985. Major polyadenylated transcripts of cassava latent virus and location of the gene encoding coat protein. European Molecular Biology Organization Journal 4(1):33-37. Engl., Sum. Engl., 34 Refs., Illus. (John Innes Inst., Colney Lane, Norwich NR4 7UH, England)

Cassava; Cassava African mosaic virus; Analysis; United Kingdom.

The nucleotide sequences of infectious cloned DNAs 1 and 2 of a Kenyan isolate of CLV were determined. Five virus-specific polyadenylated transcripts were identified and mapped either to the viral or complementary-sense DNAs of both components of the CLV genome, confirming that transcription is bidirectional on both DNAs. A major mRNA was translated in vitro to yield a 30,000 mol. wt. product, which is precipitated by antibodies raised against whole virus, and was mapped by both the S1 nuclease procedure and hybrid-arrested translation to the long open reading frame in the viral sense of DNA 1 which encodes the coat protein. Other transcripts were of sufficient size and appropriate origin to encode at least 5 potential products. (AS) See also 0438 0471 0484 0543 0558 0562 0611 0616 0617 0622 0633 0636 0643

E05 MYCOPLASMOSES

Véase además 0499 0617

E06 NEMATODES

0514

23090 ANDERSON, C.L.; GOOCH, P.S. 1983. Plant parasitic nematodes recorded from the ASEAN region. In Sing, K.G., ed. Exotic plant quarantine pests & procedures for introduction of plant materials. Serdang, Selangor, Malaysia, Asean Plant Quarantine Centre and Training Institute. pp.225-235. Engl., 3 Refs.

Cassava; Nematodes; Asia.

A list of the plant parasitic nematodes recorded in the SE Asia region is presented. In Indonesia and Malaysia no nematodes have been recorded parasitizing cassava. However, the following species have been recorded in the Philippines: Criconemella curvata, Helicotylenchus concavus, H. dihystera, H. multicinctus, and H. pseudorobustus, Hemicriconemoides cocophillus, Hemicycliophora gracilis and H. penetrans, Longidorus sp., Meloidogyne spp., Pratylenchus brachyurus and P. zeae, Rotylenchulus reniformis, Rotylenchus sp., Tylenchorhynchus martini and T. triglyphus, and Xiphinema insigne. In Thailand P. brachyurus and T. martini have been recorded. Meloidogyne spp. are considered the most important nematode pest of cassava in the region. Recommendations for their control and to avoid their dissemination throughout the region are given. (CIAT

F00 PEST CONTROL AND ENTOMOLOGY

F01 INJURIOUS INSECTS AND THEIR CONTROL

0515

25746 BELLOTTI, A.C.; REYES, J.A.; GUERRERO, J.M.; VARELA, A.M. 1985. The mealybug and cassava green spider mite complex in the Americas: problems of and potential for biological control. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.393-416. Engl., 36 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mononychellus; Mononychellus tanajoa; Mononychellus caribbeanae; Phenacoccus; Phenacoccus manihoti; Biological control; Predators and parasites; Phenacoccus herreni; Colombia.

Damage and problems caused by green spider mites (Mononychellus spp.) and cassava mealybugs (Phenacoccus spp.) in the Americas are discussed. A list of 32 predators and parasites of cassava mites in the neotropics is given. This list includes, among others, 16 predator mites of the Phytoseiidae family and various coleopteran species of the genera Oligota and Stethorus. Work carried out to control Mononychellus spp. using these predators is reviewed. Regarding the mealybug, 25 parasites have been recorded in Phenacoccus gossypii, P. herreni, and P. manihoti in the Americas. Of these, 21 belong to the Encyrtidae family and include the Anagyrus, Apoanagyrus, Aenasius, and Acerophaga genera. The pathogenic fungus Cladosporium sp. was recently identified parasitizing P. herreni in Colombia and in Brazil. Forty-three predators of the Phenacoccus spp. previously mentioned have also been recorded. The situation of P. gossypii and P. herreni is analyzed since they present different problems and forms of attack; their biological control is discussed. A problem with the complex of natural enemies of the mealybug is the presence of various hyperparasites which reduce the populations of natural enemies. Since P. herreni is an economically important pest, the determination of its center of origin is important for the identification of its most efficient natural enemies. (CIAT)

0516

25747 BELLOTTI, A.C.; BYRNE, D.H.; HERSHEY, C.H.; VARGAS, O.; VARELA, A.M. 1985. The potential of host plant resistance in cassava for control of mites and mealybugs. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.417-439. Engl., 18 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mononychellus; Phenacoccus; Phenacoccus herreni; Resistance; Cultivars; Plant breeding; Hybrids; Insect biology; Pest damage; Colombia.

CIAT's program for the selection of cv. resistant to the mite and mealybug complex is described. The damage caused by these pests is presented and the resistance mechanisms are discussed. The study of the life cycle of Phenacoccus gossypii in 5 cassava cv. showed that there are var. differences in relation to the biological development of the insect. (CIAT)

0517

21872 BODDEN P., R.; DIAZ C., F. 1979. Dinámica de población de Telenomus sphingis Ashmead en relación a poblaciones de Erinnyis ello L. en yuca. (Population dynamics of Telenomus sphingis in relation to Erinnyis ello populations in cassava). In Annual Meeting of the Caribbean Food Crops Society, 16th., Santo Domingo, República Dominicana, 1979. Proceedings.

Santo Domingo. pp.71-82. Span., Sum. Span., Fr., Engl., 20 Refs., Illus.

Cassava; Erinnyis ello; Predators and parasites; Dominican Republic.

The population dynamics of Erinnyis ello, the most important cassava pest in the Dominican Republic, was studied for 2 yr in relation to the egg parasite Telenomus sphingis, which is widespread in all the cassava producing areas of the country. In San Cristobal weekly evaluations were made of 36 randomly selected plants in an area of 0.25 ha. Four leaves were observed on each plant up to 5 mo. of age and thereafter, 10 leaves until the crop was 10 mo. old. The E. ello eggs collected were counted and taken to the lab. where they hatched and the percentage of parasitism was determined. Parasitism of E. ello eggs by T. sphingis ranged from 40 to 100 percent. The highest percentage was obtained during the wet season when the greatest no. of eggs were laid in the field. T. sphingis may be considered a promissory parasite for the biological control of E. ello in the Dominican Republic. (AS-CIAT)

0518

21876 DIAZ C., F.; BODDEN P., R.; PEÑA, A. 1979. Pérdidas causadas en yuca por la mosca del cogollo. (Cassava losses due to shoot flies). In Annual Meeting of the Caribbean Food Crops Society, 16th., Santo Domingo, República Dominicana, 1979. Proceedings. Santo Domingo. pp.133-138. Span., Sum. Span., Fr., Engl., 3 Refs., Illus.

Cassava; Carpolonchaea chalybea; Cultivars; Insecticides; Pest damage; Dominican Republic.

A trial was carried out in San Cristóbal, Dominican Republic, to determine the extent cassava yields are affected by the attack of shoot flies (Carpolonchaea chalybea), considered an important pest of this crop. A completely randomized block design was used with 2 treatments (control and application of monocrotophos (1.5 cc/litre) every 15 days) and 4 replications each. Monocrotophos-treated plots yielded, on the av., 21.8 MT/ha compared with the control which yielded 27.6 MT/ha. The damage caused by C. chalybea did not affect the yield. Rainfall and RH were observed to affect the pest population. (AS-CIAT)

0519

26168 FABRES, G.; LE RU, B.; KIYINDOU, A.; BIASSANGAMA, A.; BOUSSIENGUE, J. ; EPOUNA MOUINGA, S. 1984. La cochenille du manioc et sa biocoenose au Congo 1979-84. (The cassava mealybug and its biocenosis in Congo, 1979-84). Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 116p. Fr., 173 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus; Phenacoccus manihoti; Insect biology; Predators and parasites; Biological control; Congo.

Papers on the work carried out by the Office de la Recherche Scientifique et Technique Outre-Mer and the Direction Générale de la Recherche Scientifique on the cassava mealybug in Brazzaville, Congo, are presented. The subjects covered include biology, population dynamics, biotic and abiotic factors that affect the frequency of the insect, and predators and parasites. Individual papers are recorded in this publication under the following consecutive no.: 0520, 0525, 0526, 0527, and 0528. (CIAT)

0520

26171 FABRES, G.; LE RU, B. 1984. Etude des relations plante-insecte pour la mise au point de méthodes de régulation des populations de la cochenille du manioc. (Study of the plant-insect relationships for the improvement of methods for controlling cassava mealybug populations). In _____.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.57-71. Fr., Sum. Fr., Engl., 27 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Cultivars; Leaves; Timing; Water stress; Congo.

The impact of some physiological parameters of the cassava plant on the biotic potential of Phenacoccus manihoti is discussed. These parameters are plant var., age of leaves and of the plantation, and water stress. Agronomic methods compatible with the utilization of entomophagous insects, or even with their acclimatation procedures, are proposed. (AS (extract))

0521

22986 GANGA, T. 1981. Rapport d'exécution du programme de lutte biologique contre la cochenille du manioc en République Populaire du Congo. (Report on the execution of the biological control program against the cassava mealybug in Congo). Rome, Italy, Organization des Nations Unies pour L'Alimentation et L'Agriculture. 9p. Fr., 7 Refs.

Cassava; Phenacoccus manihoti; Insect biology; Predators and parasites; Biological control; Congo.

The project for the control of Phenacoccus manihoti in Congo is presented. Its phases, personnel, equipment, and climatic conditions are described. The biological cycle of the pest and the climatic factors that influence its development are presented. Some of the natural enemies of P. manihoti are Anagyrus sp., Exochomus flaviventris, E. concavus, Hyperaspis senegalensis, Scymmus (Nephus) sp., and Sthetorus sp. The rearing of Hyperaspis sp., its release and efficiency in the control of P. manihoti are described. (CIAT)

0522

26361 GERLING, D. 1985. Parasitoids attacking Bemisia tabaci (Hom.: Aleyrodidae) in eastern Africa. Entomophaga 30(2):163-165. Engl., Sum. Engl., Fr., 3 Refs. (Chiredzi Research Station, P.O. Box 97, Chiredzi, Zimbabwe)

Cassava; Bemisia; Predators and parasites; Kenya; Malawi; Zimbabwe.

A survey was conducted in Kenya, Malawi, and Zimbabwe in 1984 to find parasites of Bemisia tabaci, an important pest of field crops, that might be introduced into Israel for control of the aleyrodid. The pest was found mainly on cassava but also on cotton. The 2 principal parasite species found were Eretmocerus mundus and Encarsia sublutea. The parasitism rates varied, at times reaching over 60 percent. E. sublutea is also an important parasite of Trialeurodes vaporariorum and is known from Hawaii as Prospaltella transvena (E. transvena). (AS)

0523

24553 JURUENA, L.F.; CACHAPUZ, L.M.M. 1983. Pragas da mandioca. (Cassava pests). In Reuniao Tecnica Anual de Culturas Energeticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronómicas. pp.149-152. Port. (Inst. de

Pesquisas Agronómicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Erinnyis ello; Atta; Silba pendula; Iatrophobia brasiliensis; Coelosternus granicolis; Coelosternus manihoti; Coelosternus notaticeps; Coelosternus rugicollis; Brazil.

The morphology, damage, and control of the most important pests of cassava in the state of Rio Grande do Sul, Brazil, are described. These are Erinnyis ello, Atta spp., Acromyrmex spp., Silba pendula, Iatrophobia brasiliensis, and Coelosternus spp. (CIAT)

0524

21678 KEYSER, J.M. 1985. The wasp that catches the pests. International Agricultural Development. November-December 1985:16-17. Engl., Illus.

Cassava; Phenacoccus manihoti; Predators and parasites; Biological control; Cassava programs; Mononychellus; Africa.

The work of the biological control unit established at the International Institute of Tropical Agriculture in 1979 to control cassava pests, particularly Phenacoccus manihoti and Mononychellus spp., is described. Apoanagyrus lopezi, a parasitic wasp imported from South America, is considered the most promising natural enemy of P. manihoti taking into account its ability to establish itself readily in the field, significantly reduce cassava mealybug damage, and then survive the rainy season when mealybug populations are naturally low. Other species, particularly Diomus, a lady beetle, have shown great potential to multiply and attack the mealybug during the dry season only to disappear after the rains begin, at least in the particular ecologies where it has so far been released. The Commonwealth Institute of Biological Control as well as CIAT and the Empresa Brasileira de Pesquisa Agropecuaria assist in the explorations in Latin America and in releases of natural enemies in East Africa. So far, natural enemy releases have been made only on an exptl. basis, to see which parasitoid or predator establishes itself in which ecological zone, and how well it spreads. Work on the control of cassava green mites has been expanded and it has been found that among the mite predators there are phytoseiid mites, which appear to be better biological control agents at low mite populations than most insect predators. (CIAT)

0525

26172 LE RU, B.; SILVIE, P.; PAPIEROK, B. 1984. L'entomophthorale Neozygites fumosa pathogene de la cochenille du manioc, Phenacoccus manihoti (Hom.:Pseudococcidae) en République Populaire du Congo. (The entomophthoraceous Neozygites fumosa, pathogen of the cassava mealybug Phenacoccus manihoti (Hom.:Pseudococcidae), in the People's Republic of Congo). In Fabres, G.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.98-104. Also in Entomophaga 30(1):1985. Fr., Sum. Fr., Engl., 19 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Predators and parasites; Congo.

The entomophthoraceous fungus Neozygites fumosa, which was only known in southern USA, was found in the People's Republic of Congo, on the cassava mealybug (Phenacoccus manihoti). Slight biometrical variations appear within the fungal species. Among the entomophthorales cited in the literature as parasitizing Coccoidea, only 2 species can be retained with

Cassava. Production. Research. Cameroon.

The emphasis of agricultural research in Cameroon was shifted from cash to food crops with the 5th Development Plan. The position in the national economy of the major food crops (maize, sorghum, rice, cassava, sweet potatoes, yams, soybean, cowpea, fruits, and to a lesser degree, vegetables) is described as well as the problems related to their development and the goals to be achieved by research workers. Work is supported by soil research, and it is argued that farming systems research should receive greater attention. [Abstracts on Tropical Agriculture]

0370

24548 ENRIQUEZ T., J. 1985. Plan operativo para 1985 de la Provincia de Napo. Normas técnicas del cultivo. (1985 operational plan for the Napo Province. Technical norms of the crop). Ecuador, Programa Tubérculos y Raíces; proyecto yuca. 40p. Span.

Cassava. Production. Cultivation. Cultivars. Hybrids. Development. Economics. Planting. Timing. Spacing. Fertilizers. N. P. K. Weeding. Thrips. Mononychellus tanajoa. Mononychellus megressori. Tetranychus urticae. Oligonychus. Phenacoccus. Erinnyis ello. Predators and parasites. Silba pendula. Carpolonchaea chalybea. Anastrepha pickeli. Anastrepha manihoti. Aleyrodidae. Bemisia. Trialeurodes variabilis. Vatiga manihotae. Saissetia miranda. Hemiberlesia diffinis. Aonidomytilus albus. Cecidomyiidae. Agrotis ipsilon. Xanthomonas campestris pv. manihotis. Cassava common mosaic virus. Mycoplasmoses. Cercosporidium henningsii. Cercospora caribaea. Cercospora vicosae. Oidium. Cassava superelongation. Glomerella. Uromyces manihotis. Phytophthora. Fomes lignosus. Rosellinia. Sclerotium rolfsii. Insect control. Mite control. Insecticides. Acaricides. Growth. Pruning. Root productivity. Cuttings. Roots. Storage. Rotational crops. Uses. Composition. Feeds and feeding. Costs. Ecuador.

The cassava planting program for the Napo Province, Ecuador, in 1985 and the technical norms for cultivation are presented. The strategies and course of action to fulfill the plan, the goals for the year in relation to planting surface and harvesting, production and yield, production needs, cassava var. grown in the region and in the country, and exptl. var. tested in the region are described. The plan for credit and financing of inputs (seeds, fertilizers, and pesticides) is presented. A taxonomic and botanical description of cassava, the appropriate ecological conditions for its cultivation, and specific recommendations on pests, diseases, and weeds are presented. The conservation of roots and cuttings, crop rotation, and uses of cassava, besides compositional analyses, are discussed. Data on production costs are included. [CIAT]

0371

25704 FATAO, L.; XIONG, L.; XUECHENG, T. 1986. Cassava in the agricultural economy of China. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.59-63. Engl. [South China Academy of Tropical Crops, Hainan Island, Guangdong Province, People's Republic of China]

Cassava. Ecosystems. Production. Cassava chips. Cassava starch. Income. Cultivation systems. Intercropping. Planting. Spacing. Ploughing. Harvesting. Timing. Development. China.

The situation of cassava in China is presented. Three agroclimatic zones in which cassava is cultivated (largest production, expansion, and var.

trials) are described. Yields are low (8.2 t/ha) due to poor management. Produced cassava is processed into chips or starch, which are exported. Research has been focused on the improvement of crop management practices to increase productivity. The best results have been obtained with intercropping, planting distances, tillage, and harvest times. The problems that exist for the future development of cassava in the country are (1) lack of improved var., (2) soil erosion, (3) inadequate processing and use, (4) lack of technical assistance and systematic planning, and (5) poor storage of cuttings. Possible solutions to these constraints and the future perspectives for the development of cassava are discussed. [CIAT]

0372

24556 FUNDACION PARA EL DESARROLLO INDUSTRIAL Y AGRICOLA DEL QUINDIO. 1975. Estudio de localización de una planta de harina de yuca panificable en la región del Quindío. (Location study of a cassava flour plant for bakery purposes in the Quindio region). Armenia. 17p. Span.

Cassava. Cassava flour. Development. Economics. Production. Water requirements (processing). Costs. Processing. Colombia.

A location study of a CF plant for bakery purposes in the Quindio region, Colombia, with a capacity of processing 1800 t fresh cassava/yr (600 t flour), is presented. The highly productive cassava regions located between the southwestern section of Quindio and northern Valle (Caicedonia, Quimbaya, Armenia, Montenegro, and La Tebaida) are described as well as several economic and infrastructure aspects that allow the optimum region for the location of the plant to be determined. It was concluded that the processing plant should be located in La Tebaida because of the available energy, aqueduct capacity, available telephone services, available incentives (tax exemption), road and railroad infrastructure, and proximity to the airport, to the wholesale provision market, and to the city of Armenia. [CIAT]

0373

25723 GAPASIN, D.P.; LOPEZ, E.L. 1986. Planning cassava development: the Philippine national research and development program for cassava. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.373-385. Engl., 5 Refs., Illus. [Philippine Council for Agriculture & Resources Research & Development, Los Baños, Laguna, Philippines]

Cassava. Cassava programs. Research. Development. Processing. Cassava chips. Post-harvest technology. Plant breeding. Cultivation systems. Cultivation. Socio-economic aspects. Philippines.

The systematic approach used in agricultural research and development programs in the Philippines is described. In relation to cassava, priorities and goals of the national development are discussed and the research activities are analyzed. Finally, the strategy for the implementation of the program (research network, international agencies, and budget) is presented. [CIAT]

0374

25706 GURITNO, B.; SITOMPUL, S.M. 1986. Cassava in the agricultural of Indonesia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.73-88. Engl., 11 Refs., Illus. [Centre for Root Crops Research, Faculty of Agriculture, Brawijaya Univ., Jl. May. Jen. Haryono 163, Malang, Indonesia]

Cassava. Production. Tetranychus urticae. Oidium. Xanthomonas campestris pv. manihotis. Intercropping. Costs. Income. Trade. Uses. Gaplek. Cassava starch. Consumption. Prices. Research. Development. Indonesia.

The situation of cassava in Indonesia is presented; it is the most important upland crop after maize, with an av. yield of 9.7 t/ha. The production, including costs, and its perspectives are discussed. Trade, uses, and consumption of cassava (fresh, gaplek, starch) are analyzed. Finally, research needs (var. trials, cultivation systems, extension services) and the impact that research has had in the country are presented. [CIAT]

0375

25264 INSTITUTO INTERAMERICANO DE COOPERACION PARA LA AGRICULTURA. 1983. Proyecto para el grupo campesino "Angel del Limón", El Triunfo, Choluteca. (Project for the peasant group "Angel del Limón", El Triunfo, Choluteca). Tegucigalpa, Honduras, Convenio IICA-INA-Consuplane. Unidad de Formulación de Proyectos. 13p. Span., Sum. Span.

Cassava. Socio-economic aspects. Economics. Income. Costs. Development. Honduras.

The project proposed to benefit the peasant group "Angel del Limón", beneficiary of the land reform, in the dept. of Choluteca, Honduras, is presented. It is intended to improve the income level of the group through the alternating cultivation of maize, Johnson grass, sorghum, cassava, and sesame. [CIAT]

0376

24086 JANSSEN, W.; DE JONG, G. 1980. Cassava and cassava starch; the production, processing and marketing of cassava and sour cassava starch in Mondomo, Colombia. Cali, Colombia, Centro Internacional de Agricultura Tropical. 177p. Engl., 23 Refs., Illus.

Cassava. Cultivation. Cultivars. Cultivation systems. Fallowing. Timing. Land preparation. Costs. Economics. Planting. Spacing. Weeding. Insecticides. Fertilizers. Harvesting. Prices. Intercropping. Erosion. Maize. Banana-plantains. Marketing. Cassava roots (vegetable). Cassava starch. Factories. Starch content. Distribution. Processing. Washing. Peeling. Rasping. Screening. Silting. Fermentation. Drying. Packaging. Water requirements (processing). Waste utilization. Consumption. Storage. Bakery products. Colombia.

To study the relationships between the cassava crop and its marketing and the potential marketing channels for cassava starch, the Mondomo area in Colombia was chosen due to the presence of CIAT field trials in the region. Surveys were conducted at the farm, small-scale rasping industry, middleman, and wholesaler-retailer levels. The agricultural economy is dominated by a limited no. of crop alternatives. The starch production process is described and the economic situation of the small-scale rasping industries is analyzed. A description of the middleman, product, storage, risk absorption, transportation, credit, quality control and classification, communication, and profitability is given. The end user is also considered. A general analysis is included of the marketing channel of sour starch coming from the vecinity of Santander de Quilichao, where approx. 4200-4800 ha of cassava (5000 t of starch/yr) are grown. The breeding programs should focus on the selection of var. tolerant to low fertility soils and with high starch yields/ha, the relationship between fertilizer use and starch content should be investigated and studies to solve the erosion problems related to the cultivation of cassava are

required. Of the costs involved in the small-scale rasping industries, 80% corresponds to the raw material. [CIAT]

0377

25708 JAYAWARDENA, S.D.G. 1986. Cassava in the agricultural economy of Sri Lanka. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.115-129. Engl. 5 Refs., Illus. [Central Agricultural Research Centre, Gannoruwa, Peradeniya, Sri Lanka]

Cassava. Production. Intercropping. Prices. Costs. Research. Fresh products. Development. Sri Lanka.

The situation of cassava in Sri Lanka is presented; it is a secondary crop, grown in association with other crops (coconut, pineapple), and mainly consumed fresh. Production data for the 1972-80 period are included. The production areas are described and production costs and constraints are analyzed, in addition to discussing areas of research. The uses, the potential for the production and utilization of cassava, and the implications that government policies may have on research are discussed. [CIAT]

0378

22861 JOS, J.S. 1982. High-lights of Lab to Land Programme (Phase 1). In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.1-17. Engl., Illus.

Cassava. Hybrids. Intercropping. Groundnut. Socio-economic aspects. Soil analysis. Cultivation. Fertilizers. Pest control. Economics. Income. Root productivity. Technological package. Technology transfer. Technology evaluation. India.

The methodology and outstanding results of the Lab. to Land program are described. This program was carried out among 200 families in 4 villages of the Trivandrum, Kanyakumari, and Salem districts, India, during 1979-80. The 2 main technologies transferred during this program consisted in the replacement of degenerated cassava stocks with improved clones (Sree Sahya and Sree Visakham) and cassava/groundnut intercropping. The prevailing type of agriculture before adoption, soil fertility status of the landholdings of the families involved, and agricultural practices in the villages are described. Additional income derived from using both technologies independently is shown; their potential to favor the income in all villages is thus indicated. In general, the increase in income due to the use of these technologies was more than 65% during the 1st yr. Selected results achieved with particular farmers concerning increases in cassava yield and income in the 4 villages are presented. Another impact of the program was the generation of employment, both in crop production as well as in the transformation of fresh roots into cassava chips. Training programs, field days, radio programs, and pamphlet publication, contributing to the general strategy of the program, are described. [CIAT]

0379

25532 LAME, B. 1984. Mission FAO sur le manioc en République Populaire du Benin: la culture et sa transformation. (FAO mission on cassava in Benin: the crop and its transformation). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa,

Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.87-93. Fr.

Cassava. Cultivation. Production. Cassava African mosaic virus. Xanthomonas campestris pv. manihotis. Phenacoccus manihoti. Ferrisia virgata. Mononychellus tanajoa. Tetranychus cinnabarinus. Cultivars. Processing. Drying. Steeping. Rasping. Cassava chips. Cassava flour. Gari. Tapiocas. Industrialization. Benin.

The cassava situation in Benin is presented. Of the root and tuberous crops and cereals grown in the country, cassava is the one grown the most; both its leaves and roots are used for human and animal consumption. The cropping systems are indicated, production data between 1970-81 are given, and some of the problems that have caused the fluctuations in the production (CAMV, Xanthomonas campestris pv. manihotis, Phenacoccus manihoti, Ferrisia virgata, Mononychellus tanajoa, and Tetranychus cinnabarinus) are mentioned. In 1982-83 a campaign was started to plant improved var. (TMS 30001 and TMS 30211) introduced from Nigeria and the Ivory Coast. It is suggested to gather all the available information in order to create a fact sheet on the crop that covers land preparation, weed control, fertilization, and mechanical harvest. Finally, the cassava transformation techniques, which basically involve drying, rasping, and steeping, are presented; the main products are lafun, gari, cassava chips, and tapioca. The need for industrializing the transformation and cultivation processes is highlighted. [CIAT]

0380

25538 LARTEY, B.L. 1984. Country profile. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.139-146. Engl.

Cassava. Economics. Root crops. Cultivars. Production. Cultivation. Zonocerus variegatus. Roots. Storage. Gari. Tapiocas. Cassava starch. Cassava chips. Dried roots. Small-scale processing. Research. Ghana.

Basic data on Ghana's economy and agriculture are given. The main root crops are cassava, yams, cocoyams, and sweet potatoes, cassava being produced and utilized the most. A brief account of cassava cultivation is presented; the most common var. are Gari, Queen, Williams, and Ankra. The methods used to store the roots are indicated. The most important products are gari, tapioca, starch, konkonte, and cassava chips; processing is mostly done in the rural communities. Research is being carried out on root storage and the development of cassava processing machines. [CIAT]

0381

25767 LIAN, T.S.; WELSCH, D.E. 1986. Cassava in the agricultural economy of Malaysia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.89-114. Engl., 19 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., G.P.O. Box 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Production. Prices. Economics. Costs. Cultivation. Cultivation systems. Cassava starch. Cassava chips. Fresh products. Waste utilization. Feeds and feeding. Trade. Consumption. Food products. Uses. Animal nutrition. Development. Malaysia.

The situation of cassava in Malaysia is presented. Its production (1960-81) and costs (1983) are discussed. Uses, marketing, trade, and potential use of cassava products (fresh, starch, chips, sweeteners) are analyzed, and data on prices, production, exports, and imports (1970-81) are included. Finally, the future supply of cassava in relation to policies for its development is analyzed. [CIAT]

0382

25716 LIAN, T.S.; CHAN, S.K. 1986. Improving the productivity of cassava in Peninsular Malaysia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.241-259. Engl., 11 Refs., Illus. [Malaysian Agricultural Research & Developing Inst., G.P.O. 12301, Kuala Lumpur 01-02, Malaysia]

Cassava. Soil physical properties. Climatic requirements. Temperature. Rainfall data. Cultivars. Land preparation. Planting. Spacing. Cuttings. Fertilizers. N. P. K. Mg. Weeding. Herbicides. Harvesting. Timing. Root productivity. Fomes lignosus. Tiracola plagiata. Socio-economic aspects. Research. Plant breeding. Mechanization. Cultivation. Cultivation systems. Malaysia.

The situation of cassava in Malaysia is presented and the production systems and zones (soils, temp., rainfall) in which it is grown are discussed. The technical, socioeconomic, and managerial constraints of cassava productivity are analyzed. The research objectives of the Malaysian Agricultural Research and Developing Institute's cassava program are (1) to increase the productivity of cassava in smallholdings and in plantation-scale cultivation through the breeding and selection of improved var. and the development of appropriate production technologies and (2) to improve postharvest processing and storage technology and to develop new end uses for cassava. The strategies and directions of research proposed are analyzed and results of research are presented. Finally, the assessment of yield gap and production potential are discussed. [CIAT]

0383

25711 LYNAM, J.K. 1986. A comparative analysis of cassava production and utilization in tropical Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.171-195. Engl., 18 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Production. Uses. Cultivation systems. Labor. Costs. Productivity. Consumption. Economics. Feeds and feeding. Trade. Marketing. Prices. Fresh products. Cassava starch. Cassava chips. Pellets. Gaplek. Asia.

Within an economic context (costs, prices, labor, policies), the diversities and similarities of cassava production and utilization systems in tropical Asia (India, Indonesia, Malaysia, Philippines, and Thailand) are compared and analyzed. Based on this analysis, the potential of the crop in the region is discussed. [CIAT]

0384

25717 MARISCAL, A.M. 1986. Improving the productivity of cassava in the Philippines. In Regional Workshop on Cassava in Asia, its Potential and

Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.261-276. Engl., 14 Refs. [Philippine Root Crops Research & Training Center, 8 Lourdes Street, Pasay City 3129, Philippines]

Cassava. Production. Socio-economic aspects. Costs. Prices. Technology. Post-harvest losses. Research. Technological package. Cultivars. Cultivation systems. Intercropping. Rotational crops. Fertilizers. Cuttings. Xanthomonas campestris pv. manihotis. Tetranychus urticae. Tetranychus kansawai. Roots. Storage. Cassava chips. Food products. Animal nutrition. Philippines.

The cultivated area, yield, production, and potential of cassava in the Philippines are presented. The main production constraints are analyzed, namely, socioeconomic aspects, infertile areas, inappropriate technology, and postharvest and processing problems. The projects and research activities of the Philippine Root Crop Research and Training Center, the U. of Philippines, and the Bureau of Plant Industry of the Ministry of Agriculture are discussed. These have been oriented toward the development of improved var., agronomy, and the National Feed Root Crops Program. Research results are indicated. [CIAT]

0385

25527 MICHE, J.C. 1984. FAO mission on the harvesting, processing and use of cassava in Thailand and in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.15-32. Engl., Sum. Engl.

Cassava. Production. Cultivars. Processing. Cassava chips. Pellets. Cassava starch. Marketing. Trade. Research. Development. Ethanol. Atieke. Cultivation. Mechanization. Gari. Uses. Cassava flour. Foofoo. Thailand. Ghana. Togo. Cameroon. Congo. Ivory Coast.

Information on problems existing in the cassava sector in Thailand and Ivory Coast, Ghana, Togo, Cameroon, and Congo is given. Problems related to production, utilization, processing, marketing, research, and development of cassava products in Thailand are reviewed. In Ivory Coast, there is an agroindustrial complex for the processing of dry atieke and CF. The mechanization problems of the industrial cultivation and harvesting of cassava seem to have been resolved. The problems of small material for mechanized cassava processing in Ghana and Togo are discussed; these are attributed to the shortage of cassava during that time of the year due to drought, bushfires, and diseases. Shortage of cassava was also observed in Cameroon; however, traditional food products (gari and cassava sticks) are being processed on a semi-industrial level. A comprehensive description is given on the foofoo flour production plant in Mantsoumba, Congo, which has a production capacity of 400 kg flour/h. Finally, conclusions and recommendations are given. [AS]

0386

25528 MICHE, J.C. 1984. Potential improvements of cassava processing technologies in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.33-40. Engl., Sum. Engl.

Cassava. Processing. Development. Foofoo. Gari. Small-scale processing. Industrialization. Africa.

The possibilities of improving the traditional technologies of cassava processing, at the village and industrial levels, in Africa, are discussed and analyzed. Some recommendations are given. [CIAT]

0387

24541 MONTALDO, A. 1985. Cultivo e industrialización de yuca. (Cultivation and industrialization of cassava). In _____. Cultivo e industrialización de la yuca y papa en Ecuador; informe de consultoría. Quito, Ecuador, Instituto Interamericano de Cooperación para la Agricultura. pp.1-18. Span., 16 Refs. [Facultad de Agronomía, Univ. Central de Venezuela, Apartado 97, Maracay 2101 A, Venezuela]

Cassava. Production. Productivity. Food energy. Development. Cultivation. Cultivars. Plant breeding. Uses. Composition. Ecuador.

Information is given on cassava cultivation in Ecuador where it is considered to be one of the crops to be included in a crop diversification plan to substitute cereal imports in the country. Cassava is compared with cereals and other root crops in terms of production parameters and nutritive value. Information related to the use of CF in animal feed and the utilization of by-products for human consumption is discussed. The possibilities of crop expansion in the country are analyzed and suggestions are presented for improving its cultivation. It is suggested that new technologies, products, and uses should be developed to increase cassava production and utilization; a national trials network on agronomic problems should be established and the development of the Ecuatorian cassava industry should be supported. Training should be offered in agricultural, nutritional, and industrial research, and a close link should be maintained between producers, researchers, salesmen, businessmen, and extension agents. Four strategies are recommended to accomplish the aforementioned objectives: breeding, agronomic improvement, processing technology, and diversification of end uses. Organizations participating in the plan, required germplasm materials, and priorities are listed. [CIAT]

0388

24540 MONTALDO, A. 1985. Cultivo e industrialización de la yuca y papa en Ecuador; informe de consultoría. (Cultivation and industrialization of cassava and potato in Ecuador; consultancy report). Quito, Ecuador, Instituto Interamericano de Cooperación para la Agricultura. 40p. Span., 16 Refs., Illus. [Facultad de Agronomía, Univ. Central de Venezuela, Apartado 97, Maracay 2101 A, Venezuela]

Cassava. Production. Productivity. Food energy. Development. Cultivars. Cultivation. Plant breeding. Composition. Ecuador.

A report on the cultivation and industrialization of cassava in Ecuador is presented. Aspects related to the possibilities of expansion of cassava cultivation, suggestions for the improvement of the crop, germplasm, organizations involved, and priorities to undertake the proposed plan are dealt with. The 1st national course on cassava cultivation and its alternate uses is described. A questionnaire given to the course participants and the answers given by the Ministry of Agriculture and Cattle Husbandry of Ecuador are annexed. The papers on the cultivation and industrialization of cassava presented during the course are registered in this publication under the following consecutive no.: 0366 and 0387. [CIAT]

0389

25534 N'BONGUE, R.; BAYOGO, A.J. 1984. Transformation du manioc et autres tubercules et racines en République Centrafricaine. (Transformation of cassava and other tubers and roots in the Central African Republic). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.113-118. Fr.

Cassava. Yams. Potatoes. Sweet potatoes. Cultivation. Root productivity. Injurious mites. Injurious insects. Cassava African mosaic virus. Bacterioses. Cassava chips. Cassava flour. Processing. Steeping. Industrialization. Development. Costs. Central African Republic.

The situation of the cassava, yam, sweet potato, and potato crops in the Central African Republic is presented. Cassava is the most important food crop (50-60% of the calorie intake); it is grown alone or in association with an av. yield of 7 t/ha, although the improved var. produce up to 35 t/ha. The production is affected by CAMV, mealybugs, mites, and bacterioses. The different cassava products are (1) "cossettes" or chips that are steeped to be softened and then converted into small balls that are dried on the ground; (2) chikouang or steeped roots molded into canes (10-15 x 2-5 cm) and cooked in boiling water; (3) Ngou-Kassa or a cassava, yam, and sweet potato soup; and (4) CF from the steeped chips. The project proposed by the government for the industrialization of cassava is described. [CIAT]

0390

25710 NELSON, G.C. 1986. An analysis of the international market potential for dried cassava and cassava starch. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.153-169. Engl., Sum. Engl., 4 Refs. [Agricultural Development Council, Inc. IRRI/Econ., P.O. Box 933, Manila, Philippines]

Cassava. Cassava starch. Trade. Consumption. Feeds and feeding. Feed constituents. Prices. Costs. Dried roots. Marketing.

The situation of cassava in Thailand is presented and its production, costs, cultivation, and processing are analyzed. The main products (pellets, chips, and starch) and their consumption, marketing, prices, and trade are discussed; likewise, related data are included. The dependence that the Thai cassava industry has on the EEC countries, Japan, and USA is highlighted. Alternatives to reduce this dependency are presented. [CIAT]

0391

25571 NINAN, K.N. 1984. Labour use in agriculture. Case studies of tapioca and paddy. Economic and Political Weekly 19(52-53):A-199-A-204. Engl., Sum. Engl., 11 Refs.

Cassava. Labor. Land preparation. Planting. Weeding. Fertilizers. Harvesting. Distribution. Productivity. Economics. India.

Various issues related to labor use in agriculture are discussed, with specific emphasis on cassava and paddy production, using farm level data relating to Kerala (India). In particular, the relationship between labor use on one hand and yields, farm size, and crop operations on the other, is examined. The question of labor productivity in agriculture is also discussed. [World Agricultural Economics and Rural Sociology Abstracts]

0392

25531 NYANIN, O.O. 1984. Economic feasibility of cassava in compound animal feeds in Africa. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.51-55. Engl., 3 Refs.

Cassava. Animal nutrition. Feeds and feeding. Economics. Costs. Prices. Africa.

The use of cassava in animal feeding is briefly reviewed and an economic analysis of the feasibility of cassava replacement for maize in compound feeds in Africa is made. The potential exists, but only country-specific feasibility studies with updated relevant data can truly ascertain the feasibility since the availability and prices of cassava, other cereal substitutes, and major protein sources vary from one country to the other. [CIAT]

0393

25530 NYANIN, O.O. 1984. Some economic aspects of industrial processing of cassava. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,pp.43-50. Engl.

Cassava. Processing. Gari. Costs. Prices. Economics. Nigeria.

An economic analysis of the viability of industrial processing of cassava in Africa is made, based on the industrial processing of gari employed in Nigeria. It is concluded that the financial viability of industrial processing of cassava would depend mainly on 3 endogenous variables: (1) the operational efficiency of the plant which is constrained by production factor costs and the cost of the factory; (2) the production efficiency of the equipment; and (3) the capacity at which the plant is operated. [CIAT]

0394

25547 OLYMPIO, H.K.; ALOGBLETO, K. 1984. Apercu sur la production et les utilisations des plantes a tubercules au Togo. (Survey on the production and utilization of tuber crops in Togo). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.235-242. Fr., Illus.

Cassava. Production. Cassava starch. Tapiocas. Cassava flour. Gari. Small-scale processing. Marketing. Prices. Togo.

The situation of cassava, yam, sweet potato, potato, and taro in Togo is presented. The most important crops are cassava and yam; their production, processing, and marketing are indicated. Cassava is consumed fresh or it is processed into starch, tapiocas, flour, or gari. [CIAT]

0395

24036 OSPINA, B.; BEST, R.; GOMEZ, G. 1983. Natural drying of cassava for animal feed: the establishment of small agro-industries on the Atlantic Coast of Colombia. Cali, Colombia, Centro Internacional de Agricultura Tropical. 17p. Engl., Sum. Engl., 13 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Paper presented at the Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983.

Cassava. Cassava programs. Development. Solar drying. Technology. Production. Processing. Marketing. Economics. Colombia.

The ongoing cooperative project between the Colombian Integrated Rural Development Program (DRI), the Canadian International Development Agency, and CIAT is described. Its objective is to establish small-scale cassava natural drying plants on the Atlantic Coast of Colombia. The project initiated with the setting up of a pilot drying plant in collaboration with a group of 15 farmers. In 1981 the plant operated on an exptl. basis in order to collect data on drying performance under the conditions prevailing on the Atlantic Coast and to ascertain the acceptability of the product by the animal feed industry. In 1982 the plant was operated on a semi-commercial basis to collect accurate production cost figures and to demonstrate the economic feasibility of replicating the process in other areas of the region in 1983. From the experience obtained it was concluded that for the successful establishment of drying plants, the following conditions should be met: (a) the selection of a processing technology that may be easily controlled and managed by the farmers themselves, (b) the integration of crop production, processing, and marketing activities, and (c) the provision of institutional support in terms of technical assistance, training, and credit facilities. [AS]

0396

25291 PACHICO, D.H. 1984. Nutritional objectives in agricultural research. The case of CIAT. In Pinstrup-Andersen, P.; Berg, A.; Forman, M., eds. International agricultural research and human nutrition. Washington, D.C., International Food Policy Research Institute. pp.25-40. Engl., Sum. Engl., 62 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Development. Phaseolus vulgaris. Human nutrition. Socio-economic aspects. Technology. Economics. Colombia.

The research strategies of CIAT's commodities, particularly cassava and beans, to meet CIAT's mandate, are analyzed in depth from the nutritional point of view. Collaborative research with other institutes should be given high priority. [CIAT]

0397

22862 RAJENDRAN, P.G.; NAIR, R.B. 1982. Popularising high yielding cassava hybrids—technology 1. In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.18-22. Engl., Illus.

Cassava. Hybrids. Technological package. Cultivation. Land preparation. Cuttings. Selection. Fertilizers. N. P. K. Manures. Harvesting. Root productivity. Income. India.

Results are presented on yield and income obtained with the transfer of technology related to the planting of high-yielding cassava hybrids (Sree Visakham and Sree Sahya) as substitutes of the traditional var. Cultural practices (land preparation, selection of planting material, planting method and time, fertilizers and manures, harvest) under which these hybrids can yield up to 45.0 t/ha are described. Although traditional var. can yield 8.0-12.0 t/ha, the new hybrids allowed yields between 23.5-30.0 t/ha to be obtained, which resulted in increased income. [CIAT]

0398

25543 RAVELOMANANTSOA, J.; RAKOTONANAHARY, J.P. 1984. Situation actuelle de la production et la transformation du manioc et autres tubercules a Madagascar. (Current situation of the production and transformation of cassava and other tubers in Madagascar). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.193-196. Fr.

Cassava. Production. Productivity. Processing. Cassava starch. Cassava flour. Tapiocas. Prices. Marketing. Trade. Madagascar.

The situation of cassava and potato in Madagascar is presented. Data on production and productivity of fresh and processed cassava (starch, tapioca) as well as on market and trade prices are given. [CIAT]

0399

25701 REGIONAL WORKSHOP ON CASSAVA IN ASIA, ITS POTENTIAL AND RESEARCH DEVELOPMENT NEEDS, BANGKOK, THAILAND, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. 442p. Engl., 234 Refs., Illus.

Cassava. Economics. Marketing. Production. Trade. Productivity. Germplasm. Research. Post-harvest technology. Technology. Development. Uses. Asia.

In June 1984, a regional workshop on cassava was held in Bangkok, Thailand. The objectives of the workshop were to describe and assess (1) cassava's market potential in tropical Asia, (2) new technology as the basis for increased cassava production, and (3) cassava research and development needs. Individual country reports presented discuss cassava's role in the country's agricultural economy and/or the improvement of cassava productivity. Papers presented are recorded individually in this publication under the following consecutive no.: 0235, 0242, 0246, 0252, 0290, 0297, 0298, 0349, 0350, 0371, 0373, 0374, 0377, 0381, 0382, 0383, 0384, 0390, 0401, 0405, 0406, 0410, and 0414. [CIAT]

0400

22988 REIS, A.J. DOS; FERREIRA, L.D. 1982. Levantamento técnico e economico da producao e comercializacao da mandioca nos municípios de Conceicao dos Ouros e Cachoeira de Minas, na Zona da Mata de Minas Gerais. (Technical and economic survey of cassava production and commercialization in the municipalities of Conceicao dos Ouros and Cachoeira de Minas, in the Zona da Mata of Minas Gerais). In Empresa de Pesquisa Agropecuária de Minas Gerais. Projeto mandioca: relatorio 76/79. Belo Horizonte-MG, Brasil. pp.19-20. Port. [Escola Superior de Agricultura de Lavras, Caixa Postal 37, 37.200 Lavras-MG, Brasil]

Cassava. Economics. Production. Costs. Cassava starch. Marketing. Brazil.

The results of a technical and economic survey on cassava production and commercialization in Conceicao dos Ouros and Cachoeira de Minas (Minas Gerais, Brazil) among 71 cassava producers and 17 starch factories for the 1977 harvest are briefly discussed. Agricultural practices used corresponded to a great extent to the recommended production techniques. Land contributed the most (73.06%) to the total fixed cost, and labor (42.93%) to the total variable cost. Av. costs were confirmed to decrease as the area planted increased, indicating scale economies at the farmer level. The raw material for the starch factories was provided by the surveyed and neighboring municipalities. Approx. 20% of the cassava roots

were purchased in the state of Sao Paulo. Bitter starch was produced in the main factories and was completed by the minor ones. Sweet starch was imported to mix with the bitter starch. The gross margin of commercialization was positive for both municipalities but was less in Cachoeira de Minas. [CIAT]

0401

25720 ROCHE, F.C. 1986. Cassava-based farming systems in tropical Asia: research issues and development needs. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.313-337. Engl., 29 Refs., Illus. [Agricultural Development Council, Brawijaya Univ., Jl. May. Jen. Haryono 163, Malang, Indonesia]

Cassava. Production. Root productivity. Socio-economic aspects. Economics. Labor. Cultivation. Cultivars. Cuttings. Storage. Tetranychus urticae. Oidium. Xanthomonas campestris pv. manihotis. Weeding. Nutritional requirements. Fertilizers. N. P. K. Prices. Costs. Intercropping. Development. Wastes. Erosion. Indonesia. Asia.

The technical and economic constraints to greater cassava productivity in Asia, particularly in Indonesia, are discussed. The improved cassava cultivation practices that would be needed to increase yields, the program requirements, and the necessary economic incentives for the adoption of such techniques are analyzed as well as the secondary effects of a larger production of cassava (soil erosion and water pollution from starch production). Finally, the future agroeconomic research on cassava in the region is discussed. [CIAT]

0402

23776 RODRIGUEZ, F. 1983. Desarrollo de tecnologías apropiadas para el procesamiento de yuca en las áreas rurales colombianas. (Development of proper technologies for cassava processing in the rural areas of Colombia). In Seminario Avanzado de Tecnología de Alimentos, 4o., Bogotá, Colombia, 1983. Anales. Bogotá, Instituto de Investigaciones Tecnológicas. Serie Reuniones Científicas. pp.422-425. Span.

Cassava. Processing. Socio-economic aspects. Cassava starch. Industrialization. Development. Colombia.

The general context in which the technological development of the Colombian agricultural sector has taken place is described to explain, as an example, the industrialization possibilities of cassava that exist in the Andean and coastal regions. Some alternatives that have been studied to improve the cassava industrialization process are outlined. [CIAT]

0403

25533 SAKUBU, J. 1984. Point sur les plantes a racines et tubercules amylacées au Burundi. (Starchy root and tuberous plants in Burundi). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.95-111. Fr.

Cassava. Root crops. Production. Post-harvest losses. Productivity. Human nutrition. Processing. Cassava chips. Cassava flour. Cassava pastes. Economics. Research. Cultivars. Fermentation. Protein enrichment. Burundi.

The situation of root and tuber crops in Burundi is presented. Their production, yield, postharvest losses, prices, and nutritive contribution to human nutrition (30, 11, and 9% of the calories, protein, and fat intake, resp.) are discussed in relation to cereals, legumes, oilseeds, bananas, and others. Cassava technology is analyzed, and the processes for the production of chips, flour, and pastes are described. Research priorities regarding cassava and sweet potato are indicated and the project for the protein enrichment of cassava and its use in human and animal nutrition is presented. [CIAT]

0404

25563 SARIKAPHUTI, Y. 1984. Subsidiary food crop (cassava) in Thailand. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.447-467. Engl.

Cassava. Production. Consumption. Cultivars. Sweet cassava. Bitter cassava. Animal nutrition. Human nutrition. Cassava starch. Cassava flour. Cassava chips. Pellets. Alcohol. Development. Marketing. Trade. Prices. Thailand.

The situation of cassava in Thailand is presented. Although it is not the largest cassava producer in the world, it ranks 1st in terms of quantity exported. Data on production, supply and demand, var. used, and the production of flour, starch, chips, and pellets are given. A project for the production of alcohol is presented and the government policies to overcome production, marketing, and trade constraints are indicated. [CIAT]

0405

25702 SARMA, J.S.; PAULINO, L.A. 1986. Trends in the production and use of cassava and other selected food crops in tropical Asia. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.17-41. Engl., Illus. [International Food Policy Research Inst., 1776 Massachusetts Avenue N.W., Washington D.C. 20036,0, USA]

Cassava. Production. Root crops. Cereals. Uses. Trade. Consumption. Asia.

Data on production and use of cassava, other root and tuber crops, and food grains in tropical Asia, covering the period 1961-82, are presented and discussed; global figures are also given. Based on these data the future of cassava in the region is analyzed. [CIAT]

0406

25724 SINGH, R.B. 1986. Past performance and future prospects of cassava production in Asia and the Pacific region. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.387-409. Engl., Sum. Engl. [Food & Agricultural Organization, Regional Office for Asia & the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand]

Cassava. Production. Root productivity. Productivity. Economics. Development. Uses. Consumption. Fertilizers. Costs. Cultivation systems. Asia.

The production, productivity, and area planted to cassava in 26 countries of the Asian Pacific region for 1973-83 are analyzed. This region accounts

for about 38% of the cassava produced in the world. Regional production increased at a high annual growth rate of 7.4% during this period, against a zero growth rate in the rest of the world. About 70% of the production increase was attributed to increase in area and the remaining 30% to increase in yield. The rate of growth of cassava production has, however, decelerated in recent years. Market restrictions, inadequate price and institutional support, low productivity under rainfed conditions, narrow germplasm base, lack of high-yielding, stress-tolerant, and widely-adapted var., inadequate application and inefficient management of fertilizers and water, and lack of appropriate technology for low-input conditions are the major production constraints. Besides being an important staple food, especially in marginal areas, cassava could emerge as a major feed source to meet rapidly expanding animal production in the region. However, this will depend to a large extent on the price competitiveness of cassava with coarse grains. Increased productivity and reduced unit costs of production are the most viable approaches to increase the competitiveness of cassava. Starch, sweeteners, gasohol, and SCP are other products of cassava. But, as yet, commercial production of these items, except starch, is not quite economical. Hence, additional research is called for to diversify the utilization of cassava roots. Furthermore, cassava-related economic, agricultural, and nutritional policies should be kept under continuing review to get the best out of this remarkable root crop. [AS]

0407

25546 SMITH, K. 1984. Thailand country report on cassava. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.213-234. Engl., Illus.

Cassava. Sweet cassava. Bitter cassava. Cultivars. Production. Processing. Cassava chips. Pellets. Small-scale processing. Industrialization. Tapiocas. Cassava starch. MSG. Prices. Marketing. Socio-economic aspects. Economics. Research. Development. Thailand.

The situation of cassava in Thailand is presented. It is the 2nd most important economic crop after rice, and it has had an enormous socioeconomic and political impact on the country. Most of the cassava is processed into pellets, cassava chips, starch, and monosodium glutamate. The pellets and chips are all exported; of the starch, 60% is exported and 40% is used for domestic consumption. Although most of the var. used are bitter, since the roots are all processed, there are some sweet var. such as Ha Na Tee and Yod Daeng that are grown on small scale for human consumption. Data on production of fresh and processed cassava, exports and imports, prices and consumption are given. The institutes and universities carrying out research on cassava processing and utilization in order to diversify the market and uses of cassava are mentioned as well as the projects they are executing. [CIAT]

0408

25274 STEGHART, P.B.; WHOLEY, D.W. 1984. A factory concept for integrated cassava processing operations: supporting and background information on the production of cassava chips. Vienna, United Nations Industrial Development Organization. UNIDO/IO/R.123. v.2,124p. Engl., 233 Refs., Illus.

Cassava. Cassava chips. Pellets. Production. Harvesting. Agricultural equipment. Roots. Peeling. Distribution. Storage. Mechanization. Solar

drying. Economics. Costs. Caplek. Toxicity. Animal nutrition. Human nutrition. Thailand. Indonesia.

A project to define the requirements for high quality cassava chips and to recommend the best means to achieve their production and supply is presented. The current production practices of chips and pellets are reviewed in relation to harvesting, root preparation, root transportation and storage, procedures for the elaboration of chips (manual and large-scale mechanical production techniques), small- and large-scale chip drying techniques (natural drying), pellet elaboration from chips, and quality standards and their control. Economic aspects of chip and pellet production are discussed for the cases of Thailand and Indonesia. [CIAT]

0409

25273 STEGHART, P.B.; WHOLEY, D.W. 1984. A factory concept for integrated cassava processing operations: the raw material cassava chips; production systems, quality criteria and techno-economic factors. Vienna, United Nations Industrial Development Organization. UNIDO/IO.582. v.1,137p. Engl., Sum. Engl., 233 Refs.

Cassava. Production. Uses. Toxicity. Nutritive value. Trade. Processing. Economics. Socio-economic aspects. Cassava chips. Distribution. Storage. Factories. Development. Industrialization. Drying. Solar drying. Water content. Starch content. Fibre content. Ash content. Pellets.

A project is presented to define the requirements for high-quality, dry cassava chips and for a factory producing food for human consumption and other products, and to recommend the best practical means of achieving chip production and supply. The background for cassava development, the technical and economic factors, case studies, and economic feasibility of the production systems are discussed in detail. Recommended techniques for chip production, agricultural considerations, postharvest operations, small- and large-scale chip production and drying methods, and management and storage of chips are described. Quality considerations and standards for cassava chips in terms of size and form, chemical composition, contamination with microbes and other materials, HCN toxicity, and external physical characteristics are discussed. The relation between the quality of the chips and the processed product is analyzed and results are presented of the lab. analysis of chip samples obtained in SE Asia. [CIAT]

0410

25705 SUBRAMANIAN, S.R. 1986. Cassava in the agricultural economy of India. In Regional Workshop on Cassava in Asia, its Potential and Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.65-72. Engl., 6 Refs. [Centre for Agricultural & Rural Development Studies, Tamil Nadu Agricultural Univ., Coimbatore 641003, India]

Cassava. Production. Statistical data. Productivity. Marketing. Costs. Prices. Income. Tapioca pearls. Cassava starch. Waste utilization. Cattle. Feeds and feeding. Labor. Irrigation. Cassava chips. India.

The situation of cassava in India is presented. The area planted to cassava represents only 0.2% of the cropped area of the country and it is located mostly in the southern states, Kerala and Tamil Nadu. Production, marketing, processing, and labor are analyzed and the integration of the stages of production and processing is suggested. Data on production, cultivated area, and yield (1967-82) in the country and the aforementioned states are included; also presented are production costs for 1979. [CIAT]

0411

24419 SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA. BRASIL. 1983. Avaliacao da safra de mandioca. (Evaluation of cassava production). In _____. Avaliacao da safra 1981/1982 de arroz, milho, feijao, mandioca cultivados na regiao norte. Belém-PA, Brasil, Departamento de Setores Produtivos. pp.51-63. Port., Illus.

Cassava. Production. Costs. Productivity. Brazil.

After the analysis of preceding crop cycles, the 1981-82 cassava crop cycle in the northern region of Brazil (Rodonia, Acre, Pará, Amazonas, Amapá, and Roraima) is analyzed. The northern region accounted for 13.7% of the national cassava production in the 1981-82 harvest. The main producers in the region were the states of Pará and Amazonas (77%). The highest yield in the region (17,397 kg/ha) was obtained in the state of Rodonia. The production, yield, harvested area, main producing municipalities, climatic conditions, demand for mechanized services, labor, production costs, markets, and farinha production for each state are analyzed. The perspectives for the 1982-83 harvest in the region are presented. [CIAT]

0412

24416 SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA. BRASIL. 1982. Avaliacao da safra da mandioca. (Evaluation of cassava production). In _____. Avaliacao da safra 1980/81 de arroz, feijao, mandioca e milho, cultivados na regiao norte. Belém-PA, Brasil, Departamento de Setores Produtivos. pp.57-83. Port., Illus.

Cassava. Production. Costs. Productivity. Brazil.

After the analysis of preceding crop cycles, the 1980-81 cassava crop cycle in the northern region of Brazil (Rodonia, Acre, Pará, Amazonas, Amapá, and Roraima) is analyzed. The northern region accounted for 12.2% of the national cassava production in the harvest of that year. The main producers in the region were the states of Pará (49.4%), Amazonas (27.3%), and Rodonia (12.9%). The production, yield harvested area, main producing municipalities, climatic conditions, demand for mechanized services, labor, production costs, markets, and farinha production for each state are analyzed. The perspectives for the 1981-82 harvest are presented. [CIAT]

0413

25562 TCHIENGUE, E. 1984. Transformation industrielle ou artisanale du manioc et autres tubercules au Cameroun. [Industrial or small-scale (by artisans) transformation of cassava and other tubers in Cameroon]. In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.445-446. Fr.

Cassava. Processing. Small-scale processing. Prices. Cameroon.

The processing of cassava in Cameroon is presented. Most of the processing is undertaken by small artisans. The Centre National d'Etudes et d'Expérimentation du Machinisme Agricole and the Centre d'Assistance aux Petites et Moyennes Entreprises are working on the study and design of adapted machines. [CIAT]

0414

25709 TITAPIWATANAKUN, B. 1986. Cassava in the agricultural economy of Thailand. In Regional Workshop on Cassava in Asia, its Potential and

Research Development Needs, Bangkok, Thailand, 1984. Proceedings. Cali, Colombia, Centro Internacional de Agricultura Tropical. pp.131-151. Engl., Sum. Engl., 20 Refs., Illus. [Dept. of Agricultural Economics, Faculty of Economics & Business Administration, Kasetsart Univ., Bangkhen, Bangkok 9, Thailand]

Cassava. Production. Productivity. Processing. Cassava chips. Cassava starch. Pellets. Costs. Marketing. Consumption. Uses. Food products. MSG. Textiles. Paper industry. Trade. Prices. Thailand.

The international market of cassava starch and dried cassava for animal feed is presented. Cassava starch trade is analyzed within the context of local starch production, its exports, imports, and consumption in USA, Japan, Taiwan, and EEC countries. Dried cassava for animal feed in the international market is discussed considering the demand for meat and other animal products, the no. of animals being fed commercial mixed rations, and the price of cassava relative to other feed ingredients. [CIAT]

0415

25766 UGWU, B.O. 1985. The problem of inadequate supply of raw cassava for industrial cassava processing: a case study of the Nigerian Root Crops Production Company, Enugu, Nigeria. Agricultural Systems 18(3):155-170. Engl., Sum. Engl., 17 Refs. [National Root Crops Research Inst., Umudike, Umuahia, Nigeria]

Cassava. Economics. Production. Prices. Distribution. Labor. Phenacoccus. Mononychellus. Development. Processing. Nigeria.

The reasons supporting the establishment of the Nigerian Root Crops Production Company in Enugu are given. The Company cannot operate at full capacity because of a shortage of cassava roots for processing. The factors responsible for the inadequate supply of raw cassava to the Company are identified and solutions are proposed. In order to spread the benefits of this project to small-scale farmers, as well as to minimize the cassava root supply problem, it is suggested that the Company organize these farmers as outgrowers and encourage them to supply at least 50% of its root requirements, through technical advice and the supply of improved cassava cuttings and by helping them to obtain production credit. [AS]

0416

25526 WORKSHOP ON PROCESSING TECHNOLOGIES FOR CASSAVA AND OTHER TROPICAL ROOTS AND TUBERS IN AFRICA, ABIDJAN, IVORY COAST, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.1,82p. v.2,pp.83-510. Engl., Fr., Illus.

Cassava. Processing. Industrialization. Technology. Economics. Trade. Uses. Animal nutrition. Cultivation. Gari. Composite flours. Bakery products. Cassava starch. Alcohol. Africa.

A workshop was held on the technologies of processing cassava and other tropical roots and tubers in Africa. The objectives were (1) to bring together and disseminate recently acquired knowledge and experience in storage and in small-scale mechanized and industrial processing of cassava and other African tropical roots and tubers, as well as to ascertain the economic profitability of these processing techniques; (2) to define appropriate technologies for the industrial production of local culinary preparations in order to obtain easier-to-use products; (3) to define the needs for transfer of technology at the village or industrial level; (4) to study the use of tuber/root flour and starch in composite flours for bakery

purposes. The papers presented at this workshop are recorded individually in this publication under the following consecutive no.: 0243, 0244, 0251, 0301, 0318, 0320, 0326, 0328, 0331, 0332, 0333, 0334, 0335, 0336, 0337, 0338, 0340, 0341, 0342, 0344, 0348, 0351, 0352, 0358, 0368, 0379, 0380, 0385, 0386, 0389, 0392, 0393, 0394, 0398, 0403, 0404, 0407, 0413, and 0418. [CIAT]

0417

25573 WRIGHT, M. 1984. Tapioca—solutions to pressing problems. Bangkok Bank Monthly Review 25(11):450-455. Engl., Illus.

Cassava. Production. Trade. Marketing. Prices. Economics. Cassava chips. Pellets. Cassava flour. Development. Thailand.

In 1978 cassava pellets overtook rice to become Thailand's highest foreign exchange earner with total cassava exports (pellets, flour, chips) reaching an estimated 6.03 MT in 1984. Thailand is the largest exporter of cassava with the highest proportion going to EEC countries. France is badly affected by the import of cassava, a relatively cheap animal feed, into the EEC and has used its influence to restrict cassava imports. In 1982 Thailand and the EEC set import quotas of approx. 5 MT/yr with an import duty of 6%. Future Thai policies should emphasize the importance of improved quality, storage facilities should be constructed to allow farmers and manufacturers to minimize losses, new export markets should be found, and substitute crops should be identified. [World Agricultural Economics and Rural Sociology Abstracts]

0418

25564 YEO, G. 1984. Le plan manioc et le projet agro-industriel de Toumodi. (The cassava plan and the agroindustrial project of Toumodi). In Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers in Africa, Abidjan, Ivory Coast, 1983. Proceedings. Rome, Food and Agriculture Organization of the United Nations. v.2,pp.469-484. Fr.

Cassava. Production. Development. Cassava programs. Cultivation. Economics. Uses. Mechanization. Processing. Ivory Coast.

The cassava plan and agroindustrial project of Toumodi, Ivory Coast, are presented and discussed. The basic objectives of both are the improvement of cassava cultivation and the establishment of an agricultural unit for its processing, thus normalizing the demand and stabilizing the price. Their execution, difficulties, efforts, achievements, and research carried out are analyzed. [CIAT]

See also 0229 0235 0243 0251 0294 0297 0308 0320 0326 0331 0334 0337 0338 0340 0342 0421 0423

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0419

25757 ASHOKAN, P.K.; NAIR, R.V.; SUDHAKARA, K. 1985. Studies on cassava-legume intercropping systems for the Oxisols of Kerala State, India.

Tropical Agriculture (Trinidad) 62(4):313-318. Engl., Sum. Engl., 9 Refs., Illus. [College of Horticulture, P.O. Vellanikkara 680 654, Trichur, Kerala, India]

Cassava. Intercropping. Cultivars. Beans. Legume crops. Root productivity. Productivity. Agronomic characters. Soil analysis. N. P. K. Costs. Economics. Rainfall data. Weeding. India.

A field expt. was conducted at Kerala Agricultural Univ., India, to compare the performance of 5 legumes (cowpea, groundnut, mung bean, urd bean, and soybean) intercropped with cassava. Results of 3 yr showed that cowpea may be the most remunerative intercrop for cassava in similar high rainfall Oxisols (laterite soils) of the humid tropics. The yields of cassava in monoculture and mixed culture were similar. The cost of weeding could be reduced by approx. 50% by growing cowpea as an intercrop with cassava. OM depletion was slow in intercropped plots. Total N, available P and K contents were higher in intercropped plots. The height, no. of leaves, and root no. and DM content of cassava plants were not significantly influenced by the intercrops. [AS]

0420

23773 LEDUC, B. 1980. Culture de manioc sur les tests binomes. (Cassava cultivation in the binomial tests). In _____ Liaison recherche. Developpement IDESSA/ARSO; recherche de systemes stables de cultures vivrieres dans le Sud-Ouest. Résultats de la campagne 1979. Abidjan, Cote d'Ivoire, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. pp.17,68-90,143-145,183. Fr., 7 Refs.

Cassava. Cultivars. Cultivation. Cultivation systems. Maize. Rice. Root productivity. Soil conservation practices. Ivory Coast.

Several soil protection trials with different cultivation systems, which included cassava var. CB, were carried out in 1978-79 in SW Ivory Coast in the Zagne, San Pedro, and Tabou regions. Cassava did not have a repressive effect on rice. Var. CB was not very appreciated by the farmers; they prefer the local var. Bonoua. The av. cassava yields in trials with rice, maize, and other crops for the Zagne, San Pedro, and Tabou regions were 4.35, 22.57, and 13.30 t/ha, resp. [CIAT]

0421

22863 MOHANKUMAR, C.R. 1982. Intercropping cassava with groundnut. In Central Tuber Crops Research Institute. Summary report: Lab to Land Programme Phase 1-1979-82. Trivandrum, India. Publication no.2. pp.23-24. Engl., Illus.

Cassava. Intercropping. Groundnut. Cultivation. Fertilizers. N. P. K. Productivity. Income. India.

The methodology and results are given of cassava/groundnut intercropping in Kerala, India, under the Lab. to Land program, which was carried out during 1979-82 in the villages of Karippur, Manappuram, Munchirai, and Gaj. Patti. Yields of cassava hybrids Sree Visakham and Sree Sahya over the 4 sites were between 22.94-27.98 t/ha, with an av. of 25.56 t/ha, and groundnut yield was between 440-817 kg/ha, with an av. of 617 kg/ha; this allowed increases in the av. income and a 50% increase in labor. The introduction of legumes to the cropping system also contributed to maintain soil productivity. [CIAT]

0422

25215 RAO, M.R.; MORGADO, L.B. 1985. Consorciacao com a cultura da mandioca no Nordeste do Brasil; resultados atuais e perspectivas para futuras pesquisas. (Intercropping with cassava in northeastern Brazil; current results and perspectives for future research). Petrolina-PE, Brasil, Empresa Brasileira de Pesquisa Agropecuária, Centro de Pesquisa Agropecuária do Trópico Semi-Arido. Documentos no.32. 22p. Port., Sum. Port., Engl., 12 Refs., Illus. [Centro de Pesquisa Agropecuária do Trópico Semi-Arido, Caixa Postal 23, 56.300 Petrolina-PE, Brasil]

Cassava. Cultivation systems. Intercropping. Planting. Spacing. Fertilizers. N. P. K. Harvesting. Timing. Maize. Bean. Cowpea. Brazil.

The traditional planting systems and some exptl. results are reviewed along with the perspectives for improving cassava-based intercropping systems. Cassava is intercropped mainly with maize, beans, or cowpea, individually or together. The intercropping advantage for this crop in different systems varied from 80 to 100%, compared with sole cropping. Cassava planted in double rows (2.00 x 0.60 x 0.60 m) improved the yield of intercrops but no study tested whether this effect would be obtained in single rows with larger spacing. Future studies should include (a) identification of compatible genotypes for intercropping; (b) definition of levels and methods of fertilizer application, especially in good rainfall regions; (c) effect of intercropping on pest and disease incidence; (d) identification of alternative intercrops (soybean, groundnut, sunflower, and sorghum); (e) possibility of intercropping cassava harvested at 12 mo.; and (f) comparison of different alternative planting systems under different practices and soil management. [AS]

0423

25506 WADE, M.K.; SANCHEZ, P.A. 1984. Productive potential of an annual intercropping scheme in the Amazon. Field Crops Research 9(3-4):253-263. Engl., Sum. Engl., 18 Refs., Illus. [North Carolina State Univ., Dept. of Soil Science, Tropical Soils Research Program, P.O. Box 7619, Raleigh, NC 27695, USA]

Cassava. Intercropping. Cultivars. Cowpea. Soybeans. Maize. Rice. Groundnut. Planting. Spacing. Timing. Fertilizers. N. Economics. Income. Production. Energy productivity. Protein content. Peru.

A multiple cropping system, modeled after the local traditional planting scheme, was the basis for an expt. conducted on a Typic Paleudult near Yurimaguas, Peru. The system utilized intercropping and relay planting to produce 4 and 5 crops/yr in 2 consecutive years. The effect of 1-, 2-, and 3-m row spacing of the tall component crops (maize and cassava var. Huallagina), interplanted with short-statured companion crops (soybeans and cowpea) in the 1st yr and upland rice, peanuts, and cowpeas in the 2nd yr was quantified. Monoculture checks were grown simultaneously with each of the intercrop components. The effect of various N rates on the productivity of each cropping pattern was also studied. As the row spacing widened, maize and cassava yields decreased, while yields of the short companion crops increased. The 1 m intercropping pattern was 30% more efficient in producing crop yields than the corresponding monocultures, as measured by the area-time equivalency ratio (ATER = 1.3). This treatment also produced income and calories at a rate equal to or higher than monoculture rotations or the individual monoculture checks. The 2- and 3-m intercrops produced income, calories, and protein at rates similar to the monocultures, and had ATER values near unity. Only maize (in both years) and soybeans (in the 1st yr, non-nodulated) responded to N applications;

ATER values were not affected by these rates. The rate of production of income, calories, and protein by the intercropping systems increased with additions of N in the 1st year but not in the 2nd. A multiple cropping system such as used in this expt. (with 1-m row spacing) would be equally or more productive biologically, economically, and nutritionally than the corresponding monocultures, and may provide other benefits such as greater income stability, reduced weed pressure, and reduced susceptibility to soil erosion. [AS]

0424

23068 XAVIER, J.J.B.N.; NOGUEIRA, O.L.; SA SOBRINHO, A.F. DE 1982. Mandioca em rotacao com culturas de ciclo curto (milho x feijao caupi). [Cassava in rotation with short-cycle crops (maize x cowpea)]. Manaus-AM, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual de Manaus. Pesquisa em Andamento no.35. 2p. Port. [Unidade de Execucao de Pesquisa de Ambito Estadual de Manaus, Caixa Postal 455, 69.000 Manaus-AM, Brasil]

Cassava. Cultivation systems. Rotational crops. Maize. Cowpea. Brazil.

To study the convenience of rotational crops under the physical and chemical conditions of the soil (Manaus, Brazil), the following treatments were evaluated: fertilized maize + fertilized bean + cassava, fertilized maize + fertilized bean + fertilized cassava, fertilized cassava + cassava, cassava + cassava. The harvesting of maize and bean gave yields of 2467 and 717 kg/ha, resp., and cassava presented an optimum growth. [CIAT]

See also 0235 0239 0241 0242 0245 0246 0289 0292 0294 0298 0338 0360 0370 0371 0374 0377 0378 0382 0383 0384 0399 0401

K02 Descriptive and Comparative Studies

See 0207

ABBREVIATIONS AND ACRONYMS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxigen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CAMD	Cassava African mosaic disease
CMV	Cassava African mosaic virus
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
COD	Chemical oxigen demand
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
EP	Preliminary Trials, CIAT
expt.	Experiment(s)
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (10^9)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
hp	Horsepower
IAA	Indoleacetic acid
IBA	Indolebutyric acid
IBYAN	International Bean Yield and Adaptation Nursery, CIAT
Illus.	Illustrated
in.	Inches
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilocalorie(s)
kg	Kilogram(s)
kJ	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD_{50}	Mean lethal dose
LER	Land efficiency ratio

LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	Alpha-naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
p.	Page
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pp.	Pages
pphm	Parts per hundred million
PPI	Pre planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGR	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
rpm	Revolutions per minute
Russ.	Russian
s	Second
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Species
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with N-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VEF	Bean Team Nursery, CIAT
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
vs.	Versus
W	West, watt
wk.	Week
WP	Wettable powder
wt.	Weight
yr	Year(s)
/	Per
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus

AUTHOR INDEX

ABENOJA, E.A.
0238

ACOSTA, W.D.
0347

ADJUPOLOLO, S.K.
0326

AGBIM, N.N.
0327

AGOSTINI, R.
0348

AHMAD, K.U.
0349

AJIBOLA, O.O.
0218

ALLEM, A.C.
0206

ALOSPETO, K.
0394

ANANTHARAMAN, M.
0350

ANDERSON, V.
0351

ANIMBO, A.H.
0323 0352

APILAR, E.
0290

ARCE, S.J. R.
0232

ARENE, O.O.
0233

ASHOKAN, P.K.
0417

ASTEGRO, J.C.
0329

ATKINSON, D.R.
0353

AUMAITRE, A.
0304

AYANRU, D.K.S.
0217 0261

AYERMOR, G.S.
0251

AZIZ, Z.A.
0213

BADILLO-FELICIANO, J.
0284

BAI, K.V.
0264

BALDIZAN, A.
0305

BANGUN, P.
0250

BARRETT, D.M.
0252

BARTSCH, W.
0318

BATERNA, J.P.
0238

BAUTISTA, O.K.
0254

BAYGOO, A.J.
0389

BEDERE, C.
0297

BELLO, R.W.
0322

BENNETT, F.D.
0269

BEPPU, K.
0224

BEST, R.
0395

BISEN, S.S.
0323

BLAIN, D.
0354

BLOM, P.S.
0355

BOHER, B.
0253

BONDAR, G.
0282

BORHEN, C.
0356

BOSTER, J.S.
0207

BOURDON, J.P.
0357

BREFEL, P.M.
0358

BRESSANI, R.
0300

BRICCAIDLI, A.
0306

BRON, P.G.
0273

BUCK, K.W.
0262

BUITRAGO, J.
0310

BURITICA, P.
0257

CACERES A., L.A.
0208

CADAVID L., L.F.
0227

CALLEFFI, A.
0306

CAMPOS, S.D. DA S. DE
0321

CANIOCA, J.O.D.
0345

CARTERON, J.
0297

CASTANEDA, I.
0343

CENTRAL TUBER CROPS RESEARCH INSTITUTE
0233 0357 0360

CENTRO DE PESQUISAS E DESENVOLVIMENTO, BRASIL
0361

CEPEDA, M.P.
0317

CHALKE, K.D.
0334

CHAN, S.K.
0207 0214 0230 0240 0241 0265 0286 0310 0362 0363 0364 0365 0367

CISSE, F.M.
0368

CLEFEJEU, J.L.
0258

COCK, J.H.
0211 0242 0313

COLEMAN, D.F.
0210

CONSTANT, J.L.
0297

CONTRERAS G., J.
0223

COSTA, J.G.
0307

COURSEY, D.G.
0253

COUTTS, P.H.A.
0262

CROIX-MARIE, F.
0331

CURSO NACIONAL EL CULTIVO DE YUCA Y SUS USOS ALTERNATIVOS, 1er., QUITO, ECUADOR
0366

DANIEL, J.F.
0255

DAVIS, A.
0351

DE JONG, G.
0370

DEBES, C.
0367

DIXON, R.
0303

DUBHAL, N.P.
0323

DIAME, M.M.
0368

DU PLESSIX, Y.J.
0243 0244

ECKEBIL, J.P.
0307

EL-SHARKAWY, M.A.
0211

ELIAS, L.G.
0300

ENRIQUEZ T., J.
0370

EZULIKE, T.O.
0283

FATAR, L.
0371

FERGUSON, T.U.
0243

FERNANDES, R.
0343

FERREIRA FILHO, J.R.
0287

FERREIRA, C.
0274

FERREIRA, L.D.
0400

FINDEY, M.M.
0258

FUENTES V., F.
0260

FUJIMOTO, S.
0224

FUKUDA, C.
0256

FUKUDA, M.M.S.
0256

FUNDACION PARA EL DESARROLLO INDUSTRIA Y AGRICOLA DEL QUINDIO
0372

GARASIN, J.P.
0373

GHARIA, M.M.
0323

GHOSH, J.P.
0246

GOMEZ, J.
0215 0219 0220 0317 0375

GONZALEZ A., A.
0296

GONZALEZ, F.
0343

GOPAKUMAR, K.
0293

GREENFIELD, J.N.
0348

GRIFFITH, S.J.
0311

GRIFFON, D.
0332

GUGNANI, H.C.
0337

GURITAO, G.
0247 0374

HAHN, S.K.
0280

HAMILTON, M.D.D.
0262

HAN, M.H.
0346

HAN, Y.T.
0346

HARRISON, B.D.
0266

HERNANDEZ, L.
0260

HERRAN, H.R.
0271 0272

HEYS, G.
0333

HIZUKURI, S.
0225

HOMELLER, R.H.
0227

HOSSEIN, K.M.
0207 0214 0230 0240 0241 0255 0296 0330 0362 0363 0364 0365

IKOTUN, T.
0257

IMAI, K.
0212 0218

INSTITUTO INTERAMERICANO DE COOPERACION PARA LA AGRICULTURA
0375

INSTITUTO NACIONAL DE INVESTIGACIONES AGRICOLAS, MEXICO
0289

ISSEMORE, T.
0352

IZOMKON-EFIONHIO, B.O.
0221

JANSSEN, A.
0376

JARMAN, T.R.A.
0353

JAYASINGHE, U.
0263

JAYAWARDENA, S.D.G.
0377

JIMENEZ, I.
0310

JUAO, A. DA S.J.
0380

JUG, J.J.
0264 0371

KARUNDO, P.
0297

KALAITSAKIS, P.
0313

KANDA, A.
0212

KAPUTU, V.T.
0334

KAWANO, K.
0290

KHAJAREKN, J.M.
0308

KHAJAREKN, S.
0308

KOCHELEFF, P.
0297

KULEDJO, J.A.
0342

KRUTKON, T.
0231

KUMAR, A.
0222

LABERRY S., T.
0259

LAMI, B.
0379

LAMEIRA, O.A.
0291

LAN, G.S.
0207 0214 0230 0240 0241 0285 0286
0320 0362 0363 0364 0365

LARTEY, R.L.
0335 0380

LAW, A.T.
0307

LEDUC, G.
0420

LEE, G.R.
0343

LEE, K.J.
0340

LEITNER, D.E.
0228

LEMA, K.M.
0271 0272

LIAN, T.S.
0207 0214 0230 0240 0241 0285 0286
0290 0350 0362 0363 0364 0365 0381
0382

LIENEN, I.E.
0303

LIMA, O. DE A.
0314

LOCKARD, J.M.
0210

LOCKARD, R.G.
0210

LOPEZ Z., M.
0243

LOPEZ, L.L.
0373

LOZANO, J.C.
0259 0263

LUJAN, M.
0343

LYNAM, J.K.
0383

MAAS, J.L.
0258

MANER, J.H.
0310

MANRIQUE, L.A.
0227

MARISCAL, A.A.
0290 0384

MARTINEZ H., B.
0232

MARTINEZ V., R.
0232

MAZUMBA, J.
0301

MBINGA, M.J.
0320

MCALLAN, A.B.
0311

MELLO, R.P. DE
0312

MELO, J.F.
0312

MICHE, J.C.
0383 0386

MUFUR, L.N.
0336

MUHANKUMAR, S.R.
0421

MONTALDO, A.
0387 0388

MOORE, C.P.
0313

MORAES, G.W.G. DE
0270

MOREIRA, M.A.
0312

MORENO, E.A.M.
0314

MORGADO, L.O.
0422

MORIYA, T.
0212

MSABAHA, M.A.M.
0337

MUENDANE, C.
0338

MURO, M.A. DE
0345

N'BONGUE, R.
0389

NAGAHAMA, T.
0234

NAIR, N.G.
0264

NAIR, R.B.
0397

NAIR, R.G.
0246 0292

NAIR, R.V.
0419

NAYAR, M.M.
0292

NELSON, G.C.
0390

NINAN, K.N.
0391

NJOKU, O.U.
0235

NOGUEIRA, O.L.
0424

NUNA, A.T.
0220

NUGROHO, J.M.
0297

N'ANA, I.E.
0273

NYANIN, O.O.
0392 0393

NZELIDE, F.K.
0339

NZIEFFE, A.
0340

ODEBIYI, J.A.
0283

ODERA, F.P.
0320

OLYMPIO, H.K.
0341 0394

ONYEKAERE, O.O.
0342

OSPINA, B.
0395

OYENIRAN, J.O.
0302

PACHICO, O.M.
0396

PACUMBABA, R.P.
0265

PALANISWAMI, M.S.
0294

PAPADOPOULOS, G.
0315

PARK, Y.K.
0345

PARKA, O. DE
0305

PARKA, M.
0305

PAULINO, L.A.
0405

PAVLOVSKAYA, O.E.
0315

PEDRAZA, A.
0295

PEREZ, M.
0343

PERKIN, J.
0297

PIANO, L.N.
0209 0214 0230 0240 0241 0285 0286
0330 0362 0363 0364 0365

PINO A., J.A.
0270

PIZZINATTO, A.
0321

PORTELA, R.
0310

PORTO, M.C.M.
0211

QUEVEDO, M.A.
0254

QUIZADA L., D.
0322

RADHAKRISHNAN, V.V.
0293

RAJAGURU, A.S.D.
0316

RAJENDRAN, P.G.
0397

RAKOTONANAHARY, J.P.
0398

RAMANATHAN, I.
0350

RAMANUJAM, T.
0294

RAMASWAMY, N.
0295

RAO, M.R.
0422

RAVELOMANANTSOA, J.
0393

RAVINDRAN, V.
0316

REGIONAL WORKSHOP ON CASSAVA IN ASIA, ITS POTENTIAL AND RESEARCH DEVELOPMENT NEEDS, BANGKOK, THAILAND
0399

REIS, A.J. DOS
0400

RHEE, S.K.
0345

RIBEIRO, A.F.
0274

ROBERTS, I.M.
0260

ROBERTSON, I.A.D.
0267 0268

ROBINSON, D.J.
0266

ROCHA, B.V. DA
0256

ROCHE, F.C.
0401

RODRIGUES, F. DE M.
0307

RODRIGUEZ M., S.
0234 0290

RODRIGUEZ N., A.
0234

RODRIGUEZ P., A.
0234

RODRIGUEZ, F.
0402

ROSCO, A.
0344

SA SOUZINHO, A.F. DE
0424

SAKURU, J.
0403

SANCHEZ, P.A.
0423

SANTAMARIA M., E.
0273

SANTOS, C.V.
0274

SANWAL, G.G.
0222

SARIKAPHUTI, Y.
0404

SARMA, J.S.
0405

SASSER, M.
0258

SCHMITT, A.T.
0275

SCHOONHOVEN, A. VAN
0276

SEMESI, V.M.K.
0337

SERRA, A.D.P.
0338

SHARMA, H.K.
0323

SHARMA, V.C.
0217

SHIKASAKA, K.
0225

SIEVERDING, E.
0223

SILVA, O.R. DA
0307

SILVA, V.G. DA
0307

[illegible]
0405

SINTHUPRAMA, S.
0235 0290

SITOMPUL, S.A.
0374

SMITH, R.
0407

SOARES, L.A.
0270

SOMARJU, R.
0293 0297

SONI, S.L.
0323

SRIVASTAVA, A.C.
0323

STEGHART, P.H.
0408 0409

STEIN, V.E.
0262

SUBRAMANIAN, S.R.
0410

SUDHAKARA, K.
0417

SUGANUMA, T.
0224

SULLIVAN, D.J.
0277

SUNDARARAJAN, S.
0295

SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA, BRASIL
0411 0412

SWINKELS, J.J.M.
0324

TAKEDA, Y.
0325

TCHIENGUE, F.
0411

TERRA, W.R.
0274

THANKAPPAN, R.
0294

THAPORN, C.
0235 0290

TITAPIWATANAKUN, B.
0414

TRESOROV, N.N.
0325

TURNBULL, J.
0351

UGOCHUKWU, E.N.
0321

UKWU, J.U.
0415

UNU, M.Y.
0336

VALDIVIESO, M.
0215 0219 0220 0317

VAZQUEZ, J. E.
0249

VELASCO, A.C.
0263

VENEZUELA, MINISTERIO DE AGRICULTURA Y CRIA
0237

VIANA, J. DE A.C.
0312

VIJAYAKUMAR, M.
0295

VILLAMAYOR JUNIOR, F.G.
0247

VREUGDENHIL, D.
0278

WADE, M.K.
0423

WARGIONO, J.
0250

WEITE, Z.
0298

WELSCH, D.F.
0381

WHOLEY, D.J.
0353

WHOLEY, D.W.
0408 0409

WORKSHOP ON PROCESSING TECHNOLOGIES FOR CASSAVA AND OTHER TROPICAL ROOTS AND TUBERS IN AFRICA, ABIDJAN, IVORY COAST
0416

WOUNDAH, B.U.
0210

WRIGHT, M.
0417

XAVIER, J.J.P.N.
0424

XIONG, L.
0293 0371

XUECHENG, T.
0293 0371

YANAGISAWA, T.
0216

YASEEN, M.
0278 0279 0280 0281

YEO, W.
0418

YUSUF, Z.A.M.
0346

ZIRAS, L.
0315

Subject Index

ACARICIDES
0217 0237 0370

AFLATOXINS
0293 0334

AGRICULTURAL EQUIPMENT
COSTS
0237 0408
HARVESTING
0244 0409
LAND PREPARATION
0237
PLANTING
0237 0244

ALCOHOL
0358
FERMENTATION
0345
PROCESSING
0252 0311 0345 0353 0385 0416
PRODUCTION
0292 0346 0353 0385 0404
USES
0252 0272 0318 0345 0346 0353 0385
0404 0416

ALEYRODIDAE
0237 0267 0268 0269 0370

ALUMINUM
0227

AMINO ACIDS
0220 0100
DIETARY VALUE
0358

ANASTREPHA AYANIENSIS
INSECTICIDES
0370

ANASTREPHA PICKELI
INSECTICIDES
0370

ANTIBIOTICS ALIUS
0237
INSECT CONTROL
0240 0270
INSECTICIDES
0370

APICAL MERISTEMS
TISSUE CULTURE
0290

ASCORBIC ACID
0347

ASH CONTENT
0217 0303 0306 0310 0312 0313 0316
0323 0324 0347 0409

ASPERGILLUS
0293

ATTA
0237
INSECT CONTROL
0270

BACTERIOSES
0235 0237 0242 0243 0255 0257 0258
0353 0374 0379 0384 0389 0401
DISEASE CONTROL
0240
RESISTANCE
0256 0355 0288 0296 0297

BAKERY PRODUCTS
0370
CASSAVA FLOUR
0358
COMPOSITE FLOURS
0334 0359 0416
WHEAT FLOUR
0334 0359

BANANA-PLANTAINS
0370

BEMISIA
0237 0267 0268
INSECT CONTROL
0270
INSECTICIDES
0370
RESISTANCE
0280

BEVERAGES
0334

BIOCHEMISTRY
0222 0224

BIOLOGICAL CONTROL
BACTERIOSES
0280
INJURIOUS INSECTS
0269 0270 0272 0275 0276 0278 0279
0280 0281 0370
INJURIOUS MITES
0270 0281 0280 0370
MYCOSES
0370
VIROSES
0280 0370

BITTER CASSAVA
0207 0217 0237 0261 0317 0338 0404
0407

BOLIVIA
0279

BOILING
0320 0140

BORON
0240

MANGANESE
0207 0213 0214 0227 0249 0291

MANGE
0233 0235 0257 0270 0274 0275 0281
0282 0287 0291 0307 0312 0314 0319
0321 0345 0358 0423 0424
MARKETING
0361 0409
PRODUCTION
0361 0407 0411 0417
SOCIO-ECONOMIC ASPECTS
0361

MEADS
0334

CALCIUM
0216 0245 0327
DEFICIENCIES
0230
SOIL PRODUCTIVITY
0230 0241

CALVES
0313

CAMEROON
0413
MARKETING
0395
PRODUCTION
0336 0369 0395
TRADE
0395

CANDY
0207 0214

CARBOHYDRATE CONTENT
0229 0231 0295 0300 0311 0353 0365

CARBON DIOXIDE
0211 0212 0216

CARIBBEAN
0231 0235 0245 0248 0250 0280 0281
0284 0296 0343

CARPOLONCHAEA CHALYBEA
0237
INSECTICIDES
0370
RESISTANCE
0295

CASAVE
0347

CASSAVA AFRICAN MOSAIC VIRUS
0261 0262 0265 0267 0267 0292 0326
0367 0371 0379
DISEASE CONTROL
0237 0249
ENTOMOLOGY
0268
RESISTANCE
0295
SYMPTOMATOLOGY
0264

CASSAVA BREAD
0347

CASSAVA CHIPS
0243 0304 0371
CATTLE
0351 0410
CONSUMPTION
0252 0364 0365 0381 0383 0404 0414
COSTS
0353 0364 0381 0383 0384 0389 0405
0410 0414
DETOXIFICATION PROCESSES
0317
DRYING
0252 0317 0330 0379 0416 0409
HCN CONTENT
0252 0317
INDUSTRIALIZATION
0320 0351 0358 0379 0399 0407 0409
MARKETING
0364 0365 0383 0385 0404 0407 0410
0414 0417
PRICES
0337 0353 0381 0383 0384 0404 0407
0410 0414 0417
PROCESSING
0252 0317 0320 0330 0337 0351 0364
0373 0379 0380 0385 0399 0403 0407
0409 0414
SOLAR DRYING
0252 0404 0409
STORAGE
0292 0301 0314 0408 0409
INSECTS
0353 0358
SWINE
0355
TRADE
0354 0365 0381 0383 0385 0404 0409
0414 0417

CASSAVA COMMON MOSAIC VIRUS
0237 0370

CASSAVA FLOUR
COMPOSITION
0300 0342 0358 0365
CONSUMPTION
0365 0404
COSTS
0342 0347 0372 0399
DRYING
0251 0342 0347 0379
INDUSTRIAL MACHINERY
0372
INDUSTRIAL MICROBIOLOGY
0342
INDUSTRIALIZATION
0320 0326 0331 0342 0355 0379 0399
MARKETING
0255 0342 0347 0365 0375 0374 0398
0404 0417
NUTRITIVE VALUE
0300
PRICES
0337 0338 0347 0374 0398 0404 0417
PROCESSING
0251 0261 0320 0326 0331 0337 0351
0342 0347 0358 0372 0374 0385 0399
0404 0407 0409
PRODUCTION
0251 0320 0331 0337 0338 0347 0365
0372 0373 0385 0394 0398 0403 0404
0417

PROTEIN CONTENT
0303 0358
STORAGE
0251 0253
SWINE
0353
TRADE
0365 0385 0396 0404 0417
WATER CONTENT
0303

CASSAVA LEAVES (VEGETABLE)
0320
COMPOSITION
0353

CASSAVA MEAL
0243
BOILING
0321 0340
COMPOSITION
0252 0301 0306 0310 0312 0316 0334
0342 0350
CONSUMPTION
0252
DIGESTIBILITY
0305
DRYING
0251 0252 0334 0340 0342
FACTORIES
0342
FATTENING
0305
INDUSTRIALIZATION
0340 0342 0353 0361 0396
PELLETS
0252 0305
PROCESSING
0251 0252 0320 0334 0336 0340 0342
0385 0386 0403
STORAGE
0251 0301 0310 0328
SWINE
0336 0340 0344 0351
TRADE
0385

CASSAVA PASTES
0243 0251 0320 0335 0340 0342 0385
0386 0401

CASSAVA PRODUCTS
0390
FRESH PRODUCTS
0310 0314 0377 0381
CASSAVA LEAVES (VEGETABLE)
0320 0351
CASSAVA ROOTS (VEGETABLE)
0376
CASAVE
0347
CASSAVA BREAD
0347
CASSAVA CHIPS
0243 0252 0272 0301 0308 0317
0320 0330 0337 0351 0356 0364
0365 0371 0373 0377 0390 0391
0393 0394 0395 0397 0403 0404
0407 0409 0407 0410 0414 0417
CASSAVA FLOUR
0251 0251 0320 0320 0326 0331
0337 0339 0342 0347 0353 0365
0368 0372 0373 0375 0389 0394
0396 0401 0404 0417

CASSAVA MEAL
0243 0251 0252 0301 0305 0306
0310 0312 0314 0316 0321 0334
0336 0340 0342 0351 0361 0365
0386 0403
CASSAVA STARCH
0222 0245 0252 0253 0318 0319
0320 0321 0322 0323 0324 0325
0330 0332 0344 0348 0353 0360
0364 0365 0366 0371 0374 0375
0379 0380 0381 0383 0385 0390
0394 0398 0400 0402 0404 0407
0410 0414 0416
FUFU-FUFU
0251 0340 0342 0355 0366
GAPLEK
0374 0383 0406
GARI
0243 0251 0310 0324 0330 0347
0368 0373 0380 0385 0396 0394
0416
PELLETS
0252 0308 0330 0383 0385 0404
0407 0403 0407 0414 0417
TAPIOCAS
0318 0330 0365 0383 0373 0380
0394 0373 0407 0410

CASSAVA PROGRAMS
0283 0330 0375 0419
ANIMAL NUTRITION
0358
GERMPLASM
0290
HUMAN NUTRITION
0396
PLANT BREEDING
0287 0290 0359 0371

CASSAVA STARCH
0371
ALCOHOL
0252 0319 0345 0346 0353 0365 0404
0416
ANALYSIS
0222 0245 0319 0321 0373
CONSUMPTION
0252 0354 0365 0374 0376 0381 0383
0390 0404 0414
COSTS
0353 0364 0374 0376 0381 0381 0390
0403 0413 0414
DEXTRINS
0353
DRYING
0254 0330 0376 0379
ENZYMES
0222 0332 0345
FACTORIES
0320 0379
FERMENTATION
0319 0345 0376
GELATINIZATION
0323 0324 0330
GLUCOSE
0353 0365
HYDROLYSIS
0332
INDUSTRIAL MICROBIOLOGY
0319 0345 0346 0354
INDUSTRIAL STARCHES
0414

INDUSTRIALIZATION
0316 0320 0334 0353 0376 0379 0432
0407 0416
MARKETING
0253 0364 0365 0376 0383 0385 0390
0394 0399 0400 0404 0407 0410 0414
PACKAGING
0378
PARTICLE SIZE
0323 0324
PRICES
0353 0374 0376 0381 0383 0390 0394
0398 0404 0407 0410 0414
PROCESSING
0252 0253 0318 0320 0323 0324 0330
0332 0344 0345 0353 0354 0359 0376
0377 0380 0385 0394 0398 0402 0407
0414 0416
STORAGE
0253 0353 0357 0376 0380
TEXTILES
0414
TRADE
0364 0365 0374 0381 0383 0385 0390
0398 0404 0414 0416
USES
0252 0318 0320 0322 0325 0330 0345
0346 0353 0365 0366 0374 0379 0380
0381 0383 0385 0390 0394 0404 0407
0410 0414 0416
VISCOSITY
0321 0323 0324 0325
WATER REQUIREMENTS (PROCESSING)
0353 0376

CASSAVA PONTS (VEGETABLE)
COMPOSITION
0376

CATTLE
0311 0354 0410
BEEF CATTLE
0307
DAIRY CATTLE
0312

CECIDOMYIIDAE
0237 0278 0370

CENTRAL AFRICAN REPUBLIC
0399

CERCOSPORA CARIBEA
0237 0370
RESISTANCE
0297

CERCOSPORIDIUM HENNINGSII
0236 0237 0364 0370
DISEASE CONTROL
0240
RESISTANCE
0297 0298 0297

CERCOSPORA VICOSAE
0364 0370
DISEASE CONTROL
0240
RESISTANCE
0297

CEREALS
0324 0356 0376 0405 0410 0423 0423
0424

CHICKANGUE
0340

CHRONOSOMES
0208

CLIMATIC REQUIREMENTS
0220 0236 0237 0271 0280 0353 0355
0361
GROWTH
0216 0237
PRODUCTIVITY
0214 0232 0237 0243 0312

CLONES
0217 0234 0256 0270 0293 0295
AGRONOMIC CHARACTERS
0296

COCOYAMS
0293

COLOMBIA
0211 0219 0220 0228 0229 0253 0263
0267 0276 0279 0310 0313
MARKETING
0376 0379
PRODUCTION
0353 0372 0395
SOCIO-ECONOMIC ASPECTS
0356 0376 0432

COMPOSITE FLOURS
0334 0358 0416

COMPOSITION
0213 0220 0223 0229 0230 0234 0237
0241 0244 0245 0257 0288 0291 0296
0298 0302 0304 0311 0313 0347 0362
0367 0388 0409 0423
CASSAVA FLOUR
0300 0342 0358 0365
CASSAVA MEAL
0252 0301 0306 0310 0312 0316 0334
0342 0358
CASSAVA STARCH
0252 0313 0323 0324 0325 0351 0357
0364 0365 0376
LEAVES
0214 0215 0216 0217 0219 0261 0310
0316
ROOTS
0215 0217 0221 0254 0310 0372
STEMS
0215 0217 0219 0226 0247 0248
TABLES
0365

CONFECTIONERIES
0256

CONGO
0255
MARKETING
0385
PRODUCTION
0371 0385
SOCIO-ECONOMIC ASPECTS
0340
TRADE
0385

COPPER
0230 0364

CORTEX
COMPOSITION
0217
HCN CONTENT
0217
USES
0326 0327 0329

COSTA RICA
0215 0317

CROSSBREEDING
0285 0295

CUBA
0232 0234 0248 0260 0296 0343

CULTIVARS
0215 0211 0219 0220 0224 0237 0239
0245 0254 0255 0256 0260 0261 0263
0265 0267 0268 0271 0285 0317 0320
0337 0338 0347 0349 0358 0363 0368
0376 0379 0380 0384 0385 0387 0386
0403 0404 0407 0423
AGRONOMIC CHARACTERS
0223 0296 0419
GERMPLASM
0235 0246 0290 0292
IDENTIFICATION
0207
ROOT PRODUCTIVITY
0213 0215 0227 0228 0229 0232 0233
0235 0238 0243 0247 0249 0250 0254
0286 0287 0289 0291 0294 0296 0298
0359 0370 0382 0401 0419 0420
SELECTION
0256 0287 0289 0296 0297 0364
STARCH PRODUCTIVITY
0227
TOXICITY
0310

CULTIVATION SYSTEMS
0353 0373 0381 0382 0383 0406 0420
FALLOWING
0376
INTER-CROPPING
0235 0239 0241 0242 0245 0246 0267
0289 0292 0294 0298 0359 0360 0365
0371 0374 0376 0377 0378 0384 0401
0419 0421 0422 0423
ROTATIONAL CROPS
0235 0358 0362 0365 0370 0384 0424

CULTURE MEDIA
0255 0257 0337 0343

CUTTINGS
0239 0265 0290 0360
GERMINATION
0359
PROPAGATION
0237
ROOT PRODUCTIVITY
0235 0242 0247 0248 0249 0250 0294
SPACING
0241 0243 0245 0246 0249 0289 0296
0364 0370 0382
STORAGE
0235 0237 0241 0242 0249 0359 0370
0384 0401
0290 0359 0370 0382 0377 0401

CYANIDES
0217 0321 0253
DETOXIFICATION
0317

CYANOGENESIS
0357

CYANOGENIC GLYCOSIDES
0303

CYTOGENETICS
0286 0288

CYTOLOGY
0285

DETOXIFICATION
0310 0317

DEVELOPMENTAL STAGES
BRANCHING
0207 0213 0214 0249 0293
GERMINATION
0285 0359
ROOT DEVELOPMENT
0207 0247

DEXTRINS
0353

DIGESTIBILITY
0304
CASSAVA MEAL
0305

DIOSCOREA
0253

DISEASE CONTROL
BACTERIOSES
0240
MYCOSES
0240
VIRUSES
0239 0246

DOMESTIC ANIMALS
0304 0305 0306 0307 0310 0311 0312
0314 0315 0316 0357 0358 0410

DRIED POTS
0243 0252 0292 0301 0308 0317 0320
0330 0337 0358 0371 0373 0374 0379
0380 0381 0384 0389 0401 0403
DISTRIBUTION
0353 0404 0407
MARKETING
0364 0365 0383 0385 0390 0404 0407
0410 0414 0417

DRYING
0217 0335 0340 0341
CASSAVA CHIPS
0252 0317 0330 0379 0408 0409
CASSAVA FLOUR
0251 0342 0347 0379
CASSAVA STARCH
0252 0330 0376 0379
PELLETS
0252 0330 0408 0409
TAPIOCAS
0330 0379

WATER CONTENT
0334 0409

ECOLOGY
0206 0371

ECOSYSTEMS
0371

ECUADOR
0279 0366 0370 0387 0398

ENERGY PRODUCTIVITY
0423

ENTOMOLOGY
0267 0268 0271 0273 0274 0282 0283

EPIDEMIOLOGY
0268

ERINNYIS ELLO
0237 0270 0274 0275
INSECT CONTROL
0275
INSECTICIDES
0274 0277
RESISTANCE
0299

ETHANOL
0252 0311 0345 0346 0385

EUTETRANYCHUS ORIENTALIS
INSECT CONTROL
0246

FACTORIES
CASSAVA CHIPS
0326 0403
CASSAVA FLOUR
0326 0331 0342
CASSAVA STARCH
0320 0376
GARI
0333 0342
PELLETS
0409

FALLOWING
0287 0376

FATTENING
SWINE
0306 0315

FEED CONSTITUENTS
0306 0307 0309 0310 0311 0312 0396

FEEDS AND FEEDING
0234 0252 0299 0306 0307 0308 0309
0310 0311 0312 0313 0314 0315 0316
0330 0379 0381 0383 0385 0391 0392
0403 0404 0407 0408 0410 0414 0417

FERMENTATION
0317 0331 0334 0335 0341 0342 0345
0376
PROTEIN ENRICHMENT
0320 0403

FERMENTED PRODUCTS
0252 0342 0348 0345 0346 0351 0385
0404 0416

FLOWERS
0206 0207 0255

FOLIAGE
0209 0214 0215 0217 0358
FORAGE
0234

FOMES LIGNOSUS
0364 0370 0382
DISEASE CONTROL
0240
RESISTANCE
0285 0297

FOOD ENERGY
0217 0312 0314 0316 0356 0387 0398

FOOD PRODUCTS
0221 0241 0251 0252 0312 0318 0322
0325 0326 0328 0333 0334 0335 0336
0341 0342 0353 0354 0358 0375 0376
0380 0381 0384 0385 0386 0391 0394
0403 0407 0414 0416

FUN-FUN
COMPOSITION
0342
PROCESSING
0251 0340 0342 0345 0386

FURAC
0234 0301 0307 0310 0313 0314

FRUITS
0206 0207 0255

GABON
0325 0327

GARDEN
PRODUCTION
0374 0383 0408
TRADE
0374 0383
USES
0374 0383 0406

GARI
COMPOSITION
0221 0302 0342
FACTORIES
0333 0342
FERMENTATION
0333 0335 0341 0342
HCN CONTENT
0221
INDUSTRIAL MACHINERY
0315 0321 0333
MECHANIZATION
0243 0356 0362 0385
PACKAGING
0335 0336
PROCESSING
0251 0311 0325 0331 0335 0336 0361
0362 0367 0372 0380 0385 0386 0393
0394 0416
STORAGE
0251 0302 0335 0360

GELATINIZATION
0323 0324 0330 0331 0342

GENETICS
0200

GERMINATION
CUTTINGS
0399
SEED
0293

GERMPLASM
0235 0246 0290 0292 0293 0399

GHANA
0330
MARKETING
0395
PRODUCTION
0380 0384
TRADE
0395

GLOMERELLA CINGULATA
0364
DISEASE CONTROL
0240

GLUCOSE
0353 0369

GRINDING
0330 0331

GROWTH
0208 0209 0213 0216 0231 0237 0247
0288 0379

GROWTH-CHAMBER EXPERIMENTS
0271

GUATEMALA
0390

GUINEA
0363

GUYANA
0285 0361

HARVEST INDEX
0244 0255 0293 0297 0354

HARVESTING
0252 0310 0364 0371 0377
AGRICULTURAL EQUIPMENT
0244 0304
TIMING
0215 0219 0220 0223 0234 0235 0239
0243 0245 0247 0249 0254 0302 0363
0371 0376 0382 0422

HCN CONTENT
0220 0221 0284 0289 0295 0298
CASSAVA CHIPS
0252 0317
CASSAVA MEAL
0252 0310 0316
CASSAVA STARCH
0252 0317
CORTICA
0217
LEAVES
0217 0219 0261 0310 0316
ROOTS
0217 0221 0310
STEMS
0217 0219

HERBICIDES
0228 0234 0237 0240 0244 0253 0289
0362 0363 0364 0382

HUMAN NUTRITION
0300 0345 0403 0404 0408 0409

HYBRIDS
0200 0293
PRODUCTIVITY
0294 0350 0360 0370 0378 0397
ROOT PRODUCTIVITY
0294 0370 0378 0397
SELECTION
0397

HYDROLYSIS
CASSAVA STARCH
0332

INCOME
0227 0237 0294 0347 0349 0350 0352
0365 0368 0371 0373 0375 0378 0397
0410 0421 0423

INDIA
0272 0234 0264 0294 0295 0314 0323
0359 0361 0377 0419 0421
GERMPLASM
0246 0292 0293
MARKETING
0410
PRODUCTION
0246 0292 0410
SOCIO-ECONOMIC ASPECTS
0350 0360 0376

INDONESIA
0247 0359
PRODUCTION
0297 0374 0401 0408
SOCIO-ECONOMIC ASPECTS
0401
TRADE
0374

INDUSTRIAL MACHINERY
0315 0328 0333 0344

INDUSTRIAL STARCHES
0414

INFLORESCENCES
0208 0209 0255

INJURIOUS INSECTS
0237 0240 0242 0269 0277 0351 0364
0382 0389 0415
ANASTREPHA MANIHOTI
0370
ANASTREPHA PICKELI
0370
AONIDOMYTILUS ALDUS
0237 0246 0276 0370
ATTA
0237 0275
TERMISIA
0237 0274 0288 0378

CARPOLONCHAEA CHALYBEA
0237 0296 0370
ERIONYTS ELLO
0237 0270 0274 0275 0276 0289 0370
PHENACOCCUS MANIHOTI
0217 0271 0272 0278 0279 0280 0281
0283 0370
SILIA PENDULA
0237 0276 0370
TRIALEURODES VARIABILIS
0370
ZONOCERUS VARIEGATUS
0273 0380

INJURIOUS SITES
0235 0239 0242 0243 0276 0282 0283
0283 0297 0353 0359 0389 0415
MONONYCHELLUS TANAJOA
0217 0237 0267 0370 0379
OLYGONYCHUS PERUVIANUS
0237
TETRANYCHUS CINNABARINUS
0246 0379
TETRANYCHUS URTICAE
0237 0370 0374 0384 0401

INOCULATION
0228
DISEASES AND PATHOGENS
0258

INSECT BIOLOGY
0267 0256 0271 0273 0274 0276 0282
0285

INSECTICIDES
0217 0239 0240 0269 0370 0376

INTER-CROPPING
0235 0241 0242 0245 0292 0294 0298
0359 0363 0371 0374 0377 0384 0401
BANANA-PLANTAINS
0376
BEANS
0267 0419 0422
COWPEA
0422 0423
GROUNDNUT
0237 0267 0360 0371 0421 0423
LEGUME CROPS
0267 0419 0422 0423
MAIZE
0376 0422 0423
RICE
0423
SOYBEANS
0423
SWEET-POTATOES
0245
TARO
0245
YAMS
0245

IRRIGATION
0211 0232 0246 0294 0353 0419

ISOLATION
DISEASES AND PATHOGENS
0257 0258 0263

IVORY COAST
0244 0420

MARKETING
0385
PRODUCTION
0243 0385 0418
TRADE
0385

KENYA
0267 0268
PRODUCTION
0320
SOCIO-ECONOMIC ASPECTS
0320

HONDURAS
0375

LABOUR
0383 0401 0410
HARVESTING
0363 0391
PLANTING
0391
PROCESSING
0331 0353 0415

LAND PREPARATION
0241 0245 0360 0375 0391
AGRICULTURAL EQUIPMENT
0237
MECHANIZATION
0237 0243 0382
ROOT PRODUCTIVITY
0235 0243 0294 0362 0392 0397

LATIN AMERICA
MARKETING
0348
PRODUCTION
0348
TRADE
0348

LEAF AREA
0210 0213 0214 0227 0247 0248 0285
0364

LEAVES
0205 0207 0209 0210 0211 0212 0213
0214 0215 0216 0273
ANALYSIS
0255 0261
ANIMAL NUTRITION
0310
HCN CONTENT
0217 0219 0261 0310 0316
MINERAL CONTENT
0219 0310
PROTEIN CONTENT
0219 0310 0316

LIGHT
0214

LINAMARASE
0217 0221 0261

MADAGASCAR
MARKETING
0395

MAGNESIUM
0327 0364

ROOT PRODUCTIVITY
0230 0233 0243 0382
PRODUCTION
0398
TRADE
0398

MALAYSIA
0209 0213 0214 0230 0240 0241 0285
0296 0307 0330
MARKETING
0362 0364 0365
PRODUCTION
0345 0363 0365 0381
SOCIO-ECONOMIC ASPECTS
0362 0382
TRADE
0364 0365 0381

MANURES
0237 0360 0397
OCHO
0329

MARKETING
0345 0362 0375 0399 0405
CASSAVA CHIPS
0364 0365 0383 0385 0404 0407 0410
0414 0417
CASSAVA FLOUR
0253 0342 0347 0365 0375 0374 0396
0404 0417
CASSAVA MEAL
0342 0361 0385
CASSAVA STARCH
0253 0364 0365 0376 0383 0385 0390
0394 0391 0400 0404 0407 0410 0414
GARI
0333 0342 0385 0394
PELLETS
0253 0365 0404 0407 0414 0417
TAPIOCAS
0365 0394 0398 0407 0410

MECHANIZATION
HARVESTING
0243 0361 0382 0408
PLANTING
0237 0243 0382
PROCESSING
0331 0336 0342 0353 0375 0414

METHIONINE
0300

MEXICO
0233 0259

MINERAL DEFICIENCIES
0230

MINERALS
0217 0229 0227 0229 0230 0233 0235
0237 0241 0243 0246 0247 0249 0294
0293 0307 0327 0364 0370 0382 0397
0401 0417 0421 0422

MITE CONTROL
0246 0275 0282
ACARICIDES
0217 0237 0370

MODIFIED STARCHES
0397

MOLYBDENUM
0246

MONONYCHELLUS TANAJOA
0237 0267 0374
INSECTICIDES
0217 0370

MOULDS
0302

MSG
0407 0414

MYCOPLASMOSES
0237 0370

MYCORRHIZAE
0228 0357

MYCOSES
0233 0235 0237 0242 0243 0259 0294
0364 0370 0374 0382 0401
DISEASE CONTROL
0240
RESISTANCE
0260 0265 0269 0276 0277

NIGERIA
0217 0218 0221 0233 0261 0271 0272
0273 0277 0283 0288 0302 0327 0329
0339 0393
MARKETING
0333 0342
PRODUCTION
0333 0415

NITROGEN
0227 0233 0235 0239 0243 0246 0247
0289 0294 0298 0327 0350 0364 0370
0382 0397 0401 0419 0421 0422 0423

NUTRITIONAL REQUIREMENTS
0227 0230 0233 0235 0237 0239 0243
0245 0246 0249 0294 0297 0299 0329
0353 0357 0360 0362 0363 0364 0370
0373 0384 0391 0397 0401 0406 0421
0422 0423

OIDIUM
0237 0370 0374 0401

OLIGONYCHUS TIHAPENSIS
INSECT CONTROL
0246

OLIGONYCHUS PERUVIANUS
0237

ORGANOLEPTIC EXAMINATION
0223 0284

PACKAGING
0333 0335 0376

PANAMA
0227

PAPER INDUSTRY
0414

PARTICLE SIZE
CASSAVA STARCH
0323 0324

PEELING
0252 0128 0333 0334 0335 0340 0341
0342 0347 0376 0408

PELLETS
0303 0307 0393 0404 0406 0417
PROCESSING
0252 0330 0345 0407 0409 0414

PERU
0207 0359
PRODUCTION
0423

PEST CONTROL
0217 0237 0240 0246 0276 0282 0289
0370 0376 0378

PEST DAMAGE
0276 0282
DEFOLIATION
0289

PETIOLES
0207 0215 0219

PH
0241 0242
CASSAVA STARCH
0321
SOIL ANALYSIS
0277

PHENACOCCUS
0269 0277 0279 0281 0370 0415

PHENACOCCUS MANIHOTI
0271 0272 0278 0279 0280 0281 0379
INSECTICIDES
0217
RESISTANCE
0280

PHILIPPINES
0233 0243 0254
PRODUCTION
0384
SOCIO-ECONOMIC ASPECTS
0373 0384

PHOSPHORUS
0219 0229 0230 0233 0235 0239 0243
0246 0247 0294 0294 0298 0327 0366
0364 0370 0382 0397 0419 0421 0422

PHOTOSYNTHESIS
0211 0214

PHYSIOLOGY
0209 0207 0213 0214 0216 0231 0232
0237 0242 0247 0248 0364 0170

PIGLETS
0304

PLANT ASSIMILATION
0212 0215

PLANT GEOGRAPHY
0206

PLANT HEIGHT
0227 0233 0249 0250 0275

PLANT PHYSIOLOGICAL PROCESSES
0211 0212 0214 0216 0232

PLANT REPRODUCTION
0206 0235

PLANT RESPIRATION
0211

PLANT TISSUES
0217
TISSUE CULTURE
0290

PLANTING
0239 0360 0360
AGRICULTURAL EQUIPMENT
0237 0244
COSTS
0237 0269 0362 0364 0370 0376
LABOUR
0391
MECHANIZATION
0237 0243 0382
ROOT PRODUCTIVITY
0214 0235 0242 0243 0249 0289 0294
0298 0362 0370 0382
SPACING
0214 0234 0241 0242 0245 0246 0249
0289 0291 0364 0370 0371 0376 0382
0422 0423

PLOUGHING
0237 0239 0371

POLLEN
0206

POLLINATION
0206 0235 0364

POST-HARVEST LOSSES
0231 0376 0384 0403

POTATOES
0324 0169

POULTRY
0315 0158

POWER SOURCES
0331 0333

PRESSING
0333 0339 0341 0347

PRICES
0297 0333 0337 0338 0347 0353 0356
0357 0374 0376 0377 0381 0383 0384
0390 0392 0393 0394 0398 0401 0404
0407 0410 0413 0414 0415 0417

PROCESSING
0253 0318 0323 0326 0331 0332 0337
0338 0344 0352 0353 0364 0365 0366
0372 0373 0380 0385 0386 0393 0394
0395 0398 0402 0407 0413 0414 0415
0416 0418
BOILING
0323 0140
DRYING
0251 0252 0317 0330 0334 0335 0340
0341 0342 0347 0376 0379 0409

FERMENTATION
0328 0333 0334 0335 0341 0342 0345
0376 0403
GELATINIZATION
0323 0324 0330 0333 0342
GRINDING
0330 0331
PEELING
0252 0328 0333 0334 0335 0340 0341
0342 0347 0376
PRESSING
0333 0335 0341 0347
RASPING
0328 0330 0333 0335 0336 0347 0376
0379
SCREENING
0330 0334 0335 0340 0341 0347 0376
SILTING
0330 0376
STEEPING
0251 0328 0340 0379 0389
WASHING
0252 0328 0330 0334 0335 0341 0347
0376

PROPAGATION
0237

PROPAGATION MATERIALS
0206 0209 0235 0237 0239 0241 0242
0245 0246 0247 0248 0249 0265 0285
0289 0290 0294 0298 0359 0360 0364
0376 0382 0384 0397 0401

PROTEIN CONTENT
0220 0300 0306 0311 0312 0313 0323
0324 0349 0353 0423
LEAVES
0217 0310 0316
ROOTS
0310
STEMS
0219

PROTEIN ENRICHMENT
ECONOMICS
0252 0403
FERMENTATION
0328 0403

PROTEINS
DIETARY VALUE
0314

PRUNING
0241 0254 0359 0362 0364 0370

PSEUDOMONAS
RESISTANCE
0297

PUERTO RICO
0284

RAINFALL DATA
0215 0220 0232 0235 0236 0237 0255
0266 0267 0353 0355 0362 0419

RASPING
0328 0330 0333 0335 0336 0347 0376
0379

RESISTANCE
DISEASES AND PATHOGENS
0256 0260 0285 0288 0289 0295
INJURIOUS INSECTS
0268 0289 0296
INJURIOUS MITES
0289 0297

ROOT CROPS
0238 0245 0251 0360 0403 0405

ROOT DEVELOPMENT
0207 0247

ROOT PRODUCTIVITY
0213 0214 0215 0227 0228 0229 0230
0232 0233 0235 0238 0242 0243 0247
0248 0249 0250 0284 0285 0286 0287
0289 0291 0293 0294 0295 0296 0298
0357 0362 0370 0378 0382 0389 0397
0401 0406 0419 0420

ROOTS
0206 0207 0209 0293 0326 0327 0329
ANALYSIS
0221 0224
BIOCHEMISTRY
0224
DRY MATTER
0215 0254
DRYING
0403
FAT CONTENT
0310
HCN CONTENT
0217 0221 0310
SILAGE
0310
STARCH CONTENT
0254
STORAGE
0247 0254 0310 0370 0310 0384 0406

ROSELLINIA
0237 0370

ROTATIONAL CROPS
0235 0353 0362 0365 0370 0384
MAIZE
0424

SAISSETIA MIGRA
0237
INSECT CONTROL
0270

SCLEROTIUM ROLFSII
0237 0364 0370
DISEASE CONTROL
0240

SEED
0206 0209 0290
COMPOSITION
0285
GERMINATION
0290

SHEEP
0305

SHOOTS
0247 0250 0255 0265

SILAGE
0310 0313 0314

SILBA PENDULA
0237
INSECT CONTROL
0276
INSECTICIDES
0370

SILTING
0330 0376

SMALL-SCALE EQUIPMENT
0335 0341 0352

SMALL-SCALE PROCESSING
0335 0336 0341 0342 0352 0380 0386
0394 0407 0413

SOCIO-ECONOMIC ASPECTS
0320 0340 0347 0350 0354 0355 0356
0360 0361 0362 0373 0375 0378 0382
0384 0395 0401 0402 0407 0409

SOIL AMENDMENTS
0327

SOIL ANALYSIS
0227 0229 0237 0327 0329 0379 0419

SOIL FERTILITY
0242

SOIL PHYSICAL PROPERTIES
0220 0227 0235 0237 0239 0241 0287
0297 0365 0382

SOIL REQUIREMENTS
0241 0242 0327

SOLAR DRYING
0219 0252 0334 0395 0408 0409

SOYBEANS
0423

SPHACELOMA MANIHOTICOLA
0237 0370
RESISTANCE
0260 0289 0296

SRI LANKA
PRODUCTION
0377

STARCH CONTENT
0220 0223 0229 0247 0248 0254 0285
0287 0291 0295 0299 0349 0376 0409

STARCH PRODUCTIVITY
0295
CULTIVARS
0229
FERTILIZERS
0229 0230
TIMING
0230

STATISTICAL ANALYSIS
0207 0210 0218 0249 0249 0299 0317
0321 0334

STATISTICAL DATA
0410

STEEPING
0251 0328 0340 0379 0389

STEMS
0207 0215 0249 0293
ANALYSIS
0226
HCN CONTENT
0217 0219
PLANT DEVELOPMENT
0206 0207 0247 0248

STOMATA
0211 0212 0216

STORAGE
0235 0237 0241 0242 0249 0251 0253
0254 0292 0301 0302 0310 0323 0335
0353 0359 0370 0376 0390 0394 0401
0408 0409

SULPHUR
0246

SURINAM
0281

SWEET CASSAVA
0207 0217 0237 0337 0338 0404 0407

SWEET POTATOES
0238 0245 0343 0369

SWINE
0304 0314 0357 0358
FATTENING
0306 0315
LEAVES
0310
ROOTS
0310

SYMPTOMATOLOGY
DISEASES AND PATHOGENS
0263 0264

TAIWAN
0298
PRODUCTION
0371

TANZANIA
PRODUCTION
0337

TAPIOCA PEARLS
0410

TAPIOCAS
CONSUMPTION
0365
DRYING
0330 0379
INDUSTRIAL MACHINERY
0313
INDUSTRIALIZATION
0310 0370 0407
PROCESSING
0313 0330 0358 0379 0380 0394 0398
0407

STORAGE
0390
TRADE
0365 0390
USES
0315 0330 0365 0368 0379 0380 0394
0407 0410

TAXONOMY
0206 0207 0237 0359

TECHNOLOGY
0290 0320 0331 0350 0395 0396 0399
0416
TECHNOLOGICAL PACKAGE
0292 0294 0378 0384 0397
TECHNOLOGY EVALUATION
0375

TEMPERATURE
0216 0220 0232 0271 0353 0355 0382

TETRANYCHUS CINNABARINUS
0379
INSECT CONTROL
0245

TETRANYCHUS MEDCALFORNICUS
INSECT CONTROL
0246

TETRANYCHUS URTICAE
0237 0374 0394 0401
INSECTICIDES
0370

TEXTILES
0414

THAILAND
0231 0361
GERMPLASM
0235
MARKETING
0385 0404 0407 0414 0417
PRODUCTION
0385 0404 0407 0408 0414 0417
SOCIO-ECONOMIC ASPECTS
0407
TRADE
0367 0385 0404 0414 0417

THRIPS
INSECT CONTROL
0275
INSECTICIDES
0289 0370
RESISTANCE
0267

TISSUE CULTURE
0296

TOGO
MARKETING
0385 0394
PRODUCTION
0385 0394
TRADE
0385

TOXICITY
0305 0310 0342 0409 0417

TOXICOLOGY
0335

TRADE
0348 0367 0367 0379 0405
CASSAVA CHIPS
0364 0365 0381 0383 0385 0404 0409
0414 0417
CASSAVA FLOUR
0365 0385 0395 0404 0417
CASSAVA MEAL
0385
CASSAVA STARCH
0364 0365 0374 0381 0383 0385 0390
0393 0404 0414 0416
GARI
0385 0416
PELLETS
0383 0385 0404 0409 0414 0417
TAPIOCAS
0365 0390

TRIALEURODES VAPORARIORUM
0370

TROMYCES MANIHOTIS
0267 0370

VASCULAR STREAKING
0254

VENEZUELA
0279 0305 0322
MARKETING
0347
PRODUCTION
0237 0347
SOCIO-ECONOMIC ASPECTS
0347

VISCOSITY
CASSAVA STARCH
0321 0323 0324 0325

VITAMIN A
0349

VITAMIN CONTENT
0349

WASTE UTILIZATION
0342 0376 0391 0410

WASTES
0353 0361

WATER CONTENT
0213
CASSAVA CHIPS
0409
CASSAVA FLOUR
0300
CASSAVA MEAL
0300 0310 0334
CASSAVA STARCH
0324 0325
GARI
0302
LEAVES
0310
ROOTS
0310

WATER REQUIREMENTS(PLANT)
0211 0212 0242

WATER REQUIREMENTS(PROCESSING)
0335 0353 0372 0376

WEEDING
0223 0237 0240 0243 0244 0289 0362
0363 0364 0370 0376 0392 0391 0401
0419
HOEING
0235 0250

WEEDS
0237 0243 0250 0329

XANTHOMONAS CAMPESTRIS PV. MANIHOTIS
0235 0237 0255 0257 0364 0370 0374
0377 0384 0401

DISEASE CONTROL
0240
RESISTANCE
0256 0285 0288 0296 0297

YAMS
0245 0389

ZAIRE
0265
SOCIO-ECONOMIC ASPECTS
0354

ZINC
0240

ZONOCERUS VARIEGATUS
0273 0380

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(*Manihot esculenta* Crantz)

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Abstracts on Cassava
(*Manihot esculenta* Crantz)

Vol. XII No. 3 December, 1986

CONTENTS

	INTRODUCTION	iii
	COMPONENTS OF AN ABSTRACT	iv
	HOW TO USE THE INDEXES	v
A00	BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION	1
B00	PLANT ANATOMY AND MORPHOLOGY	-
C00	PLANT PHYSIOLOGY	2
	C01 Plant Development	4
	C02 Cyanogenesis	10
	C03 Chemical Composition, Methodology and Analyses	11
	C04 Plant Nutrition	13
D00	CULTIVATION	18
	D01 Soil, Water, Climate and Fertilization	18
	D02 Cultivation Practices: Propagation, Planting, Weed Control and Harvesting	21
	D03 Energy Productivity and Yields	28
	D04 Postharvest Studies	29
E00	PLANT PATHOLOGY	31
	E02 Bacterioses	32
	E03 Mycoses	34
	E04 Viroses	35
	E05 Mycoplasmoses	39
	E06 Nematodes	39
F00	PEST CONTROL AND ENTOMOLOGY	40
	F01 Injurious Insects and their Control	40

F02 Rodents and other Noxious Animals -
F03 Injurious Mites and their Control 47

G00 GENETICS AND PLANT BREEDING 51
G01 Breeding, Germplasm, Varieties and Clones, Selection 51
G02 Cytogenetics 60

H00 NUTRITION 62
H01 Cassava Foods and Nutritive Value 62
H02 Nutritive Disorders in Humans 65
H03 Animal Feeding 68
H04 HCN Toxicity and Detoxification 72

I00 PROCESSING, PRODUCTS AND USES 73
I01 Cassava Starch and its Properties 73
I02 Uses, Industrialization, Processing and Storage 74
I03 Industrial Microbiology 78

J00 ECONOMICS AND DEVELOPMENT 80

K00 OTHER ASSOCIATED COMMODITIES 95
K01 Rotational Schemes and Intercropping 95
K02 Descriptive and Comparative Studies 97

Z00 GENERAL -

ABBREVIATIONS AND ACRONYMS 99

CUMULATIVE AUTHOR INDEX 101

CUMULATIVE SUBJECT INDEX 123

INTRODUCTION

This journal of analytical abstracts, which replaces the former combination of abstract cards and yearly cumulative volumes, is designed to provide a specialized guide to the world's literature on cassava (*Manihot esculenta* Crantz), disseminating research results and ongoing activities related to the crop.

The abstracts report condensed information from journal articles, booklets, mimeographed reports, theses, manuals and other conventional and nonconventional material, categorized into broad disciplinary fields to facilitate rapid scanning. Additionally, abstracts are author and subject indexed to enable more comprehensive consultation.

When retrospective or exhaustive coverage of a topic is desired, mechanized bibliographic searches of the entire document collection can be provided by CIAT's Documentation Center. Abstracts of all articles that match the topic of interest are provided to users who request this search service. The full text of every article abstracted by the Documentation Center is also available, through the photocopy service.

CIAT's Documentation Center also publishes journals of analytical abstracts on field beans (*Phaseolus vulgaris* L.) grown under tropical conditions and on tropical pastures. Other CIAT publications dedicated to keeping users aware of research developments in their respective fields include: Pages of Contents, Cassava Newsletter, Pastos Tropicales - Boletín Informativo, and Hojas de Fríjol.

COMPONENTS OF AN ABSTRACT

Accesion number (for photocopy requests)

Authors

Sequential number in the journal (for use of indexes)

Year of publication

19527 IKEDIOBI, C.O.; ONYIKE, E. 0145 1982. The use of linamarase in gari production. Process Biochemistry 17(4):2-5. Engl., Sum. Engl., 12 Refs., Il s. [Dept. of Biochemistry, Ahmadu Bello Univ., Zaria, Nigeria]

Original title

Author address

Additional notes

Source

Pages

Language of paper

Language of summary

Cassava. Linamarase. Uses. Gari. Fermentation. Detoxification processes. Enzymes. Nigeria.

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. [AS]

Abstract

Abstractor and/or translator

HOW TO USE THE INDEXES

The numbers listed under each entry in the author and subject indexes correspond to the abstract's sequential number, found above each abstract within the journal.

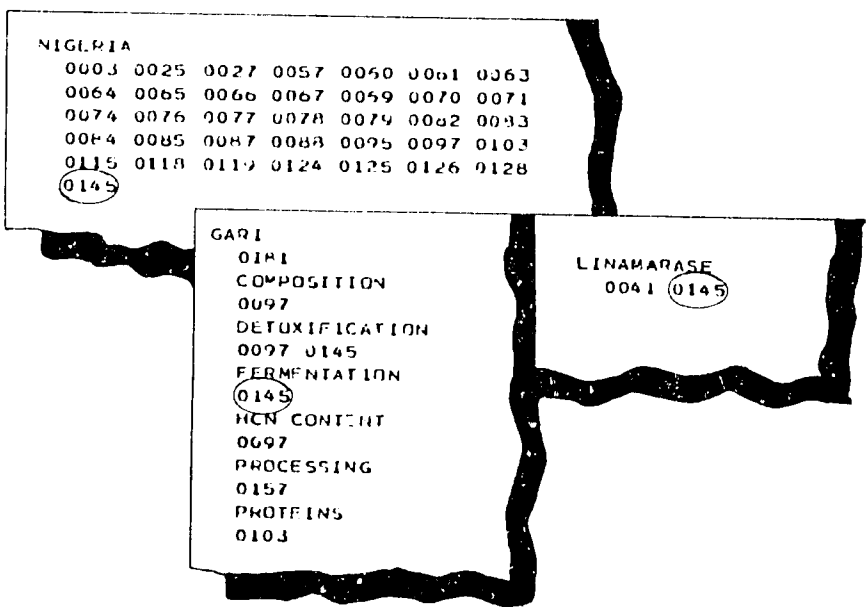
The last issue of the year contains cumulative author and subject indexes for the year.

Author Index

The Author Index can be used to find abstracts when the personal or corporate authors are known. The Author Index, which is alphabetically arranged, lists *all* author and co-author names cited in the publicaction.

Subject Index

The Subject Index presents an alphabetical list of descriptors used in cassava research, many of which are combined with other descriptors, allowing the identification of more specific topics.



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A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

0425

25578 SNEEP, J.W.; DE ROON, A.C. 1984. Euphorbiaceae. Uitgaven van de Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen 0(113):231-285. Engl.

Cassava; Manihot; Plant anatomy; Identification; Manihot glaziovii; Manihot esculenta; Manihot carthagenensis; Plant geography.

A botanical description of the Euphorbiaceae family is presented and taxonomic keys for the identification of the genera are given. Likewise, the genera Euphorbia, Pedilanthus, Phyllanthus, Margaritaria, Tragia, Dalechampia, Croton, Argythamnia, Cnidoscolus, Ricinus, Jatropha, Manihot, Acalypha, Bernardia, Adelia, Hippomane, and Hura are described in detail. Some species are also described, giving common names and place of origin. Of the genus Manihot, the species M. esculenta, M. glaziovii, and M. carthagenensis are described. (CIAT)

0426

25268 SPATH, C.D. 1973. Plant domestication: the case of Manihot esculenta. Journal of the Steward Anthropological Society 5(1):45-69. Engl., Sum. Engl., 34 Refs., Illus.

Cassava; History; Processing; Plant geography; Manihot; Sweet cassava; Bitter cassava; Propagation; Peru.

The problem of cassava domestication is analyzed. The archaeological evidence available for the origins of cassava in South America, particularly that from Peru, is outlined. The plant is discussed in terms of its morphology, habitat, growing conditions, and yield. The possible implications of the relationships between the propagation systems of the plant and its domestication are analyzed. Domestication and cultural intensification are emphasized. (CIAT) See also 0561 0594 0632

0427

24746 EL-SHARKAWY, M.A.; COCK, J.H. 1985. The humidity factor in stomatal control and its effect on crop productivity. Cali, Colombia, Centro Internacional de Agricultura Tropical. 12p. Engl., Sum. Engl., 25 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Water requirements (plant); Stomata; Carbon dioxide; Photosynthesis; Cultivars; Leaves; Colombia.

Recent studies in the lab. on the response of cassava to water stress demonstrated that plants grown in pots or in the field, with and without soil water stress, were very sensitive to changes in atmospheric humidity. Both CO2 uptake rate and H2O loss decreased greatly as VPD increased. This decrease in gas exchange rate was associated with a reduction in leaf conductance in the absence of changes in leaf water potential. The strong stomatal response to changes in VPD may be of particular importance to perennial crops, such as cassava, that may have to endure a long period of drought. Under these conditions, and in the absence of stomatal response to humidity, both photosynthesis and transpiration will continue at relatively high rates until available soil water is depleted and leaf water potential drops to the level required to induce stomatal closure, at which time both photosynthesis and transpiration will approach zero. In such case, most of the transpirational loss will occur during periods of high VPD and low photosynthesis:transpiration ratio, resulting in a low DM accumulation/unit water transpired. On the other hand, with a direct stomatal response to changes in air humidity, available soil water will be depleted slowly, as most of the transpirational loss will occur during periods of the day when VPD is low and water use efficiency is highest. With a prolonged period of limited soil water, the greater water use efficiency will lead to a greater total accumulation of photosynthate over the stress period. Thus, the direct stomatal mechanism is beneficial for those crops that experience long period of drought. However, with nonlimiting soil water conditions or only short periods of soil water stress, optimizing water use efficiency would not be as important as maximizing photosynthesis and consequently crop productivity. Under these conditions nonsensitive stomata would be advantageous. An hypothesis is presented which relates stomatal sensitivity to stomatal density and is discussed in the light of selection methods for var. with optimum productivity under differing conditions of air humidity and soil water availability. (AS)

0428

25592 EL-SHARKAWY M.A.; COCK, J.H.; HERNANDEZ, A. DEL P. 1985. Stomatal response to air humidity and its relation to stomatal density in a wide range of warm climate species. Photosynthesis Research 7:137-149. Engl., Sum. Engl., 41 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Stomata; Cultivars; Photosynthesis; Water requirements (plant); Transpiration; Colombia.

The gas exchange of 19 widely different warm climate species (including cassava) was observed at different leaf to air VPD. In all species stomata tended to close as VPD increased resulting in a decrease in net photosynthesis. The absolute reduction in leaf conductance/unit increase in VPD was greatest in those species which had a large leaf conductance at low VPDs. This would be expected even if stomata of all species were equally sensitive. However, the percentage reduction in net photosynthesis (used as a measure of the relative sensitivity of stomata of the different species) was also closely related to the maximal conductance at low VPD. Cassava had

the highest reduction in apparent photosynthetic rate and leaf conductance (85 and 86 per cent, resp.). Similarly the relative sensitivity of stomata to changes in VPD was closely related to the weighted stomatal density or "crowding index". The hypothesis is presented that stomatal closure at different VPDs is related to peristomatal evaporation coupled with a high resistance between the epidermis and the mesophyll and low resistance between the stomatal apparatus and the epidermal cells. This hypothesis is consistent with the greater relative sensitivity of stomata on leaves with a high crowding index. The results and the hypothesis are discussed in the light of selection for optimal productivity under differing conditions of RH and soil water availability, by observation of stomatal density and distribution on the 2 sides of the leaf. (AS)

0429

26178 HOZYO, Y.; MEGAWATI, M.; WARGIONO, J. 1984. Plant production and potential productivity of cassava (Manihot esculenta Crantz). Bogor, Indonesia, Central Research Institute for Food Crops. Contributions no.73. 20p. Engl., Sum. Engl., Indon., 7 Refs., Illus. (Central Research Inst. for Food Crops, Jalan Merdeka 99, Bogor, Indonesia)

Cassava; Cultivars; Leaves; Leaf area; Light; Plant physiology; Dry matter; Roots; Plant height; Growth; Indonesia.

Plant production and potential productivity of cassava were investigated during the 1981 and 1982 growing seasons at Cikeumeuh exptl. farm of Bogor Research Institute for Food Crops (Indonesia). DM production and tuberous root growth were measured and indices of plant production were analyzed. The CGR and NAR had high values in the active thickening and maturation growth stages. The orientation adjustment of the leaf blade was observed. This movement adjusted the reception of incident solar radiation throughout the day. Variations in the angle were described by the inclination, subinclination, and direction angles. The potential productivity of cassava was analyzed using grafts combining scion and stock of 2 cv. and 1 local var. The potential productivity of the tuberous root was found to be independent of scion character. However, the scion was a secondary influence of root thickening if the stock was of a late root thickening type. (AS)

0430

26368 MELIS, R.J.M.; VAN STADEN, J. 1985. Tuberization in cassava (Manihot esculenta): cytokinin and abscisic acid activity in tuberous roots. Journal of Plant Physiology 118(4):357-366. Engl., Sum. Engl., 26 Refs., Illus. (Plant Development Research Unit, Dept. of Botany, Univ. of Natal, Pietermaritzburg 3200, Republic of South Africa)

Cassava; Plant growth substances; Roots; Analysis; South Africa.

The nature and distribution of cytokinins and ABA in tuberous roots of cassava were studied. Trans-ribosylzeatin, dihydrozeatin, and trans-zeatin were tentatively identified as the major cytokinins in tuberous root extracts. Cytokinin activity was concentrated in the meristematic region of the secondary xylem and in the phloem. This suggests a role for cytokinins in the regulation of meristematic activity, which is responsible for the growth of the tuberous roots. Some cytokinin activity, which coeluted with cytokinin glucosides, was found in extracts from the phloem. Inhibitor activity, which was tentatively identified as cis-ABA, was present in tuberous root extracts. The activity of this hormone did not vary greatly between the different tissues analyzed. (AS)

0431

25585 BARRIOS, J.R. 1984. Contribución al estudio del vigor y del desarrollo inicial de las estacas de yuca (Manihot esculenta Crantz). (Contribution to the vigor and initial development of cassava cuttings). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:15-54. Span., Sum. Span., 42 Refs., Illus. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Cuttings; Germination; Timing; Dry matter; Roots; Leaves; Shoots; Leaf area; Brazil.

An expt. was conducted in the Escuela Superior de Agricultura Luiz de Queiroz (Piracicaba, Brazil) to determine the performance of 2 cassava cv. in relation to vigor and initial development when planted in sand propagators. During 2 periods, cuttings 5, 10, 15, and 20 cm long were used to evaluate the following variables: budding percentage; rate of emergence; total, aerial part, and root DM wt.; mean DM wt. of leaves and shoot stems; and mean and total leaf areas. Results show that cutting vigor during initial development is directly related to cutting size, within the limits studied. (AS-CIAT)

0432

25774 BELTRAN, J.; NARVAEZ, J.; REYES, R.; ROCA, W.M. 1984. Efecto de la concentración de nitrógeno, citoquininas, carbon activado y del volumen del recipiente sobre el crecimiento y viabilidad de los cultivos. (Effect of the nitrogen concentration, cytokinins, activated carbon, and the volume of the container on crop growth and viability). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.128-134. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; Plant growth substances; Growth; Leaves; Tissue culture; Colombia.

The effect of N, BAP, ABA, activated carbon, and the size of the container on the growth, development, and viability of cassava cv. M Col 22 and M Col 1467 cultivated in vitro was studied. Forty micromoles of total N in the medium allowed reduced growth and an acceptable viability of the material to be maintained. At low BAP concn. and high saccharose concn., or vice versa, at high BAP concn. and low saccharose concn., there is a high rate of viability. Growth was not accelerated by 2.5 milligrams ABA/liter. Viability was greater in the material cultivated in a medium with activated carbon and in larger containers. The use of activated carbon and larger containers also reduced leaf fall. (CIAT)

0433

25770 CORAL, J.C.; MAFFLA, G.; ROA, J.C.; ROCA, W.M. 1984. Efecto del cultivo de meristemos sobre el vigor y rendimiento de dos variedades de yuca Manihot esculenta Crantz. (Effect of meristem culture on the vigor and yield of two cassava varieties). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.176-182. Span.

Cassava; Cultivars; Apical meristems; Productivity; Cuttings; Leaves; Branching; Colombia.

The effect of meristem culture on the yield and vigor of cassava cv. Llanera and CMC-40 was studied. In both cv. an increase in root and propagation material productivity was observed. Llanera plants propagated through meristem culture showed an enlargement of the leaf lobes and a thicker mesophyll. The possible reasons for these changes are discussed. (CIAT)

0434

26337 INDIRA, P.; RAMANUJAM, T. 1979. Screening of varieties for salt and drought tolerance in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.70-72. Engl.

Cassava; Cultivars; Salinity; Germination; Cuttings; Fertilizers; N; P; K; Water requirements (plant); Timing; India.

Cuttings of var. H-165, H-226, H-97, and M-4 were planted in pots containing 1000, 2000, and 3000 ppm NaCl to select cassava var. tolerant to salinity; their germination was observed. Ten replications were made for each var. In pots containing 1000 ppm NaCl, only 66.6 percent of H-97 survived; in the remaining var. the percentage of survival was of 16.6. At 2000 ppm only H-97 survived (17.0 percent) and at 3000 ppm none of the var. survived. Based on selection by K:Na ratio, 14 var. were planted in pots with the recommended NPK dose and 1000 ppm NaCl. After 1 mo., leaf samples were taken to analyze K and Na contents. Var. Ce 22, S-1315, H-398, H-648, H-226, and H-1253 were tolerant to salinity; H-165, H-97 (2), H-1687, H-1423, H-97, and H-207 were moderately tolerant, and M-4 and H-2304 susceptible. The same 14 var. were used in the study on tolerance to drought. Artificial drought was induced by reducing the soil MC to 50 percent of the original level and the relative water contents of the var. were determined at the 7th, 8th, and 9th mo. Var. S-1315, H-165, H-226, H-97, H-648, Ce 22, and H-207 were tolerant to drought. (CIAT)

0435

26358 MABANZA, J.; RODRIGUEZ, A.V. 1986. Le bouturage in vitro du manioc. (In vitro cassava propagation by cuttings). Brazzaville, République Populaire du Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 4p. Fr., 8 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Republique Populaire du Congo)

Cassava; Clones; Tissue culture; Plant growth substances; Rooting; Culture media; Congo.

The in vitro performance of 2 local clones and 1 from the International Institute of Tropical Agriculture was studied using different plant growth substances. The results demonstrated that cassava clones grown in vitro differ in their performance depending on the culture medium used and that it is useful to grow certain clones in a shoot growth culture medium for 10 days and then transfer them to a whole-plant growth culture medium. (CIAT)

0436

25586 MANTILLA, J.E. 1984. Propagación de yuca (Manihot esculenta Crantz). Alternativa para incrementar la tasa de multiplicación. (Cassava propagation. Alternative to increase the multiplication rate). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:55-72. Span., Sum. Span., 6 Refs., Illus. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Cuttings; Propagation; Shoots; Germination; Timing; Plant height; Root productivity; Venezuela.

Cuttings of cassava cv. UCV 2112 (20 and 5 cm long) were planted directly in the field to increase cassava propagation material. From short cuttings emergence percentage at 30 days was 84.3 and 98.4 percent for 5- and 20-cm-long cuttings, resp. The no. of useful stems/plant for use as propagation material was 2.1 and 3.4 for the 5- and 20-cm-long cuttings, resp. Yield of commercial roots/plant was 0.93 and 1.75 kg for the 5- and 20-cm-long cuttings, resp. The 20-cm-long cuttings were found to perform better; however, when propagation material is scarce for seedbeds, it is feasible to triplicate the planting area by using 5-cm-long cuttings with the same amount of cassava stems and to increase the multiplication rate up to 2.1 times with respect to that of 20-cm-long cuttings, in identical management conditions (upland planting). (AS-CIAT)

0437

25587 MIRELES, M.; PAEZ DE CASARES, J. 1984. Inducción de "roseta" en yuca (Manihot esculenta Crantz) para la propagación múltiple de la planta in vitro. (Induction of rosette in cassava for in vitro multiple propagation of the plant). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:73-81. Span., Sum. Span., 13 Refs., Illus.

Cassava; Cultivars; Tissue culture; Apical meristems; Culture media; Plant growth substances; Venezuela.

The induction of rosette in the system of multiple propagation from different sized apical meristems of cassava cv. UCV-2578 from the germplasm bank of the U. Central of Venezuela was studied using various levels of NAA and BAP. A solid Murashige and Skoog medium was used with variations in the organic components. The crops were incubated at 25 more or less 2 degrees Celsius, 2000 lux, and 16 h of light. The induction of the rosette occurred in the 7th wk. Larger apexes gave the best response in formation of rosettes and among these, the combination of NAA-BAP had a synergistic effect, presenting the highest percentage of apex induction and the greatest rosette vigor. Treatments that included the highest doses of BAP showed a reduction in apex size and those with the highest NAA dose produced granular brown-colored callures and had not become organogenic by the end of the expt. (AS-CIAT)

0438

26348 NAIR, N.G. 1979. Development of disease free genetic stock. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.99-106. Engl.

Cassava; Tissue culture; Apical meristems; Temperature; Plant growth substances; Plant tissues; Cultivars; India.

The effect of 4 plant growth regulators on the morphogenesis of cassava meristem tips was studied. BAP was the best for morphogenesis, followed by zeatin and kinetin. To study the effect of growth regulators on the induction of morphogenesis from internodal segments of cassava, diseased plants of var. M-4 and Kalikalan were used as sources of the internodes. No morphogenesis was observed. Over 100 meristems each from heat-treated and nontreated diseased (CAMV) cassava meristems were cultured. In both cases regenerated plants remained symptom-free up to the potting stage. (CIAT)

0439

25773 NARVAEZ, J.; BELTRAN, J.; REYES, R.; ROCA, W.M. 1984. Efecto de la iluminación y la temperatura sobre el crecimiento y la viabilidad de los cultivos. (Effect of the illumination and temperature on crop growth and viability). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.135-140. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; Illumination; Temperature; Storage; Colombia.

The effect of light (0, 50, and 500 lux) and low temp. (10, 15, and 20 degrees Celsius) on cassava var. M.Col 22 grown in vitro was studied. The best treatment was that consisting of 20 degrees Celsius during the day and 10 degrees Celsius during the night and 500 lux since the no. of green leaves was highest and the viability of the axillary buds and tips was close to 100 percent. (CIAT)

0440

25688 PAEZ DE CASARES, J. 1984. Brotes foliares in vitro y su producción a partir de ápices caulinares para la micropropagación de la yuca (Manihot esculenta Crantz). 1. Efecto del agar. (Leaf shoots in vitro and their production from cauline tips for cassava micropropagation. 1. The effect of agar). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:83-99. Span., Sum. Span., 21 Refs., Illus. (Univ. Central de Venezuela, Laboratorio de Cultivo de Tejidos, Inst. de Agronomía, Facultad de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Apical meristems; Tissue culture; Culture media; Venezuela.

To produce leaf shoots, and then multiply them in vitro by means of microcuttings, of cassava cv. Tempranita (short cycle) and Cubana (intermediate cycle), 1-mm-long apexes were placed in a solid medium containing basic Murashige and Skoog salts with the organic constituents saccharose, thiamine-HCl, inositol, BAP, NAA, and GA. Four commercial brands of agar were tested: Oxoid (Oxoid Limited), Phytagar (GIBCO), Bacto (DIFCO), and Purificado (DIFCO), in 0.3 and 0.4 percent concn. Implanted material was placed under white cold light (2000 lux) for 16 h/day at 24 more or less 2 degrees Celsius and 50-75 percent RH. Shoot height was highly significative for cv. Tempranita after the 3rd wk.; at the 6th wk., shoots of both cv. were apt for cutting, leaving an axillary bud or terminal, and induced to root. Using the Purificado agar resulted in the best shoot height in both cv.; but, at the same time, this agar resulted in 2 adverse effects: a large no. of roots in cv. Cubana (less in cv. Tempranita) and callus of greater diameter in both cv. In addition, this agar is the most expensive of all used. Shoot formation was acceptable using Phytagar; shoot height did not reach that obtained with Purificado, but callus of smaller diameter and a small no. of roots were found in cv. Cubana, which generally shows a larger no. of roots. Therefore, this agar could be used at 0.4 percent since favorable responses are obtained in both cv. (AS-CIAT)

0441

26376 RAMANUJAM, T. 1985. Leaf density profile and efficiency in partitioning dry matter among high and low yielding cultivars of cassava (Manihot esculenta Crantz). Field Crops Research 10(4):291-303. Engl., Sum. Engl., 28 Refs., Illus. (Central Tuber Crops Research Inst., Trivandrum 695 017, Kerala, India)

Cassava; Cultivars; Plant development; Canopy; Leaves; Leaf area; Growth; Dry matter; Roots; Shoots; India.

The LAD and efficiency in partitioning DM for root growth were studied using cassava cv. M4, H 165, H 1423, H 2304, Ce 22, and Ci 590 which differ in their yielding ability. Low yielding cv. (M4, Ci 590, H 1423, and Ce 22) maintained either suboptimum (over 2) or supraoptimum (less than 4) levels of LAI during the major growth period and this adversely affected their light utilization efficiency. Negative correlation was shown between LAD and light transmission ratio. For better light interception and utilization, a LAI of 2.5-3.5 was optimum. Cv. difference in DM partitioning for root growth was noticed, ranging from 0.3 to 0.7/g DM. Cv. Ci 590 was most efficient (70 percent harvest efficiency) in utilizing DM for storage root growth. The leaf density profile suggested that Ci 590 productivity could be raised by increasing plant density. DM distribution between shoot and root was linearly related with total biomass. The HI was more or less constant after the 4th mo., with the onset of root bulking, to final harvest. (AS)

0442

26335 RAMANUJAM, T. 1979. Effect of growth regulators on cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.59-60. Engl.

Cassava; Plant growth substances; Cultivars; Root productivity; Plant height; Leaves; Roots; India.

The effect of 3 growth regulators on the productivity of 3 cassava var. (M-4, H-2304, and H-1687) was studied for 2 yr. Throughout the study none of the regulators affected the yield of the var. (CIAT)

0443

26334 RAMANUJAM, T.; INDIRA, P. 1979. Physiology of growth and development in cassava genotypes. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.40-58. Engl.

Cassava; Cultivars; Leaves; Leaf area; Canopy; Plant height; Root productivity; Plant development; Dry matter; Roots; Stems; Harvest index; Growth; Pruning; N; India.

Three expt. were carried out to study the physiology of growth and development of cassava var. In the 1st, the physiological variations, canopy growth, LAI, HI, DM distribution, CGR, and root productivity were evaluated using cassava var. M-4, H-165, H-2304, H-97, Ce 161, Ci 288, H-1423, Ci 167, Ci 590, and Ce 22. The mean LAI of the 10 var. ranged from 1.26 to 3.75. Plant height and stem girth did not have any relationship with root yield; however, stem girth was related to total DM production. In the 2nd, the nonbranching var. H-1687, H-2304, and M-4 were used to study the effect of topping at the 2nd, 3rd, and 4th mo. of growth on LAI. Plant height did not differ notably except when the topping took place at the 2nd mo. Except for var. M-4, the root no. was not affected by the topping. In the 3rd expt., LAI was studied in relation to N nutrition in var. H-2304. No significant changes in plant height were observed among treatments when the dose of N was larger than 100 kg/ha. The LAI was highly influenced by N up to 150 kg/ha. The CGR was very high at 250 kg N/ha in relation to the control. The root yield and no. increased significantly with N application, but above 150 kg/ha no effect was observed. (CIAT)

0444

25769 REYES, R.; ROCA, W.M. 1984. El cultivo de embriones in vitro como herramienta para la conservación e intercambio de especies silvestres de Manihot. (In vitro embryo culture as a tool for the conservation and exchange of wild Manihot species). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.301-306. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Manihot; Tissue culture; Culture media; pH; Colombia.

The work carried out at CIAT with embryo cultures for the conservation and exchange of wild Manihot species is described. Results indicate that the wild seeds require a pretreatment for their development, which consists in subjecting the seeds to 60 degrees Celsius for 20 days; the pH of the Murashige medium must be 5.5 and the saccharose concn. of 4 percent. (CIAT)

0445

25743 ROCA, W.M.; SZABADOS, L.; NARVAEZ, J.; BELTRAN, J.; REYES, R.; MAFLA, G.; ROA, J. 1985. Cassava tissue culture. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.173-204. Engl., Sum. Engl., 49 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Tissue culture; Apical meristems; Plant development; Rooting; Growth; Culture media; Germplasm; Morphogenesis; Temperature; Storage; Colombia.

Meristem and shoot tip culture techniques that have been utilized only in the last decade, mainly as a means for ridding selected cassava var. of viruses, are described in detail. More recently, the use of these techniques has been extended to the maintenance and international exchange of cassava germplasm. The future of cassava cryogenic storage is promising. Min. growth storage is now a viable method for maintaining large collections in small spaces free of pest and disease risks. International movement of in vitro cassava provides a valuable safeguard for minimizing the dangers of pest and disease dissemination. The embryo, cell, callus, protoplast, and anther culture methods are briefly discussed. (AS) See also 0462 0478 0509 0548 0556 0565 0616 0617 0623 0634 0651

0446

23944 MULINDABYUMA, J.M. 1983. Composition chimique de la patate douce et du manioc. (Chemical composition of sweet potato and cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et séiection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.107-118. Fr., Illus.

Cassava; HCN content; Cultivars; Sweet cassava; Bitter cassava; Rwanda.

Data related to the HCN content in fresh cassava, the HCN concn. in the steeping water, the ratios of the HCN concn. in the var. grown in Rubona and Karama (Rwanda), and the correlation between the solubility vs. humidity ratios at both sites are presented. The relationship between the starch and water contents of the sweet var. studied is also presented. Only the definition of the lethal dose and the resp. assessment of the min. HCN content determine the difference between sweet and bitter cassava. Indications of the performance of cassava var. can be obtained on the basis of the ecosystems and of the physical, chemical, and technical treatments to which they are submitted. (CIAT)

C03 CHEMICAL COMPOSITION, METHODOLOGY AND ANALYSES

0447

26134 HOLLOWAY, W.D.; MONRO, J.A.; GURNSEY, J.C.; POMARE, E.W.; STAGE, N.H. 1985. Dietary fiber and other constituents of some Tongan foods. Journal of Food Science 50(6):1756-1757. Engl., Sum. Engl., 15 Refs. (Applied Biochemistry Division, Dept. of Scientific & Industrial Research, Palmerston North, New Zealand)

Cassava; Water content; Food energy; Protein content; Fat content; Sugar content Starch content; Ash content; Fibre content; Tonga.

Components of dietary fiber (soluble nonstarch polysaccharide, pectin, hemicellulose, cellulose, and lignin), water, energy, protein, lipids, and starch were measured in banana, breadfruit, cassava, coconut, mango, pawpaw, plantain, sweet potato, taro, and Pacific yam, all from Tonga. Tongan foods were generally higher in dietary fiber than New Zealand foods, consistent with the hypothesis that dietary fiber is an important factor contributing to a lower incidence of certain gastrointestinal disorders in Tonga than in New Zealand. Cassava total dietary fiber content was 13.4 percent. (AS)

0448

26303 MAMAT, E.; RAGAB, M.H.H. 1971. Rapid determination of starch in tapioca tubers for control purposes. Serdang, Selangor, Food Technology Research and Development Centre of Malaysia. Report no.49. 21p. Engl., Illus.

Cassava; Starch content; Analysis; Malaysia.

Three methods to rapidly determine the starch content of cassava roots are described in detail, namely, the specific gravity, the iodine, and the anthrone methods. (CIAT)

0449

21456 PALAFOX, A.L. 1982. Animal sciences. In Guam Agricultural Experiment Station. Annual Report 1982. Mangilao, Guam, University of Guam. College of Agriculture and Life Sciences. pp.55-57. Engl., Sum. Engl., Illus.

Cassava; Cultivars; Composition; Ash content; Mineral content; Ca; P; K; Na; Mg; Cu; Fe; Mn; Zn; Leaves; Petioles; Roots; USA.

In Guam, 6 cassava cv. were evaluated to determine and differentiate their potential for human and animal nutrition. The growth and the color of stems, petioles, leaves, and roots were observed and data were taken on the no., wt., diameter, and circumference of roots; the chemical composition of leaves and petioles was also studied. The ash content varied between 6.35-7.04 percent for the leaves and between 9.25-11.15 percent for the petioles. With the exception of Mg, Cu, and Fe, the mineral content was higher in the petioles than in the leaves. Cv. GAB 2 produced the heaviest root and cv. PAL 1 the lightest (5.59 and 2.94 kg, resp.). In general, the cv. that produced the heaviest roots also produced the heaviest stems and leaves. (CIAT)

0450

26193 TELES, F.F.F.; OLIVEIRA, J.S.; SILVEIRA, A.J.; BATISTA, C.M. 1985. Fatty acids, carbohydrates and crude protein in twenty cassava cultivars (Manihot esculenta Crantz). Journal of the American Oil Chemists' Society 62(4):706-708. Engl., Sum. Engl., 10 Refs. (Depto. de Química, Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil)

Cassava; Cultivars; Fat content; Protein content; Carbohydrate content; Analysis; Brazil.

Twenty cassava cv. were analyzed for fatty acids, nonstructural carbohydrates, and CP contents. The main constituent fatty acids were myristic, palmitic, stearic, oleic, linoleic, and linolenic. Trace amounts of lauric, myristoleic, and palmitoleic acids were detected. Saturated acids ranged from 26.58 to 58.05 percent. Acid-digestible carbohydrates ranged from 11.82 to 40.70 percent of the green matter. Reducing and nonreducing soluble oligosaccharides were also determined. CP ranged from 1.39 to 4.70 percent of the DM. Linear regression analyses were made, but no significant correlations were found. Some possible genetic relationships are proposed for certain cv. (AS) See also 0446 0487 0495 0509 0633 0636 0651

C04 PLANT NUTRITION

0451

26341 BALAGOPAL, C.; POTTY, V.P. 1979. Plant microbe-interrelationship in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.79-80. Engl.

Cassava; N; Rhizobium; Inoculation; Growth; India.

The influence of cassava leaf shedding on the ammonification and nitrification process in a laterite soil was studied; the nitrification rate was constant after 105 days of incubation. The inoculation of Azotobacter did not have any effect on the growth of cassava nor were there significant differences among treatments. (CIAT)

0452

25792 BURCKHARDT, E.A.; HOWELER, R.H. 1985. Efecto de la inoculación de cepas de micorriza sobre el crecimiento de la yuca en varios suelos naturales en el invernadero. (Effect of the inoculation of mycorrhizal strains on the growth of cassava in several natural soils in the greenhouse). In Sieverding, E.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.140-153. Span., Sum. Span., 5 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Inoculation; Soil physical properties; Cultivars; Erosion; Growth; Fertilizers; P; Colombia.

A series of trials were conducted to evaluate the response of cassava to inoculation with mycorrhizal strains under various levels of P fertilization, in different natural soils and in eroded soils of cassava-growing regions in Colombia. Only strains C-1-1 (Glomus manihotis) and C-10 (Entrophospora colombiana) resulted in significative responses in the soils used. The remaining strains had a response similar to the av. of native strains. When inoculating cassava with strain C-1-1 and applying 3 doses of P in 6 natural soils, a response to P fertilization was observed only at the 100 kg/ha level. The effect of inoculation was measured with various strains in 10 natural soils, and only in the soils of Carimagua (Reserva and Alegría) a highly significant response was obtained due to the low efficiency of native mycorrhizae and to the low fertility of these 2 soils. (AS-CIAT)

0453

25791 HOWELER, R.H. 1985. Aspectos prácticos de la investigación de micorrizas vesículo-arbusculares demostrados en el cultivo de la yuca. (Practical aspects of the research on vesicular-arbuscular mycorrhizae, demonstrated in cassava). In Sieverding, E.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.44-61. Span., Sum. Span., 2 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Inoculation; Soil physical properties; Soil analysis; Cultivars; pH; Fertilizers; P; N; K; Soil fertility; Dry matter; Field experiments; Laboratory experiments; Colombia.

Results of trials on field inoculation of cassava with vesicular-arbuscular mycorrhizal strains in Carimagua and Mondomo (Colombia) were registered. Some strains such as C-1-1 (Glomus manihotis) were found to be adapted to various edaphoclimatic conditions, while others can be more specific to

certain conditions. In greenhouse trials it was confirmed that some vesicular-arbuscular mycorrhizal strains present differences in their tolerance to soil acidity and fertility, as well as to the levels of N and K fertilization. In greenhouse trials some important factors were also determined for the production of vesicular-arbuscular mycorrhizal inoculum to obtain effective sources of inoculum. These trials sought to find a more efficient and practical method for sterilizing the soil and selecting the substrate and the host plant. Finally, there is an explanation on how to handle infected rootlets, if they are to be utilized as sources of vesicular-arbuscular mycorrhizal inoculum in cassava. (AS-CIAT)

0454

25744 HOWELER, R.H. 1985. Mineral nutrition and fertilization of cassava. A review of recent research. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.249-320. Engl., Sum. Engl., 66 Refs., Illus.

Cassava; Soil physical properties; N; P; K; S; Ca; Mg; Nutrient uptake; Mineral deficiencies; Soil analysis; Plant tissues; Mineral content; pH; Al; Zn; Mn; Salinity; Fertilizers; Manures; Timing; Colombia.

Recent research on mineral nutrition and fertilization of cassava is reviewed. Cassava grows relatively well on acid and infertile soils; however, for high yields the crop requires high levels of fertilization, especially K, which is removed in large quantities with each root harvest. In many acid infertile soils it is recommended to apply a small amount of dolomitic lime (or calcitic lime with MgO) to supply Ca and Mg as nutrients. Initially P is often the most limiting element, but after a few years the level of P application can be reduced while that of K should be increased to prevent soil K exhaustion. Although the plant has large amounts of N in both tops and roots, much of this is returned to the soil in fallen leaves and is recycled. Except in very sandy and low OM soils there is a lower response to application of N than of P or K. Of the minor elements, Zn is the most important; it can be supplied cheaply as a cutting treatment in 2-4 percent $ZnSO_4.7H_2O$ solution. In general it is recommended to apply rather insoluble fertilizers or soil amendments broadcast and incorporated preplanting, while highly soluble sources are best band applied near the cutting all at time of planting or split applied at planting and 2-3 mo. later in sandy soils. (AS)

0455

25512 JONAS, J. 1984. Panama installs cassava experiment. Benchmark Sites News 8(3-4):5,8. Engl.

Cassava; Research; Cultivars; Al; Agricultural lime; Leaf area; Root productivity; Branching; Panama.

As part of a cooperative research effort with International Benchmark Sites Network for Agrotechnology Transfer, the Instituto de Investigación Agropecuaria de Panamá established 2 cassava expt. in May 1984, in a Typic Tropudult of Ocu in the Province of Veraguas. One expt. was designed to study the differential response of cassava cv. to Al toxicity and the other to observe the response of cassava to increasing application rates of lime. Preliminary results of the 1st expt. showed a range of branching habits that appeared to be var. in character; data indicated that root yield performance is not associated with dominance of a particular branching habit. Also, no clear relationship was found between LAI and root yield. In general, the results indicate the existence of local genotypes with the potential to produce relatively high yields under high Al content and low pH conditions. (CIAT)

0456

26333 MOHANKUMAR, B.; NAIR, P.G.; POTTY, V.P. 1979. Effect of sulphur containing fertil'zers on the yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.39-40. Engl.

Cassava; Cultivars; Fertilizers; S; Soil analysis; Root productivity; Starch content; HCN content; India.

The effect of several fertilizers with or without S on the yield and quality of cassava was studied in a randomized block design with 9 treatments and 4 replications. The soluble S content of the soil increased with the application of different levels of the S-containing fertilizers, but it decreased with the age of the crop. In general, the S-containing fertilizers produced a higher cassava root yield. The root starch content also increased with the application of S-containing fertilizers, but the HCN content decreased. (CIAT)

0457

26331 MOHANKUMAR, B.; MAINI, S.B. 1979. Influence of molybdenum and nitrogen on the yield and quality of cassava in acid laterite soil. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.35-36. Engl.

Cassava; Cultivars; Mo; N; Soil physical properties; Root productivity; HCN content; Starch content; Dry matter; India.

The effect of Mo and N on the yield and quality of cassava grown in an acid laterite soil was studied in a randomized block expt. with 16 treatment combinations and 3 replications. Increasing application rates of N significantly increased root yield but there was not a significant increase in yield due to Mo application. HCN content also increased as the level of N increased, but with increasing levels of Mo it decreased slightly. None of the treatments affected the starch and DM contents or the cooking quality of the roots. (CIAT)

0458

26330 NAIR, G.M.; PRABHAKAR, M. 1979. Effect of nitrogen and potash on tuber yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.33-34. Engl.

Cassava; N; K; Cultivars; Fertilizers; Dung; P; Root productivity; Dry matter; HCN content; India.

The effect of N and K on cassava root yield and quality was studied using 4 cassava var. (H-165, H-2304, H-1687, and M-4) and 10 NK combinations (50-50, 50-100, 50-150, 75-75, 75-150, 75-225, 100-100, 100-150, 100-200, and 100-250) in a split plot design. The FYM and P were applied in a uniform basal dose of 12.5 t and 75 kg/ha, resp. Var. H-2304 was superior to the other var. in root yield. The NK fertilizer combination of 100-100 was significantly superior to the combinations 50-50, 50-100, 50-150, 75-75, and 75-150, but not to the others. The influence of N was more pronounced regarding root production than that of K. Var. H-2304 also showed the highest root DM content (35.0 percent) and var. H-165 the lowest (26.5 percent). The fertilizers did not have any effect on root DM and HCN contents. The HCN content was significantly higher in var. H-165 and lower in var. H-1687 and M-4. The N:K ratio recommended as optimum for good yield and root quality is 100:100. (CIAT)

0459

25793 SIEVERDING, E.: CADAVID, L.F.; GALVEZ A., L. 1985. Ecología de la micorriza vesículo-arbuscular en yuca y el efecto de algunas prácticas agronómicas incluyendo la inoculación de campo sobre ella y la producción de yuca. (Ecology of the vesicular-arbuscular mycorrhiza in cassava and the effect of some agronomic practices, including field inoculation, on cassava and its production). In _____.; Sánchez de Prager, M.; Bravo O., N., eds. Curso Nacional sobre Micorrizas, 1o., Cali, Colombia, 1984. Investigaciones sobre micorrizas en Colombia: memorias. Palmira, Universidad Nacional de Colombia. pp.194-208. Span., Sum. Span., 10 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Cultivars; Mulching; Temperature; Rainfall data; Inoculation; Root productivity; Colombia.

In a field trial in an Inceptisol (Quilichao, Colombia), rootlet infection of 2 cassava cv. was recorded during 1 yr, as well as the no. of spores of the vesicular-arbuscular mycorrhizae population. The effect that stubble mulching and field inoculation with Glomus manihotis had on the population of vesicular-arbuscular mycorrhizae was also determined. Overall, the infection of cassava roots was greater during rainy periods than in periods with less rainfall. Stubble mulching reduced infection, especially of M Ven 77, during the 1st half of the year. Infection increased 6 mo. after planting due to field inoculation with G. manihotis. The max. no. of spores was found 9 mo. after planting, thereafter decreasing until harvest; the no. of spores was always higher for cv. M Ven 77 than for M Col 638. The optimum no. of vesicular-arbuscular mycorrhizae spores was reached more rapidly (after 6 mo. of growth) in the stubble mulching treatment; these data also correspond to the field inoculation treatment. Without stubble mulching M Col 638 yields were lower than those of M Ven 77. Stubble increased yields significatively and both cv. yielded the same with mulching. Field inoculation increased yields, though not significatively; however, the C.V. of yield decreased due to inoculation. (AS-CIAT)

0460

25745 SIEVERDING, E.; HOWELER, R.H. 1985. Function of vesicular-arbuscular mycorrhiza for cassava growth. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.321-339. Engl., 16 Refs., Illus.

Cassava; Mycorrhizae; Growth; P; Nutritional requirements; Nutrient uptake; Inoculation; Colombia.

The symbiosis mycorrhiza/plant root, the distribution and function of vesicular-arbuscular mycorrhizal (VAM) fungi, and the importance of these in the nutrient uptake by the plant are described. The dependence of cassava on the VAM fungi is analyzed; the obtainment of inoculum sources and methods of field inoculation are described in detail. In relation to their function, the VAM fungi Glomus manihotis and Entrophospora colombiana have demonstrated to be more efficient than the native mycorrhizal populations. The collection, isolation, and maintenance of VAM fungal isolates, the screening procedures in the greenhouse (efficiency in P uptake and ability to compete with native mycorrhiza), and the transfer of technology are discussed. (CIAT)

0461

26379 SIEVERDING, E.; HOWELER, R.H. 1985. Influence of species of VA mycorrhizal fungi on cassava yield response to phosphorus fertilization. Plant and Soil 88(2):213-221. Engl., Sum. Engl., 22 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mycorrhizae; Cultivars; Field experiments; Laboratory experiments; Fertilizers; P; Colombia.

At 3 different sites with acid soils in Colombia, field trials with cassava were monitored for frequency of vesicular-arbuscular mycorrhiza. Increasing levels of P from 0 to 200 kg/ha had been applied. The fields differed in the composition of species of vesicular-arbuscular mycorrhizal fungi. At all sites, infection of the roots by the total mycorrhizal population decreased with increasing P fertilization, but at 2 sites the relative frequency and activity of 1 species, Glomus manihotis, increased with increasing P applications. This species was only present at 2 sites, and only in these sites a cassava yield response to up to 200 kg P was found. The differential activity of fungal species was confirmed in greenhouse trials, where Entrophospora colombiana was found to be most effective at 50 kg P and G. manihotis at 200 kg P. (AS) See also 0443 0464 0466 0617 0623

D00 CULTIVATION

See 0543

D01 SOIL, WATER, CLIMATE AND FERTILIZATION

0462

25208 AZEVEDO, J.N. DE 1985. Adubacao mineral radicular e foliar comparadas na cultura da mandioca (Manihot esculenta Crantz). (Comparison between root and leaf mineral fertilization in cassava). Tese Mestrado. Areia-PB, Brazil, Universidade Federal da Paraiba. 97p. Port., Sum. Port., Engl., 63 Refs., Illus.

Cassava; Climatic requirements; Temperature; Rainfall data; Soil physical properties; Land preparation; Agricultural lime; Planting; Spacing; Cultivars; Soil analysis; Fertilizers; N; P; K; Leaves; Roots; Dry matter; Starch content; Root productivity; Productivity; Plant height; Harvest index; Mineral content; Statistical analysis; Economics; Costs; Income; Brazil.

Comparative studies of the effects of the chemical fertilization of the roots and leaves of cassava were carried out on a medium textured dystrophic Latossol in Areia (Paraiba, Brazil) in 1983-84. A randomized block design in a 2(3) + 1 factorial arrangement was used with 9 treatments and 5 replications. Root fertilization rates were 50 kg N + 80 kg P + 40 kg K/ha, the N being applied in 2 periods and the other nutrients at planting. Foliar fertilization was applied at 60, 120, 210, and 270 days after the germination of the cuttings. Harvesting took place 12 mo. after planting. The parameters evaluated were wt. of roots and aerial parts, root DM content, stem diameter, plant height, starch content, root diameter and length, and HI. Root production was 16.32 and 9.80 t/ha for the root- and leaf-fertilized plants, resp. The root-applied P significantly influenced all the parameters studied except wt. of the fresh leaves and HI. Leaf-applied N enhanced the production of fresh leaves, although not significantly. K presented a positive and significant interaction with P for: root yield; root DM; total canopy, stem, and fresh leaf DM contents; plant height; and leaf K and P contents at 120 and 270 days, resp., after total germination of cuttings. N showed a positive and significant interaction with P for the production of fresh leaves and with the K for stem diameter and leaf P content at 60 and 270 days after the germination of the cuttings. In relation to the economic analysis, the most profitable treatment was that in which N was applied to the leaves and P and K to the roots. (AS)

0463

24732 BENVENUTI, G.; CRUZ, L.; CEDEÑO, J.; BARCIA, O.; VILLAVICENCIO, A.; TOAPANTA, C.; VALDIVIA, V. 1976. El cultivo de la yuca: instrucciones prácticas. (The cultivation of cassava: practical instructions). Portoviejo, Ecuador, Ministerio de Agricultura y Ganadería. Programa de Tubérculos y Raíces. Proyecto FAO-ECU/71/522. Serie Cultivos no.5. 18p. Span., Illus.

Cassava; Cultivation; Soil physical properties; Soil analysis; Land preparation; Cultivars; Cuttings; Selection; Planting; Spacing; Timing; Fertilizers; Water requirements (plant); Weeding; Herbicides; Insecticides; Disease control; Harvesting; Root productivity; Storage; Rotational crops; Ecuador.

A practical manual with recommendations for the successful cultivation of cassava is presented. The recommended practices emphasize land selection and its proper preparation, soil analysis, planting of good cassava var.,

and the utilization of selected cuttings. Instructions are given for the planting of cuttings in vertical, slanted, or horizontal position, spacing and planting time, and adequate fertilization. Plant water requirements, manual and chemical weed control, chemical pest control and cultural disease control, pruning, yields, preservation of roots and cuttings, and the need of crop rotation (especially with legumes, maize, sesame, cotton, and others) are indicated. (CIAT)

0464

25259 HOWELER, R.H.; CADAVID, L.F. 1984. Prácticas de conservación de suelos para producción de yuca en ladera. (Soil conservation practices for the production of cassava on hillsides). Suelos Ecuatoriales 14(1):303-310. Span., 5 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cultivars; P; Nutritional requirements; Agricultural lime; Land preparation; Fertilizers; N; K; Dung; Erosion; Colombia.

To identify cultural practices that permit the cultivation of cassava on hillsides without causing damage to the soil, the results of research on cassava in the Mondomo region (Cauca, Colombia) regarding adapted cv., adequate fertilization, methods of soil preparation, and erosion control practices are presented. Among 21 cassava cv., planted in plots with 0 and 150 kg of P/ha, the best yields were obtained with P application and the cv. M Col 113, CMC 40, and CMC 92 (37.4, 36.4, and 34.3 t/ha, resp.). It was confirmed that once the soil is eroded, it is difficult to recover its productivity through fertilization since not only the nutrients of the vegetal cover are lost but also the water retention capacity, the good structure, and a large proportion of the mycorrhizae population. The fertilization recommended for the soils in the region consists of 100 kg N, 50 kg P, and 100 kg K/ha. Among 7 soil preparation treatments and cultivation practices in Agua Blanca, the least soil losses due to erosion and the highest yields (13.3 and 17.6 t/ha) were obtained (1) soil preparation with oxen, double cassava rows alternated with 1 m of Brachiaria and (2) without preparation and planting with a pick ax at 80 x 80 cm, with the application of lime and fertilizers. On hillsides, to improve the yields/ha it is required to have good fertilization, use adapted var. with good yield potential, select healthy and thick cuttings, control ants and white grubs, and have a good weed control. To better control the runoff, it is recommended to prepare the land and plant the crop in contour, plant strips of live grass barriers, cover the soil with maize or sugarcane mulch, and intercrop cassava with fast growing crops. (CIAT)

0465

24584 JACKSON, G.; BREEN, J. 1985. Cassava. In _____. Collecting, describing and evaluating root crops. Suva, Fiji, Food and Agriculture Organization of the United Nations. RAS/83/001. Field Document no.8. pp.6,8-11,38-46,59,61-62,64-68,80-84,91-95. Engl., 32 Refs., Illus. (Plant Protection Project, United National Development Program, Private Mail Bag, Suva, Fiji)

Cassava; Cultivation; Planting; Spacing; Fertilizers; Insecticides; Acaricides; Harvesting; Plant anatomy; Agronomic characters; Propagation; Cuttings; Amblypelta; Unaspis citri; Tetranychus; Cercosporidium henningsii; Cassava African mosaic virus; Selection; Oceania.

Recommendations on the cultivation (planting, fertilizers, weeding, pest control, harvesting) and rapid propagation techniques of cassava, sweet potato, yam, and edible aroids in the South Pacific are given. A list of descriptors for the identification of cassava is also presented as well as the evaluation guidelines. (CIAT)

0466

26332 MOHANKUMAR, B.; NAIR, P.G. 1979. Effect of level and frequency of lime application on the yield and quality of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.36-39. Engl.

Cassava; Agricultural lime; Cultivars; pH; Soil analysis; P; Ca; Root productivity; Starch content; HCN content; Mineral content; K; Economics; India.

The effect of lime application on the yield and quality of cassava grown in a laterite soil was studied in a randomized block expt. with 15 treatments and 3 replications. Soil pH and exchangeable Ca content progressively increased as the level of lime increased. Lime application had a beneficial effect on the increase of available P, although the effect was not too pronounced due to the high initial P status of the soil. The root productivity and starch and P contents also increased with lime application, but the different levels of lime did not influence root HCN or K contents. (CIAT)

0467

23936 WILFRID, J. 1983. Influence des facteurs écologiques dans la croissance et le rendement de la patate douce (Ipomea batatas poi ·) et du manioc (Manihot esculenta Crantz). (Influence of ecological factors on the growth and yield of sweet potato and cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.28-36. Fr.

Cassava; Climatic requirements; Temperature; Rainfall data; Photoperiod; Soil requirements; pH; Nutritional requirements; Soil conservation practices; Rwanda.

The climatic (temp., photoperiod, alt., rainfall) and edaphic (soil pH) requirements of cassava in Rwanda are described. Soil preservation is discussed. (CIAT) See also 0434 0453 0454 0455 0456 0457 0458 0459 0470 0475 0477 0487 0490 0548 0549 0556 0610 0611 0616 0617 0620 0622 0623 0627 0630 0632 0633 0640 0643 0644 0646 0650 0653

0468

26180 COCK, J.H. 1986. Cassava production. In _____., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.17-22. Engl., 1 Ref. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Production; Cuttings; Growth; Plant development; Root productivity; Ecosystems; Propagation; Cultivation; Uses; Colombia.

The worldwide importance of cassava and its uses are mentioned, and the growth and development of cassava propagated through cuttings are described as well as the cultivation systems used for cassava production. (CIAT)

0469

25742 COCK, J.H. 1985. Rapid propagation techniques for cassava. In _____.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.165-171. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Propagation; Cuttings; Shoots; Growth-chamber experiments; Rooting; Leaves; Petioles; Temperature; Colombia.

Two techniques for rapid propagation of cassava developed at CIAT, multiple production of shoots and propagation of axillary buds, are described. The 1st requires the use of lignified cuttings, from which the shoots are removed to be rooted; each shoot consists of a node, an internode, an axillary bud, and a leaf. The 2nd uses unlignified material as propagules. Leaves with their axillary bud and a small portion of stem tissue are cut from healthy mother plants; the leaf lobes are cut so that the leaf forms a rosette. (CIAT)

0470

25270 FRESCO, L.; MUAKA, T.; N'TEN ANGIUNG, S.; PEETERS, L. 1983. Le manioc: variétés et techniques culturales; résultats des essais réalisés a Kingungi, Mosambo et Lobo (Bandundu). (Cassava: varieties and cultivation techniques; results of the trials carried out in Kingungi, Mosambo, and Lobo (Bandundu)). Zaire-Afrique no.176:355-362. Fr.

Cassava; Cultivars; Cultivation; Root productivity; Zaire.

A trial was conducted in 3 localities (Lobo, Mosambo, Kingungi) in Zaire to study 6 var. from the Programme National Manioc, 2 local var., 2 cultivation techniques (planting on ridges with or without burning and with or without green manure), and the planting site. Yields depended on the agroecological environment and the cultivation techniques, and varied from 1 to more than 20 t/ha according to the var. and the trial plot. After 12 mo. most of the var. show an av. superior to the one obtained traditionally as long as (1) planting is done at the beginning of the rainy season in fields left under fallow for several years; (2) healthy 20-25 cm cuttings, a plant density of 10,000 plants/ha, and contour ridges are used; and (3) weeding is practiced regularly. (CIAT)

0471

26179 GLOBAL WORKSHOP ON ROOT AND TUBER CROPS PROPAGATION, CALI, COLOMBIA. 1983. Proceedings of a Regional Workshop. Cock, J.H., ed. Cali, Centro Internacional de Agricultura Tropical. 240p. Engl., 192 Refs., Illus.

Cassava; Cuttings; Propagation; Production; Uses; Cultivars; Timing; Fertilizers; N; P; K; Storage; Mycoses; Injurious insects; Injurious mites; Viroses; Disease control; Insecticides; Colombia.

Papers presented at the Global Workshop on Root and Tuber Crops Propagation, held in Cali, Colombia, were related to seed or planting material of the following crops: potato, cassava, sweet potato, yam, and cocoyam. Aspects covered were production systems, seed production, physiology and sanitary problems, rapid propagation techniques, and storage. The papers related with cassava are recorded individually in this publication under the following consecutive no.: 0468, 0472, 0476, 0477, 0478, 0479, 0481, 0483, 0484, 0486, and 0511 (CIAT)

0472

26188 GONZALEZ L., V.W. 1986. Production of cassava planting material in Mexico. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.193-196. Engl., 6 Refs.

Cassava; Cuttings; Cassava programs; Cultivars; Propagation; Mexico.

The propagation project of the cassava research program in Mexico is described. The multiplication is based on the 2-node cutting method, and the main var. used are Costeña and Sabanera. It is important to note that in Mexico, at present, no standards exist for the certification of cassava planting material, and as a result, phytosanitary control is only exercised when the cuttings are handed over to the farmers. (CIAT)

0473

26160 INDUSTRIA DE POLVILHO TRADICAO. BRASIL. s.f.. Conheca a cortadeira de ramas Tradicao. (Get to know the traditional stem cutter). Jaboti-PR, Brasil. 1p. Port., Illus.

Cassava; Stems; Cuttings; Agricultural equipment; Mechanization; Brazil.

The advantages of a cassava stem cutter for the uniform production of cuttings are indicated and a photo is included. Also included are the addresses where additional information can be obtained. (CIAT)

0474

26322 KAMALAM, P. 1979. Development of disease free genetic stocks. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.17-18. Engl.

Cassava; Cuttings; Propagation; Root productivity; Cultivars; India.

Single-node and 2-node cuttings of cassava cv. H-2304, together with control cuttings (20 cm long), were planted directly in the field with 4 replications at 2 different spacings (90 and 45 cm) for each treatment. The harvest took place at 9 mo. in 1978 and at 14 mo. in 1979. The 2-node and the control cuttings, spaced at 45 cm, gave significantly superior yields than the other treatments in both years. (CIAT)

0475

24583 KRAMER, M. 1981. La siembra de la yuca: impresiones recogidas de la literatura, y propuesta de una investigación de campo en La Sierra. (Cassava cultivation: concepts collected from the literature, and a proposal for field research in La Sierra). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 17p. Span., 16 Refs.,

Illus. (Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana)

Cassava; Production; Bitter cassava; Erosion; Planting; Cuttings; Soil conservation practices; Intercropping; Dominican Republic.

Based on a literature review, the planting conditions of cassava (cuttings, position, depth), possibilities to control erosion, and a proposal of field research in La Sierra (Dominican Republic) are presented. (CIAT)

0476

26181 LEIHNER, D.E. 1986. Current practices in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.41-45. Engl., 7 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Selection; Colombia.

The current practices (selection, cutting, preparation, and handling before planting) used for the production of cassava cuttings are reviewed, and the aspects that require improvement are discussed. It is suggested to use healthy, mature cuttings of the proper length, nondamaging cutting practices, and chemical protection. (CIAT)

0477

26182 LEIHNER, D.E. 1986. Physiological problems in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.57-72. Engl., 4 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Cultivars; Timing; Harvesting; Dry matter; Starch content; Roots; Root productivity; Germination; Plant tissues; Planting; Spacing; Fertilizers; N; P; K; Colombia.

The influence of the genotype, the age of the plant and plant tissue, the planting density, and NPK fertilization on the production of cassava planting material is reviewed. Cv. differ widely in their ability to produce planting material; this ability is greatly influenced by the distribution of top growth among parts useful and those not useful for cutting production. The ratio of suitable stem material to total top dry wt. is particularly high in cv. with a late branching and erect growth habit. Cutting production increases with plant age, reaching an optimum in some cases and continuing to increase in others. Besides plant age, the age of tissue within the plant seems to have an influence on the performance of the cuttings in a subsequent crop. Cuttings coming from the lower and middle portion of the primary stems (older tissue) are normally thick and have large carbohydrate reserves. This leads to fast sprouting and vigorous early growth. Cuttings from younger tissue sprout more slowly, but they produce higher commercial and total root yields. It is feasible to use higher than normal planting densities if an increased cutting production in limited space is desired. Plant nutrition interacts with genotypic characteristics in modifying growth habit; therefore, good natural soil fertility or a modest fertilization on poor soils should be adequate to optimize cutting production. (CIAT)

0478

26185 LEIHNER, D.E. 1986. Storage and regeneration of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops

Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional ce Agricultura Tropical. pp.131-138. Engl., 6 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Storage; Water content; Phenacoccus; Fusarium; Diplodia; Glomerella; Curvularia; Aspergillus; Germination; Colombia.

The factors related to cassava cutting deterioration during storage were identified, and the control of such factors through appropriate cutting management is discussed. The water loss and viability, the insects and fungi that infest the cuttings during storage, and the effect of long-term storage on germination are analyzed. Expt. in which stored cassava cuttings were soaked in water or in a nutrient solution to improve germination vigor are described. The best results were obtained when the cuttings were soaked for 240 min, either in water or in the nutrient solution. In the latter case, the root yield was higher than that obtained with fresh cuttings. (CIAT)

0479

26183 LOZANO, J.C.; BELLOTTI, A.; VARGAS, O. 1986. Sanitary problems in the production of cassava planting material. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.74-85. Engl., 26 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cuttings; Storage; Glomerella cingulata; Fusarium; Diplodia; Rosellinia; Sclerotium rolfsii; Mononychellus; Thrips; Neosilba perezi; Carpolonchaea chalybea; Anastrepha manihoti; Anastrepha pickeli; Erwinia carotovora; Phenacoccus; Armillariella; Aonidomytilus albus; Saissetia nigra; Chilomina clarkei; Lagochirus; Coelosternus; Lepturges; Euleeriops manihoti; Agrotis ipsilon; Phyllophaga; Leucopholis rorida; Insecticides; Colombia.

The pathogens (fungi, viruses, and mycoplasmas) and pests (insects and mites) that can attack cassava planting material before harvest, during storage, and after planting are presented. The pathological problems that occur, if proper sanitary measures (clean propagation material, clean rooting media, and clean tools) are not taken, are discussed. Finally control measures are detailed. (CIAT)

0480

23939 MULINDANGABO, J. 1983. Diverses méthodes de propagation du manioc. (Several methods for the propagation of cassava). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rutona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.52-59. Fr.

Cassava; Propagation; Cuttings; Seed; Cultivars; Rwanda.

The methods of sexual (seeds) and vegetative (cuttings) propagation of cassava used in Rwanda are described. For sexual propagation, the form of preparation of the seedbeds, the planting of the seeds and their germination, and the factors that determine the spacing are described in detail. The need of a perfect hygiene for normal development is made evident. In relation to propagation by cuttings, the preparation of the planting material, the ways of planting the cuttings depending on the climate and soil, and the rapid multiplication technique of cassava, which consists in obtaining a high no. of individuals from 2-node cuttings coming from just 1 adult plant, are described. The use of cuttings from the apex, and green and terminal parts of the plant is also described in detail.

(CIAT)

0481

26187 NAIR, G.M.; PRABHAKAR, M.; NAIR, N.G.; GHOSH, S.P. 1986. Production of cassava planting material in India. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.187-192. Engl., 6 Refs.

Cassava; Cuttings; Timing; Propagation; Tissue culture; Apical meristems; India.

The different means that exist in India to propagate cassava are described as well as the rapid propagation techniques that have been developed. The factors affecting the cutting quality (age, thickness, length, viability, and mechanical damage of the cutting) are discussed. Finally, the disease elimination through tissue culture, the problems that limit the multiplication and distribution of planting material, and the strategies for increasing planting material production are analyzed. (CIAT)

0482

23938 NEZEHOSE, J.B. 1983. Multiplication et diffusion du manioc et de la patate douce au Rwanda. (Multiplication and dissemination of cassava and sweet potato in Rwanda). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.48-51. Fr.

Cassava; Production; Root productivity; Cultivars; Statistical data; Cuttings; Propagation; Rwanda.

The 1980 statistics related to cassava in Rwanda are given. In the Kigoma commune, bitter cassava var. Eala 07 and sweet cassava var. Bukarasa, Maguruyinkware, and Mulundi were multiplied at Bumbogo I (20.0 ha) and Bumbogo II (13.5 ha), allowing 1,675,000 cuttings to be available for an area of 167.5 ha. The potential needs of the crop are 454,890,000 cuttings or 9098.0 ha under multiplication. The problems related to the multiplication and diffusion of cassava, among them the lack of knowledge of cassava utilization, CAMV, use of infested cuttings, and insufficient assistance to the farmer, are discussed. (CIAT)

0483

26189 OKEKE, J.E.; OKOLI, O.O.; UTOH, N.O. 1986. Production of cassava planting material in Nigeria. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.197-204. Engl., 7 Refs.

Cassava; Cuttings; Cassava programs; Propagation; Pruning; Cultivars; Nigeria.

The methods that have been used to increase cassava cutting production in Nigeria are described in detail. They include pruning and spacing, node no. and planting position, and the use of rapid multiplication techniques. The multiplication and distribution of planting material are also analyzed. (CIAT)

0484

26190 PANDEY, S.J. 1986. Production of cassava planting material in Zaire. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop.

Cali, Centro Internacional de Agricultura Tropical. pp.205-216. Engl., Illus.

Cassava; Cuttings; Cassava programs; Propagation; Storage; Cultivars; Cassava African mosaic virus; Colletotrichum manihotis; Zaire.

The climatic, edaphic, and agronomic conditions of Zaire are described. The cassava research program is discussed and the work that has been carried out in relation to the age, length, and storage of cuttings is described in detail. Work on the effect of CAMV on germination and growth of cuttings and on the elimination of anthracnose through the selection of clean and healthy planting material has also been undertaken. Finally, the multiplication and distribution of clones are discussed. (CIAT)

0485

25589 QUINTERO, F. 1984. Comportamiento de dos cultivares de yuca en cinco épocas de cosecha. (Performance of two cassava cultivars in five harvesting times). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:101-109. Span., Sum. Span., 7 Refs. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Facultad de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Harvesting; Timing; Dry matter; Starch content; Root productivity; Venezuela.

When the field performance of 2 cassava cv. (UCV-2221 and UCV-2078) was studied over 5 harvests (6, 8, 10, 12, and 14 mo.) in the U. Central of Venezuela, highly significant differences were obtained among treatments (cv. and harvest times). Fresh root yields were highest for both cv. at 10, 12, and 14 mo. with 11.21, 15.08, and 19.77 t/ha, resp., for cv. UCV-2221 and 15.16, 13.66, and 20.48 t/ha, resp., for cv. UCV-2078. UCV-2221 presented the max. starch value (80.2 percent) at 12 mo. and its lowest values (70.7 and 72.2 percent) at 6 and 14 mo., resp. UCV-2078 had its max. starch percentage (86.2) at 12 mo. and the lowest (75.5 and 75.2) at 8 and 14 mo., resp. (AS-CIAT)

0486

26186 RODRIGUEZ N., A. 1986. Production of cassava planting material in Cuba. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.181-185. Engl., 4 Refs.

Cassava; Cuttings; Cassava programs; Propagation; Cultivars; Xanthomonas campestris pv. manihotis; Resistance; Cuba.

The objectives of the production program for cassava planting material in Cuba are to (1) promote the rapid adoption of superior clones for human consumption and resistant or tolerant to both Xanthomonas campestris pv. manihotis and Sphaceloma manihoticola; (2) propagate material that is acceptably free from cutting-transmitted diseases and pests; (3) obtain vigorous cuttings that guarantee high germination levels, so that the amount of replanting is kept to a min.; and (4) establish a base for subsequent yield increase through the use of clones with superior quality and high yield potential. The 4 phases or categories (breeder's seed, basic seed, registered seed, and certified seed) through which a var. must pass before cuttings can be considered suitable for release as certified seed are described, as well as the available commercial and precommercial clones. The impact of basic seed production of the research program is highlighted.

(CIAT) See also 0431 0436 0463 0464 0465 0487 0489 0548 0556 0610 0611 0613 0616 0617 0620 0622 0623 0627 0632 0633 0636 0640 0643 0644 0646 0653

D03 ENERGY PRODUCTIVITY AND YIELDS

0487

23739 ASHOKAN, P.K.; POTTY, N.N.; NAIR, R.V. 1983. A note on the optimum stage of harvest in cassava. South Indian Horticulture 31(1):47-48. Engl. (College of Horticulture, P.O. Vellanikara 680 634, Trichur, Kerala, India)

Cassava; Cultivars; Harvesting; Timing; Root productivity; India.

In 1978-79, at the Coconut Research Station, India, a randomized block design expt. with 6 replications was undertaken to determine the optimum age for harvesting cassava var. M4. Harvesting took place at 7, 8, 9, and 10 mo. after planting. The specific gravity of the roots at all ages indicated a high DM content. (CIAT)

0488

26197 KALMBACHER, R.S.; MARTIN, F.G.; MISLEVY, P. 1985. Fermentation substrate and forage from south Florida cropping sequences. Biomass 7(1):1-11. Engl., Sum. Engl., 20 Refs. (Ona Agricultural Research Center, Ona, FL 33865, USA)

Cassava; Cultivars; Root productivity; Energy productivity; USA.

Maize, sorghum, sweet potato, Jerusalem artichoke, and cassava were grown as alcohol biomass crops in various sequences in 1981 and 1982, on a sandy, siliceous, hyperthermic, typic Haplaquod soil. Herbage yield and yield of nonfermentable by-products were measured as potential cattle feed. Grain produced from maize followed by sorghum averaged 11.4 t/ha and was greater (P less than 0.05) than other grain crop sequences. Highest (P less than 0.05) root yields were from sweet potato (5.1 t/ha) in 1981 and cassava (5.3 t/ha) in 1982. Total nonstructural carbohydrate was greatest for maize/sorghum (6.0 t/ha) and maize/sweet potato (6.8 t/ha) sequences. Sweet potato and cassava crops were hindered by high rainfall and poorly drained soil. Cropping sequences including maize and sorghum produced more cattle feed, and they can be expected to produce more alcohol biomass with fewer cultural problems, on south-central Florida (USA) flatwoods soils. (AS)

0489

24551 MONTAGNER, W. 1983. Rendimento de raizes de mandioca em funcao de espacamento e densidade populacional. (Cassava root yield in function of the spacing and population density). In Reuniao Técnica Anual de Culturas Energéticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronômicas. pp.143-145. Port. (Inst. de Pesquisas Agronômicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Cultivars; Planting; Spacing; Root productivity; Brazil.

At the phytotechnical exptl. station of Taquari, Brazil, a trial was carried out to determine the optimum plant spacing in terms of productivity for cassava cv. L7. A randomized block exptl. design was used with 6 treatments (8333, 10,000, 10,416, 12,500, 13,888, and 16,600 plants/ha) and 4 replications. The highest yield (28.44 t/ha) was obtained with the highest density. The statistical analysis did not indicate any significant differences among the different treatments. No optimum density can be recommended since the results obtained are completely opposed to the ones obtained in previous trials. (CIAT)

D04 POSTHARVEST STUDIES

0491

26338 BALAGOPALAN, C.; POTTY, V.P.; PADMAJA, G. 1979. Improvement of preservation technology for cassava tubers and chips. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.72. Engl.

Cassava; Cultivars; Roots; Storage; India.

During 48 days roots of cassava var. H-2304, H-165, H-226, H-1687, and M-4 were stored in humid (40-45 percent) sawdust; the percentage of damage was recorded on a weekly basis. The results demonstrate that intact cassava can be stored for a prolonged time as long as the storage aeration and humidity are controlled. Storage did not affect root cooking quality. (CIAT)

0492

24550 MONTAGNER, W. 1983. Porcentagem de mudas de mandioca vivas em funcao de diversos métodos de hibernacao. (Percentage of live cassava cuttings in function of different hibernation methods). In Reuniao Técnica Anual de Culturas Energéticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronómicas. pp.140-142. Port. (Inst. de Pesquisas Agronómicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Cuttings; Cultivars; Storage; Germination; Brazil.

At the phytotechnical exptl. station of Taquari, Brazil, several storage methods of cassava cuttings were studied. Under the shade of trees, the stems were left horizontally on the ground, alone or covered with rice straw, or in vertical position alone or covered with straw. Without shade, the stems were left on the ground covered with earth or straw, or in a ditch and covered with straw. The highest percentage of cuttings that survived the winter (44.4 percent) was obtained with the unshaded treatment of stems left on the ground and covered with earth and the lowest (10.0 percent), with stems under shade left on the ground and covered with straw. (CIAT)

0493

25507 TANIGUCHI, T.; DATA, E.S.; BURDEN, O.J.; URITANI, I.; GORGONIO, M.; UMERES, E. 1984. The appearance of antifungal activity in cassava root tissues in response to physiological and microbial deteriorations. Annals of the Phytopathological Society of Japan 50(2):286-288. Engl., 8 Refs., Illus. (Faculty of Agriculture, Nagoya Univ., Nagoya, 464, Japan)

Cassava; Roots; Deterioration; Moulds; Analysis; Japan.

The production of antifungal substances in cassava root tissues showing physiological deterioration and microbial rotting is elucidated. Cassava root tissues, either with physiological deterioration or inoculated with Pythium sp. and Botryodiplodia theobromae, were extracted with ethanol and the extracts were run in TLC. The antifungal activity was detected by spraying the plates with a spore suspension of Alternaria alternata. Results indicate that cassava produces antifungal materials in response to physiological and microbial deterioration. (CIAT)

0494

21869 WHEATLEY, C.; GOMEZ, G. 1985. Evaluation of some quality characteristics in cassava storage roots. Qualitas Plantarum Plant Foods for Human Nutrition 35:121-129. Engl., Sum. Engl., 14 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Roots; Cultivars; Harvesting; Timing; Dry matter; Sugar content; Starch content; Organoleptic examination; Palatability; Deterioration; Colombia.

The susceptibility to physiological deterioration and the hardness (penetration) of fresh peeled cassava roots, as well as the cooking time, taste, and texture of cooked roots of 4 (1 local and 3 promising) cv. at 4 plant ages (6, 8, 10, and 12 mo.) were evaluated. Var. or cv., plant age, and their interactions significantly affected all these parameters. Roots produced by the local cv. (M Col 113) had lower DM contents and susceptibility to physiological deterioration, a longer cooking time, and higher penetration measurements than the promising cv. Physiological deterioration and penetration values tended to decrease; cooking time increased with plant age. The variation in correlation coefficients between quality and chemical parameters among the different cv. was substantial, with no correlation being significant in all 4 cv. The exptl. results demonstrate the great variability among cassava cv. in the root quality factors. (AS)

0495

21129 WHEATLEY, C.; COCK, J. 1985. Methods of aflatoxin analysis-with particular reference to cassava samples. International Journal of Epidemiology 14(1):185. Engl., 8 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Aflatoxins; Analysis; Colombia.

In a letter to the editor the existent methods for the analysis of aflatoxins are discussed. The interference of scopoletin, a nontoxic coumarin involved in the physiological deterioration of cassava, in the aflatoxin analysis is indicated. Both compounds have similar characteristics under UV light and TLC. A simple method of distinguishing between the 2 has been developed; the fluorescent extract is exposed to I vapor, which eliminates the fluorescence of the scopoletin without affecting that of the aflatoxin. Experience in Colombia has demonstrated that blue UV fluorescence in both fresh and processed cassava is invariably due to scopoletin. While the presence of some aflatoxin would not be unexpected, the high mean concn. reported (460 ppb) probably exaggerate the risk of cassava consumption. (CIAT)

0496

25754 WHEATLEY, C.C. 1985. Storage of cassava roots for human consumption. In Cock, J.H.; Reves, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.673-684. Engl., 12 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Roots; Deterioration; Storage; Post-harvest technology; Harvesting; Packaging; Distribution; Dry matter; Starch content; Sugar content; Colombia.

The physiological principles for storing cassava roots are discussed and storage techniques in straw and earth silos and in wooden boxes with moist sawdust are briefly described. A detailed description is given of the methodology for storing roots in polyethylene bags: harvest, root selection, treatment, packing, storage, and transportation. The methodology designed to evaluate postharvest losses, the parameters to be considered for estimating the quality of stored roots, and the potential of this storage technology are presented. (CIAT) See also 0617

0497

23089 SINGH, K.G. 1983. Plant quarantine development in the ASEAN and threats by pests. In _____ ed. Exotic plant quarantine pests & procedures for introduction of plant materials. Serdang, Selangor, Malaysia, Asean Plant Quarantine Centre and Training Institute. pp.283-302. Engl., 7 Refs., Illus.

Cassava; Quarantine measures; Phaeolus manihoti; Xanthomonas campestris pv. cassavae; Cassava African mosaic virus; Cassava mosaic virus; Cassava brown streak virus; Cassava latent virus; Mycoplasmoses; Frog skin disease; Thrips; Mononychellus tanajoa; Oligonychus peruvianus; Asia.

The regional cooperation, area covered, legislation, and establishment of the Plant Quarantine Centre and Training Institute of the countries belonging to the Association of South-East Asia Nations (ASEAN) are discussed. Main pests and diseases of the most important crops in the region, among them cassava, that have not yet been introduced into the region or that have a restricted distribution are listed. Maps are also included. (CIAT)

0498

26164 DIANESE, J.C. 1985. Atividade pectolítica das patovares de Xanthomonas campestris que afetam a mandioca. (Pectolytic activity of Xanthomonas campestris pathovars that affect cassava). Revista de Microbiología 16(3):195-202. Port., Sum. Port., Engl., 24 Refs., Illus. (Depto. de Biologia Vegetal, Univ. de Brasilia, Caixa Postal 153081, 70.910 Brasilia-DF, Brasil)

Cassava; Xanthomonas campestris pv. cassavae; Xanthomonas campestris pv. manihotis; Culture media; Analysis; Biochemistry; Brazil.

Xanthomonas campestris pv. cassavae from Africa (Xca) and Colombia (Xcc) and X. campestris pv. manihotis (Xcm), all 3 pathogenic to cassava, were compared with X. campestris pv. campestris (Xc) isolate NRRL-B1459A, based on their ability to produce enzymes which degrade pectic substances. Xc showed high polygalacturonic acid-transeliminase and pectinesterase activities. These enzymes induced leakage of electrolytes, maceration, and cell death on tissues of potato tubers. Xcc followed a similar pattern; however, Xca and Xcm had low enzymatic activities upon pectic substrates and were unable to cause maceration and cell death on potato tubers. Xcm presented polygalacturonase activity limited to the 1st 22 h of incubation at 30 degrees Celsius. (AS)

0499

25749 LOZANO, C. 1985. Bacterial leaf spot of cassava. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.510-511. Engl. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Xanthomonas campestris pv. cassavae; Agrobacterium tumefasciens; Pseudomonas; Mycoplasmoses; Symptomatology; Disease control; Biochemistry; Colombia.

The cassava diseases caused by Xanthomonas campestris pv. cassavae, Agrobacterium tumefasciens, and Pseudomonas solanacearum and their control are briefly described. The symptoms produced by the causal agent of the witches' broom disease and its control are also presented. (CIAT)

0500

25591 MARCANO, M.; TRUJILLO, G.; LUCIANI, J. 1984. Propagación del añublo bacteriano (AB) mediante esquejes de material de yuca (Manihot esculenta Crantz) resistente y susceptible a la enfermedad en las condiciones ambientales del Estado Aragua. (Propagation of bacterial blight through cassava cuttings, resistant and susceptible to the disease, under the environmental conditions of the state of Aragua).. In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:171-185. Span., Sum. Span., 15 Refs., Illus.

Cassava; Cultivars; Cuttings; Xanthomonas campestris pv. manihotis; Isolation; Symptomatology; Resistance; Venezuela.

Propagation of Xanthomonas campestris pv. manihotis was studied using cuttings of cassava plants having different degrees of resistance and previously attacked by the pathogen. The bacteria X. campestris pv. manihotis was found to translocate along the stems of material from CBB-susceptible clon UCV 2386; therefore, propagation material from these plants is contaminated with the disease, resulting in a high percentage of

diseased plants. Susceptible cassava plants attacked by CBB must not be used as propagation material. Resistant clon UCV 2339 showed that the pathogen is restricted to the zone visibly attacked and does not translocate to the rest of the plant, allowing bacteria-free material to be obtained from resistant material previously attacked by the pathogen. (AS-CIAT) See also 0465 0503 0507 0543 0549 0611 0617 0622 0632 0633 0636 0643 0646

E03 MYCOSES

0501

26347 CHACKO, C.I. 1979. Interrelationship, pathogenicity, and integrated control of Cercospora spp. of cassava and groundnut in an intercropping system. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.95-99. Engl.

Cassava; Groundnut; Intercropping; Cercosporidium henningsii; Isolation; Laboratory experiments; Research; India.

Cercosporidium henningsii and Cercospora personata were isolated into pure culture from diseased tissues of intercropped cassava and groundnut, resp. The growth and sporulation of the fungal isolates in culture were studied, and the effect of carbendazim, methylbenzimidazole carbonate, benomyl, and thiophanate on the inhibition of growth, spore germination, and sporulation of these isolates was assessed. The spore germination was more sensitive to inhibition by these chemicals than the growth of the 2 fungi, the sporulation being the least sensitive to the chemicals tested. (CIAT)

0502

25751 LOZANO, C. 1985. Fungal diseases. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.527-555. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Leaves; Cercosporidium henningsii; Symptomatology; Disease control; Phaeoramularia manihotis; Cercospora vicosae; Phoma; Oidium; Sphaceloma manihoticola; Isolation; Analysis; Plant growth substances; Resistance; Inoculation; Glomerella manihotis; Gloeosporium manihotis; Cuttings; Botryodiplodia theobromae; Roots; Phytophthora drechsleri; Rosellinia; Diplodia; Sclerotium rolfsii; Fomes lignosus; Fusarium; Colombia.

Symptoms, dissemination, and control of fungal diseases affecting cassava leaves, stems, and roots are presented. Among the former are those caused by Cercosporidium henningsii, Phaeoramularia manihotis, Cercospora vicosae, Phoma spp., and Oidium manihotis. The taxonomy, sexual reproduction, host range, and physiology of Sphaceloma manihoticola, causal agent of the superelongation disease, are summarized as well as the resistance of some cassava cv. Among the diseases that affect the quality of cassava cuttings are those caused by Glomerella manihotis and Gloeosporium manihotis. Stem rot is caused by Glomerella manihotis, Botryodiplodia theobromae, and an unidentified basidiomycete; causal agents of root rot are Phytophthora drechsleri, Pythium spp., Rosellinia necatrix, Armillariella mellea, Rigidoporus lignosus, Diplodia manihotis, Fomes lignosus, and Sclerotium rolfsii. (CIAT) See also 0471 0479 0484 0503 0507 0549 0558 0611 0617 0622 0632 0646

E04 VIROSES

0503

23941 BIRANDANO, B. 1983. Maladies du manioc et de la patate douce. (Diseases of cassava and sweet potato). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.91-95. Fr.

Cassava; Cassava African mosaic virus; Vectors; Bemisia; Xanthomonas campestris pv. cassavae; Disease control; Resistance; Cercosporidium henningsii; Phaeoramularia manihotis; Phoma; Colletotrichum manihotis; Rwanda.

The characteristics of CAMV and its means of propagation (Bemisia sp.) are described. The losses it causes in cassava vary between 20-90 percent. Control measures include the use of healthy cuttings and resistant var., and the systematic elimination of diseased plants. Bacteriosis, one of the most severe diseases of cassava, is transmitted in Rwanda by Xanthomonas campestris pv. cassavae. The ecosystems of the pathogen, means of transmission, and way of contamination are described. As control measures, cuttings from healthy plants must be used and crop residues burnt to thus avoid the conservation of the inoculum from one season to the next. Results of a trial for resistance to bacterioses, carried out by the International Institute of Tropical Agriculture, confirmed the resistance of 7 varieties to X. campestris pv. cassavae. Cercosporidium henningsii, Phaeoramularia manihotis, Phoma, Colletotrichum manihotis, and root rots also attack cassava in Rwanda but without causing severe damage. (CIAT)

0504

26343 EDISON, S.; BIRADAR, R.S. 1979. Cassava mosaic: (a) estimation of crop loss due to the disease in cultivator's field. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.87. Engl.

Cassava; Cassava African mosaic virus; Pest damage; India.

In the Trivandrum district, India, a survey was started to determine the damage caused by CAMV, but due to the lack of a permission from the authorities of the Department of Agriculture it could not be continued. (CIAT)

0505

26344 EDISON, S. 1979. Cassava mosaic: (c) survey for the population of whitefly and spread of the mosaic disease. In Central Tuber Crops Resarch Institute. Annual progress report 1978-1979. Trivandrum, India. pp.87-91. Engl.

Cassava; Cassava African mosaic virus; Vectors; Bemisia; Cultivars; India.

In Kerala, India, an expt. was established to locate areas where the population of whiteflies could be the min. so that a disease-free seed multiplication program could be arranged in these areas. Ten centers were selected to conduct the study. The Ambalavayal and Nileswar centers harbored the lowest populations of the insect vector. (CIAT)

0506

26345 EDISON, S. 1979. Cassava mosaic: (e) diagnosis of mosaic disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.91. Engl.

Cassava; Cassava African mosaic virus; Cultivars; India.

A long-term project was prepared to systematically study CAMV and help with an early diagnosis of the disease symptoms. Attempts to transmit the disease through sap failed. A collection of the diseased plants collected from the Trivandrum, Alleppey, and Kanyakumari districts (India) is being maintained at the Central Tuber Crops Research Institute for further studies. (CIAT)

0507

25752 LOZANO, J.C.; NOLT, B. 1985. Cassava quarantine. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.595-615. Engl., 76 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Quarantine measures; Cuttings; Seed; Colletotrichum; Phoma; Diplodia; Xanthomonas campestris pv. manihotis; Mycoplasmoses; Anastrepha manihoti; Anastrepha pickeli; Viroses; Cassava African mosaic virus; Cassava common mosaic virus; Cassava brown streak virus; Cassava vein mosaic virus; Frog skin disease; Cassava Caribbean mosaic virus; Cassava latent virus; Mononychellus tanajoa; Phenacoccus manihoti; Aonidomytilus albus; Tetranychus cinnabarinus; Thrips; Saissetia nigra; Phenacoccus herreni; Colombia.

Cassava pest and disease complexes are described, along with quarantine problems. Pathogens and pests disseminated through botanical seed or through vegetative planting material are presented. Pathogens disseminated through botanical seed are divided into those that infest and those that infect the seed. Pathogens disseminated through vegetative planting material are divided into localized and systemic pathogens; the latter include fungal, bacterial, viral, and mycoplasma-like pathogens. The most important pests disseminated via vegetative planting material are Mononychellus tanajoa, Frankliniella williamsi, Aonidomytilus albus, Saissetia spp., Phenacoccus manihoti, and P. herreni. Sanitary measures required to minimize the risks of disseminating pathogens and pests through propagative material are reviewed. (CIAT)

0508

25771 MAFFLA, G.; ROA, J.C.; ROCA, W.M. 1984. Erradicación de la enfermedad cuero de sapo de la yuca Manihot esculenta, por medio del cultivo de meristemos. Efecto de la termoterapia, y del tamaño del explante sobre la tasa de saneamiento. (Elimination of the frog skin disease from cassava through meristem culture. Effect of the heat therapy and the size of the explant on the rate of cleaning). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.171-175. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Frog skin disease; Symptomatology; Cultivars; Temperature; Analysis; Tissue culture; Apical meristems; Grafting; Disease control; Cuttings; Illumination; Photoperiod; Colombia.

The frog skin disease, produced by a virus, and the techniques used for the cleaning of cassava clones affected, are described. To verify the cleaning of the material obtained through meristem culture, heat therapy was used and transmission tests through grafting and tests for detecting the disease through electrophoresis were done. The clean material underwent another cycle to confirm the cleaning; to date the material has gone through 8 cycles. The best results were obtained with small explants. (CIAT)

0509

26349 NAIR, N.G.; MALATHI, V.G. 1979. Determination of yield loss and biochemical changes due to cassava mosaic and development of diagnostic test for identification of the disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.107-109. Engl.

Cassava; Cultivars; Harvesting; Timing; Leaves; Plant height; HCN content; Carbohydrate content; Protein content; India.

The effect of disease severity caused by CAMV on plant growth parameters was studied on var. H-97, H-226, H-1687, H-2304, and M-4. At 4 mo. after planting, the total no. of leaves produced, no. of leaves retained, and plant height were assessed. The percentage of reduction in all the 3 characters was max. in H-97. The changes in leaf HCN, total carbohydrate, and protein contents were also determined. Statistically significant differences in the levels of constituents between healthy and diseased plants were observed only in var. H-97 and H-2304. In the former, there was an increase in both HCN and total carbohydrates concn. and a decrease in the protein levels. In the latter, while the levels of total carbohydrates increased, the protein and HCN levels decreased. (CIAT)

0510

25750 NOLT, B. 1985. Cassava virology. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.517-527. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Cassava African mosaic virus; Vectors; Disease control; Analysis; Cassava brown streak virus; Symptomatology; Cassava common mosaic virus; Cassava vein mosaic virus; Cassava latent virus; Cassava Caribbean mosaic virus; Frog skin disease; Cassava symptomless virus; Colombia.

The morphology, symptoms produced, dissemination, and control of the cassava African mosaic, cassava brown streak, cassava common mosaic, cassava vein mosaic, latent, symptomless, and Caribbean mosaic viruses are described; information on the frog skin disease is also given. The available methods for virus detection in cassava are presented. (CIAT)

0511

26184 SCHILDE-RENTSCHLER, L.; ROCA, W.M. 1986. Virus elimination in potato and cassava. In Cock, J.H., ed. Global Workshop on Root and Tuber Crops Propagation, Cali, Colombia, 1983. Proceedings of a Regional Workshop. Cali, Centro Internacional de Agricultura Tropical. pp.89-95. Engl., 17 Refs. (Centro Internacional de la Papa, Apartado 169, Lima, Perú)

Cassava; Viroses; Tissue culture; Apical meristems; Disease control; Peru; Colombia.

The following techniques used for the elimination of viruses in potato and cassava are presented: meristem culture, thermotherapy, and chemotherapy. The effectiveness of routine procedures is discussed as well as the importance of testing plants regenerated from meristem culture. (CIAT)

0512

26346 SHANTA, P. 1979. Cassava mosaic-symptomatology of the disease. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.92-95. Engl.

Cassava; Cassava African mosaic virus; Cultivars; Symptomatology; Stems;

India.

Five cassava var. (M-4, H-226, H-2304, H-1687, and Kalikalan) were used to study the symptomatology of CAMV and to standardize an indexing system to assess, codify, and quantify the intensity of the disease. There was a high correlation between the calculated index and the actual one observed. Considerable variation in disease severity among var. was noticed. M-4 had the lowest index value and Kalikalan the highest. By culturing serially numbered nodes cut individually from an infected stem, it was seen that not all nodes from a systemically diseased stem were infected. Taking advantage of the information on the irregular distribution pattern of the pathogen in infected stems, the possibility of building up disease-free stocks of highly diseased local var. was demonstrated, and a disease-free stock of Kalikalan is maintained in the field. (CIAT)

0513

26194 TOWNSEND, R.; STANLEY, J.; CURSON, S.J.; SHORT, M.N. 1985. Major polyadenylated transcripts of cassava latent virus and location of the gene encoding coat protein. European Molecular Biology Organization Journal 4(1):33-37. Engl., Sum. Engl., 34 Refs., Illus. (John Innes Inst., Colney Lane, Norwich NR4 7UH, England)

Cassava; Cassava African mosaic virus; Analysis; United Kingdom.

The nucleotide sequences of infectious cloned DNAs 1 and 2 of a Kenyan isolate of CLV were determined. Five virus-specific polyadenylated transcripts were identified and mapped either to the viral or complementary-sense DNAs of both components of the CLV genome, confirming that transcription is bidirectional on both DNAs. A major mRNA was translated in vitro to yield a 30,000 mol. wt. product, which is precipitated by antibodies raised against whole virus, and was mapped by both the S1 nuclease procedure and hybrid-arrested translation to the long open reading frame in the viral sense of DNA 1 which encodes the coat protein. Other transcripts were of sufficient size and appropriate origin to encode at least 5 potential products. (AS) See also 0438 0471 0484 0543 0558 0562 0611 0616 0617 0622 0633 0636 0643

E05 MYCOPLASMOSES

Véase además 0499 0617

E06 NEMATODES

0514

23090 ANDERSON, C.L.; GOOCH, P.S. 1983. Plant parasitic nematodes recorded from the ASEAN region. In Sing, K.G., ed. Exotic plant quarantine pests & procedures for introduction of plant materials. Serdang, Selangor, Malaysia, Asean Plant Quarantine Centre and Training Institute. pp.225-235. Engl., 3 Refs.

Cassava; Nematodes; Asia.

A list of the plant parasitic nematodes recorded in the SE Asia region is presented. In Indonesia and Malaysia no nematodes have been recorded parasitizing cassava. However, the following species have been recorded in the Philippines: Criconemella curvata, Helicotylenchus concavus, H. dihystera, H. multicinctus, and H. pseudorobustus, Hemicriconemoides cocophillus, Hemicycliophora gracilis and H. penetrans, Longidorus sp., Meloidogyne spp., Pratylenchus brachyurus and P. zeae, Rotylenchulus reniformis, Rotylenchus sp., Tylenchorhynchus martini and T. triglyphus, and Xiphinema insigne. In Thailand P. brachyurus and T. martini have been recorded. Meloidogyne spp. are considered the most important nematode pest of cassava in the region. Recommendations for their control and to avoid their dissemination throughout the region are given. (CIAT

F01 INJURIOUS INSECTS AND THEIR CONTROL

0515

25746 BELLOTTI, A.C.; REYES, J.A.; GUERRERO, J.M.; VARELA, A.M. 1985. The mealybug and cassava green spider mite complex in the Americas: problems of and potential for biological control. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.393-416. Engl., 36 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mononychellus; Mononychellus tanajoa; Mononychellus caribbeanae; Phenacoccus; Phenacoccus manihoti; Biological control; Predators and parasites; Phenacoccus herreni; Colombia.

Damage and problems caused by green spider mites (Mononychellus spp.) and cassava mealybugs (Phenacoccus spp.) in the Americas are discussed. A list of 32 predators and parasites of cassava mites in the neotropics is given. This list includes, among others, 16 predator mites of the Phytoseiidae family and various coleopteran species of the genera Oligota and Stethorus. Work carried out to control Mononychellus spp. using these predators is reviewed. Regarding the mealybug, 25 parasites have been recorded in Phenacoccus gossypii, P. herreni, and P. manihoti in the Americas. Of these, 21 belong to the Encyrtidae family and include the Anagyrus, Apoanagyrus, Aenasius, and Acerophaga genera. The pathogenic fungus Cladosporium sp. was recently identified parasitizing P. herreni in Colombia and in Brazil. Forty-three predators of the Phenacoccus spp. previously mentioned have also been recorded. The situation of P. gossypii and P. herreni is analyzed since they present different problems and forms of attack; their biological control is discussed. A problem with the complex of natural enemies of the mealybug is the presence of various hyperparasites which reduce the populations of natural enemies. Since P. herreni is an economically important pest, the determination of its center of origin is important for the identification of its most efficient natural enemies. (CIAT)

0516

25747 BELLOTTI, A.C.; BYRNE, D.H.; HERSHEY, C.H.; VARGAS, O.; VARELA, A.M. 1985. The potential of host plant resistance in cassava for control of mites and mealybugs. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.417-439. Engl., 18 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Mononychellus; Phenacoccus; Phenacoccus herreni; Resistance; Cultivars; Plant breeding; Hybrids; Insect biology; Pest damage; Colombia.

CIAT's program for the selection of cv. resistant to the mite and mealybug complex is described. The damage caused by these pests is presented and the resistance mechanisms are discussed. The study of the life cycle of Phenacoccus gossypii in 5 cassava cv. showed that there are var. differences in relation to the biological development of the insect. (CIAT)

0517

21872 BODDEN P., R.; DIAZ C., F. 1979. Dinámica de población de Telenomus sphingis Ashmead en relación a poblaciones de Erinnyis ello L. en yuca. (Population dynamics of Telenomus sphingis in relation to Erinnyis ello populations in cassava). In Annual Meeting of the Caribbean Food Crops Society, 16th., Santo Domingo, República Dominicana, 1979. Proceedings.

Santo Domingo. pp.71-82. Span., Sum. Span., Fr., Engl., 20 Refs., Illus.

Cassava; Erinnyis ello; Predators and parasites; Dominican Republic.

The population dynamics of Erinnyis ello, the most important cassava pest in the Dominican Republic, was studied for 2 yr in relation to the egg parasite Telenomus sphingis, which is widespread in all the cassava producing areas of the country. In San Cristobal weekly evaluations were made of 36 randomly selected plants in an area of 0.25 ha. Four leaves were observed on each plant up to 5 mo. of age and thereafter, 10 leaves until the crop was 10 mo. old. The E. ello eggs collected were counted and taken to the lab. where they hatched and the percentage of parasitism was determined. Parasitism of E. ello eggs by T. sphingis ranged from 40 to 100 percent. The highest percentage was obtained during the wet season when the greatest no. of eggs were laid in the field. T. sphingis may be considered a promissory parasite for the biological control of E. ello in the Dominican Republic. (AS-CIAT)

0518

21876 DIAZ C., F.; BODDEN P., R.; PEÑA, A. 1979. Pérdidas causadas en yuca por la mosca del cogollo. (Cassava losses due to shoot flies). In Annual Meeting of the Caribbean Food Crops Society, 16th., Santo Domingo, República Dominicana, 1979. Proceedings. Santo Domingo. pp.133-138. Span., Sum. Span., Fr., Engl., 3 Refs., Illus.

Cassava; Carpolonchaea chalybea; Cultivars; Insecticides; Pest damage; Dominican Republic.

A trial was carried out in San Cristóbal, Dominican Republic, to determine the extent cassava yields are affected by the attack of shoot flies (Carpolonchaea chalybea), considered an important pest of this crop. A completely randomized block design was used with 2 treatments (control and application of monocrotophos (1.5 cc/litre) every 15 days) and 4 replications each. Monocrotophos-treated plots yielded, on the av., 21.8 MT/ha compared with the control which yielded 27.6 MT/ha. The damage caused by C. chalybea did not affect the yield. Rainfall and RH were observed to affect the pest population. (AS-CIAT)

0519

26168 FABRES, G.; LE RU, B.; KIYINDOU, A.; BIASSANGAMA, A.; BOUSSIENGUE, J. ; EPOUNA MOUINGA, S. 1984. La cochenille du manioc et sa biocoenose au Congo 1979-84. (The cassava mealybug and its biocenosis in Congo, 1979-84). Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 116p. Fr., 173 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus; Phenacoccus manihoti; Insect biology; Predators and parasites; Biological control; Congo.

Papers on the work carried out by the Office de la Recherche Scientifique et Technique Outre-Mer and the Direction Générale de la Recherche Scientifique on the cassava mealybug in Brazzaville, Congo, are presented. The subjects covered include biology, population dynamics, biotic and abiotic factors that affect the frequency of the insect, and predators and parasites. Individual papers are recorded in this publication under the following consecutive no.: 0520, 0525, 0526, 0527, and 0528. (CIAT)

0520

26171 FABRES, G.; LE RU, B. 1984. Etude des relations plante-insecte pour la mise au point de méthodes de régulation des populations de la cochenille du manioc. (Study of the plant-insect relationships for the improvement of methods for controlling cassava mealybug populations). In _____.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.57-71. Fr., Sum. Fr., Engl., 27 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Cultivars; Leaves; Timing; Water stress; Congo.

The impact of some physiological parameters of the cassava plant on the biotic potential of Phenacoccus manihoti is discussed. These parameters are plant var., age of leaves and of the plantation, and water stress. Agronomic methods compatible with the utilization of entomophagous insects, or even with their acclimatation procedures, are proposed. (AS (extract))

0521

22986 GANGA, T. 1981. Rapport d'exécution du programme de lutte biologique contre la cochenille du manioc en République Populaire du Congo. (Report on the execution of the biological control program against the cassava mealybug in Congo). Rome, Italy, Organization des Nations Unies pour L'Alimentation et L'Agriculture. 9p. Fr., 7 Refs.

Cassava; Phenacoccus manihoti; Insect biology; Predators and parasites; Biological control; Congo.

The project for the control of Phenacoccus manihoti in Congo is presented. Its phases, personnel, equipment, and climatic conditions are described. The biological cycle of the pest and the climatic factors that influence its development are presented. Some of the natural enemies of P. manihoti are Anagyrus sp., Exochomus flaviventris, E. concavus, Hyperaspis senegalensis, Scymmus (Nephus) sp., and Sthetorus sp. The rearing of Hyperaspis sp., its release and efficiency in the control of P. manihoti are described. (CIAT)

0522

26361 GERLING, D. 1985. Parasitoids attacking Bemisia tabaci (Hom.: Aleyrodidae) in eastern Africa. Entomophaga 30(2):163-165. Engl., Sum. Engl., Fr., 3 Refs. (Chiredzi Research Station, P.O. Box 97, Chiredzi, Zimbabwe)

Cassava; Bemisia; Predators and parasites; Kenya; Malawi; Zimbabwe.

A survey was conducted in Kenya, Malawi, and Zimbabwe in 1984 to find parasites of Bemisia tabaci, an important pest of field crops, that might be introduced into Israel for control of the aleyrodid. The pest was found mainly on cassava but also on cotton. The 2 principal parasite species found were Eretmocerus mundus and Encarsia sublutea. The parasitism rates varied, at times reaching over 60 percent. E. sublutea is also an important parasite of Trialeurodes vaporariorum and is known from Hawaii as Prospaltella transvena (E. transvena). (AS)

0523

24553 JURUENA, L.F.; CACHAPUZ, L.M.M. 1983. Pragas da mandioca. (Cassava pests). In Reuniao Tecnica Anual de Culturas Energeticas do IPAGRO, Porto Alegre-RS, Brasil, 1983. Trabalhos apresentados. Porto Alegre, Instituto de Pesquisas Agronómicas. pp.149-152. Port. (Inst. de

Pesquisas Agronómicas, Rua Goncalves Dias 570, 90.000 Porto Alegre-RS, Brasil)

Cassava; Erinnyis ello; Atta; Silba pendula; Iatrophobia brasiliensis; Coelosternus granicolis; Coelosternus manihoti; Coelosternus notaticeps; Coelosternus rugicollis; Brazil.

The morphology, damage, and control of the most important pests of cassava in the state of Rio Grande do Sul, Brazil, are described. These are Erinnyis ello, Atta spp., Acromyrmex spp., Silba pendula, Iatrophobia brasiliensis, and Coelosternus spp. (CIAT)

0524

21678 KEYSER, J.M. 1985. The wasp that catches the pests. International Agricultural Development. November-December 1985:16-17. Engl., Illus.

Cassava; Phenacoccus manihoti; Predators and parasites; Biological control; Cassava programs; Mononychellus; Africa.

The work of the biological control unit established at the International Institute of Tropical Agriculture in 1979 to control cassava pests, particularly Phenacoccus manihoti and Mononychellus spp., is described. Apoanagyrus lopezi, a parasitic wasp imported from South America, is considered the most promising natural enemy of P. manihoti taking into account its ability to establish itself readily in the field, significantly reduce cassava mealybug damage, and then survive the rainy season when mealybug populations are naturally low. Other species, particularly Diomus, a lady beetle, have shown great potential to multiply and attack the mealybug during the dry season only to disappear after the rains begin, at least in the particular ecologies where it has so far been released. The Commonwealth Institute of Biological Control as well as CIAT and the Empresa Brasileira de Pesquisa Agropecuaria assist in the explorations in Latin America and in releases of natural enemies in East Africa. So far, natural enemy releases have been made only on an exptl. basis, to see which parasitoid or predator establishes itself in which ecological zone, and how well it spreads. Work on the control of cassava green mites has been expanded and it has been found that among the mite predators there are phytoseiid mites, which appear to be better biological control agents at low mite populations than most insect predators. (CIAT)

0525

26172 LE RU, B.; SILVIE, P.; PAPIEROK, B. 1984. L'entomophthorale Neozygites fumosa pathogene de la cochenille du manioc, Phenacoccus manihoti (Hom.:Pseudococcidae) en République Populaire du Congo. (The entomophthoraceous Neozygites fumosa, pathogen of the cassava mealybug Phenacoccus manihoti (Hom.:Pseudococcidae), in the People's Republic of Congo). In Fabres, G.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.98-104. Also in Entomophaga 30(1):1985. Fr., Sum. Fr., Engl., 19 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Predators and parasites; Congo.

The entomophthoraceous fungus Neozygites fumosa, which was only known in southern USA, was found in the People's Republic of Congo, on the cassava mealybug (Phenacoccus manihoti). Slight biometrical variations appear within the fungal species. Among the entomophthorales cited in the literature as parasitizing Coccoidea, only 2 species can be retained with

certainty: N. fumosa and Conidiobolus pseudococci, both attacking Pseudococcidae. (AS)

0526

26173 LE RU, B. 1984. Etude de l'évolution d'une mycose a Neozygites fumosa (Zygomycetes, Entomophthorales) dans une population de la cochenille du manioc, Phenacoccus manihoti (Hom.:Pseudococcidae). (Study of the evolution of the mycoses caused by Neozygites fumosa (Zygomycetes, Entomophthoraceae) in a cassava mealybug Phenacoccus manihoti (Hom.:Pseudococcidae) population). In Fabres, G.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.105-114. Also in Entomophaga 31(1), 1986. Fr., Sum. Fr., Engl., 20 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Predators and parasites; Congo.

In 1982 the regulatory action of the entomophthoraceous fungus Neozygites fumosa was reported for the 1st time in a population of the cassava mealybug, Phenacoccus manihoti, in the People's Republic of Congo. This pathogen is by far the natural enemy which intervenes most significantly in the regulation of the insect. The development of the disease in the host insect appears to be influenced by a RH of at least 90 percent along with a min. daily temp. greater than 20 degrees Celsius. The spread of the disease also seems to be affected by the host density. Throughout the entire study, the adult forms were more infected than the larval forms. (AS)

0527

26170 LE RU, B.; FABRES, G. 1984. Influence de la température et de l'hygrométrie relative sur le taux d'accroissement des populations de la cochenille du manioc, Phenacoccus manihoti (Hom. Pseudococcidae) au Congo. (Influence of the temperature and relative humidity on the population growth rate of the cassava mealybug, Phenacoccus manihoti (Hom. Pseudococcidae) in Congo). In Fabres, G.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.39-55. Fr., Sum. Fr., 21 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Insect biology; Temperature; Water requirements (plant); Laboratory experiments; Congo.

The demographic parameters of the cassava mealybug were estimated for different combinations of temp. and RH: 20, 25, and 30 degrees Celsius at 50, 75, and 100 percent RH. Temp. variations affect the length of the development period and the growth capacity the most, growth capacity being max. at 30 degrees Celsius and 75 percent RH. Simulations of the growth of the mealybug population were compared with the incidence profiles observed over 3 yr in the same location in Congo. The trend of the incidence profiles seems to be determined by the thermic conditions of the gradation period. (CIAT)

0528

26169 LE RU, B.; PAPIEROK, B. 1984. Taux intrinseque d'accroissement naturel de la cochenille du manioc, Phenacoccus manihoti Matile-Ferrero (Homopteres, Pseudococcidae). Intéret d'une méthode simplifiée d'estimation de r(m). (Intrinsic natural growth rates of the cassava mealybug, Phenacoccus manihoti (Homoptera, Pseudococcidae). Need of a

simplified method to estimate r(m)). In Fabres, G.; Le Ru, B.; Kiyindou, A.; Biassangama, A.; Boussiengue, J.; Epouna Mouinga, S. La cochenille du manioc et sa biocoenose au Congo 1979-84. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. pp.14-26. Fr., 24 Refs., Illus. (Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo)

Cassava; Phenacoccus manihoti; Insect biology; Congo.

Based on a life and natality table of Phenacoccus manihoti established at temp. of 27 plus or minus 7 degrees Celsius and a RH of 75 plus or minus 24 percent, a method for the determination of the intrinsic natural growth rate, r(m), of the insect is presented. This method and 2 other methods previously proposed are compared and discussed. With the proposed simplified method the relationships between the presence and frequency of P. manihoti and the environmental conditions, the influence of the physiological stage of the plant on the population dynamics of the insect, and the genetic var. resistance of cassava to P. manihoti can be assessed easier. (CIAT)

0529

21195 LOHR, B. 1981. Untersuchungen zur Biologie, Okologie, wirtschaftlichen Bedeutung und Bekämpfung des Maniokzünslers Chilomina clarkei (Amsel) (Lepidoptera:Pyralidae). (Study of the cassava stemborer, Chilomina clarkei (Amsel) (Lepidoptera:Pyralidae) and the importance of its management and control). Ing.Agr. Thesis. Giessen, Justus Liebig-Universitat Giessen. 98p. Germ., Sum. Germ., 91 Refs., Illus.

Cassava; Cultivars; Chilomina clarkei; Climatic requirements; Soil physical properties; Insect biology; Insect control; Simulation models; Pest damage; Colombia.

The biology, ecology, and control of Chilomina clarkei was studied in Colombia in 6 cassava cv. (CMC 40, HMC 2, Llanera, M Col 638, M Col 1684, and M Ven 77). All the stages of the stemborer are night creatures, with the exception of the moth that emerges at sunrise. Under lab. conditions the life cycles of the male and the female lasted 4.6 and 5.6 days, resp. The observed fertility was of 228.6 eggs deposited in the axillary lamina of the buds. The no. of larval phases was between 6-12 and the pupa reached its max. development between the 8th and the 11th stage. The length of the larval stage was of 47.4 days, and the pupal stage covered a lapse of 3 days for the preparation of the cocoon and 17.9 days for pupae eclosion. The 1st 4 larval stages occurred outside the plant. Depending on the cv., a large difference was seen in the length of the larval cycle; this influence was not on the duration of the individual larval stages but on the av. no. of larval stages. No influence on the length of the pupal stages was observed. All year long, in the rainy season as well as in the dry season, evidence of the stemborer was found; depending on the larval stage, it was possible to observe between 4-6 generations/year. The survival rate of the eggs largely depended on the climatic conditions (16 and 4 percent in the rainy and dry seasons, resp.). An influence of the cv. on egg survival was also observed. The distribution of the attack was casual, although in all the plantations the larger attacks were observed at the edges of the plots. In La Dorada a high rate of eggs parasitized with Trichogramma sp. (82.4 percent) was observed. In Carimagua, the parasitoid Agathis sp. was found parasitizing the larvae (44.2 percent) from Sept. to Jan., and Brachymeria sp. was found parasitizing the pupae all year round, with an av. rate or more than 19.0 percent. A mycosis (Spicaria sp.) and a probable virosis were also observed in the larvae and the pupae, the latter causing an epizootic with a 100 percent mortality in La Dorada. The influence of 2 gradual attacks (8-12 and 16-20 larvae/plant) and a simulated damage (100

percent defoliation) on cv. CMC 40 was studied; the yield was reduced by 35, 44, and 44 percent, resp. Yield reduction did not considerably affect the quality or the quantity of the attacked plants, producers of planting material. The treatment of the cuttings with aldrin had a good effect for 6 wk.; although a 50 percent mortality was obtained, it can not be concluded that this treatment is the best control method. Under lab. conditions. none of the treatments with carbaryl, Dipel (a Bacillus thuringiensis suspension), Spicaria sp., or the possible virus exerted any control on the nonborer larvae, although the treatment with the viral suspension had a good control on the borer larvae. (AS-CIAT)

0530

26386 WILLIAMS, D.J. 1985. A new species of Ferrisia (Hemiptera:Pseudococcidae) on cassava (Manihot esculenta) from Paraguay and on ragweed (Ambrosia tenuifolia) from Argentina. Bulletin of Entomological Research 75(2):255-258. Engl., Sum. Engl., 3 Refs., Illus. (Commonwealth Inst. of Entomology, c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, England)

Cassava; Ferrisia meridionalis; Paraguay.

Ferrisia meridionalis on cassava from Paraguay and on ragweed from Argentina is described. Characters are given to differentiate it from F. virgata with which it may be easily confused on cassava in South America. (AS)

0531

26385 WILLIAMS, D.J. 1985. Pseudococcus mandio sp. n. (Hemiptera:Pseudococcidae) on cassava roots in Paraguay, Bolivia and Brazil Bulletin of Entomological Research 75(3):545-547. Engl., Sum. Engl., 2 Refs., Illus. (Commonwealth Inst. of Entomology, c/o British Museum (Natural History), Cromwell Road, London, SW7 5BD, England)

Cassava; Pseudococcus mandio; Roots; Paraguay; Bolivia; Brazil.

Pseudococcus mandio sp. n. found on cassava roots in Paraguay, Bolivia, and Brazil is described. In Paraguay, it is probably associated with wilting of the plant and, in common with most mealybugs, it appears to be a phloem-feeder. There is evidence of sufficient phloem in the roots, and this may be identical with the phloem of the stems. The mealybug is related to P. affinis in possessing swollen hind femora with numerous translucent pores, and discoidal pores around the eyes, but the oral rim ducts are either few or absent entirely. (AS) See also 0465 0471 0479 0497 0536 0537 0543 0544 0548 0549 0616 0617 0622 0632 0643

F03 INJURIOUS MITES AND THEIR CONTROL

0532

23942 GATSINZI, F. 1983. Principaux ravageurs de la patate douce et du manioc au Rwanda. (Major pests of sweet potato and cassava in Rwanda). In Ndamage, G.; Gaterasi, T.; Mulindangabo, J., eds. Culture et sélection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.96-98. Fr.

Cassava; Mononychellus tanajoa; Mite control; Acaricides; Rwanda.

The incidence of insect attack in cassava in Rwanda is low. Its main enemies are the small sucking species (cochineals, whiteflies, and mites). The green mite (Mononychellus tanajoa) is controlled by cultural methods (better planting times, use of noninfested cuttings, and planting resistant var.) and the use of acaricides such as dicofol (2.0-4.0 kg/ha) and dimethoate (0.5-1.0 kg/ha). (CIAT)

0533

26191 GUTIERREZ, J.; SCHICHA, E. 1984. Phytoseiidae and Tetranychoidea in Fiji and other South Pacific islands (Acari). International Journal of Entomology 26(4):386-388. Engl., Sum. Engl., 11 Refs. (Office de la Recherche Scientifique et Technique Outre-mer, BP A5 Nouméa, New Caledonia)

Cassava; Tetranychus lambi; Tetranychus marianae; Phytoseiulus macropilis; Fiji.

During short collection trips in 1976-81 to Fiji, Wallace and Futuna Isles, the Cook Islands, and French Polynesia, 12 species of Tetranychoidea and 7 of Phytoseiidae were found. A checklist of food plants of economic importance is given, including cassava, with the mite names and collection localities and dates. (AS)

0534

25781 GUTIERREZ, J. 1977. Les acariens phytophages ayant une incidence economique dans la zone d'action de la Commision du Pacifique Sud. (Economically significant phytophagous mites in the area of the South Pacific Commission). Nouvelle Calédonie, Office de la Recherche Scientifique et Technique Outre-mer de Nouméa. 21p. Paper presented at Regional Meeting on Plant Protection, Nouméa, Nouvelle-Calédonie, 1977. Fr., Sum. Engl., Fr., 27 Refs., Illus.

Cassava; Oligonychus thelytokus; Tetranychus lambi; Tetranychus marianae; Tetranychus neocaledonicus; Tetranychus urticae; Brevipalpus californicus; Oceania.

The species of phytophagous mites found on cassava and other plants in the area of the South Pacific Commission which includes Fiji, New Hebrides, New Caledonia, American and Western Samoa, Papua New Guinea, Tahiti, and Tonga, among other islands, are reported. In New Caledonia Oligonychus thelytokus, Tetranychus lambi, T. marianae, T. neocaledonicus, T. urticae, and Brevipalpus californicus have been reported on cassava. T. neocaledonicus has also been reported on cassava in Western Samoa. (CIAT)

0535

26352 PILLAI, K.S.; PALANISWAMI, M.S. 1979. Biology and bionomices of the spider mite complex of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.119-121. Engl.

Cassava; Tetranychus cinnabarinus; Insect biology; Biological control; Predators and parasites; India.

The biology of Tetranychus cinnabarinus under lab. conditions is described. The incubation, larval, protonymphal, and deutonymphal periods last 5.30, 2.70, 3.65, and 4.90 days, resp., and the total life period from egg to adult averages 16.45 days. The av. male:female ratio is 1:2.04. Some of the natural enemies that have been recorded are Pharoscymnus hornii, Stethorus gilvifrons, Oligota sp., Poecilochroa sp., Olios sp., and Scolothrips indicus. (CIAT)

0536

26350 PILLAI, K.S.; PALANISWAMI, M.S. 1979. Chemical control of pest complex on cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.109-116. Engl.

Cassava; Cultivars; Injurious mites; Acaricides; Mite control; Root productivity; Statistical analysis; Thrips; Insecticides; Insect control; India.

The yield loss due to spider mite infestation was assessed in cassava var. H-2304, H-1687, and M-4 planted during 2 different seasons. Plants were sprayed monthly and bimonthly with monocrotophos 0.05 percent. In the 1st season the yield losses in untreated controls, when compared with monthly spraying in different var., ranged from 17 to 20 percent while in bimonthly spraying the losses ranged from 10 to 14 percent. The statistical analysis showed that monthly spraying was highly effective to produce significant yield increase over the control. No interaction was observed between var. and treatments. In the 2nd season the mite attack was considerably higher. The monthly treatment was also highly significant and the bimonthly treatment was significantly superior to control but inferior to the monthly treatment. Again there was no interaction between var. and treatments. In another expt. monocrotophos, tafethion, dimethoate, phosalone, and dicofol were evaluated for spider mite control. The mean mite population/leaf ranged from 11.98 to 82.03 in the different treatments vs. 189.18 in the control. The effect of water application during pest incidence on the control of the pest was also evaluated. Both the chemical treatment and water spraying were significantly superior to the untreated control in all var. Finally, 10 insecticides were tried on var. H-2304 to determine the control of thrips, particularly Retithrips syriacus. No significant differences were observed among treatments, and the thrip population was higher and the yield lower in the control. (CIAT)

0537

26351 PILLAI, K.S.; PALANISWAMI, M.S. 1979. Survey of insect and non-insect pests of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.117-118. Engl.

Cassava; Injurious mites; Thrips; Aleyrodidae; India.

A survey was carried out on the different cassava pest populations at different research centers in India (Trivandrum, Kozha, and Neeleswar in Kerala, and Salem and Muzhukkode in Tamil Nadu). The spider mites were considered pests during the drier periods, populations being greater at Trivandrum, Neeleswar, and Muzhukkode, smaller at Kozha, and almost nil at Salem. (CIAT)

0538

25778 YANINEK, J.S.; HERREN, H.R.; GUTIERREZ, A.P. 1985. Factors affecting the phenology and population dynamics of the cassava green mite, Mononychellus progresivus Doreste. Ibadan, Nigeria, International Institute of Tropical Agriculture. 26p. Engl., Sum. Engl., 22 Refs., Illus.

Cassava; Mononychellus progresivus; Cultivars; Insect biology; Rainfall data; Timing; Leaves; Canopy; Nigeria.

In the absence of effective natural enemies, leaf production during the dry season and rainfall mortality during the wet season were the most important factors affecting the phenology and ecology of the cassava green mite, Mononychellus progresivus, in cassava fields at the International Institute of Tropical Agriculture (Ibadan, Nigeria). M. progresivus populations increased on new leaf growth during the dry season, averaging 20-200 mites/leaf depending on plant and leaf ages and cassava var. Drought stress associated with the dry season caused leaf production to decline and limited M. progresivus populations on preferred young leaves. Early rains produced a flush of new foliage which supported an increase in mite no., but rainfall-induced mortality during the wet season drove M. progresivus populations to less than 1 mite/leaf. M. progresivus age structure was relatively constant within each stratum of the plant canopy, but varied between strata. Differences in M. progresivus age structure between foliage strata were related to leaf age. (AS)

0539

25777 YANINEK, J.S.; HERREN, H.R. 1985. History of cassava green mites, Mononychellus spp., in Africa: invasion, spread and damage. Ibadan, Nigeria, International Institute of Tropical Agriculture. 27p. Engl., Sum. Engl., 55 Refs.

Cassava; Mononychellus tanajoa; Mononychellus progresivus; History; Insect biology; Ecology; Pest damage; Mite control; Biological control; Predators and parasites; Africa.

The history of the invasion and spread of the cassava green mite, Mononychellus spp. (Acari: Tetranychidae), in Africa is reported. The previous work on the taxonomy, biology, ecology, pest status, and attempts to control these exotic pests is also reviewed. (AS)

0540

25779 YANINEK, J.S.; GUTIERREZ, A.P.; HERREN, H.R. 1985. The influence of temperature and host plant quality on the biotic potential of the cassava green mite, Mononychellus progresivus Doreste. Ibadan, Nigeria, International Institute of Tropical Agriculture. 37p. Engl., Sum. Engl., 30 Refs., Illus.

Cassava; Mononychellus progresivus; Cultivars; Temperature; Leaves; Timing; Insect biology; Climatic requirements; Laboratory experiments; Nigeria.

Age-specific life table studies of the cassava green mite, Mononychellus progresivus, were conducted on cassava to measure the effect of temp., season (drought stress), plant and leaf ages on developmental times, fecundity, survival, and intrinsic rate of increase (r(m)). Developmental time of each life stage and survival on a calendar day basis were negatively related to temp. in the range tested (20, 24, 27, 31, and 34 degrees Celsius). The lower developmental threshold was estimated to be 14.4 degrees Celsius. On a degree-day basis, patterns of survival and fecundity were comparable at 24, 27, and 31 degrees Celsius, but were reduced at 20 and 34 degrees Celsius. Estimates of r(m) on a degree-day basis were

similar at all temp., except 34 degrees Celsius where it was lower. Host plant age and leaf age had little effect on developmental times, regardless of season. However, fecundity and r(m) were enhanced on young plants and leaves. These results indicate that the population growth potential of M. progresivus is greater during the wet season compared with the dry season. A simple population model was developed to illustrate how rainfall mortality suppressed the growth potential of M. progresivus populations during the wet season to a level consistent with levels observed in the field. (AS)

0541

25776 YANINEK, J.S.; BAUMGAERTNER, J.; GUTIERREZ, A.P. 1985. Presence-absence and enumerative sampling plans for the cassava green mite, Mononychellus progresivus Doreste. Ibadan, Nigeria, International Institute of Tropical Agriculture. 28p. Engl., Sum. Engl., 24 Refs., Illus.

Cassava; Mononychellus progresivus; Cultivars; Leaves; Statistical analysis; Nigeria.

Sampling plans were developed at the International Institute of Tropical Agriculture (Ibadan, Nigeria) for the cassava green mite, Mononychellus progresivus, on cassava. Analysis of the within-plant distribution of M. progresivus showed that the highest mite densities occurred on new foliage on all age plants. Based on the within-plant distribution of M. progresivus, the 1st developed leaf was selected as the sampling unit for monitoring mite populations. An analysis of variance to mean relationship of M. progresivus indicated that the populations were weakly aggregated. The dispersion pattern was described by the a and b parameters of Taylor's power law. This relationship was incorporated into a sampling procedure for estimating relative M. progresivus densities. For densities less than 30 mites/leaf a presence-absence procedure using sequential sampling was developed, while at densities above 30 mites/leaf, an enumerative procedure based on a quick count protocol was described. (AS)

0542

25780 YANINEK, J.S. 1984. The impact of the cassava green mite, Mononychellus progresivus Doreste, on dry matter production and allocation in cassava, Manihot esculenta Crantz. Ibadan, Nigeria, International Institute of Tropical Agriculture. 25p. Engl., Sum. Engl., 29 Refs., Illus.

Cassava; Mononychellus progresivus; Pest damage; Dry matter; Leaves; Roots; Stems; Cultivars; Nigeria.

Cassava green mite (CGM) feeding damage on cassava was assessed by comparing mite-free and mite-infested plants at the International Institute of Tropical Agriculture (Ibadan, Nigeria). Reductions in leaf, stem, and root DM during the dry season were due to both drought stress and to mite feeding. Dry season mite damage was also expressed in the ensuing wet season, where yield losses depended on plant growth rates. Plants recovered from the drought-related losses, but were not able to compensate for CGM damage. The rate of DM reduction varied with plant part and planting date. CGM feeding did not affect the partitioning of DM between roots and stems. (AS) See also 0465 0471 0479 0497 0515 0516 0544 0548 0558 0562 0616 0617 0622 0632 0633 0643 0646

G00 GENETICS AND PLANT BREEDING

G01 BREEDING, GERMPLASM, VARIETIES AND CLONES, SELECTION

0543

22772 ARRAUDEAU, M. 1981. Rapport de mission Haute-Volta (19-23 Septembre 1981). Le programme tubercules en Haute Volta. (Burkina Faso mission report (19-23 September 1981). The tuber crop program in Burkina Faso). Paris, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. 13p. Fr. (Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres, 110 rue de l'Université, 75.007, Paris, France)

Cassava; Cassava programs; Development; Clones; Resistance; Research; Burkina Faso.

The project of the tuber crop program in Burkina Faso is presented. It includes 3 operations: (1) the increase of yam production, (2) the study of the feasibility of extending cassava cultivation, and (3) the study of the possibilities of increasing sweet potato production. Currently, cassava clones are being collected and the evolution of bacterioses and of Phenacoccus manihoti is being controlled. Among the activities to be carried out are the introduction of plant material resistant to CAMV and to bacterioses, the selection of drought-resistant clones with different maturity, and the establishment of commercial cultivation techniques. (CIAT)

0544

25748 BELLOTTI, A.C.; HERSHEY, C.; VARGAS, O. 1985. Recent advances in resistance to insect and mite pests of cassava (Manihot esculenta Crantz). In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.441-470. Engl., 57 Refs. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Resistance; Injurious insects; Injurious mites; Mononychellus; Tetranychus; Thrips; Phenacoccus manihoti; Phenacoccus herreni; Aleyrodidae; Vatiga illudens; Vatiga manihotae; Cyrtomenus bergi; Germplasm; Selection; Ecosystems; Colombia.

The complex of injurious cassava insects and mites and the damage they cause are described. Depending on the degree of damage, cassava pests can be divided into 4 categories: key, occasional, incidental, and potential. Recent research advances on cassava resistance to mites and insects are analyzed, and the technique for evaluating cassava germplasm for resistance to pests is described in detail. Resistance to Mononychellus spp., Tetranychus spp., Frankliniella williamsi, Phenacoccus manihoti, P. herreni, Aleurotrachelus socialis, Aleurothrixus aepim, Bemisia tuberculata, B. tabaci, Trialeurodes variabilis, Vatiga manihotae, V. illudens, and Cyrtomenus bergi is discussed. (CIAT)

0545

26353 BIRADAR, R.S.; RAJENDRAN, P.G. 1979. Biometrical studies in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.121-122. Engl.

Cassava; Cultivars; Statistical analysis; Plant height; Productivity; Leaves; Roots; India.

The divergence of 24 cassava var. from different countries (Colombia, Nigeria, Uganda, Madagascar, Ghana, Gabon, Malaysia, Sri Lanka, and India) was analyzed. Observations on plant height, wt. of vegetative part, total

no. of leaves formed, and root no. and yield were recorded. The analysis of variance for individual characters revealed highly significant differences among the entries for each of the 5 characters studied. Mahalanobis's D2 was employed to determine the degree of divergence between entries. The total no. of leaves was the largest contributor to the divergence in 119 of the 276 comparisons (43.12 percent); the no. of roots contributed the least by scoring rank 1 in only 14 comparisons (5.07 percent). On the basis of D2 values, 24 entries were grouped into 11 clusters using Tocher's method. None of the clusters contained 2 entries of the same origin. (CIAT)

0546

25739 BUENO, A. 1985. Hybridization and breeding methodologies appropriate to cassava. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.91-106. Engl., Sum. Engl., 27 Refs.

Cassava; Flowers; Anthers; Pollen; Flowering; Timing; Hybridizing; Pollination; Plant breeding; Polyploidy; Mutation; Tissue culture; Colombia.

The flower biology and pollination habit of cassava are reviewed. Hand crossing and open pollination procedures are discussed. Methods of cassava breeding, such as introduction of cv. and hybrid progenies, intraspecific and interspecific hybridization, and population improvement, and nonconventional methods (polyploidy, mutation, tissue culture) are presented. A half-sib recurrent selection scheme proposed by the Centro Nacional de Pesquisa de Mandioca e Fruticultura, Brazil, is explained. (AS)

0547

24042 BUENO, A.; FUKUDA, W.M.G. 1984. Cultivares de mandioca selecionadas no Centro Nacional de Pesquisa de Mandioca e Fruticultura - 1984. (Cassava cultivars selected at the Centro Nacional de Pesquisa de Mandioca e Fruticultura - 1984). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Comunicado Técnico no.4. 8p. Port., 2 Refs. (Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil)

Cassava; Cultivars; Selection; Cuttings; Tissue culture; Climatic requirements; Rainfall data; Temperature; Productivity; Root productivity; Plant anatomy; Agronomic characters; Brazil.

The process of botanical and agronomic evaluation, multiplication, management, and use of cassava cv. at the Centro Nacional de Pesquisa de Mandioca e Fruticultura, Brazil, during the period 1982-83 are described. Av. annual yields of roots and aerial part are given for the following 12 cassava cv. selected at the Center from 1977 to 1982: Vassourinha IP, Aipim Bravo Branco, Iracema, Palmeira Preta, Tola Roxa, Maria Pau, Paulo Rosa, Variedad 77, Peru Branca, Jaburú, S. Joao I, and Maracana. Their main agronomic and botanical characteristics are mentioned. The av. root yields for the 12 var. range between 20.2-32.0 t/ha and for the aerial parts between 11.8-21.5 t/ha. (CIAT)

0548

26318 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1979. Cassava: salient features. In _____. Annual progress report 1978-1979. Trivandrum, India. pp.5-8. Engl.

Cassava; Germplasm; Plant breeding; Cytogenetics; Cultivation; Fertilizers; Intercropping; Root productivity; Plant physiology; Cultivars; Salinity; Industrial microbiology; Alcohol; Roots; Storage; Cassava starch;

Processing; Cassava African mosaic virus; Tissue culture; Plant growth substances; Injurious mites; Thrips; Acaricides; India.

The most outstanding results of the research on cassava carried out in 1978-79, by the Central Tuber Crops Research Institute, India, are summarized. In the area of plant breeding, germplasm acquisitions, selection of var. for resistance to mites, hybrid evaluation, and cytological studies are presented. The effect of fertilizers, manures, and intercropping on root productivity is briefly discussed. The LAI, the yield, and the selection of var. resistant to salinity and drought are also analyzed. Results on alcohol production, starch saccharification, and the control of CAMV, thrips, and mites are discussed. (CIAT)

0549

25753 COCK, J.H. 1985. The stability of performance of cassava genotypes. In _____.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.617-652. Engl., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Ecosystems; Temperature; Rainfall data; Soil fertility; pH; Photoperiod; Water requirements (plant); Cultivars; Selection; P; Diseases and pathogens; Injurious insects; Injurious mites; Plant breeding; Genotypes; Soil fertility; Cuttings; Planting; Harvesting; Timing; Intercropping; Weeding; Pest control; Colombia.

The main causes of variability or instability in the development of cassava genotypes are discussed, and the characteristics of the ecosystems in which they have been tested are described. The factors causing instability are temp., photoperiod, water, soil, diseases, and pests. Spatial, temporal, and system stabilities are analyzed. The factors affecting system stability are soil fertility, selection and storage of cuttings, planting and harvesting dates, planting systems, and crop and pest management. The development of genotypes and the release of cassava var. are discussed. While stability of yield over time (temporal stability and across management practices (system stability) are important to the farmer, it is important to consider microspatial stability (within an ecological region) and macrospatial stability (across a major edaphoclimatic zone) to maximize the application of research results. (CIAT)

0550

25738 HERSHEY, C.H. 1985. Cassava germplasm resources. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.65-89. Engl., Sum. Engl., 39 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Germplasm; History; Plant geography; Manihot; Seed; Cuttings; Storage; Tissue culture; Analysis; Selection; Resistance; Plant development; Root productivity; Roots; Research; Colombia.

The origin, evolution, and dispersal of cassava are reviewed. Cassava germplasm collection, conservation, and evaluation are discussed. Finally, the available documentation and utilization of the existent cassava germplasm collections are analyzed. (CIAT)

0551

26321 HRISHI, N.; RAJENDRAN, P.G.; KAMALAM, P.; NAIR, N.G.; PILLAI, K.S.; MAINI, S.B.; MOHANKUMAR, C.R.; RAMANUJAM, T. 1979. Genetic improvement of cassava for yield and quality. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.14-17.

Engl.

Cassava; Hybrids; Selection; Root productivity; Cassava African mosaic virus; Resistance; Dry matter; Harvest index; India.

Around 3000 cassava hybrid seedlings from the Central Tuber Crops Research Institute (India) and 5000 exotic seedlings from seeds obtained at the International Institute of Tropical Agriculture (IITA, Nigeria) were evaluated for yield, HI, disease resistance, plant type, and root quality. From the hybrids 230 selections were made and from the IITA seedlings, 352. Under 1st clonal evaluation 121 hybrids were assessed for various attributes and 26 selections were made for 2nd clonal evaluation. Thirteen hybrids and selections under the advanced yield trial were harvested at 6 and 10 mo. and evaluated for yield, cooking quality, and field resistance to CAMV. A study was conducted on the variation of DM content, cooking quality, and HI in the seedling progenies of 3 crosses of Ce 22, Ce 110, Ce 177, and Ci 776, which showed varying DM content and HI. Highest mean DM was obtained in the cross Ce 22 x Ce 177. In the crosses Ce 22 (low HI) x Ce 110 (high HI) and Ce 22 x Ci 776 (high HI), about half of the seedling population had HI exceeding the mid-parental value. In the cross where both the parents had low HI, more than 45 percent of the seedlings did not have any roots at all. (CIAT)

0552

24092 INSTITUT DES SCIENCES AGRONOMIQUES DU BURUNDI. 1982. Manioc et patate douce. (Cassava and sweet potato). In _____. Ses objetifs-ses réalisations 1962-1982. p.10. Fr.

Cassava; Cassava programs; Research; Burundi.

In 1981 a new cassava and sweet potato program was initiated in Burundi. In 1985, it was hoped to have identified the best local var. to disseminate them throughout the main regions of the country. In the long term, researchers will develop plant material not only more productive but also with other interesting characteristics: better preservation of cassava roots in the soil and with higher vitamin A content, and higher sugar content in sweet potato. The Institut des Sciences Agronomiques du Burundi therefore enriched its genetic reserve with the acquisition of var. from rural areas as well as from other agricultural research institutes: CIAT, International Institute of Tropical Agriculture, and Institut des Sciences Agronomiques du Rwanda. (Full text-CIAT)

0553

25255 INSTITUTE OF PLANT BREEDING. PHILIPPINES. s.f. Datu 1 (UPL-Ca1). Laguna, Philippines, College of Agriculture. University of the Philippines at Los Baños. 2p. Engl., Illus.

Cassava; Bitter cassava; Cultivars; Root productivity; Starch content; Dry matter; Plant height; Resistance; Cassava bacterial blight; Cercospora; Philippines.

The origin, yield, field characteristics, and disease resistance of the bitter cassava var. (HCN over 200 ppm) Datu 1, developed by the U. of Philippines at Los Baños, are briefly presented. It probably originated in Indonesia; it yields 42 t/ha and has DM and starch contents of 37 and 27 percent, resp. Plant height is 255 cm and the var. is resistant to bacterial blight and Cercospora leaf spot. (CIAT)

0554

25256 INSTITUTE OF PLANT BREEDING. PHILIPPINES. s.f. Lakan 1 (UPL-Ca2). Laguna, Philippines, College of Agriculture. University of the Philippines at Los Baños. 2p. Engl., Illus.

Cassava; Sweet cassava; Cultivars; Root productivity; Starch content; Dry matter; Plant height; Cassava bacterial blight; Cercospora; Philippines.

The origin, yield, field characteristics, and disease resistance of the sweet cassava var. (HCN less than 100 ppm) Lakan 1, developed by the U. of Philippines at Los Baños, are briefly presented. The var. originates from a cv. from Indonesia, it yields 32 t/ha and has starch and DM contents of 32 and 44 percent, resp. Plant height is 248 cm, and the var. is resistant to bacterial blight and Cercospora leaf spot. (CIAT)

0555

25740 KAWANO, K. 1985. Inherent and environmental factors related to cassava varietal selection. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.107-132. Engl., Sum. Engl., 25 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Plant breeding; Harvest index; Selection; Productivity; Xanthomonas campestris pv. manihotis; Sphaceloma manihoticola; Inheritance; Agronomic characters; Germplasm; Ecosystems; Cultivation systems; Hybridization; Colombia.

Factors related to defining a breeding and selection scheme, as well as experiences related to defining selection environments in cassava, are presented. In segregating populations or single-row trials, HI can be used as the most important selection criterion for the final yield although a good balance should be maintained between HI and canopy density. The great majority of important agronomic characters are controlled by additive polygenes; thus, a straightforward hybridization scheme followed by simple phenotypic selection is effective in creating desirable recombinants. The incorporation of exotic germplasm into hybridization and selection schemes is recommended, and special care must be taken in defining selection sites and accompanying cultural practices. Selection sites must be located in the most representative cassava production areas and the cultural practices of the selection plots must be adjusted within the reach of the av. farmer. (AS (extract))

0556

25741 LIAN, T.S. 1985. Selection for yield potential. In Cock, J.H.; Reyes, J.A., eds. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. pp.133-163. Engl., Sum. Engl., 55 Refs., Illus.

Cassava; Root productivity; Leaves; Leaf area; Branching; Harvest index; Dry matter; Harvesting; Timing; Inheritance; Selection; Nutritional requirements; Climatic requirements; Soil requirements; Intercropping; Shading; Mechanization; Malaysia.

The need for standardizing cultural and management practices in selection trials is emphasized, as this would help to reduce the variability due to the environment. Basic understanding of DM production in the cassava plant and its distribution into root storage is necessary to aid breeders in selecting for high yield potential. The roles of individual leaf size, leaf life, leaf production rate, and branching in relation to LAI are discussed. As top growth takes priority over root growth, long leaf life would be beneficial in reducing the need for a fast rate of production of new leaves, an energy-consuming process. At the same time, heavily branched genotypes are undesirable as the dense top growth shortens leaf life and requires a large proportion of DM for maintenance and growth of stem material. A high

HI implies a genotype in which DM storage in the roots is favored. Being highly heritable and easy to estimate, HI is a very practical selection criterion; however, attention should be given to root yield so that small plants of low yield but high HI are not obtained. There must also be adequate top growth throughout the crop cycle to produce the DM for root storage. As total root no. is highly related to root yield, it is important to select for at least more than 8-10 roots/plant to ensure that the root sink is not limiting to yield. The highly heritable and stable nature of root DM or starch content lends itself favorably to simple selection for high dry root yield. In-depth understanding of the physiological basis of yield in cassava must be attained for fuller exploitation of its yield potential-either through cultural or genetic manipulation. The fundamental ability of cassava to adapt to relatively poor environments must not be overlooked if future expansion in cassava production is envisaged. It might be worthwhile to exploit the yield potential of cassava in special ecoenvironments, such as selecting genotypes suited to particular soil fertility levels and different agroclimatic regions and cropping patterns. (AS)

0557

25590 LUCIANI, J.F. 1984. Avance en la selección por contenido en materia seca en plantas de yuca de libre polinización. (Advances in the selection for dry matter content in free-pollination cassava plants). In Montaldo, A., comp. Avances en las investigaciones en los cultivos de raíces y tubérculos tropicales en Venezuela. Revista de la Facultad de Agronomía de la Universidad Central de Venezuela. Alcance no.33:111-123. Span., Sum. Span., 5 Refs., Illus. (Univ. Central de Venezuela, Sección Raíces y Tubérculos, Inst. de Agronomía, Facultad de Agronomía, Maracay, Venezuela)

Cassava; Cultivars; Seed; Propagation; Dry matter; Clones; Selection; Venezuela.

Variability in DM content of 43 plants of sexual origin, obtained from free-pollinated seed of cassava var. UCV-2221 (Branca de Santa Catarina), was studied. Ten clones were selected from the 1st clonal propagation, based on root DM content. Clones LM-26 and LM-40 were selected from the 3rd clonal propagation, based on DM content and resistance to lodging. It is recommended to continue yield trials with these 2 clones. (AS-CIAT)

0558

23935 MULINDANGABO, J. 1983. Premiers résultats de la sélection du manioc au Rwanda. (First results of cassava selection in Rwanda). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.10-18. Fr.

Cassava; Cultivars; Seed; Root productivity; Selection; Sweet cassava; Bitter cassava; Rwanda.

In 1978 a cassava selection program was designed to find disease-resistant productive var. The selection was carried out in the greenhouse and a slight attack of CAMV was observed. No bacterioses were observed and cercosporioses did not have economic importance. The green mite attacked all the seedlings, although some clones presented some tolerance. The best plants were selected among the best families. The clonal evaluation trials verified and confirmed the results of observations made in the greenhouse, and the material was evaluated for yield. Cercosporidium henningsii attacked all the clones but did not damage the upper leaves, and the attack by Phaeoramularia manihotis was unimportant; the green mite continued to be

the worst pest of cassava. Clones yielding over 20 t/ha were kept for the selection trials where they were compared with a local control. The clones showed tolerance to CAMV and sensitivity to cercosporioses and to mite attack. There was a great genetic variation in terms of resistance to drought and the degree of green mite attack. The 44 selected var. chosen after the 1st harvest of the selection trial were submitted to an advanced yield trial carried out in 4 locations. Although the fiber content of var. Creolinha Java impeded its acceptance, its excellent production at the 4 sites makes it worthy of a study to propose its large-scale diffusion. Creolinha, Ntolili seed 16, Kiryumukwe/3, Kibombwe/13, and Kiryumukwe/18 were statistically equal among themselves but superior to the rest. Kibombwe/13 adapted well at the 4 sites. Eala 07 (bitter) always performed well; its improvement and crossbreeding with new var. are foreseen. There was a highly significant difference among environments. Sweet var. Mulundi, Maguruyinkware, I.Y.T. Bulk 1977/11, P.Y.T. Bulk 1977/29, P.Y.T. Bulk 1977/66, Kiryumukwe/21, Kibombwe/13, Kiryumukwe/3, I.Y.T. Bulk 1977/17, and Kibombwe/14, and the bitter var. Eala 07, Creolinha, Ntolili seed 16, P.Y.T. Bulk 1977/69, P.Y.T. Bulk 1977/19, Kiryumukwe/18, 30395-1977/11, Maguruyinkware/1, Eala 07/4, and Amarga 6 mois seed 2/3, were selected to take part of a multilocational trial. (CIAT)

0559

26324 NAIR, R.B. 1979. Breeding for short duration and high yielding cultivars of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.20-21. Engl.

Cassava; Clones; Selection; Harvest index; Flowering; Resistance; Diseases and pathogens; Pests; India.

Five cassava clones (Ci 175, Ci 197, Ci 206, Ci 719, H-165) were assessed for earliness in root maturity, cooking quality of the roots, flowering habit, and resistance to pests and diseases. Only Ci 175 seemed to be of short duration. The other clones did not flower. (CIAT)

0560

26323 NAIR, R.B. 1979. Breeding for the transference of quality characters of M4 - to the released cassava hybrids. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.18-20. Engl.

Cassava; Cultivars; Hybrids; Selection; Harvest index; Dry matter; Starch content; HCN content; India.

Of 28 cassava hybrids tested against var. M-4 for good cooking quality of the roots and root yield, only 9 were found to be promising. (CIAT)

0561

26155 NASSAR, N.M.A. 1985. Manihot neusana Nassar: a new species native to Parana, Brazil. Canadian Journal of Plant Science 65:1097-1100. Engl., Sum. Engl., Fr., 8 Refs., Illus. (Dept. of Agronomy, Univ. of Brasilia, 70.919 Brasilia, Brasil)

Cassava; Manihot; Manihot neusana; Plant anatomy; Plant geography; Brazil.

A new species of Manihot, M. neusana Nassar, was collected from the state of Parana, Brazil. It was grown and studied in the living collection at the U. de Brasilia. The new species is closely related to M. pohlii, but differs from the latter in geographic distribution, growth habit, fruit shape and color, and seed shape and size. This species possesses interesting characteristics from a plant breeding point of view, such as tolerance to low temp., resistance to stemborers, and an evergreen habit. (AS)

0562

26319 RAJENDRAN, P.G.; MAINI, S.B.; NAIR, N.G.; PILLAI, K.S. 1979. Collection, evaluation and conservation of germplasm of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.9-11. Engl.

Cassava; Germplasm; Harvesting; Timing; Resistance; Injurious mites; Cassava African mosaic virus; Selection; India.

In 1978-79 the cassava germplasm of the Central Tuber Crops Research Institute (India) was enriched with the acquisition of 27 indigenous entries and 111 and 22 selections from the International Institute of Tropical Agriculture (Nigeria) and CIAT (Colombia), resp. Studies on earliness were carried out on 200 entries that were harvested either at 6 or 10 mo.; above 20 percent of the entries studied showed earliness, giving even 80-100 percent of the yield at the 6-mo. harvesting. In the evaluation of resistance to pest infestation, 300 entries were observed for mite damage; hairless-leaved var. were less resistant than hairy-leaved var. A total of 120 lines of a Nigerian seedling population were also screened for CAMV incidence; only 48 lines remained completely healthy. (CIAT)

0563

26320 RAJENDRAN, P.G.; KAMALAN, P.; HRISHI, N.; NAIR, N.G.; MOORTHY, S.N. 1979. Population improvement of cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.12-13. Engl.

Cassava; Cultivars; Root productivity; Harvest index; Selection; India.

Fifteen progeny selections, included in a preliminary evaluation trial with 2 replications in a randomized block design with var. H-2304 as control, were harvested at 9.5 mo. Evaluation parameters were plant type, branching habit, root no. and wt., wt. of vegetative part, size, color of skin and rind, and cooking quality of the roots. S137-20 was superior in yield to all other var. and S-82 gave the highest HI. Thirty-four seedling selections were included in a row trial in augmented design with H-2304 as control. On the basis of higher root yield, shape, cooking quality, and higher HI, 14 selections were made; of these, 78-26 and 78-12 gave higher yields than the control. (CIAT)

0564

24545 RIBEIRO, J.L.; AZEVEDO, J.N. DE; SILVA, P.H.S. DA 1984. Avaliacao de cultivares de mandioca em diferentes ecossistemas no Estado do Piauí. (Evaluation of cassava cultivars in different ecosystems in the state of Piauí). Teresina-PI, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual. Pesquisa em Andamento no.29. 6p. Port. (Unidade de Execucao de Pesquisa de Ambito Estadual de Teresina, Caixa Postal 01, 64.000 Teresina-PI, Brasil)

Cassava; Cultivars; Selection; Root productivity; Starch content; Productivity; Harvesting; Timing; Brazil.

The root and aerial part yields and starch contents of different cassava cv. in several ecosystems of the state of Piauí, Brazil, are presented. The largest root yields/locality were obtained with Mandioca Semente in Teresina (18.3 t/ha), Manoel Moleque in Urucuí (22.8 t/ha), Maria dos Anjos in Cristino Castro (18.7 t/ha), Vermelhinha in Angical (21.6 t/ha), and Mandioca Preta in Batalha (22.0 t/ha). The highest root yields and starch contents obtained with the studied cv. were observed in the harvests done

14-18 mo. after planting. The cv. Vermelhinha, Caxiana, Maria dos Anjos, Goela de Jacu, Casteliana, Sutinga, Olho de Urubu, Cruvela, Jabuti, Serrana, Manoel Moleque, and Manipebinha had starch contents over 30 percent. The largest aerial part productivities were obtained 10-14 mo. after planting, cv. Vermelhinha, Joao Vaz Preta, Amarelinha, Maria dos Anjos, Amansa Burro, Cruvela, Casteliana, and Serrana being outstanding. (CIAT)

0565

25775 ROCA, W.M. 1984. Aplicaciones de herramientas biotecnológicas en el CIAT. (Applications of biotechnological tools at CIAT). In Perea D., M.; Angarita Z., A., eds. Congreso Nacional de Cultivo de Tejidos Vegetales, 1er., Bogotá, Colombia, 1984. Memorias. Bogotá, Universidad Nacional de Colombia. pp.42-62. Span. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Tissue culture; Apical meristems; Temperature; Cultivars; Viroses; Storage; Germplasm; Colombia.

The applications that biotechnology has for CIAT's crops, particularly cassava, are presented. The use of meristem cultures and thermotherapy to propagate cassava and to clean clones that present diseases such as CBB or viruses is described. Work carried out to increase the vigor of var. using in vitro propagation and work on embryo culture are mentioned. The efficiency and advantages of in vitro culture for germplasm conservation and transportation are highlighted. Work of cryogenics and protoplast culture is also described. The need for biochemical parameters (isoenzymes) to evaluate phenotypic stability of the material maintained in vitro is emphasized. Biotechnology, in the case of cassava, could be applied to (1) select characters controlled by recessive genes, at low levels of ploidy; (2) transfer genes that have cytoplasmic inheritance; (3) rescue seeds of very difficult crosses; (4) germinate immature seeds of wild materials; (5) recombine genetic material that cannot be hybridized; (6) generate greater variability through somaclonal variation or in vitro selection; (7) shorten the period for breeding through in vitro fertilization. (CIAT) See also 0465 0477 0486 0566 0616 0617 0633 0636

G02 CYTOGENETICS

0566

26326 BAI, K.V.; JOS, J.S. 1979. Aneuploidy in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.21-22. Engl.

Cassava; Chromosomes; Cytogenetics; Cultivars; Hybrids; Fruits; Seed; Germination; Pollination; India.

Tetraploidy was induced in the cassava var. OP-4, OP-7, and Ce-834, and octoploidy was induced in tetraploid cassava var. 300. Results will be determined when the plants flower. Three tetraploid cassava hybrids (H-1687, H-2304, and H-1857) were crossed with 3 diploid var. (OP-2, OP-4, and OP-7). About 202 fruits were collected from these crosses and 471 seeds were obtained; of these, 178 were sown. The percentage of germination was very poor since only 10 seeds germinated and only 6 seedlings survived the transplanting. From the reciprocal crosses, 882 flowers were pollinated and 65 fruits were collected; 145 seeds were obtained and 111 were sown, of which only 7 germinated and 6 seedlings survived the transplanting. (CIAT)

0567

26157 JOS, J.S.; BAI, K.V.; NAIR, R.B. 1984. Asynapsis in cassava. Cytologia 49(2):273-277. Engl., Sum. Engl., 19 Refs., Illus. (Central Tuber Crops Research Inst., Trivandrum 695017, India)

Cassava; Clones; Anthers; Pollen; Chromosomes; Cytogenetics; India.

A completely male sterile clone was identified in the cassava germplasm and detailed meiosis showed it to be asynaptic. At pachytene all the chromosomes remained as univalents without any semblance to pairing. Metaphase I also showed 36 univalents in 97 percent of pollen mother cells. The bivalent-like association in metaphase I was as low as 0.03/cell but the absence of pairing at pachytene and the lack of well defined chiasmata suggested that they were only univalents lying closely together due to factors other than true pairing. The later stages were not well defined and univalents were noticed to divide. The scattering of chromosomes and irregular groupings resulted in polyads; consequently, all the pollen were sterile. The type of asynapsis noticed was complete. The presence of pollen sterility in all the plants of Ce-258 throughout the season ruled out environmental factors and suggested it was of genic nature. (AS)

0568

26325 JOS, J.S.; BAI, K.V.; NAIR, S.G. 1979. Sterility barriers in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. p.21. Engl.

Cassava; Flowers; Pollen; Plant fertility; Microsporogenesis; India.

An attempt was made to make nutrition more available to developing microspores of cassava plants through foliar spraying of sucrose solution, thus making the flowers male fertile so they could be used in breeding programs. However, no successful results were obtained. The genetic stock Ci 709 was found to be completely male sterile; the disjunction of microspores was normal but the pollen was sterile. (CIAT)

0569

25733 ORREGO A., J.I.; HERSHEY, C.H. 1984. Almacenamiento del polen de yuca (Manihot esculenta Crantz) por medio de liofilización y varios regímenes de humedad y temperatura. (Storage of cassava pollen by freeze-drying and various humidity and temperature regimes). Acta

Agronómica 34(1):21-25. Span., Sum. Span., Engl., 11 Refs.

Cassava; Cultivars; Pollen; Culture media; Storage; Temperature; Germination; Pollination; Colombia.

Trials were carried out on in vitro germination of pollen of cassava var. MBRA 20 and MCOL 1413. The media included sucrose concn. from 0 to 70 percent, with addition of microelements (150 ppm H_3BO_3 + 450 ppm $Ca(NO_3)_2$ + 150 ppm $MgSO_4$ + 150 ppm KNO_3). No germination was observed in any of the media utilized. Conservation of pollen of MCOL 1413 was attempted by various treatments, (no drying--control, drying over silica gel 24 and 48 h, freeze-dried 4 and 8 h), and later stored at 23.5, 8, and -12 degrees Celsius during 2 and 4 wk. For all treatments in which seed was produced after pollen storage, none of the seed was viable. The method of pollen staining by 1 percent acetocarmine as a test of pollen viability was effective for fresh pollen, but not for stored pollen. (AS) See also 0548 0616

H00 NUTRITION

H01 CASSAVA FOODS AND NUTRITIVE VALUE

0570

25263 CHACON M., M.; GUTIERREZ O., E.; CARVAJAL F., R.; ARIAS M., L.F. 1984. Posibilidades de la sustitución parcial de harina de trigo en la galletería comercial. (Possibilities of the partial substitution of wheat flour in the commercial production of cookies). Costa Rica, Centro de Investigaciones en Tecnología de Alimentos. Avance no.5. 24p. Span., 11 Refs.

Cassava; Bakery products; Composite flours; Wheat flour; Cassava flour; Analysis; Viscosity; Water content; Organoleptic examination; Statistical analysis; Costs; Costa Rica.

The optimum substitution level of CF and other flours for wheat flour in the elaboration of cookies was determined, and the properties of the resulting mixtures were evaluated. The performance of the mixtures for sweet cookies made by a rotary machine was also analyzed, and the costs of each of the substitute flours were considered. The following are the accepted specifications for a flour usable for cookie-making: MC, 13-14 percent; pH, 6.1-6.8; solute retention in alkaline water, 50-60 percent; expansion, 2.5-2.7 cm. CF presented a 7.4 percent MC, pH = 6.3, and 0.3 cm of expansion. The most appropriate mixtures of wheat flour/CF had from 5 up to 30 percent CF; the mixture with 10 percent presented the best characteristics according to the organoleptic examination. CF had costs 3 times higher than that of commercial wheat flour, and the cost of the composite CF was 30.9 percent higher. (CIAT)

0571

26176 CHANDRA SHEKARA, S.; SHURPALEKAR, S.R. 1984. On the use of potato and cassava flours in soft dough biscuits. Journal of Food Science and Technology 21(4):239-241. Engl., Sum. Engl., 5 Refs. (Flour Milling & Baking Technology, Central Food Technological Research Inst., Mysore 13, India)

Cassava; Cassava flour; Potatoes; Flours; Cultivars; Wheat flour; Composition; Bakery products; Composite flours; Organoleptic examination; India.

Biscuits were prepared by blending cassava and potato flours at 10, 20, 30, and 40 percent levels separately along with wheat flour. The biscuits prepared from wheat/cassava blends were of acceptable quality up to 20 percent cassava, but with 40 percent blend, biscuits were graded as poor. Potato flour could be used up to 30 percent; at 40 percent blend, potato flavor became pronounced. Potato flour gave higher values for spread factor than CF. Composite wheat/cassava/potato flours were also blended keeping wheat flour at 60 parts and altering each of the potato and cassava flours to 10:30, 20:20, 30:10, and 40:0. A wheat/cassava/potato blend of 60:20:20 gave biscuits of satisfactory quality. Changing the potato:cassava ratio to 10:30 or 30:10 also yielded satisfactory quality biscuits. (Food Science and Technology Abstracts)

0572

26158 EASTWOOD, M.A.; ADAMSON, I.; BRYDON, W.G. 1982. A comparison of the effect of yam, cassava and alfalfa based diets on cholesterol metabolism in the rat. Proceedings of the Nutrition Society 41(2):61. Engl., 2 Refs. (Wolfson Gastrointestinal Laboratories, Dept. of Medicine, Western General Hospital, Creare Road South, Edinburgh, Scotland EH4 2XV)

Cassava; Yams; Alfalfa; Laboratory animals; Metabolism; United Kingdom.

Wistar rats were fed on yam, cassava, and alfalfa to observe the effects on cholesterol metabolism after dietary cholesterol supplementation. Skimmed milk, supplemented with 0.2 percent met., was the protein source for the yam- and cassava-based diets. On the last 3 days of the study, feces were collected, freeze-dried, and analyzed for bile acids and neutral sterols. At the end of the feeding period, serum was analyzed for high density lipoprotein and total cholesterol in all animals. Animals were sacrificed, and liver cholesterol determined. In the cassava- and alfalfa-fed animals there was relatively low serum cholesterol, high liver cholesterol, and high fecal steroid excretion. The alfalfa- and cassava-based diets appear to cause a shift in cholesterol from serum to liver to feces, preventing hypercholesterolemia by promoting loss of fecal steroids. (CIAT)

0573

26196 LINA, S.; REDDY, P.R. 1984. Development and evaluation of low-cost indigenous food mixes for preschoolers of Trichur, Kerala. 1. A survey of nutritional adequacy among selected preschoolers and formulation of diets. Indian Journal of Nutrition and Dietetics 21(7):241-251. Engl., Sum. Engl., 9 Refs., Illus.

Cassava; Human nutrition; Malnutrition; Anaemia; Deficiency diseases; Diets; Food products; Nutritive value; Food energy; India.

Nutritional adequacy of the diets of preschoolers of the low-income groups of Trichur (Kerala, India) was assessed. Annual prevalence of nutritional deficiency diseases was of the order of 1-2 percent for protein-calorie malnutrition, 0.29-0.76 for nutritional anemia, and 0.09-0.25 for vitamin deficiency. The survey results showed that at age 18-24 mo. the mean daily protein intake was marginal, whereas the energy deficit was around 200-300 kcal. Six food mixes were formulated using Eleusine coracana, wheat, Dolichos sesquipedalis, and plantain, cassava, and fish powders. The protein content of the mixes was approx. 13-14 percent and the energy value was approx. 325 kcal/100 g. Costs of the mixes are given. The mixes had good physiological tolerance and were well accepted by children. The studies on shelf life yielded favorable results. (AS)

0574

23943 NDOREYAHO-MUKANKUSI, V. 1983. Importance du manioc et de la patate douce dans l'alimentation rwandaise. (The importance of cassava and sweet potato in the Rwandan nutrition). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.98-106. Fr.

Cassava; Production; Human nutrition; Sweet cassava; Bitter cassava; Processing; Detoxification processes; Composition; Roots; Leaves; Steeping; Drying; Food energy; Rwanda.

The importance of cassava and sweet potato for human nutrition in Rwanda is discussed, and a cost comparison (represented in labor time) for the energy intake coming from these 2 crops, on one hand, and that from meat on the other, according to the weighted min. wage for 1978, is presented. The classification of cassava into sweet and bitter var., depending on its linamarin content, is presented, and the methods used to eliminate the toxicity and facilitate the consumption of cassava are discussed. The chemical composition of cassava and its dietary value in relation to the processing methods used are analyzed. Given the low nutritive value of the crop, it is recommended to create cassava by-product industries, such as starch or tapioca, and to explore the possibility of manufacturing enriched

by-products (e.g. cheese of vegetal origin), with which the protein consumption of the population would be increased by 4 percent. (CIAT) See also 0447 0587 0594 0595 0598 0599 0602 0618 0619 0620 0622 0632 0633 0638 0640 0643 0644 0646 0647 0653

0575

21686 CLIFF, J.; ESSERS, S.; ROSLING, H. 1985. Ankle clonus correlating with cyanide intake from cassava in rural children from Mozambique. Maputo, Mozambique, Ministry of Health. 10p. Engl., Sum. Engl., 17 Refs., Illus.

Cassava; Toxicology; Clinical manifestations; Human health; Thiocyanates; Analysis; Mozambique.

Dietary cyanide intake, measured as urinary SCN excretion and neurologic function, was studied in apparently healthy schoolchildren from an area in Mozambique previously affected by an epidemic of spastic paraparesis attributed to cyanide exposure from cassava. Cassava consumption, cyanide exposure, and ankle clonus rate were all higher in these children than in children from neighboring areas where no paraparesis had been reported. Furthermore, SCN excretions were higher in children with clonus compared with children without clonus from the same area. These results support the hypothesis that cyanide exposure under certain conditions can cause lesions of the corticospinal tracts. The rate of ankle clonus in schoolchildren may serve as an epidemiological indicator of this disorder. (AS)

0576

21683 CLIFF, J.; MARTENSSON, J.; LUNDQVIST, P.; ROSLING, H. 1985. Association of high cyanide and low sulphur intake in cassava-induced spastic paraparesis. Lancet. November 30:1211-1213. Engl., Sum. Engl., 21 Refs.

Cassava; Bitter cassava; Toxicology; Solar drying; Detoxification processes; Thiocyanates; Analysis; Biochemistry; Human physiology; Mozambique.

Urinary excretion of S compounds was studied in children from a population in Mozambique that had been affected, during a drought, by an epidemic of spastic paraparesis attributed to cyanide exposure from cassava. The children had increased SCN and decreased inorganic sulphate excretion, indicating high cyanide and low S-containing amino acid intake. Children from a neighboring cassava-eating area, where no cases of spastic paraparesis had occurred, had lower SCN excretion but higher inorganic sulphate excretion. These results support the hypothesis that the epidemic was due to the combined effects of high dietary cyanide exposure and S deficiency. (AS)

0577

21687 CLIFF, J.; LUNDQVIST, P.; ROSLING, H.; SORBO, B.; WIDE, L. 1985. Thyroid function in a cassava-eating population affected by epidemic spastic paraparesis. Maputo, Mozambique, Ministry of Health. 12p. Engl., Sum. Engl., 22 Refs., Illus.

Cassava; Toxicology; Solar drying; Human physiology; Thiocyanates; Iodine; Analysis; Mozambique.

Thyroid function was studied in a rural population in Mozambique that had been affected by an epidemic of spastic paraparesis attributed to dietary cyanide exposure from cassava. Lab. investigation on a sample of this population demonstrated very high levels of serum and urinary SCN, indicating a heavy exposure to cyanide. The urinary excretion of I was within normal limits, indicating an adequate I intake. The serum levels of free T4 index were somewhat decreased and serum free T3 index, T3:T4 ratio, and TSH were somewhat raised. This hormone pattern indicates an adaptation to the antithyroid effect of SCN, but it does not indicate overt

hypothyroidism. A follow-up study on school children was thus performed, and it also demonstrated high SCN exposure, adequate I intake but an absence of endemic goitre. The results show that the thyroid gland, if I supply is adequate, is capable of adaptation to a heavy body burden of SCN without development of overt hypothyroidism or goitre. (AS)

0578

22306 HERSHMAN, J.M.; DANG TRAN, D.; SHARP, B.; LE MY; KENT, J.R.; LE NGOC BINH; REED, A.W.; LAM DINH, P.; VAN HERLE, A.J.; NGUYEN, A.T.; TRAN XUAN, T.; NGUYEN VAN, V.; SUGAWARA, M.; PEKARY, A.E. 1983. Endemic goitre in Vietnam. Journal of Clininal Endocrinology and Metabolism 57(2):243-249. Engl., Sum. Engl., 22 Refs., Illus. (Endocrinology-111D, Wadsworth Veterans Administration Medical Center, Los Angeles, CA 90073, USA)

Cassava; Endemic goitre; Biochemistry; Analysis; Thiocyanates; Iodine; Vietnam.

To define the role of various factors which contribute to endemic goiter, which involves 15 percent of Vietnam's population, 935 people in Vancon, a lowland commune with goiter appearing only in the past decade, and 619 people in Dich Giao, a highland commune with endemic goiter treated erratically with iodized salt, were surveyed. In Dich Giao, cassava, a goitrogenic food, constitutes half of the dietary caloric intake. The prevalence of goiter was 45 percent in Vancon and 28 percent in Dich Giao. Lab. studies were carried out in a subgroup of 63 subjects in Vancon, 52 subjects in Dich Giao, and a control group of 46 women in Hanoi. The mean serum TSH levels were 1.4 plus or minus 0.1 (plus or minus SE) microunits/ml in Hanoi, 3.6 plus or minus 0.5 microunits/ml in Vancon (P less than 0.001), and 2.4 plus or minus 0.2 microunits/ml in Dich Giao (P less than 0.05). The mean serum T4 concn. were similar in the 3 groups, but the mean free T4 concn. was low in Vancon. Serum T3 levels and the T3:T4 ratios were significantly elevated in the goitrous regions. The mean serum thyroglobulin (Tg) concn. were 27 plus or minus 3 ng/ml in Hanoi, 101 plus or minus 20 ng/ml in Vancon (P less than 0.01), and 44 plus or minus 5 ng/ml in Dich Giao (P less than 0.01). The 4-h thyroid uptake was higher in Vancon than in Hanoi. The urinary I concn. was low in both goitrous regions, and urinary SCN was increased in Dich Giao, reflecting the ingestion of cassava. For all regions combined, there was a direct correlation between serum TSH and T3 and between serum TSH and Tg. In Vancon, where I deficiency was more severe, there was an inverse correlation between thyroid uptake and the urinary I concn.; thyroid uptake correlated directly with serum T3, the T3:T4 ratio, and serum Tg. In Dich Giao, there was no correlation between urinary SCN and thyroid uptake or urinary I levels. The data show that low I intake is a major factor in the causation of goiter in Vancon, where I deficiency had not been suspected. The ingestion of cassava in Dich Giao did not cause a major change in thyroid hormone economy even though I intake was marginally low; the data suggest that the goitrogenic effect of cassava is easily overcome by supplementary I, even when it is ingested irregularly. (AS)

0579

21682 ROSLING, H. 1986. Cassava, cyanide and epidemic spastic paraparesis; a study in Mozambique on dietary cyanide exposure. Doctorial Thesis. Uppsala, Sweden, University of Uppsala. Acta Universitatis Upsaliensis no.19. 52p. Engl., Sum. Engl., 121 Refs., Illus.

Cassava; Human nutrition; Human physiology; Thiocyanates; Cyanides; Toxicology; Analysis; Biochemistry; Bitter cassava; Mozambique.

An epidemic of 1102 cases of spastic paraparesis in a drought-stricken area of Mozambique was associated with a high dietary intake of cyanide from cassava roots. Cassava was the only crop to survive the drought. Due to lack of other food, the roots, which had a high cyanide content, were eaten without prolonged sun-drying normally applied to reduce toxicity. High cyanide intake was indicated by very high serum levels of SCN. Follow-up studies showed that the population affected also had a low intake of S, measured as the urinary excretion of inorganic sulphate. The combination of high cyanide and low S intake is the most probable etiology of the paraparesis observed but the results are not conclusive. The neurological lesions may have been caused by impaired synthesis of essential S compounds or they may have been an effect of cyanide per se. The instability of cyanide in blood precluded its determination. However, the addition of Ag ions to blood specimens was found to stabilize cyanide. This new method will facilitate transport of specimens in tropical climates and thereby future determinations of blood cyanide in cassava-eaters. The ankle clonus rate was high among apparently healthy children from the affected area. Children with clonus had higher cyanide intake, measured as urinary SCN. Further studies indicated that the thyroid gland, in the presence of an adequate I intake, can adapt to a heavy body burden of SCN without development of goitre or hypothyroidism. Cassava toxicity may cause problems under special circumstances. However, the yield of cassava is high and an increased cultivation may thereby in many areas improve the health of poor peasant families, provided that efficient methods for cyanide reduction are used, that some protein-rich supplementary food is available, and that I supplementation is given when necessary. (AS) See also 0589

0580

25767 BAHRI, S.; HAMID, H.; GINTING, N.; ARIFIN, Z.; YUNINGSIH. 1984. Pengaruh pemberian singkong pahit (Manihot esculenta) terhadap pertumbuhan dan keadaan kelenjar thyroid ayam pedaging. (Effect of bitter cassava on growth and the thyroid of chickens). Penyakit Hewan 16(27):173-178. Mal., Sum. Engl., Mal., 14 Refs., Illus. (Balai Penelitian Penyakit Hewan, Bogor, Indonesia)

Cassava; Bitter cassava; Poultry; Animal nutrition; Indonesia.

Diets containing cassava at 0, 15, 30, 45, and 60 percent were given to chickens from 1 day until 7 wk. old, at Balai Penelitian Penyakit Hewan (Bogor, Indonesia). Mean daily body wt. gain was decreased significantly when diets with more than 30 percent cassava were given. The wt. of the thyroid gland was not affected by dietary cassava up to 60 percent, but chickens given 60 percent cassava had slight hyperplasia of thyroid epithelial cells and colloid deficiency in the small follicles. (AS)

0581

24706 CASTAGNETTI, G.B. 1982. Manioca nel razionamento dei suini. (Cassava in swine rations). Informatore Zootecnico 29(22):24-28. Ital., Sum. Ital., 14 Refs., Illus. (Istituto di Microbiologia e Industrie, Facolta di Agraria, Universita di Bologna, Bologna, Italy)

Cassava; Swine; Cassava meal; Cassava chips; Pellets; Feed constituents; Composition; Italy.

The chemical composition and the nutritive characteristics of cassava are reviewed. The advantages and disadvantages of CM, cassava chips, and pellets are discussed as well as their potential use for swine feeding in Italy. Finally, the protein enrichment of cassava by fermentation with Candida tropicalis and the price of cassava in relation to that of cereals are analyzed. (CIAT)

0582

24585 MAMCHAK, I.V.; PEIKA, M.D. 1983. (El engorde de terneros mediante el uso de la semola de tapioca). (Fattening steers using cassava semolina). Zhivotnovodstvo no.11:51-52. Russ.,

Cassava; Animal nutrition; Cattle; Cassava meal; Feeds and feeding; Feed constituents; Economics.

Thirty calves of black race between 14-15 mo. old were separated into 3 groups of 10 animals each to study the effect of cassava semolina on the fattening of the animals. During the balance period (36 days) the 3 groups received a sole ration of 30 kg granulated semolina and concentrate. In the basic period (96 days), 40 kg cassava semolina (85.7 and 14.3 percent CF and maize seed, resp.) were given to group 1, 57 kg to group 2, and 71 kg to group 3. The 3 groups also received concentrate in decreasing amounts with increased cassava semolina. The increase in the amount of the cassava semolina given did not have a negative effect on animal growth. The 3 diets were also profitable. Cassava semolina can be given to calves for 24 h up to a value of 70 kg/head. (CIAT)

0583

26329 NAIR, G.M.; RAGHAVAN, K.V.; NAMBISAN, B. 1979. Prospects of rearing eri silk worms with cassava leaves. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.30-32. Engl.,

Cassava; Animal nutrition; Uses; Silkworm; Leaves; Defoliation; Root productivity; Dry matter; Starch content; HCN content; Economics; Income; India.

In a randomized block design with 3 replications, the effect of the defoliation caused by the rearing of silk worms on the root yield and DM, starch, and HCN contents of cassava was studied. Cassava root yield was reduced by the defoliation treatments. Starch, DM, and HCN contents did not show variations due to defoliation. The economics of rearing silk worms on cassava proved to be unprofitable. (CIAT)

0584

25783 NICOLAIEWSKY, S.; DAGOSTIN, J.; CAETANO, L.A.P. 1984. Substituicao parcial ou total do milho por farinha de mandioca em racoes para suinos em crescimento e terminacao. Porto Alegre-RS, Brasil, Universidade Federal do Rio Grande do Sul. 11p. Port., Sum. Port., Engl., 15 Refs. (Univ. Federal do Rio Grande do Sul, Deptd. de Zootecnia, Caixa Postal 776, 90.000 Porto Alegre-RS, Brasil)

Cassava; Cassava meal; Animal nutrition; Swine; Maize; Feeds and feeding; Metabolism; Brazil.

To evaluate the effect of 50 or 100 percent substitution of CM for maize in growing and finishing pig rations, 2 expt. were conducted, each using 48 castrated Large White x Landrace males. In the 1st expt. the animals received the exptl. rations from 54.0 to 98.0 kg (slaughter wt.) and in the 2nd, from 23.7 to 97.0 kg. The animals were killed 24 h after reaching the slaughter wt. The hot carcass was evaluated by the Brazilian method of carcass classification, described by Associacao Brasileira de Criadores de Suinos (1973). A completely randomized design was used with 3 treatments, 4 replications/treatment, and 4 animals/replication. The substitution of 50 or 100 percent CM for maize improved the av. daily gain and did not affect feed efficiency and carcass characteristics. Although the 50 percent substitution did not affect av. daily gain, feed efficiency, or carcass characteristics in the 2nd expt., the 100 percent substitution affected feed efficiency. (AS)

0585

23723 1982. PORCS: UTILISATION du manioc. (Pigs: cassava utilization). Cultivar no.153:141-142. Fr., Illus.

Cassava; Swine; Animal nutrition; Piglets; Feed constituents; Composition; Starch content; HCN content; France.

The effect of substituting cassava from Thailand (poorer quality) or from Malawi (better quality) for maize in the feeding of growing pigs and piglets was compared. In the 1st trial with growing pigs, cassava from Thailand was supplied at 2 levels (15 and 30 percent) and that from Malawi at only 1 level (30 percent). To supplement the lack of amino acids the diets also contained soybeans and were isoenergetic. In the 2nd trial with piglets, maize was replaced by cassava from Thailand at 10 and 20 percent and by cassava from Malawi at 10 percent. The substitution of high quality cassava for maize in the feeding of piglets is possible up to 20 percent and in the ration for growing pigs up to 30 percent, as long as the N balance is maintained with soybean supplementation. For each 15 percent of cassava that is introduced in the ration, 1 point of soybean cake must be added in relation to maize and 2 in relation to wheat or barley. (CIAT)

0586

26381 STEVENSON, M.H. 1985. Effect of added cassava root meal, ZnO and their interaction on the production and quality of eggs from laying hens. Journal of the Science of Food and Agriculture 36(10):909-914. Engl., Sum. Engl., 25 Refs. (Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland)

Cassava; Poultry; Cassava meal; Feed constituents; Eggs; Statistical analysis; United Kingdom.

A total of 216 (108 Hisex Brown, 108 Warren Studler) laying hens were given 1 of 12 dietary treatments. These were 4 basic diets with 0, 200, 400, and 600 g added cassava/kg, and each basic diet was further subdivided and ZnO added to provide 100 and 200 mg Zn/kg. None of the production traits measured was significantly affected by either added cassava or ZnO but there was a quadratic response in food intake to added cassava. ZnO addition significantly improved egg quality (assessed by Haugh score) but did not affect shell thickness. Haugh score was significantly affected by added cassava, the responses being significant after 2 wk. of storage. The interaction between Zn level and cassava level significantly affected egg quality. (AS)

0587

21692 TEWE, O.O.; AFOLABI, A.O.; GRISSOM, F.E.G.; LITTLETON, G.K.; OKE, O.L. 1984. Effect of varying dietary cyanide levels on serum thyroxine and protein metabolites in pigs. Nutrition Reports International 30(5):1249-1253. Engl., Sum. Engl., 16 Refs. (Nutritional Biochemistry Division, Dept. of Animal Science, Univ. of Ibadan, Nigeria)

Cassava; Cortex; Solar drying; Feed constituents; HCN content; Swine; Animal nutrition; Human nutrition; Physiology; Nigeria.

Three cassava-based diets containing 0, 96, and 400 ppm cyanide (diets 1, 2, and 3) were fed to 30 pigs. The effects on serum thyroxine and protein metabolites were determined on days 35 and 72 of trial. Serum thyroxine decreased from diets 1 to 3 on day 35. A similar but not significant trend was observed on day 72. Values obtained on day 72 were slightly lower than day 35 on diets 1 and 2. Serum thyroxine was higher in males than females. Serum urea increased with higher dietary cyanide levels for both periods. Serum total proteins, serum albumin, glutamic oxaloacetic and glutamic-pyruvate transaminases were similar in all treatments. Cyanide intake in pigs has significant effects on thyroid and protein metabolism. (AS)

0588

26154 TUDOR, G.D.; INKERMAN, P.A. 1986. Intensive production for large ruminants based on cassava or bagasse. Yeerongpilly, Queensland, Department of Primary Industries, Animal Research Institute. 23p. Paper presented at Australian Asian Fibrous Agricultural Residues Research Workshop, Los Baños, Philippines, 1986. Engl., Sum. Engl., 9 Refs., Illus. (Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia)

Cassava; Animal nutrition; Cattle; Cassava chips; Concentrates; Feed constituents; Feeds and feeding; Metabolism; Statistical analysis; Australia.

Two separate expt. were conducted to determine the production potential of cassava roots and bagasse as animal feed. Cattle fattened on a high energy grain-based feedlot diet (90 percent concentrate/10 percent roughage)

consumed significantly (P less than 0.01) more OM (8.8 kg/day) and gained (P less than 0.05) live wt. faster (1.23 kg/day) than the test cassava diet, which was also 90 percent concentrate/10 percent roughage (6.2 and 0.99, resp.). However, the conversion of feed to live wt. gain was 13 percent better in cattle fed cassava than those fed grain (6.6 vs. 7.2 kg OM/kg live wt. gain) and significantly (P less than 0.01) better (26 percent) for feed to carcass gain (7.3 vs. 9.9 kg OM/kg hot carcass wt. gain). Although feed intake and daily gain of cattle fed the cassava-based diet were lower than for cattle fed grain diets, the conversion of food to carcass gain was significantly better. This better conversion would possibly be associated with the continuous, simultaneous release of N and starch in the rumen resulting from the many small feeds. (AS (extract)) See also 0603 0614 0617 0620 0629 0635 0644

H04 HCN TOXICITY AND DETOXIFICATION

0589

26200 FRAKES, R.A.; SHARMA, R.P.; CALVIN, C.W. 1985. Developmental toxicity of the cyanogenic glycoside linamarin in the golden hamster. Teratology 31(2):241-246. Engl., Sum. Engl., 29 Refs. (Toxicology Program, UMC 56, Utah State Univ., Logan, UT 84322, USA)

Cassava; Toxicity; Linamarin; Laboratory animals; Laboratory experiments; Animal physiology; USA.

Pregnant hamsters received an oral dose of 70, 100, 120, or 140 mg of linamarin/kg or an equivalent vol. of isotonic saline during the early primitive streak stage of gestation. A dose of 120 or 140 mg the glycoside/kg was associated with an increased incidence of vertebral and rib anomalies as well as the production of encephaloceles in the offspring. These larger doses of linamarin also resulted in obvious maternal toxicity. Linamarin treatment had no effect on fetal body wt., ossification of fetal skeletons, embryonic mortality, or litter size. Although ingestion of the cyanogenic glycoside was associated with a significant teratogenic response, the effects occurred only at doses that elicited signs of maternal intoxication. (AS)

0590

26167 LIENER, I.E. 1983. Removal by processing of naturally occurring toxicants and antinutrients. In Shemilt, L.W., ed. International Conference on Chemistry and World Food Supplies, Manila, Philippines, 1982. Chemistry and world food supplies: the new frontiers: paper presented. Oxford, England, Pergamon Press. pp.453-463. Engl., Sum. Engl., 49 Refs., Illus. (Dept. of Biochemistry, College of Biological Sciences, Univ. of Minnesota, St. Paul, MN 55108, USA)

Cassava; Linamarin; Linamarase; HCN; Processing; Toxicity; Detoxification; USA.

Examples of foods of plant origin are cited whereby natural toxicants have been effectively eliminated since if not destroyed, by proper processing, these may adversely affect the nutritive properties of the protein. Those which are protein, such as the protease inhibitors and lectins that are widely distributed in legumes and cereal grains, are destroyed by heat treatment and hence pose little risk to the consumer when such foods are properly processed. Many plants, including cassava, contain glycosides which, upon hydrolysis by endogenous enzymes, release compounds which may be toxic. In the case of cassava, peeling, cooking (boiling, roasting, frying), sun-drying, and fermentation help reduce its toxicity. Although traditional methods of preparation reduce cyanide content, evidence exists that ataxic neuropathy may be associated with cassava consumption. Suitable processing techniques or traditional methods of preparation often take advantage of the enzymatic release of these toxic constituents in order to detoxify such foods. The destruction of a no. of other toxic factors may be facilitated by the use of enzymes of microbial origin. (AS) See also 0576 0579 0603

I00 PROCESSING, PRODUCTS AND USES

I01 CASSAVA STARCH AND ITS PROPERTIES

0591

26133 NAGAHAMA, T.; FUJIMOTO, S.; SUGANUMA, T. 1985. Starches from yam, taro, and cassava. Memoirs of the Kagoshima University Research Center for the South Pacific 6(1):1-10. Jap., Sum. Engl., Jap., 21 Refs., Illus. (Laboratory of Applied Starch Chemistry, Faculty of Agriculture, Kagoshima Univ. 21-24, Korimoto 1-Chome, Kagoshima 890, Japan)

Cassava; Cassava starch; Particle size; Gelatinization; Japan.

Starch samples were prepared in the lab. from 3 typical tropical tuber crops, 2 var. each: yam (Guam, wild and cultivated), taro (Oahu in Hawaii, wet- and dry-land), and cassava (Semarang in Java, bitter and sweet). The samples were examined for granule size and shape, X-ray diffraction pattern, I coloration, swelling power, solubility, and amylogram, among other properties. In general, the starch examined was characteristic of each crop species; however, there were similarities between the 2 var. of each. Yam starch granules were small (2-3 microns) and the X-ray diffraction pattern was B-type, contrasting with taro and cassava starches which were A-type. The starch-I absorption spectra of yam starch indicated a low amylose content and a relatively short chain length. On gelatinization, yam starch had an extremely high swelling ability and was very hard to break. Taro starch granules were also small and the starch had very high values in whiteness and yield. The other properties of taro starch were found to be intermediate between those of yam starch and cassava starch. Cassava starch granules were relatively large, gelatinized easily, and seemed to be soft in structure. (AS)

0592

22760 NELSON, G.C. 1984. Starch. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.91-109. Engl., 6 Refs.

Cassava; Cassava starch; Trade; History; Uses; Processing; Small-scale processing, Costs; Income; Development; Labour; Indonesia.

The history of cassava starch in Indonesia and the world starch market are briefly reviewed. Household, medium-scale, and large-scale automated starch production are discussed as well as quality, costs, returns, government policies, social profitability, and labor. The growth in household production, the role of the bolting mill, and the potential starch demand are also analyzed. (CIAT) See also 0548 0597 0601 0604 0616 0638 0646

0593

26192 BUCH, G.J.; O'DONNELL, D.C. 1985. Adjuncts used in brewing. Food Technology in Australia 37(1):28-30. Engl., Sum. Engl., 4 Refs., Illus. (Central Laboratory, Tooheys Ltd., P.O. Box 58, Lidcombe, NSW 2141, Australia)

Cassava; Food products; Beverages; Uses; Australia.

By definition of the New South Wales Pure Food Act 1908 (Australia), beer can be produced from malted or unmalted cereal products or any other carbohydrated source. Adjuncts are defined and common adjuncts used in brewing are listed together with the reasons for their use. Development in processing technology has made possible the use of novel adjuncts and lab., pilot, and plant trials are described using materials such as torrified barley, pregelatinized rice flour, cassava, and whey-derived hydrolysate. Although cassava could be successfully used for brewing, the cost of CM does not make it an economically viable adjunct. (AS)

0594

23772 DE LA RIVE BOX-LASOCKI, B. 1982. Man and Manihot. Volume 2. An annotated bibliography on cassava cultivation and processing among Amerindians. Wageningen, Netherlands. Mededelingen van de Vakgroepen Sociologie van de Landbouwhogeschool, no.5. 167p. Engl., 138 Refs., Illus. (Landbouwhogeschool, Hollandseweg 1, 6706 KN Wageningen, Netherlands)

Cassava; Socioeconomic aspects; Economics; Production; Human nutrition; Cultivation; Cassava meal; Cassava flour; Processing; Ecology; Casave; Toxicity; History; Plant geography; South America; Caribbean; Central America.

An annotated bibliography on cassava cultivation and processing among Amerindians is presented; a subject index is also included. The articles presented in vol. 1 are registered in vol. 10 no. 3 of the journal "Abstracts on Cassava", under the following consecutive no.: 0353, 0354, 0355, 0376, and 0501. (CIAT)

0595

26360 ETEJERE, E.O.; BHAT, R.B. 1985. Traditional preparation and uses of cassava in Nigeria. Economic Botany 39(2):157-164. Engl.,Sum. Engl., 16 Refs., Illus. (Dept. of Biological Sciences, Univ. of Ilorin, Private Mail Bag 1515, Ilorin, Nigeria)

Cassava; Gari; Cassava starch; Foofoo; Cassava flour; Tapiocas; Processing; Nigeria.

Various methods of cassava preparation are practiced by different ethnic groups in Nigeria. These methods involve peeling cassava roots, soaking roots in streams, grating cassava, and pressing grated cassava. Other methods include heating sieved grated cassava, boiling peeled cassava roots, and pounding boiled or dried cassava roots. The traditional cassava-based products are gari, fufu, akpu, CF, edible starch, and tapioca. Detoxification of fresh cassava roots is partly achieved through cell rupture during cutting and grating,soaking in running or standing water in earthen pots for 3-5 days, heating, drying, and boiling. (AS)

0596

26174 KREMER, R. 1982. Einsatz von Big-Blaster Luftkanonen im tapioka-silo. (Operation of the Big-Blaster air cannon in a cassava

silo). Kraftfutter 65(5):204. Germ., Sum. Germ., Engl., Fr., Illus. (VSR Engineering GmbH Foerdertechnik, 4330 Mülheim, Germany)

Cassava; Industrial machinery; Germany Federal Republic.

The functioning of an air cannon system that allows the automatic discharge of cassava in a big silo plant, for its transshipment, is described. (CIAT)

0597

26342 MOORTHY, S.N. 1979. Structural changes to enhance quality of starch for industrial utilization. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.80-87. Engl.

Cassava; Cassava starch; Modified starches; India.

Cassava starch was subjected to steam pressure, oxidation with bromine under pressure, and derivatization treatments. With the 1st treatment the desired viscosity could be obtained by establishing the proper treatment conditions. Bromine decomposed starch even at low pressures for small periods, giving rise to gummy products that are free-flowing when the temp. is raised. High pressure and long treatments gave tarry and granular products. Some ester derivatives were obtained by the reaction of the corresponding acid or anhydride with a starch suspension in dilute alkali (pH 8). Acetyl and malic acid derivatives were more easily formed and tartaric acid derivative showed some suspension properties. Various catalysts, bases, and reagents were used to accelerate the preparation of the acetyl derivative. The efficiency of the catalysts followed the order $SnCl_2$, $MnCl_2$, $ZnCl_2$, and $AlCl_3$; among the different bases, pyridine was the best. (CIAT)

0598

20053 NAIGEON, C. 1984. Farinha, gari et attiéké: Trois facons de préparer le manioc liées aux structures sociales. (Farinha, gari, and attieke: three ways of preparing cassava which are related to social structures). Inter Tropiques Agricultures no.7:12-13. Fr., Illus.

Cassava; Cassava meal; Attieke; Gari; Processing; Brazil; Ivory Coast; Nigeria.

The processing of cassava to produce farinha in Brazil, attieke in Ivory Coast, and gari in Nigeria is described. Illustrations are included. (CIAT)

0599

21695 NEWELL DUNFORD ENGINEERING LIMITED. s.f. Agroindustrial equipment for converting cassava into dried gari. Surrey, United Kingdom. 4p. Engl., Fr., Illus.

Cassava; Gari; Processing; Industrial machinery; Mechanization; Nigeria.

The industrial machinery, manufactured jointly by the Federal Institute of Industrial Research, Oshodi, in Nigeria and Newell Dunford Engineering Ltda, for the mechanization of the process that converts cassava into dry gari is presented with illustrations. The advantages of the product thus obtained and the different steps of the process are described. Design data are given for 2 sizes of the processing units. (CIAT)

0600

21697 NIVOBA. HOLLAND. 1979. Compact plant; link-system for the production of starch from cassava. Veendam. 40p. Engl., Illus.

Cassava; Cassava starch; Modified starches; Industrial starches; Glucose industry; Dextrins; Factories; Industrialization; Development; Netherlands.

A compact plant for the processing of cassava and other root crops into industrial/commercial starch, modified starches, cold-soluble modified starches, glucose, dextrine, and combinations is described. The compact plant consists of 2 main elements: modules and a space structure. The capacity of the plant ranges between 2000-3000 kg raw material/h and the production is of 400-600 kg/h. A miniplant with smaller capacities is described. Blueprints, diagrams, and photos of the equipment that constitute both types of plants are included. It is pointed out that the compact plant closes the gap between the large-scale industrial plants and the small-scale rural industries. (CIAT)

0601

21700 NIVOBA. HOLLAND. 1978. Cassava starch plant; process description of a plant using hydrocyclones. Veendam. 34p. Engl., Illus.

Cassava; Cassava starch; Processing; Washing; Rasping; Silting; Screening; Drying; Wastes; Waste utilization; Production; Factories; Industrialization; Development; Water requirements (processing); Netherlands.

A cassava starch plant, with a production capacity of 30-60 t starch/day based on hydrocyclones is described. The production process consists of the reception, washing and cleaning, chopping, milling, extraction, pulp dewatering and refining, starch dewatering, starch drying with a pneumatic system, further handling of starch, and process water and effluent treatments. Factors that should be considered when selecting the plant site, such as water, raw material, roads, infrastructure, and environment, are discussed. The paddle washers and drumwashers are described, and the required equipment is listed, with blueprints, diagrams, and photos of the plant and equipment included. (CIAT)

0602

21699 NIVOBA. HOLLAND. 1978. Gari plant; process description of a plant for the industrial production of gari. Veendam. 16p. Engl., Illus.

Cassava; Gari; Processing; Washing; Peeling; Rasping; Fermentation; Drying; Industrialization; Development; Industrial machinery; Factories; Netherlands.

A gari factory, with a processing capacity of 4000 kg cassava roots/h, is described. The processing steps are cleaning, control grating, fermentation, garification, and drying. The required equipment is specified and information is given on the operational parameters and the analysis of the product. Photos and illustrations of the equipment and blueprints of the plant are included. (CIAT)

0603

25734 OKEKE, G.C.; OBIOHA, F.C.; UDEOGU, A.E. 1985. Comparison of detoxification methods for cassava-borne cyanide. Nutrition Reports International 32(1):139-147. Engl., Sum. Engl., 16 Refs. (Dept. of Animal Science, Univ. of Nigeria, Nsukka, Nigeria)

Cassava; Bitter cassava; Cortex; HCN content; Detoxification processes; Cooking; Boiling; Drying; Silage; Protein content; Fibre content; Fat content; Ash content; Ca; P; Mineral content; Statistical analysis; Nigeria.

Five different methods for the processing of bitter cassava peels are described, and compared in relation to their effectiveness in rapid reduction of HCN. Results show that a significant negative correlation exists between HCN decline and time for each of the methods. Regression analyses also indicate that the min. processing times required to achieve

safe HCN levels for monogastric animal feeding are 6.95 min, 30.16 min, 13.38 h, 3.24 days, and 7.61 days for boiling, roasting, soaking, ensiling, and sun-drying, resp. (AS)

0604

20059 SCHMIDT-LEPLAIDEUR, M.A. 1984. Hydrolyse du manioc: chassez le naturel il revient au galop. (Hydrolysis of cassava: if it is natural it is faster). Inter Tropiques Agricultures n.8:18. Fr., Illus.

Cassava; Cassava starch; Hydrolysis; Processing; Africa.

The hydrolysis of cassava starch based on traditional processing techniques is discussed. (CIAT)

0605

26199 1984. TAPIOCA DEXTRIN can supplement butterfat to cut calories in creamy frozen desserts. Food Engineering 56(9):41. Engl., Illus.

Cassava; Food products; Dextrins; Uses; USA.

A tapioca dextrin product, N-Oil, from National Starch & Chemical Corp., is reported. The product may be added to desserts having low butterfat concn. to improve creaminess to a level obtained in high-butterfat desserts. It is available in powder form and may be dry-blended with other ice cream ingredients before adding to cold liquid. Oil/shortening supplementation may be in whipped toppings, salad dressings (e.g., fruit-flavored mustard) as well as frozen desserts. (Food Science and Technology Abstracts) See also 0468 0496 0548 0570 0571 0583 0592 0608 0609 0616 0617 0618 0619 0620 0624 0629 0634 0640 0643 0644 0646 0649 0653

I03 INDUSTRIAL MICROBIOLOGY

0606

26340 BALAGOPALAN, C.; POTTY, V.P.; MOORTHY, S.N. 1979. Fermentation of cassava for industrially important products. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.74-78. Engl.

Cassava; Fermentation; Hydrolysis; Cassava flour; Industrial microbiology; Alcohol; Ethanol; Gelatinization; India.

Three saccharifying agents (acid, malt, and a commercial amyloglucosidase enzyme) were used for the hydrolysis of cassava starch in the production of alcohol. With the acid the highest alcohol yield was obtained after 2.5 h of hydrolysis and 0.1 N HCl (44.5 ml alcohol/100 mg CF). With the malt the highest yield was obtained with 15 percent malt at 45 degrees Celsius and a pH of 5.1 (32.1 ml alcohol/100 g cassava starch). In both cases Saccharomyces cerevisiae was added to the hydrolysate. With the commercial enzyme the highest yield (23.5 ml alcohol/100 mg cassava starch) was obtained with an enzyme concn. of 750 mg and after 24 h. (CIAT)

0607

26339 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1979. Training report of Dr. C. Balagopal an at the University of Guelph, Ontario Canada (19-4-78 to 15-10-78). In _____. Annual progress report 1978-1979. Trivandrum, India. pp.73-74. Engl.

Cassava; Fermentation; Industrial microbiology; Protein enrichment; Analysis; Biochemistry; Laboratory experiments; Canada.

Several studies on SCP production from cassava are presented. Trichoderma viride isolate I-23 was grown in cassava extract medium containing 2.5 percent starch. The required doubling time for T. viride was 4 h and max. mycelial yield was obtained at 28-36 h. The protein percentage in the mycelium varied from 44 to 46 and the final carbohydrate concn. in the medium was 0.70 percent. A mutant of Aspergillus fumigatus I-21, which failed to grow at 37 degrees Celsius, was used for further studies to induce cold sensitivity. Preliminary results indicated that Cephalosporium eichhoriniae is unable to grow at pH 6 and above. (CIAT)

0608

21674 LIU, S.Y.; LIANG, C.L. 1983. Studies on the efficiency of alcohol production in sweet potato, cassava, and potato. Journal of Agricultural Research of China 32(2):111-121. Engl., Sum. Engl., Chin., 14 Refs. (Dept. of Agronomy, Tropical Agricultural Research Inst., Wufeng, Taiwan)

Cassava; Sweet potatoes; Potatoes; Cultivars; Cassava starch; Alcohol; Production; Fermentation; Industrial microbiology; Taiwan.

Three starchy crops (sweet potato, cassava, and potato) were used to study the efficiency of alcohol production in Taiwan. The alcohol yield of starchy crops depended not only on the starch content, but also on the yield/ha, water content, growth period, and the degree of starch purification. The simplest method for saccharification and fermentation was to mix the starch with yeast (Saccharomyces cerevisiae), alpha-amylase solution, and distilled water at the beginning of the process, saving energy and reducing labor costs. Using this method, alcohol yields of 5.9, 7.5, and 5.2 percent were obtained for sweet potato, cassava, and potato, resp. When purified starch was used, the alcohol production rates were 9.9, 10.5, and 9.5 percent for sweet potato, cassava, and potato, resp. Yields/ha

averaged 16.0, 15.4, and 11.7 t for sweet potato, cassava, and potato, resp., for the period 1976-80. If calculation is based on purified starch, the following amounts of alcohol/ha can be distilled: 1850 liters from sweet potato, 2296 liters from cassava, and 760 liters from potato. During the purification process, a large amount of material is lost. If this loss is minimized, the alcohol yield from purified starch can be increased by as much as 1.40-1.83 times. (AS (extract))

0609

26198 ZHANG BEIQING. 1983. (Alcoholic fermentation of uncooked sweet potato). Food and Fermentation Industries no.6:59-63. Chin., 7 Refs., Illus.

Cassava; Cassava starch; Alcohol; China.

Alcohol production from uncooked root materials (potato, sweet potato, and cassava) in China is discussed. Root starch can readily be hydrolysed by Aspergillus niger. A process in which production costs would be decreased significantly due to low energy consumption is described. (Food Science and Technology Abstracts) See also 0548 0616

0610

23183 ADAPTIVE AGRICULTURAL RESEARCH ON SMALL SCALE CASSAVA AND RICE CULTIVATORS IN THE DOMINICAN REPUBLIC. 1983. Annual Report 1982. Netherlands, Wageningen Agricultural University. 65p. Engl., Sum. Engl., 20 Refs., Illus.

Cassava; Cassava programs; Development; Research; Cultivars; Erosion; Intercropping; Bitter cassava; Costs; Production; Harvesting; Mechanization; Agricultural equipment; Dominican Republic.

The activities of the Adaptive Agricultural Research Project carried out by the Wageningen Agricultural U. (Netherlands) and the Dominican Republic's Ministry of Agriculture during 1981-82 are described and someresults are given. The case studies among cassava cultivators highlighted 3 problems that the farmers have to face: unpredictable prices, loss of soil fertility, and increasing land shortage. The farmers are ready to adapt their cultivation systems to changing ecological and market demands. Var. also change whenever it is necessary to adjust to a decrease in soil fertility or an increase in the demand for cassava with a higher starch content. A cassava harvesting device, developed in Surinam, was also tested; more research on the planting position of the cutting, land preparation, and var. used is required to promote this device that makes cassava harvesting easier. (CIAT)

0611

25258 AFRICAN PRODUCTS (PTY) LTD. 1985. Cassava today. South Africa. 11p. Engl., Illus.

Cassava; Cultivation; Soil physical properties; Fertilizers; Herbicides; Cassava African mosaic virus; Cassava bacterial blight; Tissue culture; Diplodia; Marketing; Forage; Silage; Research; Distribution; Costs; South Africa.

A synthesis of the development of cassava cultivation in South Africa is presented as a means to promote the crop in the region by the African Products Ltd. enterprise. The agronomic characteristics that make the crop suitable for the zone, general cultivation practices and management, generalities on pests and diseases, marketing guarantees, special facilities provided by the enterprise to the farmers, and production costs are described. Two testimonies of farmers that have obtained excellent results with cassava in the region and a brief review of the future of cassava in South Africa are presented. (CIAT)

0612

25510 ALONSO Q., C. 1979. Uso potencial-agroindustria. (Potential use-agroindustry). Bogotá, Colombia. Oficina de Planeación del Sector Agropecuario. 11p. Paper presented at Primer Simposio Nacional sobre Utilización y Perspectivas de la Yuca. Span.

Cassava; Marketing; Development; Economics; Cassava starch; Cassava chips; Cassava flour; Glucose; Uses; Trade; Colombia.

The possibilities of cassava industrialization in Colombia for obtaining products for domestic consumption and for export are discussed. The supply and demand are analyzed, and the products found to have markets include starch, chips for animal nutrition, flours for human and animal nutrition, and glucose (also to obtain industrial alcohols). The uses of such products in laundries, the paper, textile, and glucose industries, as adhesives, and to develop and propagate yeasts are mentioned. The export possibilities are

analyzed and it is highlighted that the demanding markets can be conquered with quality and prices. It is considered convenient to think more about agroindustrial products and not about those obtained from the cassava processing agroindustry; cassava would therefore be an alternative raw material among other basic materials (potato, maize, yam) from which the products can be obtained. Thus a larger setup that implies scale economies would be possible in the country with the subsequent lower production cost/unit with better technologies and the resultant improved quality. If unforeseen deficiencies occur due to a raw material, it would be replaced by another, the industry would continue, and a sustained supply would be secured; the 3 key elements that secure the markets, quantity, quality, and sustained supply, would thus be available. (CIAT)

0613

22065 AY, P. 1985. Practical application of research results and unknown reasons of their efficiency. Examples from Nigeria. Entwicklung Landlicher Raum 19(6):23-24. Engl., Sum. Engl., Illus. (Institut de la Recherche Agronomique, Research Project B.P. 2067, Yaounde Mesca, Cameroon)

Cassava; Cassava programs; Development; Cultivars; Cuttings; Intercropping; Maize; Weeding, Harvesting; Nigeria.

The International Institute of Tropical Agriculture in Ibadan, Nigeria, in cooperation with national institutions, is supporting on-farm research activities in programs for several African countries. Some research results on farming systems are presented and the complex effects of research results on several levels of development processes are analyzed. Although practical work and pragmatic experiences on the village level are emphasized, it is hoped that the examples will stimulate theoretical discussions. (AS)

0614

26305 BEST, R.; OSPINA P., B., comp. 1985. El desarrollo agro-industrial del cultivo de la yuca en la Costa Atlántica de Colombia. Cuarto informe sobre el desarrollo de la agroindustria de yuca seca durante el período julio 1984-junio 1985. (The agroindustrial development of cassava on the Atlantic Coast of Colombia. Fourth report on the development of the dried cassava agroindustry from July 1984 to June 1985). Cali, Colombia, Centro Internacional de Agricultura Tropical. Proyecto Cooperativo DRI-CIAT. v.1,49p. Span., Sum. Span. (CIAT, Apartado Aéreo 6713. Cali, Colombia)

Cassava; Cassava chips; Solar drying; Costs; Economics; Development; Production; Statistical data; Marketing; Labour; Distribution; Technology transfer; Colombia.

From July 1984 to June 1985, 13 new drying plants were established on the Atlantic Coast of Colombia for a total of 20 plants. During the 1984-85 campaign, these plants processed 7158 t fresh cassava (total of 3006 t dry cassava), representing an increase of 217 percent over the previous campaign. Of the 20 plants, only 14 gave profits. Plants giving losses were late in initiating operations due to delays in the construction; these are expected to operate normally during the next campaign. The profitability of some of the new plants was also affected by the fact that the groups established to operate them were conformed by farmers of low or no capacity to produce cassava. Therefore, the enterprises were subjected to the supply of cassava by non-members, representing no guarantee of attraction for membership to the cooperative or association. The attraction price of fresh cassava continues to be the main factor in determining the economic profitability of the drying process. During the 1st semester of 1985, a program was established to produce improved cassava seed, at both

the farmer and national research center levels. The technical advisory teams in each department have favorably increased their no. and coverage of cassava plants; new markets for dry cassava have also been established. Trade union actions among farmers involved in the project have increased. Likewise, significative advances were achieved in the creation of an officially recognized federation of dry cassava producers of the Atlantic Coast, FEPROYUSCA. Future plans include the establishment of 6 new cassava drying plants in Córdoba, 6 in Sucre, 7 in Bolívar, 1 in Atlántico, and 1 in Cesar. It is estimated that dry cassava production in the 35 plants that will operate on the Atlantic Coast during the 1985-86 campaign will reach a total of approx. 5500 t. (AS-CIAT)

0615

26356 BODE, P. 1986. La organización campesina para el secado de yuca; análisis de tres asociaciones de campesinos que producen yuca seca en la Costa Atlántica de Colombia. (The peasant organization for drying cassava; analysis of three peasant associations that produce dried cassava on the Atlántic Coast of Colombia). Cali, Colombia, Centro Internacional de Agricultura Tropical. Documento de Trabajo no.11. 87p. Span., Sum. Span., Engl., 9 Refs., Illus.

Cassava; Socioeconomic aspects; Economics; Production; Costs; Cassava chips; Solar drying; Marketing; Cassava roots (vegetable); Cassava starch; Colombia.

The work carried out to study the feasibility of organizing the cassava agroindustry within small farmers' associations on the Atlantic Coast of Colombia is summarized. Three of the existent associations are analyzed at 2 levels: the individual farmer's level and the associations' level. In the former case, the factors influencing the small farmers to participate in the associations were studied in relation to land tenure, control over capital sources, and cassava marketing. At the associations' level, topics such as members' participation in the association, the role of leadership, and institutional structure were considered. Based on the analysis, the circumstances favoring the development of small farmers' associations for the production of dry cassava are discussed. (AS)

0616

26317 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1979. Annual progress report 1978-1979. Trivandrum, India. 228p. Engl.

Cassava; Cassava programs; Germplasm; Plant breeding; Cytogenetics; Cultivation; Fertilizers; Intercropping; Root productivity; Plant physiology; Cultivars; Salinity; Industrial microbiology; Alcohol; Roots; Storage; Cassava starch; Processing; Cassava African mosaic virus; Tissue culture; Plant growth substances; Tetranychus cinnabarinus; Thrips; Mite control; Acaricides; Marketing; India.

The results of the research on cassava carried out in 1978-79 by the Central Tuber Crops Research Institute, India, are presented. The research areas include plant breeding, cultivation and management, physiology, processing and utilization, tissue culture, marketing, and control of CAMV, thrips, and mites. The individual papers are registered in this same publication under the following consecutive no.: 0434, 0438, 0442, 0443, 0451, 0456, 0457, 0458, 0466, 0474, 0490, 0491, 0501, 0504, 0505, 0506, 0509, 0512, 0535, 0536, 0537, 0545, 0548, 0551, 0559, 0560, 0562, 0563, 0566, 0568, 0583, 0597, 0606, 0607, 0628, 0650, and 0651. (CIAT)

0617

25737 COCK, J.H.; REYES, J.A., eds. 1985. Cassava: research, production and utilization. Cali, Colombia, Centro Internacional de Agricultura

Tropical. Cassava Program. 752p. Engl.

Cassava; Physiology; Plant breeding; Germplasm; Tissue culture; Cultivation; Cuttings; Propagation; Fertilizers; Nutritional requirements; Mycorrhizae; Phenacoccus; Mononychellus; Resistance; Xanthomonas campestris pv. manihotis; Erwinia carotovora; Cassava African mosaic virus; Cassava brown streak virus; Cassava common mosaic virus; Cassava vein mosaic virus; Frog skin disease; Cassava latent virus; Cassava Caribbean mosaic virus; Cassava symptomless virus; Analysis; Cercosporidium henningsii; Phaeoramularia caribaea; Cercospora vicosae; Phoma; Phyllosticta; Sphaceloma manihoticola; Quarantine measures; Roots; Deterioration; Storage; Cassava chips; Drying; Animal nutrition; Colombia.

The latest advances in research on cassava, particularly in relation to physiology, plant breeding and germplasm, agronomic practices, pests and diseases, and processing and utilization, are presented. The individual papers are registered in this same publication under the following consecutive no.: 0445, 0454, 0460, 0469, 0496, 0499, 0502, 0507, 0510, 0515, 0516, 0544, 0546, 0549, 0550, 0555, and 0556. (CIAT)

0618

24546 DEFFIT, P. 1985. Situación actual de la producción y comercialización del casabe en el municipio Autónomo Maturín del Estado Monagas. (Current situation of casave production and commercialization in the municipality Autónomo Maturín of the state of Monagas). Tesis Ing.Agr. Jusepín, Venezuela, Universidad de Oriente. 65p. Span., 27 Refs., Illus.

Cassava; Casave; Socioeconomic aspects; Production; Cultivars; Processing; Small-scale processing; Rasping; Washing; Pressing; Screening; Drying; Income; Marketing; Storage; Prices; Distribution; Venezuela.

In total, 37 casave producers of the municipality of Autónomo Maturín, Venezuela, were interviewed to (1) identify the productive units in the area, (2) know the social conditions of the producers and the processes that compose the elaboration of the product, (3) ascertain the costs and net income/casave producer, and (4) determine the mean quantity of casave cakes commercialized in the region. The social characterization of casave producers is given, and the elaboration process (peeling, washing, rasping, pressing, screening, laying out, and drying) and the var. used are discussed. An av. casave cake (5 mm thick and 95 mm in diameter) requires 2 kg CF for its elaboration. In the peripheral market of Maturín, a very low percentage of the total casave production produced in the area is sold. Marketing aspects (storage, prices, transportation) are presented, and some recommendations to improve the processing technique and the conditions of the producers are given. (CIAT)

0619

22759 DIXON, J.A. 1984. Consumption. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.F. The cassava economy of Java. California, Stanford University Press. pp.63-90. Engl., Sum. Engl., 16 Refs., Illus.

Cassava; Gaplek; Cassava products; Fresh products; Cassava leaves (vegetable); Cassava roots (vegetable); Composition; Nutritive value; Food energy; Consumption; Socioeconomic aspects; Economics; Prices; Indonesia.

The importance of cassava and cassava products in the diets of both urban and rural residents of Java, Indonesia, is discussed. Urban demand is small and mostly for fresh roots, starch, and starch-based products; virtually no gaplek is eaten in urban areas. Rural demand per capita is about 6 times

the demand in urban areas and is divided among 3 main product forms: fresh roots (about 40 percent), gaplek (about 40 percent), and starch and starch-based products (the remaining 20 percent). Major differences are observed among rural regions and by season. Much more cassava is consumed in the upland areas of Java and in those lowland areas where irrigation is difficult. People in West Java and on Madura rely heavily on fresh roots, whereas others eat a more equal combination of fresh roots and gaplek. The form of cassava consumption frequently reflects the harvest schedule of cassava and whether a substitute staple such as rice or maize is available at low prices. Changes in demand for cassava will depend in part on changes in economic variables. Analysis indicates that a uniform rise in income across income groups will lead to some increase in per capita cassava consumption. The increase would come from more fresh root and starch demand among middle- and upper-income consumers and from more gaplek consumption by poor consumers in rural areas. Major decreases in the relative price of cassava would likely lead to substantial increases in rural consumption of gaplek and to significant increases of fresh root and starch demand in both rural and urban areas. In the long term, new food uses for cassava roots or cassava products also hold some promise for expanding the domestic demand for cassava on Java. (AS)

0620

22756 FALCON, W.P.; JONES, W.O.; PEARSON, S.R.; DIXON, J.A.; NELSON, G.C.; ROCHE, F.C.; UNNEVEHR, L.J. 1984. The cassava economy of Java. California, Stanford University Press. 226p. Engl., Sum. Engl., 169 Refs., Illus.

Cassava; Production; Productivity; Climatic requirements; Rainfall data; Cultivation systems; Socioeconomic aspects; Fertilizers; Costs; Income; Labour; Prices; Economics; Consumption; Nutritive value; Food energy; Gaplek; Cassava starch; Development; Marketing; Distribution; Trade; Pellets; Feeds and feeding; Indonesia.

A study was carried out on Java to determine whether increases in cassava production are technically and economically feasible, and, if so, whether increased production might improve food security in Indonesia. Although the major emphasis is on Java, the study has much broader application. The insights that can be obtained from analyzing a complete commodity system are illustrated; empirical meaning is given to global interdependence, since much of Java's cassava economy is conditioned by the Commonwealth Agricultural Policy, thus contributing substantially to the meagre research on cassava. After an introductory chapter that includes a description of cassava's place in the world food system, subsequent chapters analyze the prospects for and implications of expanding cassava production on Java by considering several related topics: the principal cassava producing systems in upland areas of southern Java; the demand for fresh and processed cassava for human consumption; starch manufacture and trade; the export market for gaplek pellets (a dried form of cassava); marketing efficiency and price formulation; and cassava policy in the broader context of Indonesia's food policy. Individual chapters are registered in this publication under the following consecutive no.: 0592, 0619, 0621, 0635, 0639, 0640, and 0645. (World Agricultural Economics and Rural Sociology Abstracts)

0621

22763 FALCON, W.P.; JONES, W.O.; PEARSON, S.R. 1984. Cassava's role in food policy. In _____.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.163-181. Engl., Sum. Engl., 7 Refs., Illus.

Cassava; Development; Production; Income; Labour; Food energy; Prices; Consumption; Marketing; Processing; Trade; Fertilizers; Indonesia.

Price policy is discussed in the context of Indonesia's food policy. The study of cassava in this country, started in 1979, has showed that this crop can make an important contribution to income growth, improved income distribution through new employment, better nutrition, and food security. Therefore, options for government policy in advancing growth, equity, security, and nutrition objectives are analyzed in the light of the economic constraints and opportunities anticipated for the 1980's. (CIAT)

0622

25271 FRESCO, L. 1982. Women and cassava production; an approach to improving agricultural productivity in rural Zaire. Netherlands, Wageningen Agricultural University. 22p. Also summarized in Farming Systems Support Project Newsletter 2(2):3-5. 1984. Engl., 8 Refs.

Cassava; Socioeconomic aspects; Cultivation systems; Intercropping; Cultivation; Cassava products; Cassava leaves (vegetable); Cassava bacterial blight; Cassava African mosaic virus; Glomerella manihotis; Mononychellus; Phenacoccus; Phytophthora; Root productivity; Marketing; Income; Prices; Soil fertility; Zaire.

To develop a more systematic approach for helping women farmers to improve their agricultural productivity in the Zairian regions of Kwango-Kwilu, the special features of previous experiences are highlighted. Women farmers were identified as the main agricultural producers in the region and cassava production as the most important agricultural activity. The role played by women in cassava production and production constraints are described. These include soil fertility, the system of "crop imposition", pest and disease incidence, unfavorable agricultural prices, absence of a distribution system for agricultural inputs, lack of knowledge of alternatives for the existing cropping system, an ineffective agricultural extension service, poor organization of the farmers, and absence of male labor in agricultural activities. Women's practices and criteria are discussed as well as the contribution of the existing agricultural research and the exptl. approach used. Regarding the impact of expt. on extension and research to institutionalize innovations and thus increase cassava productivity, the improvement of cultivation techniques and the need for reforestation and fallow periods are briefly analyzed as well as the use and multiplication of improved var., the agricultural extension carried out by female community leaders called "animatrices", the government extension service, the nongovernmental agencies network, tools and processing, and agricultural research. (CIAT)

0623

25209 FUKAI, S. 1985. Estimation of cassava productivity for ethanol production; final report. St. Lucia, Department of Agriculture. University of Queensland. 76p. Engl., Sum. Engl., 35 Refs., Illus. (Dept. of Agriculture, Univ. of Queensland, St. Lucia, Qld. 4067, Australia)

Cassava; Cultivars; History; Climatic requirements; Temperature; Water requirements (plant); Solar radiation; Photoperiod; Fertilizers; Soil analysis; Rotational crops; Intercropping; N; P; K; Soybeans; Root productivity; Mathematical model; Australia.

Research was conducted on the physiology and agronomy of cassava to estimate its potential productivity for ethanol production in northern Australia, and to identify suitable cropping systems. A cassava growth model was developed and used for the estimation of productivity. The study was confined to Queensland and northern New South Wales where existing infrastructure, if desired, allows immediate establishment of a cassava industry. Two major

environmental constraints to productivity in northern Australia are low temp. in winter in central-southern Queensland and in northern New South Wales, and low availability of water in general, except in very high rainfall areas. Without these constraints and under favorable agronomic conditions in north Queensland, the model predicts annual economic yield of over 20 t/ha (dry wt.). In southern Queensland, low temp. in winter will limit the potential economic yield to around 10 t/ha in dry land and 14 t/ha under irrigated conditions. These estimates from the model are close to exptl. results. Cv. M AUS 7 is well adapted to Australian conditions, and produced the highest yield in most cv. trials. Response to fertilizer was usually small under the conditions used, but removal of nutrients from the soil was often quite high. Cropping systems studies with M AUS 7 showed that cassava can be grown as a continuous annual crop for up to 3 yr without any adverse effect. Alternatively, it could be grown as a perennial crop for 3 yr before harvesting. Substantial economic advantages of a perennial over an annual cassava system are likely. This cv. can be intercropped with a quick maturing soybean, almost full cassava yield being maintained with an additional soybean grain yield of about 2 t/ha. (AS)

0624

25290 GOMEZ F., I.; TORRES R., M.; ORNELAS A., F. 1984. Reporte condensado de avances sobre el desarrollo integral de la yuca en México. (Condensed report on the advances of integrated cassava development in Mexico). México, D.F., Secretaría de Agricultura y Recursos Hidráulicos. 13p. Span.

Cassava; Production; History; Cultivation; Processing; Cassava flour; Cassava leaf meal; Development; Uses; Mexico.

Advances in the project of integrated cassava development in Mexico, called "the mechanized cultivation and industrialization of cassava", are reported. The structure of the project includes (1) cassava rapid propagation nurseries, (2) the machine station, (3) the arable surface, and (4) the agroindustry. The products that will be obtained from the primary agroindustry include white CF from the roots with 2 percent protein, green CF from the leaves and stems with 17 percent protein, mixtures of the white and green CF to obtain pellets as substitutes of imported sorghum, purified white CF for human consumption with 2 percent protein for mixtures up to 20 percent with wheat flours for breadmaking and up to 15 percent with maize flours to make tortillas, white CF enriched with up to 35 percent SCP, and balanced foods based on protein-enriched cassava mixtures. High density fructose, ethanol, and sorbitol will also be produced and, in the future, other chemical products of cassava (up to 132 different ones) will be developed. Hopefully in 1985 the physical integration of several 12,000-ha modules will begin, based on an increase of 4000 ha/yr in different territories in which this national cassava development has been promoted. (CIAT)

0625

21688 ISLAM, S. 1986. The making of manioc. South, February 1986:57. Engl.

Cassava; Production; Trade; Prices; Thailand.

The new agreement between the EEC and Thailand is discussed; it allows Thailand to increase its cassava export quota, by 2 million tons (subject to a 6 percent import levy) until the end of 1991. The Community also agreed to Thai demands for greater flexibility in the application of the quota taking into account the annual fluctuations in production. However, exports in any one year can not exceed 5.5 million tons. In spite of the help provided by the EEC for crop diversification in Thailand, cassava production

has increased by 1.[illegible] million tons; restriction of quotas probably increased prices in Europe, encouraging farmers to plant more. (CIAT)

0626

26166 JANSSEN, W.; WHEATLEY, C. 1985. Urban cassava markets; the impact of fresh root storage. Food Policy 10(3):265-277. Engl., Sum. Engl., 31 Refs., Illus. (CIAT, Apartado Aéreo 6713, Cali, Colombia)

Cassava; Roots; Storage; Deterioration; Marketing; Technology; Technology transfer; Prices; Costs; Colombia.

Although fresh cassava is important in rural nutrition patterns, its role in urban food markets is limited and declining. Within the context of Colombia, the third most important cassava-producing country in Latin America, both the structure of the marketing channel and consumer preferences are considered in explaining this difference. The principal factor limiting urban market vol. and demand was identified as the rapid root postharvest deterioration which necessitates high margins to cover marketing risks. Appropriate storage techniques which overcome this problem are evaluated and their possible positive impact, through reduction of marketing margins, on retail and farmgate prices as well as on urban consumption is estimated. A strategy for storage technology adoption is discussed. (AS)

0627

23937 KAMANZI, F. 1983. Situation de la culture du manioc en milieu rural. (Situation of cassava in the rural environment). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J., eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.37-42. Fr.

Cassava; History; Bitter cassava; Sweet cassava; Climatic requirements; Intercropping; Plant geography; Production; Statistical data; Root productivity; Development; Rwanda.

The history of the introduction of cassava cultivation in Rwanda is presented. There are 2 groups of var. currently grown: bitter (Eala 07, the most diffused) and sweet (Mulundi, adapted to the south and central regions; Kiryumukwe and Bukarasa, to the East; and Maguruyinkware). The requirements for cassava cultivation are described. The av. production in Rwanda is of 15 t fresh cassava/ha. Cassava is planted on ridges or on the flat, spaced at 1 x 1 m, in the 1st season (Oct.-Nov.) to avoid the damage caused by the green mite. It is also grown in association as the main or as a secondary crop. According to the ecological regions and the yields obtained, cassava is geographically divided into 4 zones, or into 3 zones according to the area planted. The place occupied by cassava among the food crops varies from one region to the other; in general, the cultivation of cassava increases with the reduction of arable lands, an indication of an advanced degradation that deserves land improvement measures. The main constraints of cassava cultivation are (1) lack of available lands, (2) disorganized market (no price control of either fresh cassava or its by-products), (3) pests and diseases (CAMV, bacterioses, and green mite), and (4) limited utilization. Recommendations to increase cassava production are given, these include soil improvement with organic and/or mineral manures, the organization of the cassava market, and the utilization of a profitable technology. Also in the short- and long-term, high yielding resistant var. must be developed. (CIAT)

0628

26354 LAKSHMI, K.R. 1979. Market trend in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum,

India. pp.123-124. Engl.

Cassava; Prices; Production; Marketing; India.

The long-term trend and seasonal fluctuations in cassava prices in India were estimated, and the responsible factors identified. The exact nature of the relationship between the price, area, and production of cassava and those of close substitutes was also established. In Kerala, the compound growth area, production growth rate, and productivity growth rate were 1.9, 7.4, and 5.4 percent, resp. It is concluded that the farmers' habit of harvesting the area under cassava by lots to suit their convenience and the availability of buyers may explain the lack of seasonal fluctuation in the farm price of cassava. (CIAT)

0629

22082 LEIHNER, D.E. 1985. Integrierte maniok-erzeugung und -verarbeitung in Kolumbien. (Integrated cassava production and processing in Colombia). Entwicklung Landlicher Raum 19(6):20-22. Germ., Sum. Engl., 5 Refs., Illus. (Universitat Hohenheim, Institut fur Pflanzenproduktion in den Tropen und Subtropen, Kirchnerstrabe 5, 7000 Stuttgart-Hohenheim, Germany)

Cassava; Cassava chips; Solar drying; Development; Production; Marketing; Colombia.

In cooperation with the International Development Research Center and the Colombian development service DRI, CIAT has initiated a pilot project on the northern coast of Colombia directed toward the fragmentation and solar drying of cassava for the feed industry, i.e. the integrated production, processing, and marketing of cassava. This project is liable to become an extraordinary success, particularly because all processes, from production to marketing, remain in the hands of the farmers themselves and because they are able to carry them out by their own simple means. Likewise, the process provides employment at a season when manpower is particularly abundant. There is a secure and growing demand on the part of the feedstuff industry, on the regional level and far beyond it. Since 1983, the idea and its realization have spread from the north coast of Colombia to Panama, Dominican Republic, and Mexico, in form of a series of smallholder self-aid organizations among the cassava producers. The pilot project represents thus a successful example of how technology development by research can be transferred into practice, and how it is in a position to positively influence the living standard of the rural population in a larger geographical scope. (AS)

0630

25784 LIBONATI, V.F.; ANDRADE, J.C. DE; GUERREIRO, P.M. DA S. 1979. Producao dos principais alimentos de origem vegetal: mandioca. (Production of the main foods of vegetal origin: cassava). In _____. Alguns aspectos da producao de alimentos no Estado do Pará. Belém-PA, Brasil, Faculdade de Ciencias Agrarias do Pará. Servico de Documentacao e Informacao. Informe Técnico no.1. pp.4-8,57-76. Port.

Cassava; Production; Root productivity; Cassava meal; Brazil.

The main food products of the state of Pará (Brazil), among them cassava, are presented. Production data for the 1970-76 period, importance of the crop in the state, cropping systems, and uses (farinha) are indicated. (CIAT)

0631

26156 1985. MANIOC MOUNTAIN. Economic Development Report. September 1985:11-12. Engl.

Cassava; Trade; Thailand.

The trade agreement between the EEC countries and Thailand to reduce the cassava import quotas of the latter is discussed, and the difficulty of the diversification from cassava into other crops, such as rubber and cashew nuts, is highlighted. (CIAT)

0632

24726 MARTINEZ V., C.A. 1985. Estudio de especies más importantes en el país en el aspecto de la producción y la comercialización: la mandioca. (Study of the most important species in the country regarding production and commercialization: cassava). Municipalidad de Asunción; Mercado Central de Abasto. Asunción, Paraguay, Departamento de Asistencia Técnica Operacional. 25p. Span., 4 Refs., Illus.

Cassava; History; Plant geography; Plant anatomy; Bitter cassava; Sweet cassava; Cultivars; Cultivation; Climatic requirements; Costs; pH; Land preparation; Planting; Timing; Spacing; Cuttings; Storage; Weeding; Harvesting; Fertilizers; N; P; K; Economics; Root productivity; Erinnyis ello; Mononychellus tanajoa; Tetranychus urticae; Oligonychus peruvianus; Thrips; Silba pendula; Anastrepha manihoti; Anastrepha pickeli; Aleyrodidae; Aonidomytilus albus; Atta; Vatiga illudens; Vatiga manihotae; Phenacoccus manihoti; Insecticides; Xanthomonas campestris pv. manihotis; Cercosporidium henningsii; Cercospora vicosae; Phaeoramularia manihotis; Erwinia carotovora; Erwinia cassavae; Oidium; Phytophthora; Marketing; Distribution; Consumption; Prices; Cassava products; Paraguay.

The situation of cassava in Paraguay is presented. Its origin, geographical distribution, var. used, and production and costs are described. Cultivation practices (soil and preparation, planting time, materials, and ways, fertilization, harvest) are indicated and a list of the main pests and diseases is given. Marketing, distribution, and prices are discussed and the commercialization in Paraguay is compared with that existent in other countries. Finally, some typical dishes are mentioned. (CIAT)

0633

23934 NDAMAGE, G.; GATARASI, T.; MULINDANGABO, J., eds. 1983. Culture et sélection du manioc et de la patate douce au Rwanda. (Cultivation and selection of cassava and sweet potato in Rwanda). Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. 125p. Fr., 63 Refs., Illus.

Cassava; Selection; Cultivation; Propagation; Intercropping; Cassava African mosaic virus; Xanthomonas campestris pv. cassavae; Mycoses; Mononychellus tanajoa; Disease control; Mite control; Human nutrition; Composition; Rwanda.

The following topics on the cultivation and selection of cassava and sweet potato in the country, presented at the study sessions carried out by the Institut des Sciences Agronomiques du Rwanda, are discussed: influence of ecological factors on growth and yield, multiplication and diffusion, association with other crops, main pests and diseases, importance in the population's nutrition, and chemical composition. Preliminary results on the selection of cassava, the situation of cassava cultivation in the rural media, and several methods for its propagation are also presented. Individual papers are registered in this publication under the following consecutive no.: 0446, 0467, 0480, 0482, 0503, 0532, 0558, 0574, 0627, and

0649. (CIAT)

0634

26177 N.D. ENGINEERING OF SURREY, ENGLAND. 1985. Cassava conversion-the Guinea project. African Farming and Food Processing March-April 1985:28-29. Engl., Illus.

Cassava; Gari; Processing; Development; Factories; Guinea.

The establishment of a cassava farm/gari factory complex (site location) in Guinea is described, as well as the processing of cassava into gari. (CIAT)

0635

22761 NELSON, G.C. 1984. Gaplek. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.110-135. Engl., Sum. Engl., 19 Refs.

Cassava; Gaplek; Animal nutrition; Feeds and feeding; Trade; Development; Prices; Processing; Cassava chips; Pellets; Costs; Indonesia.

The export market for gaplek chips and pellets in Indonesia is analyzed. Since the establishment of the agricultural policies of the European Community and the binding of the import tariff on gaplek products to 6 percent, the European market has been the major determinant of international trade in gaplek. The development of this trade during the 1970's is reviewed, and the policies of the European Community during the last years are discussed. (CIAT)

0636

25292 OKIGBO, B.N.; AY, P. 1984. Nutrition in the research and training activities of IITA. In Pinstrup-Andersen, P.; Berg, A.; Forman, M., eds. International agricultural research and human nutrition. Washington, D.C., International Food Policy Research Institute. pp.125-139. Engl., 7 Refs.

Cassava; Cassava programs; Research; Cultivars; HCN content; Selection; Resistance; Cassava African mosaic virus; Xanthomonas campestris pv. manihotis; Harvesting; Mechanization; Leaves; Protein content; Development; Nigeria.

The various aspects of the research and training carried out by the International Institute of Tropical Agriculture (IITA) that have nutritional implications for the commodities, farming systems, and geographical areas covered by its mandate are reviewed. The stages in the food chain that are affected by IITA's research, the problem of evaluating the nutritional effects of IITA's work, and directions that can be taken to ensure that its future research, training, and related activities will have more effective nutritional content are considered. In relation to cassava, the search of high yielding, low HCN var., resistant to CAMV and Xanthomonas campestris pv. manihotis, and easy to harvest mechanically is analyzed as well as the research on cassava leaves and their use. (CIAT)

0637

26371 OKORJI, E.C.; OBIECHINA, C.O.B. 1985. Bases for farm resource allocation in the traditional farming system: a comparative study of productivity of farm resources in Abakaliki area of Anambra State, Nigeria. Agricultural Systems 17(4):197-210. Engl., Sum. Engl., 4 Refs. (Dept. of Agricultural Economics, Univ. of Nigeria, Nsukka, Nigeria)

Cassava; Productivity; Economics; Labour; Costs; Income; Nigeria.

A study was carried out in Anambra State, Nigeria, to determine the returns to utilization of farm resources in 3 crop enterprises: a yam-based crop mixture, a cassava-based crop mixture, and rice. It was found that prime land, prime labor, and a large proportion of household cash were allocated to the production of the yam-based crop mixture relative to other crop enterprises. Cost return analysis indicated that all scarce resources such as labor, land, and capital were more productive in monetary terms in the cassava-based crop mixture and the rice enterprises than in the yam-based one. The cultural value of yam transcends the monetary and food security values; it includes intangible values such as social status. The special place of yam in the crop production system militates against practical solutions such as the transfer of farm resources from the less productive yam-based crop mixture to the more productive enterprises. (AS)

0638

25257 OLIVEIRA, F.N.S. 1985. A cultura da mandioca no Estado de Rondonia. (Cassava cultivation in the state of Rondonia). Porto Velho-RO, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual de Porto Velho. Documentos no.14. 10p. Port., 1 Ref. (Empresa Brasileira de Pesquisa Agropecuária, Unidade de Execucao de Pesquisa de Ambito Estadual de Porto Velho, Caixa Postal 406, 78.900 Porto Velho-RO, Brasil)

Cassava; Cassava meal; Cassava starch; Production; Productivity; Small-scale processing; Brazil.

The situation of cassava cultivation in the state of Rondonia, Brazil, is described regarding technical and economic aspects. Seventy-five percent of the production of roots is transformed into flour at the same site where it is produced and in a rustic form. The crop is more widespread in Porto Velho (19.3 percent), Colorado D'oeste (18.5 percent), and Guajará Mirin (14.9 percent). In 1982-83, 24,253 ha were planted with a total production of 407,608 t roots. Cassava cultivation in the region is characterized by a low index of technology adoption. (CIAT)

0639

22757 PEARSON, S.R.; FALCON, W.P.; JONES, W.O. 1984. Cassava and Java. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.1-7. Engl., 7 Refs.

Cassava; Economics; Production; Marketing; Consumption; Indonesia.

The importance of the study of cassava in Indonesia is discussed. In this country cassava is regarded as a positive solution to reduce rice imports. The situation of cassava in the world food system is analyzed. (CIAT)

0640

22758 ROCHE, F.C. 1984. Production systems. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.8-62. Engl., 30 Refs., Illus.

Cassava; Production; Costs; Income; Cultivation systems; Development; Economics; Root productivity; Erosion; Socioeconomic aspects; Rainfall data; Timing; Harvesting; Fertilizers; Tetranychus urticae; Oidium; Xanthomonas campestris pv. manihotis; Consumption; Gaplek; Cassava starch; N; P; K; Cuttings; Intercropping; Prices; Development; Indonesia.

Cassava production in Java and Indonesia during the 1970's is analyzed. The main production systems are described and the agroclimatic and socioeconomic characteristics of cassava producing regions are reviewed. The results of village-level surveys carried out in 3 of the major producing regions are presented. The potential benefits of using improved cultural practices are discussed, and the economic and institutional factors that influence the adaptability and regional distribution of these technologies are analyzed. Finally, policy alternatives to develop previously ignored upland cropping systems are discussed. (CIAT)

0641

23762 ROMANOFF, S. 1985. Estimado del costo de apoyo institucional para asociaciones procesadoras de yuca en la Costa Norte de Colombia. (Estimation of the cost of the institutional support to the cassava processing associations on the Northern Coast of Colombia). Cali, Colombia, Centro Internacional de Agricultura Tropical. Programa de Yuca. Documento de Trabajo no.3. 23p. Span., 2 Refs.

Cassava; Development; Cassava chips; Solar drying; Cassava programs; Costs; Economics; Colombia.

The institutional costs involved in the promotion and development of cassava processing plants on the Northern Coast of Colombia are presented, and the implication that these might have on future plans is analyzed and discussed. (CIAT)

0642

23763 ROMANOFF, S. 1985. Looking at the books: social accounting of three cassava drying (appropriate technology) cooperative associations in Colombia. Cali, Colombia, Centro Internacional de Agricultura Tropical. Cassava Program. Working Document no.2. 34p. Engl., 11 Refs., Illus.

Cassava; Socioeconomic aspects; Cassava chips; Solar drying; Costs; Prices; Income; Economics; Colombia.

The social infrastructure of the farmers' associations on the Northern Coast of Colombia that produce dried cassava chips is analyzed, and the benefits received by both members and nonmembers are indicated. The benefits received by the members vary, depending on the affiliation and the member himself. Political, ideological, and sociological factors affect the no. of beneficiaries. No matter how homogeneous the membership of an association or cooperative is, differential participation can create interest groups within the association that will determine the group cohesion and the use of resources. The lower the price an association pays for cassava, the more the low-sales members benefit from membership, and the higher the price, the more the high-sales members benefit. Low-income members benefit more from wages and profits than from sales. (CIAT)

0643

21696 TEXACO AGRO-INDUSTRIAL (NIGERIA) LIMITED. 1984. Texagri. A key to Nigeria's green revolution. Abeokuta, Nigeria. 23p. Engl., Illus.

Cassava; Development; Production; Gari; Cultivation; Climatic requirements; Cultivation systems; Land preparation; Herbicides; Fertilizers; Insect control; Predators and parasites; Disease control; Processing; Dietary value; Power sources; Labour; Nigeria.

The philosophy and organization of the private enterprise Texagri of Texaco in Nigeria are described; its objective is the modern production of cassava and its by-product gari. General aspects on cassava including history, botany, advantages, ecology, misunderstandings about the crop, nutrition,

toxicity, and industrial use are presented. The edaphoclimatic and sociological (farmers association) characteristics of the Texagri cassava plantation are described, and information is presented on the gari production factory (facilities and labor) and the progress achieved. The cultural practices, cassava clones from the International Institute of Tropical Agriculture (IITA) that are used and the yields obtained, pest and weed control, and crop rotation are described in detail; the advantages of using improved clones are also discussed. Currently the IITA cassava clones 30555 and 30772, resistant to CAMV and CBB, are produced. (CIAT)

0644

23494 THORNTON, D.S. 1973. Agriculture in south-east Ghana; summary report. Berkshire, England, University of Reading, Department of Agricultural Economics and Management. Development Study no.12. v.1,221p. Engl., Sum. Engl., 77 Refs., Illus. (Dept. of Agricultural Economics & Management, Univ. of Reading, Berkshire, RG6 2AH, England)

Cassava; Socioeconomic aspects; Cultivation; Cultivation systems; Labour; Marketing; Development; Research; Climatic requirements; Weeding; Processing; Gari; Prices; Cassava starch; Consumption; Cultivars; Ghana.

The agricultural and socioeconomic situation in Ghana is presented. The main agricultural products (maize, cassava, groundnut, and oil palm) are analyzed within the context of cultivation systems, labor, capital, marketing, and possibilities for improvement. Recommendations for the agricultural development planning in the country are presented. (CIAT)

0645

22762 UNNEVEHR, L.J. 1984. Marketing and price formation. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.136-162. Engl., 4 Refs., Illus.

Cassava; Marketing; Trade; Prices; Cassava roots (vegetable); Gaplek; Distribution; Socioeconomic aspects; Costs; Storage; Indonesia.

The marketing efficiency and the capacity of the market to expand operations in response to an increased supply of and demand for cassava products in Indonesia are analyzed. The components of the cassava system are integrated through examination of domestic and international price determination for cassava products. (CIAT)

0646

24724 WARGIONO, J. 1985. Cassava improvement in Indonesia. Bogor, Indonesia, Research Institute for Food Crops. 49p. Paper presented at Cassava Research Short Course, Cali, Colombia, 1985. Engl., 16 Refs., Illus.

Cassava; Production; Uses; Consumption; Cassava products; Cassava starch; Gaplek; Cultivation; Planting; Timing; Land preparation; Cuttings; Weeding; Fertilizers; N; P; K; Tetranychus urticae; Oidium; Xanthomonas campestris pv. manihotis; Soil physical properties; Harvesting; Processing; Marketing; Distribution; Packaging; Income; Indonesia.

Different aspects of the cultivation, utilization, and economy of cassava in Indonesia are described. The production systems are presented, and cassava utilization for human consumption and for industrial purposes in the manufacture of starch and gaplek is discussed. The current cropping system is described, and recommendations on planting time, land and cutting preparation, weed control, fertilization, harvesting, and postharvest technology are presented. The existent marketing channels, means of

transportation and packaging, and the benefits received by the cassava producers are reviewed. (CIAT)

0647

25252 WONGSARIVEJ, S. 1983. Potential markets for Thai tapioca starch. Mag.Sc. Thesis. Bangkok. Thailand, Thammasat University. 147p. Engl., Sum. Engl., 29 Refs., Illus.

Cassava; Cassava starch; Cassava chips; Pellets; Trade; Marketing; Uses; MSG; Paper industry; Textiles; Food products; Alcohol; Confectioneries; Development; Thailand.

The potential of both domestic and foreign markets for Thai cassava starch was studied. Domestic demand of cassava starch comes from 2 groups: industries (84 percent) and direct human consumption (16 percent). Cassava starch is used as raw material in food, monosodium glutamate, paper, and textile industries. For direct human consumption, cassava starch is mostly used in home-cooked food. The domestic market is quite reliable and has good potential, with an av. growth rate of approx. 10 percent. The major foreign markets for Thai cassava starch are Taiwan, Japan, Belgium, and USA, which account for 87 percent of total cassava starch exports. It is concluded that the prospect of foreign markets is quite limited by the restrictions, for instance the import quota and tariff in Japan, and the competition with local starch. It was also found that the most important factor limiting Thai cassava exports is the restrictions in each country aimed at protecting local starches. However, Belgium and Singapore are other high potential markets, though not for their domestic consumption but for re-exporting. Other potential foreign markets are France, Malaysia, Germany, Australia, and Bangladesh. The av. growth rate of the cassava export market is about 21 percent. The alternative uses of cassava starch (ethyl alcohol, sugar, and SCP) are recommended. (AS) See also 0482 0582 0592 0600 0601 0602 0649

K00 OTHER ASSOCIATED COMMODITIES

K01 ROTATIONAL SCHEMES AND INTERCROPPING

0648

23495 NEUMANN, I.F. 1984. La promotion des cultures associées au projet. (The promotion of project-related crops). Nyabisindu, Rwanda, Projet Agro-pastoral de Nyabisindu. Etudes et Experiences no.4. 80p. Fr., 6 Refs., Illus.

Cassava; Intercropping; Soil fertility; Sweet cassava; Bitter cassava; Planting; Spacing; Beans; Soybeans; Erosion; Soil conservation practices; Root productivity; Rwanda.

The experiences of the Projet Agro-Pastoral de Nyabisindu, Rwanda, related to the development of improved crop associations, their dissemination and importance, are described. The traditional associated cropping systems are summarized and analyzed based on the results of the survey carried out by the project among 66 farmers. Recommendations on the dissemination of associated cropping to control diseases and erosion are given. When cassava was associated with beans and soybeans at different plant spacings, root productivity was 3.5 times higher in the association than in the pure stand (9.07 vs. 2.37 t/ha). (CIAT)

0649

23940 NYABYENDA, P. 1983. Association de la patate douce et du manioc avec d'autres cultures. (Association of sweet potatoes and cassava with other crops). In Ndamage, G.; Gatarasi, T.; Mulindangabo, J.. eds. Culture et selection du manioc et de la patate douce au Rwanda. Journées d'études, Rubona, 1983. Compte-rendu. Rwanda, Institut des Sciences Agronomiques du Rwanda. pp.60-67. Fr.

Cassava; Intercropping; Beans; Soybeans; Cowpea; Groundnut; Maize; Root productivity; Rwanda.

According to a study carried out in 1982 at the Faculty of Agronomy of the Université Nationale du Rwanda in Gashumba, cassava and sweet potato are the crops least planted in association with others. Since 1978 the Institut des Sciences Agronomiques du Rwanda carries out intercropping trials to determine the advantages of the associations over the pure crops, to identify the most profitable associations, and to study the feasibility of their generalization. Legumes, grasses, and tubers (cassava, sweet potato, and potato) were therefore planted in binary and tertiary trials. Cassava trials were planted in Karama to test its combinations with beans, soybeans, cowpea, groundnut, and maize. An increase in maize and legume yields was observed compared with those of the resp. monocrops, but monocropped cassava gave the highest yield. In Karama in 1982, 2 cassava and sweet potato intercropping trials were also carried out: the 1st to determine the optimum planting dates of the associated crops and the 2nd to evaluate the influence of compost on the associated crops. Both crops proved to be more profitable planted in monoculture. (CIAT)

0650

26328 PRABHAKAR, M.; MOHANKUMAR, C.R.; NAIR, G.M. 1979. Intercropping legumes, vegetables and medicinal plants in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.25-30. Engl.

Cassava; Intercropping; Maize; Groundnut; Cowpea; Legume crops; Beans; Soybeans; Planting; Spacing; Root productivity; Productivity; Prices; Income; Economics; Cultivars; India.

In a 1st expt. with 12 treatments and 1 control, the possibility of intercropping 2 crops with cassava during its growing phase was studied. All associated crops reduced the productivity of cassava roots. In addition to the control, the combination cassava/cowpea gave the highest yield (25.21 t/ha). The most profitable combination was cassava/peanuts. The agroclimatic conditions of Kerala, India, did not favor the planting of a 2nd crop in association. In a 2nd expt. in a randomized block design and 3 replications, cassava was intercropped with 5 vegetables. The highest yield (18.87 t/ha) was obtained with cassava in monoculture (control) followed by the combination cassava/beans (16.60 t/ha), which was also the most profitable. Cassava yields were not significatively different for the different treatments. In a 3rd expt., the possibility of intercropping cassava with medicinal plants was studied. Of the 2 plants studied, Vinca rosea and Cassia angustifolia, only the 1st established. Cassava yield was not affected. In a 4th expt., 7 var. of Cajanus cajan were intercropped with the cassava var. H-1687. Cassava yields were not significatively different among the different var. and spacings. The design of another expt. to study the effect of the different fertilizer combinations on associated crops is indicated. (CIAT)

0651

26336 RAMANUJAM, T.; INDIRA, P.; NAIR, G.M. 1979. Shade tolerance studies in cassava. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.61-72. Engl.

Cassava; Cultivars; Intercropping; Shading; Plant height; Leaves; Leaf area; Timing; Dry matter; Stems; Roots; Plant pigments; Root productivity; Pruning; Planting; Spacing; Harvest index; HCN content; India.

Plant height, no. of leaves, leaf area, LAI, DM distribution in leaves, stems, and roots, chlorophyll content, and production of roots of 14 cassava var. planted under the shade of coconut palms were studied. In relation to the control, plant height increased significatively for all var., but the no. and growth of leaves were not altered by shade. DM distribution indicated that plants accumulated more dry wt. in the leaves and stems than in the roots, indicating a poor source-sink relationship. The no. of roots was very low in most var. Even though the chlorophyll content was not affected by shade, the specific leaf wt. was reduced by 50 percent. The HI was also very low in plants under shade. Var. H-1687, H-165, H-2304, H-97 (2), and Ci 590 gave the highest yields. The effect of spacing and pruning of plants at 4, 5, and 6 mo. of age on cassava growth and yield under shade was studied in a 2nd expt. Pruning did not affect plant height, stem girth, or LAI. A significative increase was observed in the DM content when pruning was done in the 4th [illegible]. Spacing affected stem and leaf DM content; the plants were taller and the stem girth greater at wider spacings, but the LAI at harvest was greater (2.75) at closer spacings in comparison with the widest (1.20). There was no significative effect on HI, although it was low (0.21-0.39) in all treatments, demonstrating the poor production under shade. Spacing had a significative effect on yield--at wider spacings, greater productivity. HCN content was significatively lower at spacings wider or closer than 90 x 90 cm. Pruning did not affect HCN content. (CIAT)

See also 0463 0475 0501 0548 0556 0613 0616 0622 0623 0627 0633 0640

0652

25756 ASCENCIO, J. 1985. Determinación del área foliar en plantas de caraota (Phaseolus vulgaris L.), yuca (Manihot esculenta Crantz) y batata (Ipomoea batatas (L.) Poir.) utilizando dimensiones lineales y de peso seco de las hojas. Turrialba 35(1):55-64. Span., Sum. Engl., Span., 13 Refs., Illus. (Univ. Central de Venezuela, Facultad de Agronomía, Depto. de Botánica, Maracay, Venezuela)

Cassava; Leaf area; Cultivars; Leaves; Statistical analysis; Mathematical model; Venezuela.

Correlation and regression analyses were used in this study to determine the most suitable equations for predicting leaf area in bean, cassava, and sweet potato, based on linear measurements, and leaf dry wt. The best predictive equations were selected on the basis of goodness of fit, comparison of the values observed with those calculated, and standard error of estimate. (AS)

0653

21691 DUFOUR, D.L. 1984. The time and energy expenditure of indigenous women horticulturalists in the northwest Amazon. American Journal of Physical Anthropology 65(1):37-46. Engl., Sum. Engl., 20 Refs., Illus. (Dept. of Anthropology, Univ. of Colorado, Boulder, CO 80309, USA)

Cassava; Bitter cassava; Socioeconomic aspects; Cultivation; Processing; Colombia.

The energy cost of subsistence activities and the daily time and energy budgets of Tatuyo women in Colombia were assessed as part of a village energy flow study. The Tatuyo are swidden (slash and burn) horticulturalists relying on bitter cassava as a staple crop. Except for the actual felling of new gardens, women are responsible for most of the horticultural work and food preparation. Time budgets were assessed using 24 h activity diaries. Rates of energy expenditure in typical activities were measured by indirect calorimetry using a Max-Planck respirometer. Daily energy expenditure was calculated using these rates in conjunction with the activity diaries. Rates of energy expenditure in standard activities were moderate and broadly comparable with published values for other populations living in tropical environments. The mean daily energy expenditure was 2133 kcal. This value is similar to that reported for other subsistence horticulturalists and close to the FAO recommendation for energy intake for moderately active individuals. (AS)

0654

21684 LUNDQUIST, P.; ROSLING, H.; SORBO, B. 1985. Determination of cyanide in whole blood, erythrocytes, and plasma. Clinical Chemistry 31(4):591-593. Engl., Sum. Engl., 28 Refs., Illus. (Dept. of Clinical Chemistry, Univ. of Linkoping, S-581 85 Linkoping, Sweden)

Cassava; Cyanides; Thiocyanates; Analysis; Biochemistry; Human physiology; Sweden.

A method for determining cyanide in whole blood, erythrocytes, and plasma after stabilization of cyanide by addition of Ag ions is described. The cyanide is then transferred from the acidified sample, by aeration, into NaOH and quantified by the König reaction, with sodium hypochlorite as the chlorinating agent. A rapid loss of measurable cyanide found when cyanide was added to plasma in the absence of Ag ions was attributed to a reaction with serum albumin. Cyanide added to whole blood was bound to a saturable component in erythrocytes, which was identified as methemoglobin. (AS) See

also 0457

ABBREVIATIONS AND ACRONYMS

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Afr.	Afrikaans
a.i.	Active ingredient
alt.	Altitude
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BOD	Biochemical oxigen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
°C	Degrees Celsius (centigrade)
ca.	About (circa)
CAMD	Cassava African mosaic disease
CMV	Cassava African mosaic virus
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
COD	Chemical oxigen demand
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
C.V.	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
DM	Dry matter
DNA	Deoxyribonucleic acid
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EEC	European Economic Community
e.g.	For example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
Engl.	English
EP	Preliminary Trials, CIAT
expt.	Experiment(s)
exptl.	Experimental
°F	Degrees Fahrenheit
Fr.	French
ft-ca	Foot candles (10.76 lux)
FYM	Farmyard manure
g	Gram(s)
G	Giga (109)
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
Germ.	German
GERs	Glucose entry rates
GLC	Gas-liquid chromatography
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
hp	Horsepower
IAA	Indoleacetic acid
IBA	Indolebutyric acid
IBYAN	International Bean Yield and Adaptation Nursery, CIAT
Illus.	Illustrated
in.	Inches
Ital.	Italian
IU	International unit
J	Joule
Jap.	Japanese
kat	Katal(amount of enzymatic activity that converts 1 mole of substrate/s)
kcal	Kilocalorie(s)
kg	Kilogram(s)
kJ	Kilojoule
km	Kilometer(s)
KNap	Potassium naphthenate
kR	Kiloroentgen(s)
l	Liter(s)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD50	Mean lethal dose
LER	Land efficiency ratio

LPC	Leaf protein concentrate
lx	Lux
M	Mega
M	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mo.	Month
mol. wt.	Molecular weight
m.p.	Melting point
NAA	Alpha-naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO_2 exchange
NE	Northeast
NER	Net energy ratio
nm	Nanometer(s) (10^{-9} m)
no.	Number(s)
NPFs	Negative production factors
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
p.	Page
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
pp.	Pages
pphm	Parts per hundred million
PPI	Pre planting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
pv.	Pathovar
Ref(s).	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor-chromatography
RGR	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Rom.	Romanian
rpm	Revolutions per minute
Russ.	Russian
s	Second
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
sp.	Species
Span.	Spanish
spp.	Species
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
t	Ton(s)
TDN	Total digestible nutrients
temp.	Temperature
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid compound with N-methylmethanamine
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VEF	Bean Team Nursery, CIAT
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
vs.	Versus
W	West, watt
wk.	Week
WP	Wettable powder
wt.	Weight
yr	Year(s)
/	Per
%	Percent(age)
>	More than, greater than
<	Less than
≤	Equal to or less than
≥	Equal to or greater than
±	Plus or minus

CUMULATIVE AUTHOR INDEX

ABAS, A.G.
0018

ABE, T.
0078

ABENOJA, E.A.
0238

ABIDIN K., Z.
0105

ACOSTA-ESPINOZA, J.
0101 0102

ACOSTA, W.O.
0347

ADAMSON, I.
0572

ADAPTIVE AGRICULTURAL RESEARCH ON SMALL SCALE CASSAVA AND RICE CULTIVATORS IN THE DOMINICAN REPUBLIC
0610

ADETOLA, J.A.
0126

ADJORLOLO, S.K.
0326

AFOLABI, A.O.
0587

AFRICAN PRODUCTS (PTY) LTD.
0611

AGBIM, N.N.
0327

AGOSTINI, B.
0348

AGOUNKE, D.
0095

AHMAD, K.U.
0349

AHMED, S.Y.
0136

AJIBOLA, O.O.
0218

AKPALOO, Y.
0095

ALAM, M.M.
0079

ALAZARD, D.
0157

ALEXANDER, J.C.
0205

ALLEM, A.C.
0206

ALOGBLETO, K.
0394

ALONSO Q., C.
0612

ALVARADO, M.I.
0160

ALVES, M.L.B.
0061

AMCHOZO, M.C. DE M.
0111

ANANG, K.A.
0161

ANANTHARAMAN, M.
0350

ANDERSON, C.L.
0514

ANDERSON, M.
0351

ANDRADE, J.C. DE
0630

ANIMBO, H.N.
0328 0352

ANJOS, J.T. DOS
0028

APILAR, E.
0290

ARAUJO, E.F. DE
0011

ARAYA, V.H.
0160

ARCE S., R.
0232

ARENE, O.P.
0233

ARIAS F., J.
0195

ARIAS M., L.F.
0570

ARIFIN, Z.
0580

ARRAUDEAU, M.
0543

ASCENCIO, J.
0652

ASHOKAN, P.K.
0419 0487

ASIEGBU, J.E.
0329

ATEGA, P.C.
0162

ATHAYDE, J.T.
0062 0064 0065 0067

ATIKUL, J.
0163

ATKINSON, D.R.
0353

ATU, U.G.
0075

AUGUSTIN, M.A.
0112

AULD, S.J.M.
0010

AUMAITRE, A.
0304

AUTRIQUE, A.
0058 0059

AY, P.
0613 0636

AYANRU, D.K.G.
0217 0261

AYERNOR, G.S.
0251

AZEVEDO, J.N. DE
0462 0564

AZIZ, Z.A.
0213

AZMANSYAH, DT. A.
0164

BADILLO-FELICIANO, J.
0284

BAENTE, C.M.
0162

BAHRI, S.
0580

BAI, K.V.
0264 0566 0567 0568

BALAGOPAL, C.
0156 0451

BALAGOPALAN, C.
0491 0606

BALAKRISHNAN, S.
0074

BALDIZAN, A.
0305

BANGUN, P
0250

BARCIA, O.
0463

BARRETT, D.M.
0252

BARRIOS B., D.D.
0165

BARRIOS, J.R.
0150 0431

BARTSCH, W.
0318

BASLEP, A.
0166

BATERNA, J.P.
0236

BATISTA, C.M.
0450

BATISTA, U.G.
0065

BAUMGAERTNER, J.
0541

BAUTISTA, O.K.
0254

BAYOGO, A.J.
0389

BECKER, J.
0121

BEDERE, C.
0299

BELLO, R.A.
0322

BELLOTTI, A.C.
0479 0515 0516 0544

BELTRAN, J.
0008 0432 0439 0445

BENDER, H.
0154

BENNETT, D.E.
0021

BENNETT, F.D.
0080 0085 0096 0269

BENVENUTI, G.
0167 0463

BEPPU, K.
0224

BERNAL DE GOMEZ, R.
0168

BERNARD, V.
0024

BERRY, S.K.
0112

BEST, R.
0395 0614

BHAT, R.B.
0595

BIASSANGAMA, F.
0519

BIRADAR, R.S.
0504 0545

BIRANDANO, B.
0503

BISEN, S.S.
0323

BLAIN, D.
0354

BLOM, P.S.
0355

BOCK, K.R.
0072 0073

BODDEN F., R.
0517 0518

BODE, P.
0615

BOHER, B.
0255

BOJANIC H., A.J.
0022

BONDAR, G.
0282

BORREN, C.
0356

BORRERO B., H.M.
0081

BOSTER, J.S.
0207

BOURDON, J.P.
0357

BOUSSIENGUE, J.
0519

BOX, L.
0169 0170

BREDEL, P.M.
0358

BREEN, J.
0465

BRESSANI, R.
0113 0300

BRITO, J.A.Q. DE
0082

BROCCAIOLI, A.
0306

BRUINSMA, D.H.
0171

BRUN, P.G.
0270

BRYDON, W.G.
0572

BUCH, G.J.
0593

BUCK, K.W.
0262

BUENO, A.
0546 0547

BUITRAGO A., J.
0132

BUITRAGO, J.
0310

BURCKHARDT, E.A.
0452

BURDEN, G.J.
0493

BURITICA, P.
0259

BUSHUK, W.
0013

BUZIK, R.B.
0125

BYRNE, D.H.
0516

CACERES A., L.A.
0208

CACHAPUZ, L.M.M.
0523

CADAVID L., L.F.
0229

CADAVID, L.F.
0459 0464

CAETANO, L.A.P.
0584

CAETANO, L.F.
0196 0197

CALDAS, L.S.
0011

CALDAS, R. DE A.
0011

CALDAS, G.C.
0017 0044 0049 0083 0199

CALDERON D., R.A.
0165

CALEFFI, A.
0306

CALVIN, C.W.
0589

CAMPOS, S.D. DA S. DE
0321

CAPELLAN H., P.J.
0172

CARDOSO, A.A.
0197

CARIOCA, J.O.B.
0345

CARLTON, C.
0159

CARTERON, B.
0299

CARVAJAL F., R.
0570

CARVALHO, L.E.
0173

CARVALHO, P.C. DE
0017

CARVALHO, V.P. DE
0051 0052 0053 0054

CASADEI, E.
0119

CASTAEDA, I.
0343

CASTAGNETTI, G.B.
0581

CASTILLO H., A.
0001 0002

CASTILLOA, J.J.
0001 0002 0003 0004 0145

CASTRONI, S.
0003 0145

CEDEC, J.
0463

CENTRAL TUBER CROPS RESEARCH INSTITUTE
0103 0174 0239 0359 0360 0548 0607
0616

CENTRO DE PESQUISAS E DESENVOLVIMENTO, BRASIL
0361

CEREDA, M.P.
0319

CHACKO, C.I.
0501

CHACON M., M.
0570

CHALFOUN, S.M.
0051 0052 0053 0054

CHALWE, K.D.
0334

CHAN, S.K.
0018 0209 0214 0230 0240 0241 0285
0286 0330 0362 0363 0364 0365 0382

CHANDLER, F.
0031

CHANDRA SHEKARA, S.
0114 0571

CHANDRASEKARAN, S.
0155

CHEVREAU, B.
0032

CHIU, C.W.
0137

CIPTADI, W.
0146

CISSE, F.A.
0368

CIVEROLO, E.L.
0258

CLIFF, J.
0120 0575 0576 0577

COCK, J.H.
0211 0242 0313 0427 0428 0468 0469
0495 0549 0617

COELHO, Y. DA S.
0083

COLEMAN, D.F.
0216

COLINA, R.
0003

CONSTANT, J.L.
0299

CONTRERAS G., J.
0223

COOPER, B.R.
0023

CORAL, J.C.
0433

COSTA, J.B.
0307

COURSEY, D.G.
0253

COUTTS, H.H.A.
0262

CROIX-MARIE, F.
0331
CRUZ, L.
0463

CURSO NACIONAL EL CULTIVO DE LA YUCA Y SUS USOS ALTERNOS, QUITO, ECUADOR
0366

CURSON, S.J.
0513

DAGOSTIN, J.
0584

DANG TRAN, D.
0578

DANIEL, J.F.
0255

DATA, E.S.
0493

DAVIS, M.
0351

DE JONG, G.
0376

DE LA RIVE BOX-LASOCKI, B.
0594

DE ROON, A.C.
0425

DEBES, C.
0367

DEFFIT, P.
0618

DESTRIZA, T.T.
0204

DHAR, S.C.
0155

DIANESE, J.C.
0498

DIAZ C., F.
0517 0518

DIAZ, M.
0004 0145

DIXON, J.A.
0619 0620

DIXON, R.
0305

DOBBAL, N.P.
0323

DOORMAN, F.
0024 0027

DRAME, M.M.
0368

DU PLESSIX, Y.J.
0243 0244

DUFOUR, D.L.
0653

DUNSTAN, W.R.
0010

EASTWOOD, M.A.
0572

ECKEBIL, J.P.
0369

EDIRISAH-AIDOO, K.
0138

EDISON, S.
0504 0505 0506

EFFENDI, S.
0201

EKPENYONG, T.E.
0012

EL-SHARKAWY, M.A.
0211 0427 0428

ELIAS, L.G.
0113 0300

ELIZONDO, D.
0160

ELUWA, M.C.
0088

ENRIQUEZ T., J.
0370

EFOUNA MOUINGA, S.
0519

ESSERS, S.
0575

ETEJERE, E.O.
0595

EZETA, F.N.
0017

EZULIKE, T.O.
0283

FABRES, G.
0519 0520 0527

FALCON, W.P.
0620 0621 0639

FARIAS, A.R.N.
0063

FATAO, L.
0371

FEAU, C.
0198

FERGUSON, L.B.
0159

FERGUSON, T.U.
0245

FERNANDEZ, M.
0048

FERNANDEZ, R.
0343

FERRARI, G.
0004

FERREIRA FILHO, J.P.
0287

FERREIRA, C.
0092 0274

FERREIRA, L.D.
0400

FINNEY, M.M.
0255

FIORETTO, R.A.
0033

FRAKES, R.A.
0589

FRESCO, L.
0470 0622

FUENTES V., E.
0260

FUJIMOTO, S.
0224 0591

FUKAI, S.
0623

FUKUDA, C.
0064 0065 0256

FUKUDA, W.M.G.
0256 0547

FUNDACION PARA EL DESARROLLO INDUSTRIAL Y AGRICOLA DEL QUNDIO, COLOMBIA
0372

FURTADO, M.J.
0062 0067 0123

GALVEZ A., L.
0459

GANGA, T.
0521

GAPASIN, D.P.
0373

GARCIA G., C.A.
0084

GATARASI, T.
0633

GATSINZI, F.
0532

GERLING, D.
0522

GHARIA, M.M.
0323

GHILDYAL, N.P.
0136

GHOSH, S.P.
0246 0481

GINTING, N.
0580

GLOBAL WORKSHOP ON ROOT AND TUBER CROPS PROPAGATION, CALI, COLOMBIA
0471

GOMEZ F., I.
0175 0624

GOMEZ, G.
0135 0215 0219 0220 0317 0395 0494

GOMEZ, G.G.
0122

GONZALEZ A., A.
0296

GONZALEZ C., J.F.
0147

GONZALEZ L., V.W.
0472

GONZALEZ, F.
0343

GOOCH, P.S.
0514

GOPAKUMAR, K.
0293

GORDON, C.I.
0124

GORGONIO, M.
0493

GREENFIELD, J.N.
0348

GRIFFITH, E.S.
0311

GRIFFON, D.
0332

GRISSOM, F.E.G.
0587

GUERREIRO, P.M. DA S.
0630

GUERRERO, J.M.
0515

GUGNANI, H.C.
0339

GUIRAN, G. DE.
0076

GURITNO, B.
0247 0374

GURNSEY, J.C.
0447

GUTIERREZ O., E.
0570

GUTIERREZ, A.P.
0538 0540 0541

GUTIERREZ, J.
0533 0534

HAHN, S.K.
0288

HAMID, H.
0580

HAMILTON, W.D.O.
0262

HAN, M.H.
0346

HAN, Y.T.
0346

HARRISON, B.D.
0266

HENRY, T.A.
0010

HERNANDEZ, A. DEL P.
0428

HERNANDEZ, E.
0260

HERREN, H.R.
0085 0086 0100 0271 0272 0538 0539
0540

HERRERA F., C.J.
0087

HERRERA, E.
0145

HERSHEY, C.H.
0009 0516 0544 0550 0569

HERSHMAN, J.M.
0578

HEYS, G.
0333

HILL, D.C.
0205

HIZUKURI, S.
0225

HOBT, H.
0025

HOLLOWAY, W.D.
0447

HOWELER, R.H.
0027 0229 0452 0453 0454 0460 0461
0464

HOZYO, Y.
0429

HRISHI, N.
0551 0563

HRUSKA, A.J.
0034

HUEI-WANG, S.
0051

HUGHES, P.A.
0056

HUSSAIN, A.
0013

HUSSEIN, K.M.
0209 0214 0230 0240 0241 0285 0286
0330 0362 0363 0364 0365

IHEAGWAM, E.U.
0088

IKOTUN, T.
0063 0257

ILYUKHINA, L.A.
0125

IMAI, K.
0212 0216

INDIRA, P.
0014 0434 0443 0651

INKERMAN, P.A.
0588

INSTITUT DE RECHERCHES AGRONOMIQUES
TROPICALES ET DES CULTURES
VIVRIERES
0026

INSTITUT DES SCIENCES AGRONOMIQUES DU
BURUNDI
0552

INSTITUTE OF PLANT BREEDING,
PHILIPPINES
0553 0554

INSTITUTO INTERAMERICANO DE
COOPERACION PARA LA AGRICULTURA
0375

INSTITUTO NACIONAL DE INVESTIGACIONES
AGRICOLAS, MEXICO
0289

ISLAM, S.
0625

ISMAYADI, S.
0035

ISSEMBRE, T.
0352

IZOMKUN-ETIOBHIO, B.O.
0221

JACKSON, G.
0465

JACKSON, J.C.
0176

JANSEN, P.
0119

JANSSEN, W.
0376 0626

JARA, R.
0177

JARMAN, T.R.W.
0353

JAYASINGHE, U.
0263

JAYAWARDENA, S.D.G.
0377

JESUS, V.S. DE
0015

JIMENEZ, I.
0310

JOAO, W. DA S.J.
0300

JOHNSON, B.B.
0178

JOHNSON, I.M.
0179

JONAS, J.
0455

JONES, W.O.
0620 0621 0639

JOS, J.S.
0110 0264 0378 0566 0567 0568

JOSEPH, P.J.
0074

JURUENA, L.F.
0523

JUSTE, E.S.J.
0052

KABONDO, P.
0299

KALAISSAKIS, P.
0315

KALMBACHER, R.S.
0488

KAMALAM, P.
0474 0551 0563

KAMANZI, F.
0627

KANDA, A.
0212

KANYENDA, E.E.
0128

KAPUTO, M.T.
0334

KAWANO, K.
0290 0555

KAZANTZIS, D.
0139

KEMP, D.C.
0179

KENT, J.R.
0578

KEYSER, J.M.
0524

KHAJARERN, J.M.
0308

KHAJARERN, S.
0308

KIRILOV, M.P.
0125

KIYINDOU, A.
0519

KNAPE, G.
0121

KOCHELEFF, P.
0299

KOLEOSO, O.A.
0342

KOSIKOWSKI, F.V.
0116

KRAMER, M.
0475

KREMER, R.
0596

KRUTKUN, T.
0231

KUMAR, A.
0222

KUNHI, A.A.M.
0136

LABAYAN, A.L.
0050

LABERRY S., R.
0259

LAKSHMI, K.R.
0628

LAM DINH, P.
0578

LAME, R.
0379

LAMEIRA, O.A.
0291

LAN, G.S.
0068 0209 0214 0230 0240 0241 0285
0286 0330 0362 0363 0364 0365

LARTEY, B.L.
0335 0380

LAW, A.T.
0309

LE MY.
0578

LE NGOC BINH
0578

LE PU, B.
0519 0520 0525 0526 0527 0528

LEDUC, B.
0420

LEE, C.M.
0139

LEE, G.M.
0346

LEE, K.J.
0346

LEESBERG, J.
0027

LEIHNER, D.E.
0228 0476 0477 0478 0629

LEMA, K.M.
0086 0271 0272

LIAN, T.S.
0068 0104 0105 0106 0209 0214 0230
0240 0241 0285 0286 0290 0330 0362
0363 0364 0365 0381 0382 0556

LIANG, C.L.
0608

LIBONATI, V.F.
0630

LIENER, I.E.
0303 0590

LIMA, U. DE A.
0319

LINA, F.
0573

LITTLETON, G.K.
0587

LIU, S.Y.
0608

LOCKARD, J.M.
0210

LOCKARD, R.G.
0210

LOHR, B.
0529

LONGE, O.G.
0126

LONSANE, B.K.
0135

LOPEZ Z., M.
0248

LOPEZ, E.L.
0373

LORETO, A.B.
0148

LOZANO, C.
0499 0502

LOZANO, J.C.
0259 0263 0479 0507

LUALLEN, T.E.
0140

LUC, M.
076

LUCIANI, J.
0500

LUCIANI, J.F.
0004 0557

LUJAN, M.
0543

LUNA R., J.M.
0036

LUNDBORG, G.
0089

LUNDQUIST, P.
0654

LUNDQVIST, P.
0576 0577

LYNAM, J.K.
0181 0383

MAAS, J.L.
0258

MABANZA, J.
0435

MACBAILEY, F.E.
0180

MACEDO, M.M.C.
0049

MACHADO, J.E.O.
0149

MADRID B., M.A.
0127

MAFFLA, G.
0433 0508

MAFLA, G.
0008 0445

MAINI, S.B.
0457 0551 0562

MAKAMBILA, C.
0069

MAKHAMBERA, P.E.
0128

MAKINA, D.W.
0077

MALATHI, V.G.
0509

MAMAT, E.
0448

MAMCHAK, I.V.
0582

MANER, J.H.
0310

MANILAL, V.B.
0156

MANNAN, M.A.
0043

MANRIQUE, L.A.
0227

MANTILLA, J.E.
0436

MARCANO, M.
0500

MARISCAL, A.M.
0290 0384

MARTELLI, A.
0120

MARTENSSON, J.
0576

MARTIN, F.G.
0489

MARTINEZ G., J.E.
0127

MARTINEZ M., B.
0232

MARTINEZ V., C.A.
0632

MARTINEZ V., R.
0232

MATHEW, A.V.
0074

MATOS F., R.
0048

MATTOS, P.I.P. DE
0044 0049 0199

MAXWELL, S.
0022

MAZUMBA, J.
0301

MBINGA, M.J.
0320

MCALLAN, A.B.
0311

MCDOWELL, I.
0115

MEDINA, V.M.
0109

MEGAWATI, M.
0429

MELIS, R.J.M.
0430

MELLO, R.P. DE
0312

MELO, J.F.
0312

MICHE, J.C.
0385 0386

MIRELES, M.
0437

MISLEVY, P.
0488

MOFOR, E.N.
0336

MOHANKUMAR, B.
0456 0457 0466

MOHANKUMAR, C.R.
0421 0490 0551 0650

MOLIN, A.
0119 0120

MONDARDO, E.
0028

MONRO, J.A.
0447

MONTAGNER, W.
0037 0489 0492

MONTALDO, A.
0150 0387 0388

MONTILLA S., J. DE J.
0129

MONTILLA, J.J.
0150

MOORE, C.P.
0313

MOORTHY, S.N.
0563 0597 0606

MORAES, A.
0052

MORAES, A.R. DE
0052

MORAES, G.W.G. DE
0270

MORAES, O. DE
0028

MORALES, E.A.
0109

MOREIRA, H.A.
0312

MORENO, E.A.H.
0314

MORENO, R.A.
0200

MORGADO, L.B.
0422

MORIYA, T.
0212

MOSQUEDA, M.
0151

MSABAHA, M.A.M.
0337

MUAKA, T.
0470

MUENDANE, A.
0338

MULINDABYUMA, J.N.
0446

MULINDANGABO, J.
0480 0558 0633

MURO, M.A. DE
0345

N'BONGUE, R.
0389

N'TEN ANGIUNG, S.
0470

NAGAHAMA, T.
0224 0591

NAIGEON, C.
0598

NAIR, G.M.
0202 0453 0481 0490 0583 0650 0651

NAIR, N.G.
0264 0438 0481 0509 0551 0562 0563

NAIR, P.G.
0456 0466

NAIR, R.B.
0110 0397 0559 0560 0567

NAIR, R.G.
0246 0292

NAIR, R.V.
0419 0487

NAIR, S.G.
0568

NAMBISAN, B.
0583

NARANJO P., A.J.
0141

NARAYANAN, C.S.
0156

NARVAEZ, J.
0008 0432 0439 0445

NASCIMENTO, A.S. DO
0083

NASSAR, N.M.A.
0561

NAVARRETE, D.A.
0113

NAYAR, N.M.
0292

NDAMAGE, G.
0633

NDIOKWERE, C.L.
0029

NDOREYAHO-MUKANKUSI, V.
0574

NELSON, G.C.
0390 0592 0620 0635

NEUENSCHWANDER, P.
0086

NEUMANN, I.F.
0648

NEWELL DUNFORD ENGINEERING LIMITED, ENGLAND
0599

NEZENOSE, J.B.
0482

NGHIEP, L.T.
0181

NGUYEN VAN, V.
0578

NGUYEN, A.T.
0573

NICOLAIEWSKY, S.
0584

NINAN, K.N.
0391

NIVOBA. HOLLAND
0600 0601 0602

NJOKU, B.B.
0233

NOGUEIRA, O.L.
0424

NOLT, B.
0507 0510

NOMA, A.T.
0220

NUGROHO, J.H.
0046 0297

NWANA, I.E.
0273

NYABYENDA, P.
0649

NYANIN, O.O.
0392 0393

NZELIBE, F.K.
0339

NZIEFFE, A.
0340

O'DONNELL, D.C.
0593

O'HAIR, S.K.
0045

OBANDO G., L.
0195

OBIECHINA, C.O.B.
0637

OBIOHA, F.C.
0603

ODEBIYI, J.A.
0283

ODERA, F.P.
0320

ODURO, K.A.
0115

OGBUJI, R.O.
0075

OKE, O.L.
0587

OKEKE, G.C.
0603

OKEKE, J.E.
0483

OKEZIE, B.O.
0116

OKIGBO, B.N.
0636

OKOLI, O.O.
0483

OKORJI, E.C.
0637

OLIVEIRA, F.N.S.
0638

OLIVEIRA, H. DE F.
0016

OLIVEIRA, J.S.
0450

OLYMPIO, H.K.
0341 0394

ONYEKWERE, O.O.
0342

ORNELAS A., F.
0624

ORREGO A., J.I.
0569

OSPINA P., B.
0614

OSPINA, B.
0395

OYENIRAN, J.O.
0302

PACHICO, D.H.
0396

PACUMBABA, R.P.
0265

PADMAJA, G.
0491

PAEZ DE CASARES, J.
0437 0440

PALAFOX, A.L.
0449

PALANISWAMI, M.S.
0098 0294 0535 0536 0537

PANDEY, S.J.
0484

PAPADOPOULOS, G.
0315

PAPIEROK, B.
0525 0528

PARAGUAY, MINISTERIO DE AGRICULTURA
Y GANADERIA
0142 0182

PARDO, C.
0135

PARK, Y.K.
0345

PARRA, O. DE
0305

PARRA, R.
0305

PASARIBU, D.
0201

PAULINO, L.A.
0405

PAVLOVSKAYA, O.E.
0325

PAYNE, P.
0179

PAZ, J.E.
0038

PEA, A.
0518

PEARSON, S.R.
0620 0621 0639

PEDRAZA, A.
0296

PEETERS, L.
0470

PEIKA, M.D.
0582

PEKARY, A.E.
0578

PERALTA D., S.V.
0130

PEREZ C., L.E.
0172

PEREZ S., E.E.
0151

PEREZ, M.
0343

PERREAUX, D.
0060

PERRIN, J.
0299

PHILIPPINE COUNCIL FOR AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT
0055 0183

PHUKON, J.C.D.
0133

PIANG, L.N.
0209 0214 0230 0240 0241 0285 0286 0330 0362 0363 0364 0365

PILLAI, K.S.
0098 0535 0536 0537 0551 0562

PINO A., J.A.
0260

PINO P., L.T.
0005

PINTO C., G.
0117

PINTO S., R.
0143 0144

PIZZINATTO, A.
0321

PLUMBLEY, R.A.
0056

POESPODARSONO, S.
0046

POMARE, E.W.
0447

PORTELA, R.
0122 0310

PORTO, M.C.M.
0007 0211

POTTY, N.N.
0487

POTTY, V.P.
0451 0456 0491 0606

POUZET, D.
0005

PRABHAKAR, M.
0202 0458 0481 0490 0650

PROVERBS, C.
0184

PUNITHALINGAM, E.
0070

QUEVEDO, M.A.
0254

QUEZADA L., O.
0322

QUINTERO, F.
0003 0145 0485

RADHAKRISHNAN, V.V.
0293

RAGAB, M.H.H.
0448

RAGHAVAN, K.V.
0583

RAIMBAULT, M.
0157

RAJAGURU, A.S.B.
0316

RAJENDRAN, P.G.
0397 0545 0551 0562 0563

RAKOTONANAHARY, J.P.
0398

RAMANATHAN, S.
0350

RAMANUJAM, T.
0014 0294 0434 0441 0442 0443 0551
0651

RAMASWAMY, N.
0255

RAMIREZ, H.
0008 0013

RAMOS F., J.R.
0152 0152

RAO, M.R.
0422

RASHID, M.M.
0043

RAVELOMANANTSOA, J.
0398

RAVINDRAN, V.
0316

REDDY, P.R. 1 0573

REDONDO, T.R.
0162

REED, A.W.
0578

REGIONAL WORKSHOP ON CASSAVA IN ASIA, ITS POTENTIAL AND RESEARCH DEVELOPMENT NEEDS, BANGKOK, THAILAND
0399

REIS, A.J. DOS
0400

REYES, J.A.
0515

REYES, J.A.
0617

REYES, R.
0008 0432 0439 0444 0445

RHEE, S.K.
0346

RIBEIRO, A.F.
0274

RIBEIRO, J.L.
0564

RINCON C., C.J.
0143

ROA, J.
0008 0445

ROA, J.C.
0433 0508

ROBERTS, I.M.
0266

ROBERTSON, I.A.D.
0267 0268

ROBINSON, D.J.
0266

ROCA, W.
0013

ROCA, W.M.
0008 0009 0432 0433 0439 0444 0445
0508 0511 0565

ROCHA, B.V. DA
0256

ROCHE, F.C.
0203 0401 0640

ROCHE, F.C.
0620

RODRIGUES, E.M.
0017

RODRIGUES, F. DE M.
0307

RODRIGUEZ, A.
0008 0119

RODRIGUEZ, A.V.
0435

RODRIGUEZ, F.
0402

RODRIGUEZ, J.
0008

RODRIGUEZ, J.A.
0009

RODRIGUEZ M., S.
0234 0296

RODRIGUEZ N., A.
0234 0486

RODRIGUEZ R., A.
0234

ROEGE, W.
0344

ROJAS, M.
0160

ROMANOFF, S.
0641 0642

ROMEIRO, R. DA S.
0064 0065

ROSARIO, E.J. DEL
0158

ROSLING, H.
0119 0120 0575 0576 0577 0579 0654

ROWE, A.G.
0107

SA SOBRINHO, A.F. DE.
0424

SADJAD, S.
0047

SAKA, V.W.
0077

SAKUBU, J.
0403

SALICK, J.
0090

SAMOKHIN, A.V.
0125

SANABRUSIA V., E.
0185

SANCHEZ, P.A.
0423

SANINT, L.R.
0186 0187

SANTAMARIA H., E.
0223

SANTOS, A.F. DOS
0062 0067

SANTOS, C.D.
0091 0092 0274

SANTOS, J.
0122

SANWAL, G.G.
0222

SARIKAPHUTI, Y.
0404

SARMA, J.S.
0405

SASSER, M.
0258

SCHICHA, E.
0099 0533

SCHILDE-RENTSCHLER, L.
0511

SCHMIDT-LEPLAIDEUR, M.A.
0604

SCHMIDT, A.
0121

SCHMITT, A.T.
0275

SCHOONHOVEN, A. VAN
0276

SCHULZE, W.D.
0121

SCHWABE, W.W.
0057

SEFA-DEDEH, S.
0118

SEMESI, V.M.D.
0337

SEMINAR ON CASSAVA PRODUCTION, ST. THOMAS, BARBADOS
0030

SENG, Y.Y.
0153

SERRA, A.D.P.
0338

SHANTA, P.
0512

SHARMA, H.W.
0323

SHARMA, R.P.
0589

SHARMA, V.C.
0217

SHARP, B.
0578

SHIRASAKA, K.
0225

SHORT, M.N.
0513

SHRIMPTON, R.
0111

SHURPALEKAR, S.R.
0114 0571

SIEVERDING, E.
0019 0020 0228 0459 0460 0461

SILVA, A.B.
0093

SILVA, J.R. DA
0108

SILVA, P.H.S. DA
0564

SILVA, [illegible]. DE O.E.
0109

SILVA, U.R. DA
0307

SILVA, V.G. DA
0307

SILVEIRA, A.J.
0450

SILVEIRA, A.J. DA
0197

SILVIE, P.
0525

SINGH, K.G.
0497

SINGH, R.B.
0406

SINTHUPRAMA, S.
0235 0290

SITOMPUL, S.M.
0374

SMITH, K.
0407

SNEEP, J.W.
0425

SOARES, L.A.
0270

SOENARJO, R.
0290 0297

SOLEY M., A.
0188

SONI, P.L.
0323

SORBC, B.
0577 0654

SOSA V., M.
0048

SOUZA, A. DA S.
0044 0049 0199

SPATH, C.D.
0426

SPIESMAIER, A.K.
0189

SRIVASTAVA, H.C.
0323

STAGE, N.H.
0447

STANLEY, J.
0513

STEUHART, P.B
0408 0409

STEIN, V.E.
0262

STEVENSON, M.H.
0586

SUBRAMANIAN, S.R.
0410

SUDHAKARA, K.
0419

SUGANUMA, T.
0224 0591

SUGAWARA, M.
0578

SUGIMORI, M.H.
0066

SULLIVAN, D.J.
0277

SUNDARARAJAN, S.
0295

SUPERINTENDENCIA DO DESENVOLVIMENTO DA AMAZONIA, BRASIL
0411 0412

SUPERINTENDENCIA DO PLANO DE VALORIZACAO ECONOMICA DA REGIAO DA FRONTEIRA SUDOESTE DO PAIS, BRASIL
0190

SWINKELS, J.J.M.
0324

SZABADOS, L.
0445

TABLANTE T., O.J.
0039

TAI, L.H.
0018

TAKEDA, Y.
0225

TALATALA, R.L.
0040

TAN, K.H.
0159

TANIGUCHI, T.
0493

TANZANIA. MINISTRY OF AGRICULTURE
0191

TCHIENGUE, F.
0413

TELES, F.F.F.
0450

TERRA, W.R.
0091 0092 0274

TERRY, E.R.
0060

TEWE, O.O.
0131 0132 0587

TEXACO AGRO-INDUSTRIAL (NIGERIA) LIMITED
0643

THANGAVELU, K.
0133

THANKAPPAN, M.
0294

THORNTON, D.S.
0644

TIRAPORN, C.
0235 0290

TITAPIWATANAKUN, B.
0414

TOAPANTA, C.
0463

TORRES R., M.
0624

TOWNSEND, R.
0513

TRANXUAN, T.
0578

TREGUBOV, N.N.
0325

TRUJILLO, C.
0122

TRUJILLO, G.
0500

TUDOR, G.D.
0134 0588

TURNBULL, J.
0353

UDEOGU, A.E.
0603

UGOCHUKWU, E.N.
0221

UGWU, B.O.
0415

UMERES,E.
0493

UNE, M.Y.
0236

UNNEVEHR, L.J.
0192 0620 0645

URITANI, I.
0493

UTOH, N.O.
0483

VALDIVIA, V.
0463

VALDIVIESO, M.
0135 0215 0219 0220 0317

VAN HERLE, A.J.
0578

VAN STADEN, J.
0430

VARELA, A.M.
0515 0516

VARGAS, O.
0479 0516 0544

VAZQUEZ B., E.
0248

VELASCO, A.C.
0263

VENEZUELA. MINISTERIO DE AGRICULTURA Y CRIA
0237

VIANA, J. DE A.C.
0312

VIEIRA, C.
0[illegible]97

VIJAYAKUMAR, M.
0295

VILLAMAYOR JUNIOR, F.G.
0041 0050 0204 0249

VILLAMIZAR S., J.C.
0152 0152

VILLAVICENCIO, A.
0463

VILLEGAS G., A.
0094

VREUGDENHIL, D.
0226

WADE, M.K.
0423

WALTER-ECHOLS, G.
0095

WARGIONO, J.
0042 0250 0429 0646

WARWICK, D.R.N.
0071

WATANABE, H.
0078

WATTS, R.
0193

WEITE, Z. 1 0298

WELSCH, D.E.
0194 0381

WHEATLEY, C.
0494 0495 0626

WHEATLEY, C.C.
0057 0496

WHOLEY, D.J.
0353

WHOLEY, D.W.
0408 0409

WIDE, L.
0577

WILFRID, J.
0467

WILLIAMS, D.J.
0530 0531

WITSENBURG, W.W.
0171

WONG, R.L.
0158

WONGSARIVEJ, S.
0647

WORKSHOP ON PROCESSING TECHNOLOGIES FOR CASSAVA AND OTHER TROPICAL ROOTS AND TUBERS IN AFRICA, ABIJDAN, IVORY COAST
0416

WOUNUAH, D.D.
0210

WRIGHT, M.
0417

WURDEMANN, W.
0171

XAVIER, J.J.B.N.
0424

XIONG, L.
0298 0371

XUECHENG, T.
0298 0371

YANAGISAWA, T.
0216

YANINEK, J.S.
0100 0538 0539 0540 0541 0542

YASEEN, M.
0080 0096 0097 0278 0279 0280 0281

YEO, G.
0418

YUNINGSIH.
0580

YUSOF, M.
0106

YUSOF, Z.A.M.
0346

YUSUF H., M.
0105

ZAPATA, L.E.
0135

ZHANG BEIQING.
0609

ZIRAS, E.
0205 0315

CUMULATIVE SUBJECT INDEX

ABSORPTION
0017

ACARICIDES
0038 0058 0059 0079 0083 0098 0168
0174 0217 0239 0370 0465 0532 0536
0548 0616

ADHESIVES
0107 0143 0165

AFLATOXINS
0299 0338 0495

AGRICULTURAL LIME
0019 0174 0455 0462 0464 0466

AGROBACTERIUM TUMEFASCIENS
0499

AGROTIS IPSILON
0479

ALCOHOL
0358
FERMENTATION
0174 0345 0606 0608
PROCESSING
0174 0178 0183 0252 0318 0345 0353
0385 0416 0548 0606 0608 0616
PRODUCTION
0178 0292 0346 0353 0385 0404 0608
USES
0150 0158 0174 0178 0183 0252 0292
0318 0345 0346 0353 0385 0404 0416
0548 0606 0608 0609 0616 0647

ALEYRODIDAE
0073 0085 0167 0237 0267 0268 0288
0370 0503 0505 0522 0537 0544 0632

ALUMINIUM
0227 0454 0455

AMBLYPELTA
0465

AMINO ACIDS
0121 0220 0300
ANALYSIS
0113
DIETARY VALUE
0358
LEAVES
0014

ANAEMIA
0573

ANASTREPHA MANIHOTI
0507
INSECT CONTROL
BIOLOGICAL CONTROL
0034 0370
INSECTICIDES
0034 0370 0479 0632

ANASTREPHA PACKELI
0507
INSECT CONTROL
BIOLOGICAL CONTROL
0370
INSECTICIDES
0370 0479 0632

ANIMAL PHYSIOLOGY
0064 0131 0132 0589

ANTHERS
0004 0105 0110 0567 0569
TISSUE CULTURE
0108 0546

AONIDOMYTILUS ALBUS
0174 0237 0507
INSECT CONTROL
0246
BIOLOGICAL CONTROL
0276 0370
INSECTICIDES
0082 0370 0479 0632

APICAL MERISTEMS
0433
TISSUE CULTURE
0008 0174 0290 0437 0438 0440 0481
0508 0511 0565
MORPHOGENESIS
0445

ARMILLARIELLA
0479

ASCORBIC ACID
0349

ASH CONTENT
0012 0114 0122 0126 0135 0219 0300
0306 0310 0312 0313 0316 0323 0324
0349 0409 0447 0449 0603

ASPERGILLUS
0036 0084 0299 0478
INDUSTRIAL MICROBIOLOGY
0157 0159

ATTA
0167 0237 0523
INSECT CONTROL
BIOLOGICAL CONTROL
0276
INSECTICIDES
0632

ATTIEKE
0598

AUSTRALIA
0134 0588 0593 0623

BACTERIOSES
0061 0062 0063 0064 0065 0066 0071
0167 0183 0193 0203 0235 0237 0242
0243 0255 0257 0258 0353 0374 0379
0384 0389 0401 0497 0498 0507 0554
0555 0611 0622 0632 0640
DISEASE CONTROL
0058 0059 0060 0240 0499 0503 0633
RESISTANCE
0026 0256 0285 0288 0296 0297 0486
0500 0503 0553 0617 0636

BAKERY PRODUCTS
0376
CASSAVA FLOUR
0117 0135 0185 0358 0570 0571
COMPOSITE FLOURS
0117 0135 0185 0334 0358 0416 0570
0571
WHEAT FLOUR
0117 0135 0334 0358 0570 0571

BANANA-PLANTAINS
0022 0113 0186 0187 0376

BEMISIA
0073 0167 0174 0237 0267 0268 0505
0522
INSECT CONTROL
BIOLOGICAL CONTROL
0276 0370
INSECTICIDES
0058 0059 0370
RESISTANCE
0085 0288 0503

BEVERAGES
0334 0593

BIOCHEMISTRY
0008 0011 0013 0056 0064 0092 0119
0120 0156 0157 0174 0222 0224 0498
0499 0576 0578 0579 0607 0654

BIOLOGICAL CONTROL
0643
BACTERIOSES
0288
INJURIOUS INSECTS
0034 0079 0080 0081 0085 0086 0087
0089 0090 0095 0096 0097 0100 0269
0270 0272 0275 0276 0278 0279 0280
0288 0370 0515 0519 0521 0524 0525
0526
INJURIOUS MITES
0079 0085 0086 0089 0095 0099 0100
0276 0283 0288 0370 0515 0524 0535
0539
MYCOSES
0034 0370
VIROSES
0034 0288 0370

BIOMASS PRODUCTION
0045 0050 0159

BITTER CASSAVA
0010 0015 0016 0077 0084 0119 0146
0169 0172 0207 0217 0237 0261 0337
0338 0404 0407 0426 0446 0475 0574
0576 0579 0580 0603 0610 0653
ROOT PRODUCTIVITY
0102 0553 0558 0627 0632 0648
STARCH CONTENT
0002 0553

BOILING
0328 0340
DETOXIFICATION
0603
ROOTS
0603

BOLIVIA
0279 0531
MARKETING
0022

BORON
0245

BOTRYODIPLODIA THEOBROMAE
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

BRANCHING
0043 0101 0207 0213 0214 0227 0249
0293 0433 0455 0556

BRAZIL
0011 0015 0016 0017 0028 0033 0037
0044 0049 0051 0052 0053 0054 0061
0062 0064 0065 0066 0067 0080 0083
0091 0092 0093 0096 0097 0101 0102
0108 0111 0123 0149 0196 0197 0199
0206 0236 0257 0270 0274 0275 0281
0282 0287 0291 0307 0312 0314 0319
0321 0345 0358 0422 0424 0431 0450
0462 0473 0489 0492 0498 0523 05[illegible]
0547 0561 0564 0584 0598
GERMPLASM
0109
MARKETING
0173 0361 0400
PRODUCTION
0178 0190 0361 0400 0411 0412 0630
0538
SOCIOECONOMIC ASPECTS
0173

BREADS
0334
ANALYSIS
0135
CASSAVA FLOUR
0135

BREVIPALPUS CALIFORNICUS
0534

BURKINA FASO
0543

BURUNDI
0552

CALCIUM
0012 0017 0033 0219 0246 0327 0449
0603
DEFICIENCIES
0230 0454
ROOT PRODUCTIVITY
0018 0026 0230 0243 0466

CALVES
0313

CAMEROON
0076 0413
MARKETING
0180 0385
PRODUCTION
0336 0369 0385
SOCIOECONOMIC ASPECTS
0198
TRADE
0385

CANADA
0607

CANOPY
0101 0102 0209 0214 0441 0443 0538

CARBOHYDRATE CONTENT
0012 0083 0104 0114 0135 0136 0138
0157 0159 0220 0229 0295 0300 0311
0353 0365 0447 0450 0585
LEAVES
0015 0509
ROOTS
0015 0052 0053 0103 0494 0496
STEMS
0015 0196

CARBON DIOXIDE
0007 0211 0212 0216 0427

CARIBBEAN
0021 0023 0024 0026 0027 0031 0048
0079 0080 0096 0097 0124 0232 0245
0248 0260 0280 0281 0284 0296 0343
0486 0517 0518
PRODUCTION
0030 0184 0475 0594 0610
SOCIOECONOMIC ASPECTS
0169 0594

CARPOLONCHAEA CHALYBEA
0237
INSECT CONTROL
BIOLOGICAL CONTROL
0079 0370
INSECTICIDES
0079 0370 0479 0518
RESISTANCE
0296

CASAVE
0145 0147 0172 0220 0229 0295 0300
0311 0347 0353 0365 0594 0618

CASSAREEP
USES
0033

CASSAVA AFRICAN MOSAIC VIRUS
0006 0167 0174 0193 0261 0262 0264
0265 0266 0267 0292 0320 0359 0379
0389 0465 0484 0497 0504 0505 0506
0507 0513 0548 0611 0616 0622
DISEASE CONTROL
0058 0060 0072 0239 0246 0503 0510
0633
DISEASE TRANSMISSION
0060
EPIDEMIOLOGY
0268
RESISTANCE
0103 0288 0503 0551 0562 0617 0636
SYMPTOMATOLOGY
0058 0060 0071 0510 0512

CASSAVA BACTERIAL BLIGHT
0193 0554 0611 0622
RESISTANCE
0553

CASSAVA BREAD
0147 0172 0347 0594 0618
ANALYSIS
0145

CASSAVA BROWN STREAK VIRUS
0497 0507
DISEASE CONTROL
0510
RESISTANCE
0003 0617
SYMPTOMATOLOGY
0073 0510

CASSAVA CARIBBEAN MOSAIC VIRUS
0507 0510 0617

CASSAVA CHIPS
0243 0371
CATTLE
0123 0358 0410 0588
CONSUMPTION
0116 0163 0165 0185 0189 0252 0364
0365 0381 0383 0404 0414
COSTS
0127 0153 0163 0165 0183 0185 0189
0193 0353 0364 0381 0383 0384 0389
0408 0414 0614 0615 0635 0641 0642
DETOXIFICATION PROCE
0317
DRYING
0031 0135 0149 0153 0165 0171 0185
0252 0317 0330 0379 0408 0409 0614
0615 0617 0629 0641 0642
HCN CONTENT
0135 0252 0317
INDUSTRIAL MACHINERY
0165
INDUSTRIALIZATION
0116 0165 0171 0189 0320 0353 0358
0379 0389 0407 0409
MARKETING
0116 0163 0171 0193 0364 0365 0383
0385 0404 0407 0410 0414 0417 0612
0614 0615 0629 0635 0647
PACKAGING
0165
PRICES
0163 0165 0185 0189 0337 0353 0381
0383 0384 0404 0407 0410 0414 0417
0635 0642
PROCESSING
0031 0135 0148 0149 0153 0165 0171
0174 0183 0193 0252 0317 0320 0330
0337 0353 0364 0373 0379 0380 0385
0389 0403 0407 0409 0414 0614 0617
0629 0635 0641 0642
SOLAR DRYING
0127 0149 0153 0252 0408 0409 0614
0615 0629 0641 0642
STORAGE
0116 0165 0185 0292 0301 0308 0330
0381 0383 0384 0385 0404 0407 0408
0410 0414 0417
INJURIOUS INSECTS
0174 0183 0353 0380 0617
SWINE
0123 0127 0358 0581
TRADE
0116 0163 0165 0171 0185 0193 0364
0365 0381 0383 0385 0404 0414 0417
0612 0635 0647

CASSAVA COMMON MOSAIC VIRUS
0034 0167 0237 0370 0507
DISEASE CONTROL
0510
RESISTANCE
0517
SYMPTOMATOLOGY
0510

CASSAVA FLOUR
0111
COMPOSITION
0113 0114 0130 0135 0300 0342 0358
0365 0570 0571
CONSUMPTION
0163 0165 0185 0189 0191 0365 0404
COSTS
0163 0165 0172 0185 0189 0342 0347
0372 0389

DRYING
0117 0135 0147 0165 0185 0251 0379
0618
INDUSTRIAL MACHINERY
0165 0326
INDUSTRIAL MICROBIOLOGY
0158 0342
INDUSTRIALIZATION
0165 0176 0189 0320 0326 0331 0358
0379 0389
MARKETING
0147 0163 0172 0176 0253 0342 0347
0365 0385 0394 0398 0404 0417 0612
0618
NUTRITIVE VALUE
0113 0300
ORGANOLEPTIC EXAMINATION
0570 0571
PRICES
0147 0163 0165 0176 0185 0189 0191
0337 0338 0347 0394 0398 0404 0417
0618
PROCESSING
0114 0117 0135 0145 0147 0151 0165
0251 0253 0320 0326 0331 0331 0337
0338 0342 0347 0368 0372 0379 0385
0389 0394 0398 0403 0594 0595 0606
0618 0624
PRODUCTION
0163 0165 0172 0191 0251 0320 0331
0365 0379 0385 0394 0398 0403 0404
0417 0594
PROTEIN CONTENT
0113 0300 0358
STORAGE
0147 0165 0185 0251 0253 0385 0404
0417 0618
SWINE
0130 0176 0358
TRADE
0163 0165 0176 0185 0191 0365 0385
0398 0404 0417 0612
WATER CONTENT
0300 0570

CASSAVA LATENT VIRUS
0497 0507
DISEASE CONTROL
0510
RESISTANCE
0617
SYMPTOMATOLOGY
0510

CASSAVA LEAF MEAL
0624

CASSAVA LEAVES (VEGETABLE)
0320 0353 0622
ANIMAL NUTRITION
0123
COMPOSITION
0619
HUMAN NUTRITION
0619
NUTRITIVE VALUE
0123

CASSAVA MEAL
0129 0173 0243 0582 0586 0630
BOILING
0328 0340
COMPOSITION
0122 0157 0252 0301 0306 0310 0312
0316 0334 0342 0358 0581
CONSUMPTION
0163 0165 0185 0252
DIGESTIBILITY
0305
DRYING
0165 0185 0251 0252 0340 0342
FACTORIES
0342
FATTENING
0306
INDUSTRIALIZATION
0165 0340 0342 0358 0361 0386
NUTRITIVE VALUE
0122
PELLETS
0163 0252 0385 0581
PRICES
0163 0165 0185
PROCESSING
0122 0124 0157 0165 0251 0252 0328
0334 0336 0340 0342 0385 0386 0403
0594 0595 0598 0638
STORAGE
0165 0185 0251 0252 0301 0306 0310
0316 0328 0385
SWINE
0122 0310 0314 0358 0581 0584
TRADE
0163 0165 0185 0385

CASSAVA MOSAIC VIRUS
0074 0497

CASSAVA PASTES
0243 0251 0328 0336 0340 0342 0385
0386 0403 0595 0598

CASSAVA PRODUCTS
0119 0166 0182 0632
FRESH PRODUCTS
0122 0165 0181 0185 0310 0314 0377
0381

CASSAVA LEAVES (VEGETABLE)
0320 0353 0619 0622
CASSAVA ROOTS (VEGETABLE)
0376 0615 0619 0645
PROCESSED PRODUCTS
0112 0134
CASAVE
0145 0147 0172 0300 0347 0353 0365
0594 0618
CASSAREEP
0033
CASSAVA BREAD
0145 0147 0172 0347 0594 0618
CASSAVA CHIPS
0031 0116 0123 0127 0135 0148 0153
0163 0165 0171 0174 0183 0185 0189
0320 0330 0337 0353 0358 0364 0365
0615 0617 0629 0635 0641 0642 0647
CASSAVA FLOUR
0111 0113 0114 0117 0130 0135 0145
0147 0151 0158 0163 0165 0172 0176
0326 0331 0337 0338 0342 0347 0359
CASSAVA MEAL
0129 0157 0163 0165 0173 0185 0243
0251 0252 0301 0305 0306 0310 0312
0358 0361 0385 0386 0403 0581 0582
CASSAVA STARCH
0003 0136 0137 0138 0139 0140 0141
0142 0143 0144 0145 0150 0151 0154
0176 0181 0183 0189 0192 0193 0222
0376 0379 0380 0381 0383 0385 0390
FOOFOO
0251 0340 0342 0385 0386 0595
GAPLEK
0203 0374 0383 0408 0620 0635 0640
0645 0646
GARI
0171 0193 0243 0251 0318 0326 0336
0342 0368 0379 0380 0385 0386 0394
PELLETS
0116 0161 0163 0171 0189 0252 0308
0330 0383 0385 0404 0407 0408 0409
TAPIOCAS
0164 0171 0176 0183 0318 0330 0365
0368 0379 0380 0394 0398 0407 0410

CASSAVA PROGRAMS
0089 0202 0288 0350 0395 0418 0472
0483 0484 0486 0524 0543 0552 0610
0613 0636 0641
ANIMAL NUTRITION
0107 0116 0170 0358
GERMPLASM
0107 0174 0290 0616
HUMAN NUTRITION
0396
PLANT BREEDING
0107 0174 0289 0290 0359 0373 0615

CASSAVA ROOTS (VEGETABLE)
0615 0645
COMPOSITION
0376 0619

CASSAVA STARCH
0164 0371 0597
ALCOHOL
0150 0174 0183 0252 0318 0345 0346
0353 0385 0404 0416 0548 0608 0609
0616 0647
ANALYSIS
0003 0138 0139 0140 0141 0145 0151
0154 0156 0222 0225 0319 0321 0323
CONSUMPTION
0165 0182 0189 0252 0364 0365 0374
0376 0381 0383 0390 0404 0414 0620
0640 0644 0646
COSTS
0142 0143 0165 0181 0183 0189 0193
0353 0364 0381 0383 0400 0410 0414
0592 0615
DETERIORATION
0174
DEXTRINS
0144 0165 0353 0600
DRYING
0137 0141 0165 0171 0252 0330 0376
0379 0601 0615
ENZYMES
0154 0155 0222 0345
FACTORIES
0143 0144 0171 0176 0320 0376 0601
FERMENTATION
0141 0171 0174 0319 0345 0376 0608
GELATINIZATION
0138 0151 0323 0324 0330 0591
GLUCOSE
0353 0365 0612
HYDROLYSIS
0604
INDUSTRIAL MICROBIOLOGY
0345 0346 0359 0548 0608 0616
INDUSTRIAL STARCHES
0143 0144 0165 0414 0600 0647
INDUSTRIALIZATION
0165 0171 0176 0189 0318 0320 0344
0353 0376 0379 0402 0407 0416
MARKETING
0161 0171 0176 0181 0182 0192 0193
0253 0364 0365 0376 0383 0385 0394
0398 0400 0404 0407 0410 0414 0592
0612 0615 0616 0620 0644 0646 0647
MOULDS
0156 0174
PACKAGING
0144 0165 0376 0646
PARTICLE SIZE
0003 0140 0144 0323 0324 0591

PRICES
0143 0165 0176 0181 0189 0192 0353
0374 0376 0381 0383 0390 0394 0398
0404 0407 0410 0414 0620 0640 0644
PROCESSING
0136 0137 0138 0141 0142 0143 0144
0145 0151 0156 0165 0171 0174 0183
0193 0252 0253 0318 0320 0324 0330
0344 0345 0353 0364 0368 0376 0379
0380 0385 0394 0398 0402 0407 0414
0416 0548 0592 0595 0601 0608 0616
0638 0644 0646
STORAGE
0141 0144 0165 0174 0182 0183 0252
0253 0330 0353 0359 0376 0380 0381
0383 0385 0390 0404 0407 0410 0414
0548 0616
TEXTILES
0143 0144 0414 0647
TRADE
0161 0165 0171 0176 0192 0193 0364
0365 0374 0381 0383 0385 0398 0404
0414 0416 0592 0612 0620 0647
USES
0139 0140 0144 0150 0161 0165 0171
0174 0183 0189 0193 0252 0318 0320
0322 0325 0330 0345 0346 0353 0365
0368 0374 0379 0380 0381 0383 0385
0394 0404 0407 0410 0414 0416 0548
0592 0595 0600 0608 0609 0612 0616
0620 0644 0646 0647
VISCOSITY
0137 0321 0323 0324 0325

CASSAVA SYMPTOMLESS VIRUS
0510 0617

CASSAVA VEIN MOSAIC VIRUS
0167 0507
DISEASE CONTROL
0510
RESISTANCE
0617
SYMPTOMATOLOGY
0510

CATTLE
0107 0123 0124 0125 0134 0311 0358
0410 0582 0588
BEEF CATTLE
0307
DAIRY CATTLE
0312

CECIDOMYIIDAE
0237 0276 0370

CENTRAL AFRICAN REPUBLIC
0389

CERCOSPORA
0553 0554

CERCOSPORA VICOSAE
0364 0370 0632
DISEASE CONTROL
0060 0240 0502
DISEASE TRANSMISSION
0060
INOCULATION
0502
RESISTANCE
0289 0502 0617
SYMPTOMATOLOGY
0060 0502

CERCOSPORIDIUM HENNINGSII
0034 0167 0174 0183 0235 0237 0364
0370 0465 0501 0632
DISEASE CONTROL
0058 0059 0060 0240 0502 0503
DISEASE TRANSMISSION
0060
INOCULATION
0502
RESISTANCE
0285 0289 0297 0502 0503 0617
SYMPTOMATOLOGY
0058 0059 0060 0068 0502

CEREALS
0021 0022 0118 0134 0181 0186 0187
0198 0200 0203 0324 0356 0376 0405
0420 0422 0423 0424 0584 0613 0649
0650

CHICKWANGUE
0340

CHILOMINA CLARKEI
0479 0529

CHINA
0609

CHROMOSOMES
0108 0208 0566 0567

CENTRO INTERNACIONAL DE
AGRICULTURA TROPICAL
0015 0017 0018 0021 0022 0023 0030
0031 0033 0034 0035 0036 0040 0041
0042 0045 0050 0051 0053 0054 0060
0061 0062 0067 0068 0072 0080 0083
0085 0090 0092 0097 0100 0101 0102
0104 0107 0116 0124 0127 0129 0131
0132 0143 0149 0150 0152 0152 0153
0170 0171 0175 0179 0184 0196 0203
0209 0210 0213 0214 0215 0227 0232
0233 0234 0235 0237 0238 0247 0248

0249 0252 0253 0254 0255 0257 0260
0267 0269 0275 0279 0281 0283 0284
0285 0296 0304 0315 0317 0327 0347
0353 0357 0364 0366 0370 0373 0380
0384 0387 0388 0390 0401 0406 0408
0419 0431 0436 0437 0440 0441 0462
0465 0467 0472 0475 0483 0486 0517
0518 0519 0520 0524 0538 0539 0542
0543 0547 0556 0557 0562 0577 0579
0584 0589 0594 0610 0618 0620 0621
0623 0624 0632 0636 0639 0640

CLIMATIC REQUIREMENTS
0009 0013 0015 0033 0034 0035 0038
0058 0059 0069 0078 0081 0087 0088
0116 0152 0152 0153 0157 0183 0220
0236 0239 0271 0290 0353 0355 0361
0438 0439 0467 0469 0508 0527 0529
0540 0549 0565 0632 0643 0644
GROWTH
0007 0019 0216 0237 0429 0445
PRODUCTIVITY
0007 0020 0023 0036 0043 0048 0049
0060 0102 0167 0182 0196 0199 0203
0214 0232 0237 0243 0382 0459 0462
0547 0556 0620 0623 0627

CLONES
0026 0102 0110 0217 0234 0256 0290
0293 0295 0435 0543 0557 0559 0567
AGRONOMIC CHARACTERS
0008 0296
HYBRIDIZING
0106 0108

COCOYAMS
0040 0238 0245 0245

COELOSTERNUS
0479

COELOSTERNUS GRANICOLLIS
0523

COELOSTERNUS MANIHOTIS
0523

COELOSTERNUS NOTATICEPS
0523

COELOSTERNUS RUGICOLLIS
0523

COLLETOTRICHUM
0507

COLLETOTRICHUM MANIHOTIS
0484 0503

COLOMBIA
0007 0009 0013 0019 0020 0036 0038
0057 0071 0080 0081 0082 0084 0087
0094 0096 0122 0135 0141 0152 0152
0195 0211 0219 0220 0228 0229 0259
0263 0269 0276 0279 0310 0313 0427
0428 0432 0433 0439 0444 0452 0453
0454 0459 0460 0461 0464 0469 0476
0477 0478 0479 0494 0495 0496 0499
0502 0507 0508 0510 0511 0515 0516
0529 0546 0549 0569 0641
GERMPLASM
0008 0445 0544 0550 0555 0565 0617
MARKETING
0144 0181 0376 0395 0612 0614 0615
0626 0629
PRODUCTION
0143 0356 0372 0468 0471 0614 0615
0629
SOCIOECONOMIC ASPECTS
0168 0296 0402 0642 0653
TRADE
0144 0186 0187 0612

COMPOSITE FLOURS
0114 0117 0135 0185 0334 0358 0416
0570 0571

COMPOSITION
0012 0017 0021 0035 0045 0083 0104
0115 0118 0119 0121 0127 0152 0152
0153 0159 0203 0218 0220 0223 0229
0230 0234 0237 0241 0284 0285 0287
0288 0291 0295 0298 0302 0304 0311
0313 0317 0349 0387 0388 0409 0423
0446 0447 0448 0450 0453 0454 0456
0457 0458 0466 0478 0485 0490 0551
0553 0554 0557 0560 0564 0585 0619
0633
CASSAVA FLOUR
0113 0114 0130 0135 0300 0342 0358
0365 0570 0571
CASSAVA MEAL
0122 0157 0252 0301 0306 0310 0312
0316 0334 0342 0358 0581
CASSAVA STARCH
0136 0138 0140 0144 0156 0252 0319
0323 0324 0325 0359 0364 0365 0370
LEAVES
0002 0014 0015 0018 0033 0043 0116
0167 0214 0215 0216 0217 0219 0261
0310 0316 0429 0431 0441 0443 0449
0462 0509 0542 0556 0574 0583 0636
0651
ROOTS
0015 0016 0033 0043 0051 0052 0053
0103 0107 0116 0122 0126 0128 0131
0132 0146 0167 0215 0217 0221 0254
0310 0370 0429 0431 0441 0443 0449

0462 0477 0494 0496 0542 0574 0587
0603 0651
STEMS
0015 0033 0036 0196 0217 0219 0226
0247 0248 0651
TAPIOCAS
0365

CONCENTRATES
0125 0134 0588

CONFECTIONERIES
0136 0138 0252 0647

CONGO
0069 0255 0435 0519 0520 0521 0525
0526 0527 0528
MARKETING
0385
PRODUCTION
0331 0385
SOCIOECONOMIC ASPECTS
0340
TRADE
0385

COOKING
0603

COPPER
0018 0230 0364 0449

COPTOTERMES
0279

CORTEX
COMPOSITION
0126 0128 0131 0132 0217 0587 0603
HCN CONTENT
0131 0132 0217 0587 0603
USES
0077 0126 0128 0131 0326 0327 0329
0603

COSTA RICA
0034 0215 0317 0570
MARKETING
0160 0188
SOCIOECONOMIC ASPECTS
0185
TRADE
0185

CROSSBREEDING
0102 0105 0108 0110 0285 0296

CUBA
0232 0234 0248 0260 0296 0343 0486

CULTIVARS
0001 0002 0003 0005 0006 0007 0011
0013 0014 0015 0016 0017 0019 0028
0030 0031 0032 0033 0038 0046 0048
0051 0052 0053 0054 0057 0058 0059
0061 0067 0082 0089 0114 0115 0117
0135 0141 0144 0145 0146 0149 0165
0168 0169 0172 0181 0183 0196 0203
0210 0211 0219 0220 0224 0237 0239
0245 0254 0255 0260 0261 0263 0265
0267 0268 0271 0288 0317 0320 0337
0338 0347 0349 0358 0363 0368 0376
0379 0380 0384 0385 0387 0388 0403
0404 0407 0423 0427 0428 0429 0431
0432 0433 0434 0437 0438 0439 0440
0441 0446 0449 0450 0452 0453 0461
0464 0471 0472 0480 0483 0484 0486
0491 0492 0494 0500 0505 0506 0508
0509 0512 0516 0518 0520 0529 0538
0540 0541 0542 0545 0566 0569 0571
0608 0610 0613 0618 0644 0652
AGRONOMIC CHARACTERS
0021 0034 0043 0101 0103 0104 0109
0167 0223 0296 0419 0547
ECOLOGY
0549
GERMPLASM
0104 0107 0109 0235 0246 0290 0292
0548 0565 0616
IDENTIFICATION
0062 0073 0207
ROOT PRODUCTIVITY
0020 0022 0023 0026 0036 0041 0042
0043 0045 0049 0050 0072 0083 0103
0104 0107 0167 0182 0197 0201 0204
0213 0215 0227 0228 0229 0232 0233
0235 0238 0243 0247 0249 0250 0284
0286 0287 0289 0291 0294 0296 0298
0359 0370 0382 0401 0419 0420 0436
0442 0443 0455 0456 0457 0458 0459
0462 0463 0466 0470 0474 0477 0482
0485 0487 0488 0489 0536 0547 0548
0553 0554 0558 0563 0564 0616 0623
0632 0650 0651
SELECTION
0023 0026 0072 0103 0107 0256 0287
0289 0296 0297 0364 0463 0547 0549
0557 0558 0560 0563 0564 0636
STARCH PRODUCTIVITY
0045 0104 0229
TOXICITY
0167 0310

CULTIVATION SYSTEMS
0025 0028 0032 0058 0059 0180 0353
0373 0381 0382 0383 0406 0420 0555
0620 0643 0644
FALLOWING
0022 0034 0181 0198 0376

INTERCROPPING
0021 0022 0023 0027 0044 0075 0167
0172 0174 0175 0181 0182 0195 0196
0197 0198 0199 0201 0202 0203 0204
0235 0239 0241 0242 0245 0246 0267
0289 0292 0294 0298 0359 0360 0365
0371 0374 0376 0377 0378 0384 0401
0419 0421 0422 0423 0475 0501 0548
0549 0556 0610 0613 0616 0622 0623
0627 0633 0640 0648 0649 0650 0651
ROTATIONAL CROPS
0026 0167 0200 0235 0338 0362 0365
0370 0384 0424 0463 0623
SHIFTING CULTIVATION
0176

CULTURE MEDIA
0063 0155 0156 0158 0159 0255 0257
0339 0343 0498 0569
TISSUE CULTURE
0008 0108 0435 0437 0440 0444 0445

CURVULARIA
0478

CUTTINGS
0013 0014 0015 0028 0048 0058 0059
0078 0094 0168 0172 0193 0239 0265
0290 0360 0433 0473 0475 0476 0500
0502 0507 0549 0613 0646
GERMINATION
0033 0034 0041 0082 0359 0478 0492
TIMING
0036 0038 0203 0431 0434 0436 0477
GRAFTING
0508
PROPAGATION
0031 0106 0167 0237 0436 0465 0468
0469 0471 0472 0474 0480 0481 0482
0483 0484 0486 0617
ROOT PRODUCTIVITY
0018 0022 0023 0036 0041 0050 0102
0167 0174 0182 0204 0235 0242 0247
0248 0249 0289 0294 0298 0359 0370
0382 0397 0401 0436 0463 0474 0477
0482 0547 0550 0632 0640
ROOTING
0469
SPACING
0007 0023 0034 0038 0041 0050 0102
0167 0174 0181 0182 0183 0204 0241
0242 0245 0246 0249 0289 0298 0364
0370 0382 0463 0465 0477 0632
STORAGE
0036 0167 0174 0182 0183 0203 0235
0237 0241 0242 0249 0289 0359 0370
0370 0384 0401 0463 0478 0479 0492
0617 0632

CYANIDES
0033 0217 0221 0253
DETOXIFICATION
0119 0317
HUMAN HEALTH
0119 0120
MALNUTRITION
0120
THIOCYANATES
0579 0654
TOXICOLOGY
0579

CYANOGEN
0590

CYANOGENESIS
0359
ROOTS
0146

CYANOGENIC GLUCOSIDES
0010 0116 0135 0174 0205 0303 0589

CYTOGENETICS
0110 0174 0206 0208 0546 0548 0566
0567 0568 0616

CYTOLOGY
0108 0285

DEFICIENCY DISEASES
0573

DETERIORATION
0149 0152 0152
CASSAVA STARCH
0174
ROOTS
0051 0052 0053 0054 0055 0056 0057
0116 0146 0174 0493 0494 0496 0617
0626

DETOXIFICATION
0119 0146 0310 0317 0576 0590 0603

DEVELOPMENTAL STAGES
BRANCHING
0043 0101 0207 0213 0214 0249 0293
0433 0455 0556
FLOWERING
0108 0546 0559
GERMINATION
0033 0034 0036 0038 0041 0082 0104
0105 0203 0285 0359 0431 0434 0477
0478 0492 0569
ROOT DEVELOPMENT
0174 0209 0247
ROOTING
0435 0445 0469

DEXTRINS
0144 0165 0353 0600 0605

DIETS
MALNUTRITION
0573

DIGESTIBILITY
0304
CASSAVA MEAL
0305

DIOSCOREA
0188 0253

DIPLODIA
0036 0084 0478 0479 0507 0611
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

DISEASE CONTROL
0038 0463 0508 0643
BACTERIOSES
0058 0059 0060 0240 0499 0503 0633
MYCOPLASMOSES
0499
MYCOSES
0058 0059 0060 0240 0471 0502 0503
0633
VIROSES
0058 0059 0060 0072 0239 0246 0471
0503 0510 0511

DISEASE TRANSMISSION
VECTORS
0060

DOMESTIC ANIMALS
0107 0121 0122 0123 0124 0125 0126
0127 0130 0131 0132 0134 0176 0184
0304 0305 0306 0307 0310 0311 0312
0314 0315 0316 0357 0358 0410 0580
0581 0582 0584 0585 0586 0587 0588

DOMINICAN REPUBLIC
0024 0027 0048 0517 0518
MARKETING
0172
PRODUCTION
0172 0475 0610
SOCIOECONOMIC ASPECTS
0169

DRIED ROOTS
0031 0123 0127 0134 0135 0148 0149
0153 0165 0174 0183 0185 0189 0203
0243 0252 0292 0301 0308 0317 0320
0330 0337 0358 0371 0373 0374 0379
0380 0381 0384 0389 0401 0402 0581
0588 0617 0619 0640 0641 0642
DISTRIBUTION
0192 0353 0408 0409 0614 0620 0645
0646
MARKETING
0116 0163 0171 0192 0193 0365 0383
0385 0390 0404 0407 0410 0414 0417
0612 0614 0615 0620 0629 0635 0645
0646 0647

DRYING
0119 0131 0132 0184 0219 0335 0340
0341 0574 0576 0577 0587 0603
CASSAVA CHIPS
0031 0135 0149 0153 0165 0171 0185
0252 0317 0330 0379 0408 0409 0614
0615 0617 0629 0641 0642
CASSAVA FLOUR
0117 0135 0147 0165 0185 0251 0342
0347 0379 0618
CASSAVA STARCH
0137 0141 0143 0144 0165 0171 0252
0330 0376 0379 0601 0615
INDUSTRIAL MACHINERY
0144 0165 0602
PELLETS
0171 0252 0330 0408 0409
TAPIOCAS
0171 0330 0379
WATER CONTENT
0118 0152 0153 0334 0403

ECOLOGY
0206 0371 0468 0539 0544 0555 0594
CULTIVARS
0549

ECOSYSTEMS
0090 0371 0468 0544 0549 0555

ECUADOR
0167 0279 0366 0370 0387 0388 0463

EGGS
0586

ENDEMIC GOITRE
CLINICAL MANIFESTATIONS
0578

ENERGY PRODUCTIVITY
0047 0423 0488

ENTOMOLOGY
0078 0080 0081 0084 0087 0088 0093
0094 0100 0267 0268 0271 0273 0274
0282 0283 0516 0519 0521 0527 0529
0535 0538 0539 0540

EPIDEMIOLOGY
0072 0268

ERINNYIS ELLO
0091 0092 0167 0237 0270 0274 0275
0517 0523
INSECT CONTROL
BIOLOGICAL CONTROL
0034 0276 0370
INSECTICIDES
0034 0083 0289 0370 0632
RESISTANCE
0289

EROSION
0242 0452 0464 0475 0610 0640 0648

ERWINIA CAROTOVORA
0479 0617 0632

ERWINIA CASSAVAE
0632

ETHANOL
0150 0158 0252 0318 0345 0346 0385
0606

ETHIOPIA
0071

EUDIPLOSIS BRASILIENSIS
INSECT CONTROL
BIOLOGICAL CONTROL
0079
INSECTICIDES
0079

EUTETRANYCHUS ORIENTALIS
0098 0174
INSECT CONTROL
0246

FACTORIES
CASSAVA CHIPS
0171 0320 0409
CASSAVA FLOUR
0176 0320 0331 0342
CASSAVA STARCH
0142 0143 0144 0171 0176 0320 0376
0600 0601
GARI
0171 0333 0342 0602 0634 0643
PELLETS
0171 0409
TAPIOCAS
0171 0176

FALLOWING
0022 0034 0181 0198 0327 0376

FATTENING
SWINE
0130 0306 0315

FEED CONSTITUENTS
0124 0125 0126 0127 0128 0129 0130
0134 0306 0307 0309 0310 0311 0312
0390 0581 0582 0585 0586 0587 0588
ALFALFA
0572
BONE MEAL
0122
COTTONSEED CAKE
0122
FLOURS
0122
MAIZE MEAL
0122
MEALS
0122

FEEDS AND FEEDING
0107 0116 0121 0122 0123 0124 0125
0126 0127 0128 0129 0130 0150 0161
0163 0171 0174 0184 0189 0234 0252
0289 0306 0307 0308 0309 0310 0311
0312 0313 0314 0315 0316 0330 0370
0381 0383 0385 0390 0392 0403 0404
0407 0408 0410 0414 0417 0572 0581
0582 0584 0586 0588 0603 0611 0620
0635 0647

FERMENTATION
0122 0141 0143 0144 0157 0171 0319
0333 0334 0335 0341 0342 0345 0376
0602 0606 0608
PROTEIN ENRICHMENT
0118 0174 0328 0403 0607

FERMENTED PRODUCTS
0150 0158 0174 0178 0183 0252 0292
0318 0345 0346 0353 0385 0404 0416
0548 0606 0608 0609 0616 0647

FERRISIA MERIDIONALIS
0530

FIJI
0533

FLOWERING
0108 0546 0559

FLOWERS
0004 0105 0108 0110 0206 0209 0255
0546 0567 0568 0569

FOLIAGE
0101 0102 0209 0214 0215 0219 0358
0441 0443 0538
FORAGE
0123 0234

FOMES LIGNOSUS
0183 0364 0370 0382
DISEASE CONTROL
0240 0502
INOCULATION
0502
RESISTANCE
0285 0297 0502
SYMPTOMATOLOGY
0502

FOOD ENERGY
0012 0047 0111 0116 0123 0126 0187
0193 0219 0312 0314 0316 0358 0387
0388 0447 0573 0574 0619 0620 0621

FOOD PRODUCTS
0115 0117 0118 0135 0137 0138 0140
0143 0144 0171 0174 0185 0193 0221
0243 0251 0252 0302 0318 0322 0325
0326 0328 0333 0334 0335 0336 0341
0342 0353 0358 0368 0376 0379 0380
0381 0384 0385 0386 0393 0394 0403
0407 0414 0416 0571 0573 0593 0595
0598 0599 0602 0605 0634 0643 0644
0647

FOOFOO
COMPOSITION
0342
PROCESSING
0251 0340 0342 0385 0386 0595

FORAGE
0107 0123 0234 0289 0307 0310 0313
0314 0611

FRANCE
0304 0357 0585

FRENCH GUIANA
0026 0080 0097

FROG SKIN DISEASE
0497 0507 0508 0510 0617

FRUITS
0105 0108 0206 0209 0255 0271 0566

FUSARIUM
0036 0084 0174 0478 0479
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

GABON
0328 0352

GAFLEK
0619
PRODUCTION
0203 0374 0383 0408 0620 0640 0646
TRADE
0374 0383 0620 0635 0645
USES
0374 0383 0408 0620 0635 0646

GARI
COMPOSITION
0115 0118 0221 0302 0342
FACTORIES
0171 0333 0342 0602 0634 0643
FERMENTATION
0118 0171 0335 0341
INDUSTRIAL MACHINERY
0318 0326 0333 0599 0602
MECHANIZATION
0243 0336 0342 0385 0599
NUTRITIVE VALUE
0171
PACKAGING
0333 0335
PROCESSING
0118 0171 0193 0251 0318 0326 0333
0335 0336 0341 0342 0368 0379 0380
0385 0386 0393 0394 0416 0595 0598
0602 0634 0643 0644
STORAGE
0118 0251 0302 0335 0380 0385

GELATINIZATION
0138 0151 0323 0324 0330 0333 0342
0591 0606

GENETICS
0101 0102 0110 0174 0208 0239 0246
0261 0262 0264 0265 0266 0267 0268
0288 0292 0320 0359 0379 0389

GENOTYPES
0549

GERMANY FEDERAL REPUBLIC
0121 0154 0596

GERMINATION
0104 0569
CUTTINGS
0033 0034 0036 0038 0041 0082 0203
0359 0431 0434 0436 0477 0478 0492
SEED
0105 0285 0566
TIMING
0036 0038 0203 0431 0434 0436 0477

GERMPLASM
0008 0060 0104 0106 0107 0109 0174
0235 0246 0290 0292 0293 0399 0445
0544 0548 0550 0555 0562 0565 0616
0617

GHANA
0071 0076 0115 0118 0138 0335
MARKETING
0385 0644
PRODUCTION
0380 0385
SOCIOECONOMIC ASPECTS
0644
TRADE
0385

GLOEOSPORIUM MANIHOTIS
0502

GLOMERELLA
0478

GLOMERELLA CINGULATA
0364 0479
DISEASE CONTROL
0060 0240
DISEASE TRANSMISSION
0060
SYMPTOMATOLOGY
0060 0067

GLOMERELLA MANIHOTIS
0622
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

GLUCOSE
0353 0365 0612

GLUCOSE INDUSTRY
0600

GOATS
0124

GRAFTING
0508

GRINDING
0117 0135 0144 0165 0330 0333 0333

GROWTH
0007 0017 0018 0019 0174 0206 0209
0213 0216 0231 0237 0247 0248 0370
0429 0432 0441 0443 0445 0451 0452
0460 0468

GROWTH CHAMBER EXPERIMENTS
0017 0271 0469

GUATEMALA
0113 0300

GUINEA
0076 0368 0634

GUYANA
0080 0096 0280 0281

HARVEST INDEX
0015 0041 0050 0101 0102 0104 0196
0249 0285 0293 0297 0359 0443 0462
0551 0555 0556 0559 0560 0563 0651

HARVESTING
0017 0026 0028 0030 0031 0035 0039
0104 0172 0179 0184 0244 0252 0310
0364 0391 0397 0408 0465 0496 0610
0613 0636
TIMING
0015 0019 0022 0023 0032 0046 0049
0103 0107 0141 0167 0181 0182 0183
0195 0203 0215 0219 0220 0223 0234
0235 0239 0243 0245 0247 0249 0254
0362 0363 0371 0376 0382 0422 0463
0477 0485 0487 0494 0509 0549 0556
0562 0564 0632 0640 0646

HCN CONTENT
0021 0034 0104 0119 0203 0220 0223
0284 0288 0295 0298 0446 0456 0457
0458 0466 0490 0560 0585
CASSAVA CHIPS
0135 0252 0317
CASSAVA FLOUR
0135
CASSAVA MEAL
0252 0310 0316
CASSAVA STARCH
0144 0252 0359
CORTEX
0131 0132 0217 0587 0603

LEAVES
0015 0217 0219 0261 0310 0316 0509
0583 0636 0651
ROOTS
0015 0016 0131 0132 0217 0221 0310
0587 0603 0651
STEMS
0015 0217 0219 0651

HERBICIDES
0034 0036 0037 0040 0068 0107 0167
0168 0228 0235 0237 0240 0244 0250
0289 0362 0363 0364 0382 0463 0611
0643

HISTORY
0021 0080 0090 0116 0176 0208 0243
0349 0426 0539 0550 0592 0594 0623
0624 0627 0632

HONDURAS
SOCIOECONOMIC ASPECTS
0375

HUMAN NUTRITION
0035 0111 0113 0119 0120 0170 0171
0185 0300 0396 0403 0404 0408 0409
0573 0574 0579 0587 0594 0619 0620
0633

HUMAN PHYSIOLOGY
0576 0577 0579 0654

HYBRIDS
0057 0068 0206 0290 0566
PRODUCTIVITY
0174 0294 0350 0360 0370 0378 0397
0551
RESISTANCE
0103 0516 0551
ROOT PRODUCTIVITY
0103 0174 0294 0370 0397
SELECTION
0103 0397 0560

HYDROLYSIS
0331 0606
CASSAVA STARCH
0604

ILLUMINATION
0009 0069 0439 0508

INCOME
0055 0111 0127 0147 0162 0172 0177
0178 0181 0183 0187 0202 0203 0229
0237 0294 0347 0349 0350 0362 0363
0364 0371 0374 0375 0378 0397 0410
0421 0423 0462 0583 0592 0618 0620
0621 0622 0637 0640 0642 0646 0650

INDIA
0014 0071 0074 0098 0103 0110 0114
0133 0136 0155 0156 0202 0222 0239
0264 0294 0295 0316 0323 0359 0391
0397 0419 0421 0434 0438 0441 0442
0443 0451 0456 0457 0458 0466 0474
0481 0487 0490 0491 0501 0504 0505
0506 0509 0512 0535 0536 0537 0545
0551 0559 0560 0563 0566 0567 0568
0571 0573 0583 0597 0606 0650 0651
GERMPLASM
0174 0246 0292 0293 0548 0562 0616
MARKETING
0410 0616 0628
PRODUCTION
0246 0292 0410
SOCIOECONOMIC ASPECTS
0350 0360 0378

INDONESIA
0035 0042 0046 0047 0071 0146 0164
0201 0247 0250 0429 0580
MARKETING
0161 0192 0592 0620 0621 0635 0639
0645 0646
PRODUCTION
0161 0203 0297 0374 0401 0408 0620
0621 0640 0646
SOCIOECONOMIC ASPECTS
0203 0401 0619 0620 0640 0645
TRADE
0161 0192 0374 0592 0620 0635 0645

INDUSTRIAL MACHINERY
0144 0165 0318 0326 0333 0344 0596
0599 0602

INDUSTRIAL STARCHES
0107 0143 0144 0165 0414 0600 0647

INFLORESCENCES
0004 0105 0108 0110 0206 0209 0255
0546 0567 0568 0569

INHERITANCE
0555 0556

INJURIOUS INSECTS
0022 0030 0036 0078 0080 0081 0084
0087 0090 0096 0097 0103 0182 0239
0240 0242 0269 0277 0353 0364 0382
0389 0415 0465 0471 0478 0497 0516
0529 0530 0531 0536 0537 0548 0549
0616 0617 0622
ANASTREPHA MANIHOTI
0034 0370 0479 0507 0632
ANASTREPHA PICKELI
0370 0479 0507 0632
AONIDOMYTILUS ALBUS
0082 0174 0237 0246 0276 0370 0479

0507 0632
ATTA
0167 0237 0276 0523 0632
BEMISIA
0059 0085 0167 0174 0237 0276 0288
0370
CARPOLONCHAEA CHALYBEA
0079 0237 0296 0370 0479 0518
COELOSTERNUS GRANICOLLIS
0523
COELOSTERNUS MANIHOTI
0523
COELOSTERNUS NOTATICEPS
0523
COELOSTERNUS RUGICOLLIS
0523
COPTOTERMES
0279
ERINNYIS ELLO
0034 0083 0091 0092 0167 0237 0270
0274 0275 0276 0289 0370 0517 0523
0632
EUTETRANYCHUS ORIENTALIS
0174 0246
LEUCOPHOLIS ROHIDA
0479
PHENACOCCUS MANIHOTI
0085 0086 0088 0089 0095 0100 0217
0271 0272 0278 0279 0280 0281 0288
0379 0507 0515 0519 0520 0521 0524
0525 0526 0527 0528 0544 0632
SAISSETIA NIGRA
0183 0237 0276 0479 0507
SILBA PENDULA
0167 0237 0276 0370 0523 0632
ZONOCERUS VARIEGATUS
0085 0273 0380

INJURIOUS MITES
0026 0030 0035 0059 0079 0086 0089
0099 0103 0182 0183 0235 0239 0242
0243 0276 0282 0283 0288 0297 0353
0359 0389 0415 0465 0471 0479 0516
0524 0533 0536 0537 0538 0540 0541
0542 0544 0548 0549 0562 0617 0622
MONONYCHELLUS CARIBBEANAE
0085 0515
MONONYCHELLUS TANAJOA
0058 0083 0085 0095 0100 0217 0237
0370 0379 0497 0507 0515 0532 0539
0632 0633
TETRANYCHUS CINNABARINUS
0098 0174 0246 0379 0507 0535 0616
TETRANYCHUS URTICAE
0007 0167 0203 0237 0370 0374 0384
0401 0534 0632 0640 0646

INOCULATION
0017 0019 0020 0075 0157 0228 0451
0452 0453 0459 0460
DISEASES AND PATHOGENS
0026 0061 0258 0502

INSECT BIOLOGY
0080 0081 0084 0088 0093 0094 0100
0267 0268 0271 0273 0274 0276 0282
0283 0516 0519 0521 0527 0528 0529
0535 0538 0539 0540

INSECTICIDES
0022 0034 0038 0058 0059 0079 0082
0083 0093 0102 0172 0217 0239 0240
0269 0370 0376 0463 0465 0471 0479
0518 0536 0632

IODINE
0577 0578

IPOMOEA BATATAS
0027 0155

IRON
0012 0111 0449

IRRIGATION
0021 0034 0036 0107 0174 0211 0232
0246 0294 0353 0410

ISOLATION
0010 0013
DISEASES AND PATHOGENS
0061 0063 0064 0065 0066 0073 0257
0258 0263 0500 0501 0502

ITALY
0306 0581

IVORY COAST
0006 0026 0032 0071 0076 0244 0420
0598
MARKETING
0385
PRODUCTION
0243 0385 0418
TRADE
0385

JAPAN
0078 0212 0216 0224 0225 0493 0591

KENYA
0072 0073 0267 0268 0522
PRODUCTION
0320

LABORATORY ANIMALS
0572 0589

LABOUR
0116 0185 0383 0401 0410 0620 0637
HARVESTING
0181 0203 0363 0391
LAND PREPARATION
0391 0643
PLANTING
0175 0181 0203
PROCESSING
0165 0171 0331 0331 0353 0415 0592
0614 0621 0643 0644

LACTIC ACID
0122

LAGOCHIRUS
0479

LAND PREPARATION
0024 0034 0078 0172 0180 0183 0241
0245 0360 0376 0391 0464 0643 0646
MECHANIZATION
0237 0243 0382
ROOT PRODUCTIVITY
0023 0043 0167 0174 0182 0199 0200
0204 0235 0243 0294 0362 0382 0397
0462 0463 0632

LATIN AMERICA
MARKETING
0348

LEAF AREA
0007 0210 0213 0214 0227 0247 0248
0285 0364 0429 0431 0441 0443 0455
0556 0651 0652

LEAVES
0007 0031 0038 0043 0090 0206 0207
0209 0210 0211 0212 0213 0214 0215
0216 0293 0427 0428 0429 0431 0432
0433 0441 0442 0443 0469 0520 0538
0540 0541 0542 0545 0556 0652
AMINO ACIDS
0014
ANALYSIS
0002 0005 0011 0015 0029 0092 0255
0502
ANIMAL NUTRITION
0116 0310 0583
HCN CONTENT
0015 0217 0219 0261 0310 0316 0509
0583 0636 0651
MINERAL CONTENT
0018 0033 0219 0310 0449 0462
PRODUCTION
0574
PROTEIN CONTENT
0014 0015 0310 0316 0509 0636
VITAMIN CONTENT
0167

LEGAL ASPECTS
0176

LEPTURGES
0479

LEUCOPHOLIS RORIDA
INSECT CONTROL
INSECTICIDES
0479
LIGHT
0009 0013 0069 0167 0214 0429 0439
0508

LINAMARASE
0217 0221 0261 0590

LINAMARIN
0205 0589 0590

LYSINE
0121

MADAGASCAR
MARKETING
0398
PRODUCTION
0398
TRADE
0398

MAGNESIUM
0012 0033 0068 0183 0327 0364 0449
0454
ABSORPTION
0017
ROOT PRODUCTIVITY
0018 0026 0230 0233 0243 0382

MALAWI
0077 0128 0522

MALAYSIA
0018 0025 0068 0071 0105 0112 0153
0209 0213 0214 0230 0240 0241 0285
0286 0309 0330 0448 0556
GERMPLASM
0104 0106
MARKETING
0362 0364 0365
PRODUCTION
0346 0363 0365 0381
SOCIOECONOMIC ASPECTS
0362 0382
TRADE
0364 0365 0381

MALNUTRITION
0120 0573

MANGANESE
0012 0018 0449 0454

MANIHOT CARTHAGENENSIS
0040 0425

MANIHOT GLAZIOVII
0074 0108 0425

MANIHOT NEUSANA
0561

MANIHOT POHLII
0108

MANURES
0239 0360 0397 0454
DUNG
0202 0329 0458 0464 0490

MARKETING
0022 0160 0162 0166 0180 0188 0194
0348 0362 0395 0399 0405 0611 0621
0622 0628 0631 0632 0639 0645
CASSAVA CHIPS
0116 0163 0171 0193 0364 0365 0383
0385 0404 0407 0410 0414 0417 0612
0614 0615 0629 0635 0647
CASSAVA FLOUR
0147 0163 0172 0176 0191 0253 0342
0347 0365 0385 0394 0398 0404 0417
0612 0618
CASSAVA MEAL
0163 0173 0342 0361 0385
CASSAVA STARCH
0144 0161 0171 0176 0181 0182 0192
0193 0253 0364 0365 0376 0383 0385
0390 0394 0398 0400 0404 0407 0410
0414 0592 0612 0615 0616 0620 0644
0646 0647
GARI
0171 0193 0333 0342 0385 0394 0644
PELLETS
0116 0161 0163 0171 0383 0385 0404
0407 0414 0417 0620 0635 0647
ROOTS
0116 0616 0626
TAPIOCAS
0171 0176 0365 0394 0398 0407 0410

MATHEMATICAL MODEL
0623 0652

MECHANIZATION
0473
HARVESTING
0031 0179 0184 0243 0363 0382 0408
0556 0610 0636
LAND PREPARATION
0237
PLANTING
0031 0175 0179 0184 0237 0243 0382
PROCESSING
0031 0331 0331 0336 0342 0353 0385
0418 0599

METHIONINE
0113 0121 0300

MEXICO
0009 0223 0289 0472
PRODUCTION
0624
SOCIOECONOMIC ASPECTS
0175

MICROSPOROGENESIS
0110 0206 0568

MINERAL DEFICIENCIES
0230 0454

MINERALS
0012 0014 0017 0018 0019 0020 0021
0025 0026 0028 0033 0036 0042 0043
0044 0048 0049 0050 0068 0107 0111
0174 0183 0197 0198 0199 0202 0203
0219 0226 0227 0229 0230 0233 0235
0239 0241 0243 0246 0247 0289 0294
0298 0307 0327 0364 0370 0382 0397
0401 0419 0421 0422 0434 0449 0452
0453 0454 0455 0456 0457 0458 0460
0461 0462 0464 0466 0471 0477 0490
0549 0603 0623 0632 0640 0646

MITE CONTROL
0246 0276 0282 0539 0633
ACARICIDES
0038 0058 0059 0079 0083 0098 0168
0174 0217 0239 0370 0465 0532 0536
0548 0616

MODIFIED STARCHES
0359 0597 0600

MOLYBDENUM
0246 0457

MONONYCHELLUS
0479 0515 0516 0524 0544 0617 0622

MONONYCHELLUS PROGRESIVUS
0538 0539 0540 0541 0542

MONONYCHELLUS TANAJOA
0095 0100 0237 0267 0379 0497 0507
0515 0532 0539 0633
INSECT CONTROL
BIOLOGICAL CONTROL
0370
INSECTICIDES
0058 0083 0217 0370 0632
RESISTANCE
0085

MORPHOGENESIS
PLANT TISSUES
0445

MOULDS
0051 0054 0156 0174 0302 0493

MOZAMBIQUE
0119 0120 0338 0575 0576 0577 0579

MSG
0647

MULCHING
0459

MUTATION
0546

MYCOPLASMOSES
0237 0370 0497 0499 0507

MYCORRHIZAE
0017 0019 0020 0174 0228 0359 0452
0453 0459 0460 0461 0617

MYCOSES
0006 0034 0036 0067 0068 0069 0070
0071 0084 0167 0174 0183 0203 0233
0235 0237 0242 0243 0259 0299 0364
0370 0374 0382 0401 0465 0478 0479
0484 0497 0501 0507 0554 0555 0611
0622 0632 0640 0646
DISEASE CONTROL
0058 0059 0060 0240 0471 0502 0503
0633
RESISTANCE
0260 0285 0289 0296 0297 0502 0503
0553 0617

NEMATODES
0075 0076 0077

NEOSILBA PEREZI
INSECT CONTROL
INSECTICIDES
0479

NETHERLANDS
0600 0601 0602

NIGERIA
0012 0029 0063 0071 0075 0080 0086
0088 0096 0100 0126 0131 0132 0217
0218 0221 0233 0261 0271 0272 0273
0277 0283 0288 0302 0327 0329 0339
0393 0483 0538 0540 0541 0542 0587
0595 0598 0599 0603 0613 0636 0637
MARKETING
0193 0333 0342
PRODUCTION
0193 0333 0415 0643
TRADE
0193

NITROGEN
0007 0014 0018 0019 0020 0021 0023
0025 0026 0028 0033 0042 0043 0049
0050 0068 0107 0174 0183 0196 0197
0198 0199 0202 0203 0204 0229 0233
0235 0239 0243 0246 0247 0289 0294
0298 0327 0360 0364 0370 0382 0397
0401 0419 0421 0422 0423 0434 0443
0451 0453 0454 0457 0458 0462 0464
0471 0477 0490 0623 0632 0640 0646

NUTRIENT UPTAKE
0454 0460

NUTRITIONAL REQUIREMENTS
0007 0014 0017 0018 0019 0020 0021
0025 0026 0028 0033 0035 0042 0043
0044 0048 0049 0050 0107 0167 0172
0174 0183 0195 0196 0197 0198 0199
0200 0202 0203 0204 0229 0230 0233
0235 0237 0239 0243 0245 0246 0289
0294 0297 0298 0329 0353 0359 0360
0362 0363 0364 0370 0378 0384 0391
0397 0401 0406 0421 0422 0423 0434
0452 0453 0454 0456 0458 0460 0461
0462 0464 0465 0467 0471 0477 0490
0548 0556 0611 0616 0617 0621 0623
0632 0640 0643 0646

OCEANIA
0026 0070 0071 0099 0134 0447 0465
0533 0534 0588 0593 0623

OIDIUM
0167 0203 0237 0370 0374 0401 0632
0640 0646
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502

SYMPTOMATOLOGY
0502

OLIGONYCHUS BIHARENSIS
0098 0174
INSECT CONTROL
0246

OLIGONYCHUS PERUVIANUS
0007 0167 0237 0497
INSECT CONTROL
INSECTICIDES
0632

OLIGONYCHUS THELYTOKUS
0534

ORGANOLEPTIC EXAMINATION
0223 0284 0494
CASSAVA FLOUR
0570 0571
COMPOSITE FLOURS
0570 0571

PACKAGING
0144 0165 0333 0335 0376 0496 0646

PALATABILITY
0494

PANAMA
0127 0130 0227 0455
PRODUCTION
0165
TRADE
0165

PAPER INDUSTRY
0143 0144 0414 0647

PAPUA NEW GUINEA
0070

PARAGUAY
0530 0531 0632

PARTICLE SIZE
0153
CASSAVA STARCH
0003 0140 0144 0323 0324 0591

PATENTS
FOOD PRODUCTS
0137

PEELING
0118 0135 0141 0143 0144 0147 0171
0252 0328 0333 0334 0335 0340 0341
0342 0347 0376 0408 0602

PELLETS
0116 0161 0163 0189 0308 0309 0383
0404 0408 0417 0581 0620 0647
PROCESSING
0171 0252 0330 0385 0407 0409 0414
0635

PERICONIA MANIHOTICOLA
DISEASE CONTROL
0240

PERU
0207 0358 0426 0511
PRODUCTION
0423

PEST CONTROL
0007 0022 0034 0038 0058 0059 0060
0072 0079 0082 0083 0085 0093 0098
0168 0172 0174 0182 0195 0217 0239
0240 0246 0275 0282 0289 0370 0376
0378 0463 0465 0471 0479 0499 0502
0503 0508 0510 0511 0518 0529 0532
0536 0539 0548 0549 0616 0632 0633
0643

PEST DAMAGE
0058 0059 0084 0093 0094 0276 0282
0504 0516 0518 0529 0539 0542
DEFOLIATION
0083 0289 0583

PETIOLES
0033 0090 0207 0215 0219 0449 0469

PH
0011 0023 0034 0048 0118 0122 0157
0241 0242 0444 0467 0549 0632
CASSAVA STARCH
0137 0141 0144 0155 0156 0182 0321
SOIL ANALYSIS
0014 0020 0033 0102 0167 0227 0453
0454 0466

PHAEOLUS MANIHOTI
0497

PHAEORAMULARIA CARIBAEA
0617

PHAEORAMULARIA MANIHOTIS
0632
DISEASE CONTROL
0502 0503
INOCULATION
0502
RESISTANCE
0502 0503
SYMPTOMATOLOGY
0502

PHENACOCCUS
0080 0093 0096 0097 0269 0277 0279
0281 0370 0415 0478 0479 0515 0516
0519 0617 0622

PHENACOCCUS HERRENI
0507 0515 0516 0544

PHENACOCCUS MANIHOTI
0086 0088 0095 0100 0271 0272 0278
0279 0280 0281 0379 0507 0515 0519
0520 0521 0524 0525 0526 0527 0528
INSECT CONTROL
INSECTICIDES
0217 0632
RESISTANCE
0085 0089 0288 0544

PHILIPPINES
0040 0041 0050 0071 0148 0158 0183
0204 0238 0249 0254 0553 0554
MARKETING
0162
PRODUCTION
0055 0384
SOCIOECONOMIC ASPECTS
0373 0384

PHOMA
0507
DISEASE CONTROL
0502 0503
INOCULATION
0502
RESISTANCE
0502 0503 0617
SYMPTOMATOLOGY
0502

PHOSPHORUS
0007 0012 0014 0018 0019 0020 0021
0023 0025 0026 0028 0033 0042 0043
0049 0050 0068 0107 0174 0183 0196
0197 0198 0199 0202 0203 0204 0219
0229 0230 0233 0235 0239 0242 0247
0289 0294 0298 0327 0360 0364 0370
0382 0397 0419 0421 0422 0434 0449
0452 0453 0454 0458 0460 0461 0462
0464 0466 0471 0477 0490 0549 0603
0623 0632 0640 0646
ABSORPTION
0017

PHOTOPERIOD
0467 0508 0549 0623

PHOTOSYNTHESIS
0007 0211 0214 0427 0428

PHYLLOPHAGA
0479

PHYLLOSTICTA
RESISTANCE
0617
SYMPTOMATOLOGY
0071

PHYSIOLOGY
0007 0008 0017 0018 0019 0033 0056
0064 0101 0131 0132 0174 0206 0209
0213 0214 0216 0231 0232 0237 0242
0247 0248 0364 0370 0429 0432 0441
0443 0445 0451 0452 0460 0468 0548
0576 0579 0587 0589 0616 0617 0654

PHYTOPHTHORA
0084 0237 0270 0622 0632

PHYTOPHTHORA DRECHSLERI
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

PHYTOSEIULUS MACROPILIS
0533

PIGLETS
0585

PLANT ASSIMILATION
0212 0216

PLANT FERTILITY
0568

PLANT GEOGRAPHY
0035 0090 0116 0146 0166 0167 0208
0425 0426 0550 0561 0594 0627 0632

PLANT GROWTH SUBSTANCES
0009 0174 0430 0432 0435 0437 0438
0442 0502 0548 0616

PLANT HEIGHT
0007 0033 0034 0036 0038 0043 0101
0102 0104 0196 0227 0234 0249 0250
0295 0429 0436 0442 0443 0462 0490
0509 0545 0553 0554 0651

PLANT PHYSIOLOGICAL PROCESSES
0007 0211 0212 0214 0216 0232 0427
0428 0454 0460

PLANT PIGMENTS
0651

PLANT REPRODUCTION
0102 0108 0110 0206 0285 0546 0566
0569

PLANT RESPIRATION
0211

PLANT TISSUES
0002 0013 0066 0217 0433 0454 0477
MORPHOGENESIS
0445
TISSUE CULTURE
0008 0174 0290 0438 0440 0445 0481
0508 0511 0565

PLANTING
0014 0030 0033 0046 0048 0239 0244
0260 0360 0475 0549 0646
COSTS
0022 0107 0172 0175 0181 0182 0183
0195 0203 0237 0289 0362 0364 0370
0376 0462 0632
LABOUR
0175 0181 0203 0391
MECHANIZATION
0031 0179 0184 0237 0243 0382
ROOT PRODUCTIVITY
0022 0023 0026 0036 0037 0041 0042
0043 0044 0045 0049 0050 0083 0102
0107 0167 0174 0182 0199 0200 0201
0204 0214 0235 0242 0243 0249 0289
0294 0298 0362 0370 0382 0462 0463
0477 0489 0632 0648 0650 0651
SPACING
0007 0023 0026 0032 0034 0035 0041
0050 0102 0107 0167 0174 0175 0181
0182 0183 0196 0200 0204 0234 0241
0242 0245 0246 0249 0289 0298 0364
0370 0371 0376 0382 0422 0423 0462
0463 0465 0477 0632 0648 0651

PLOUGHING
0237 0238 0371

POLLEN
0004 0105 0110 0206 0546 0567 0568
0569

POLLINATION
0102 0105 0108 0110 0206 0285 0364
0546 0566 0569

POLYPLOIDY
0546

POSTHARVEST LOSSES
0160 0251 0296 0384 0403

POSTHARVEST TECHNOLOGY
0496

POTASSIUM
0007 0014 0018 0019 0020 0021 0023
0025 0026 0028 0033 0036 0042 0043
0049 0050 0068 0107 0174 0183 0196
0197 0198 0199 0202 0203 0204 0226
0229 0230 0233 0235 0239 0241 0243
0246 0247 0289 0294 0298 0327 0360
0364 0370 0382 0397 0401 0419 0421
0422 0434 0449 0453 0454 0458 0462
0464 0466 0471 0477 0490 0623 0632
0640 0646

POTATOES
0113 0186 0187 0324 0389 0571 0608

POULTRY
0121 0123 0126 0129 0184 0316 0358
0580 0586

POWER SOURCES
0176 0331 0333 0643

PRESSING
0117 0118 0147 0165 0333 0335 0341
0347 0618

PRICES
0022 0098 0142 0143 0147 0162 0163
0165 0166 0176 0177 0181 0182 0185
0187 0189 0191 0192 0194 0198 0203
0297 0333 0337 0338 0347 0353 0356
0357 0374 0376 0377 0381 0383 0384
0390 0392 0393 0394 0398 0401 0404
0407 0410 0413 0414 0415 0417 0618
0619 0620 0621 0622 0625 0626 0628
0632 0635 0640 0642 0644 0645 0650

PROCESSING
0030 0114 0124 0136 0142 0145 0146
0146 0148 0156 0166 0178 0183 0193
0253 0318 0320 0326 0331 0331 0337
0338 0344 0352 0353 0364 0366 0368
0372 0373 0380 0385 0386 0393 0394
0395 0398 0402 0407 0413 0414 0415
0416 0418 0426 0548 0590 0592 0594
0595 0598 0599 0604 0616 0621 0624
0634 0635 0638 0643 0644 0646 0653
BOILING
0328 0340
DRYING
0031 0117 0118 0119 0131 0132 0135
0137 0141 0143 0144 0147 0149 0152
0153 0165 0171 0184 0251 0252 0317
0330 0334 0335 0340 0341 0342 0347
0376 0379 0409 0574 0576 0587 0601
0602 0614 0617 0618 0629 0641 0642

FERMENTATION
0118 0122 0141 0143 0144 0157 0171
0174 0328 0333 0335 0341 0342 0345
0376 0403 0602 0606 0607 0608
GELATINIZATION
0138 0151 0323 0324 0330 0333 0342
0591
GRINDING
0117 0135 0144 0165 0330 0333 0333
FEELING
0118 0135 0141 0143 0144 0147 0171
0252 0328 0333 0334 0335 0340 0341
0342 0347 0376 0602
PRESSING
0117 0118 0147 0165 0333 0335 0341
0347 0618
RASPING
0118 0141 0143 0144 0147 0165 0171
0328 0330 0333 0335 0336 0347 0376
0379 0601 0602 0618
SCREENING
0118 0141 0143 0144 0147 0165 0171
0330 0334 0335 0340 0341 0347 0376
0601 0618
SILTING
0143 0144 0165 0171 0330 0376 0601
STEEPING
0251 0328 0340 0379 0389 0574
WASHING
0118 0122 0135 0141 0143 0144 0147
0165 0171 0252 0328 0330 0334 0335
0341 0347 0376 0601 0602 0618

PROPAGATION
0030 0031 0106 0167 0237 0426 0436
0465 0468 0469 0471 0472 0474 0480
0481 0482 0483 0484 0486 0557 0617
0633

PROPAGATION MATERIALS
0007 0013 0014 0015 0018 0022 0023
0028 0031 0033 0034 0036 0038 0041
0048 0050 0058 0059 0078 0082 0094
0102 0105 0106 0108 0167 0168 0172
0174 0181 0182 0183 0193 0203 0204
0206 0209 0235 0237 0239 0241 0242
0245 0246 0247 0248 0249 0265 0285
0289 0290 0294 0298 0359 0360 0364
0370 0382 0384 0397 0401 0431 0433
0434 0436 0465 0468 0469 0471 0472
0473 0474 0475 0476 0477 0478 0479
0480 0481 0482 0483 0486 0492 0500
0502 0507 0508 0547 0549 0550 0557
0558 0566 0613 0617 0632 0640 0646

PROTEIN CONTENT
0012 0113 0114 0121 0135 0157 0220
0300 0306 0311 0312 0313 0323 0324
0349 0358 0423 0447 0450

LEAVES
0014 0015 0219 0310 0316 0509 0636
ROOTS
0015 0122 0126 0146 0310 0603
STEMS
0015 0219

PROTEIN ENRICHMENT
0252
ECONOMICS
0118
FERMENTATION
0118 0174 0328 0403 0607

PROTEINS
ANALYSIS
0131
DIETARY VALUE
0314

PRUNING
0050 0167 0241 0254 0359 0362 0364
0370 0443 0483 0651
DETERIORATION
0057

PSEUDOCOCCUS MANDIO
0531

PSEUDOMONAS
0174
DISEASE CONTROL
0499
RESISTANCE
0297
SYMPTOMATOLOGY
0071 0499

PUERTO RICO
0284

QUARANTINE MEASURES
0060 0497 0507 0617

RAINFALL DATA
0007 0024 0027 0029 0033 0034 0036
0038 0043 0048 0049 0058 0059 0060
0078 0102 0167 0182 0183 0196 0203
0213 0220 0232 0235 0236 0237 0255
0260 0267 0353 0355 0382 0419 0459
0462 0467 0538 0547 0549 0620 0640

RASPING
0118 0141 0143 0144 0147 0165 0171
0328 0330 0333 0335 0336 0347 0376
0379 0601 0602 0618

RESISTANCE
0051 0543 0550
DISEASES AND PATHOGENS
0003 0026 0256 0260 0285 0288 0289
0296 0486 0500 0502 0503 0551 0553
0559 0562 0617 0636
INJURIOUS INSECTS
0085 0089 0090 0103 0288 0289 0516
0544 0617
INJURIOUS MITES
0085 0089 0288 0297 0562 0617

RHIZOBIUM
0451

RHIZOPUS STOLONIFER
0211 0212 0214 0216 0232

ROOT CROPS
0040 0045 0148 0238 0245 0251 0380
0403 0405

ROOT DEVELOPMENT
0174 0209 0247

ROOT PRODUCTIVITY
0018 0020 0022 0023 0026 0036 0037
0041 0042 0043 0044 0045 0049 0050
0060 0072 0073 0083 0098 0102 0103
0104 0107 0109 0147 0167 0174 0182
0197 0198 0199 0200 0201 0202 0204
0213 0214 0215 0227 0228 0229 0230
0232 0233 0235 0238 0242 0243 0247
0248 0249 0250 0284 0285 0286 0287
0289 0291 0293 0294 0295 0296 0298
0359 0362 0370 0378 0382 0389 0397
0401 0406 0419 0420 0436 0442 0443
0455 0456 0457 0458 0459 0462 0463
0466 0468 0470 0474 0477 0482 0485
0487 0488 0489 0490 0536 0547 0548
0550 0551 0553 0554 0556 0558 0563
0564 0583 0616 0622 0623 0627 0630
0632 0640 0648 0649 0650 0651

ROOTING
0435 0445 0469

ROOTS
ANALYSIS
0001 0015 0016 0051 0056 0057 0112
0131 0132 0221 0224 0430 0493 0502
0550 0617
BIOCHEMISTRY
0056 0174 0224
DETERIORATION
0052 0053 0054 0055 0057 0116 0146
0174 0494 0496 0617 0626
DIETARY VALUE
0126 0574
DRY MATTER
0033 0043 0103 0107 0126 0215 0254
0429 0431 0441 0443 0462 0477 0494
0496 0542 0651
DRYING
0131 0132 0165 0185 0408 0574 0587
0603 0617
FAT CONTENT
0122 0126 0310 0603
GROWTH
0007 0019 0174 0206 0209 0370 0429
HCN CONTENT
0015 0131 0132 0217 0221 0310 0587
0603 0651
NUTRITIVE VALUE
0122
PACKAGING
0165
PLANT ANATOMY
0001 0007 0015 0016 0019 0033 0043
0051 0052 0053 0054 0055 0056 0057
0077 0084 0101 0102 0103 0107 0112
0116 0122 0126 0128 0131 0132 0134
0146 0165 0167 0174 0183 0185 0206
0207 0209 0215 0217 0221 0224 0249
0254 0293 0310 0326 0327 0329 0370
0380 0384 0408 0429 0430 0431 0441
0442 0443 0449 0462 0477 0491 0493
0496 0502 0531 0542 0545 0548 0550
0574 0587 0603 0616 0617 0626 0651
PLANT PHYSIOLOGY
0007 0019 0033 0056 0101 0174 0206
0209 0370 0429 0441 0443 0548 0616
PRODUCTION
0055 0165 0380 0384 0408 0574
SILAGE
0310 0603
STARCH CONTENT
0052 0053 0103 0254 0462 0477 0494
0496
STORAGE
0051 0054 0055 0057 0112 0116 0146
0165 0167 0174 0183 0185 0249 0310
0370 0370 0380 0384 0408 0408 0548
0550 0616 0617 0626
SUGAR CONTENT
0494 0496
TRADE
0116 0165 0185

ROSELLINIA
0167 0237 0370 0479
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

ROTATIONAL CROPS
0026 0167 0235 0338 0362 0365 0370
0384 0463 0623
MAIZE
0200 0424

RWANDA
0446 0467 0480 0503 0532 0558 0633
0648 0649
PRODUCTION
0482 0574 0627

SAISSETIA NIGRA
0183 0237 0507
INSECT CONTROL
BIOLOGICAL CONTROL
0276
INSECTICIDES
0479

SALINITY
0174 0434 0454 0548 0616

SCLEROTIUM ROLFSII
0237 0364 0370 0479
DISEASE CONTROL
0240 0502
INOCULATION
0502
RESISTANCE
0502
SYMPTOMATOLOGY
0502

SEED
0009 0102 0108 0206 0209 0290 0480
0507 0550 0558
COMPOSITION
0285 0557
GERMINATION
0105 0285 0566

SENEGAL
0076

SHADING
0556 0651

SHEEP
0305

SHIFTING CULTIVATION
0176

SHOOTS
0050 0247 0250 0255 0265 0431 0436
0441 0469

SILAGE
0310 0313 0314 0603 0611

SILBA PENDULA
0167 0237 0523
INSECT CONTROL
BIOLOGICAL CONTROL
0276 0370
INSECTICIDES
0370 0632

SILKWORM
0583

SILTING
0143 0144 0165 0171 0330 0376 0601

SIMULATION MODELS
0529

SOCIOECONOMIC ASPECTS
0147 0162 0168 0169 0171 0172 0173
0175 0176 0178 0180 0185 0198 0203
0320 0340 0347 0350 0354 0355 0356
0360 0361 0362 0373 0375 0378 0382
0384 0396 0401 0402 0407 0409 0594
0615 0618 0619 0620 0622 0640 0642
0644 0645 0653

SODIUM
0306 0307 0309 0311 0390 0449

SOIL AMENDMENTS
0019 0174 0327 0455 0464

SOIL ANALYSIS
0014 0015 0018 0019 0020 0028 0029
0033 0056 0078 0102 0167 0196 0227
0229 0287 0327 0329 0378 0419 0453
0454 0456 0462 0463 0466 0623

SOIL CONSERVATION PRACTICES
0024 0026 0242 0420 0467 0475 0648

SOIL FERTILITY
0023 0042 0181 0242 0453 0549 0549
0622 0648

SOIL IMPOVERISHMENT
0025

SOIL PHYSICAL PROPERTIES
0007 0014 0017 0018 0019 0020 0023
0024 0026 0028 0029 0033 0034 0036
0045 0048 0049 0078 0102 0167 0182
0196 0220 0227 0235 0237 0239 0241
0287 0297 0355 0382 0452 0453 0454
0457 0462 0463 0529 0611 0646

SOIL REQUIREMENTS
0019 0042 0174 0181 0183 0241 0242
0327 0453 0455 0464 0467 0549 0556

SOIL WATER
0007

SOLAR DRYING
0119 0127 0131 0132 0141 0144 0149
0152 0152 0153 0219 0252 0334 0395
0408 0409 0576 0577 0587 0614 0615
0629 0641 0642

SOLAR RADIATION
0623

SOLUBLE CARBOHYDRATES
0052 0053

SOUTH AFRICA
0430
MARKETING
0611

SOYBEANS
0423 0623 0648 0649 0650

SPHACELOMA MANIHOTICOLA
0237 0370 0555
DISEASE CONTROL
0502
INOCULATION
0502
RESISTANCE
0260 0289 0296 0502 0617
SYMPTOMATOLOGY
0071 0502

SRI LANKA
PRODUCTION
0377

STAMENS
0004 0105 0108 0110 0546 0567 0569

STARCH CONTENT
0002 0028 0045 0052 0053 0083 0103
0104 0114 0135 0144 0220 0223 0229
0247 0248 0254 0285 0287 0291 0295
0298 0349 0376 0409 0447 0448 0456
0457 0462 0466 0477 0485 0494 0496
0553 0554 0560 0564 0583 0585

STARCH PRODUCTIVITY
0295
CLIMATIC REQUIREMENT
0199
CULTIVARS
0045 0104 0229
FERTILIZERS
0230
HARVESTING
0104
TIMING
0230

STATISTICAL ANALYSIS
0015 0017 0018 0033 0034 0036 0048
0051 0052 0053 0082 0087 0101 0102
0104 0127 0130 0131 0132 0139 0152
0152 0168 0174 0187 0196 0197 0199
0203 0207 0210 0218 0249 0299 0317
0321 0334 0462 0536 0541 0545 0570
0586 0588 0603 0652

STATISTICAL DATA
0101 0152 0152 0187 0203 0410 0482
0614 0627

STEEPING
0251 0328 0340 0379 0389 0574

STEMS
0036 0041 0043 0196 0207 0215 0249
0293 0473 0512 0542
ANALYSIS
0015 0226
HCN CONTENT
0015 0217 0219 0651
PLANT DEVELOPMENT
0007 0033 0206 0209 0247 0248 0443

STOMATA
0005 0007 0211 0212 0216 0427 0428

STORAGE
0008 0036 0051 0052 0053 0054 0055
0057 0112 0116 0118 0141 0144 0146
0147 0165 0167 0174 0182 0183 0185
0203 0235 0237 0241 0242 0249 0251
0252 0253 0254 0289 0292 0301 0302
0306 0307 0308 0309 0310 0311 0313
0315 0316 0328 0330 0335 0353 0359
0370 0370 0376 0380 0381 0383 0384
0385 0390 0392 0401 0404 0407 0408
0408 0409 0410 0414 0417 0439 0445
0463 0471 0478 0479 0484 0491 0492
0496 0548 0550 0565 0569 0616 0617
0618 0626 0632 0645

SULPHUR
0033 0174 0183 0246 0454 0456

SURINAM
0080 0096 0281

SWEDEN
0654

SWEET CASSAVA
0010 0015 0016 0077 0084 0146 0169
0207 0217 0237 0337 0338 0404 0407
0426 0446 0574

ROOT PRODUCTIVITY
0102 0554 0558 0627 0632 0648
STARCH CONTENT
0002

SWEET POTATOES
0012 0040 0044 0113 0238 0245 0343
0389 0608

SWINE
0121 0123 0127 0176 0184 0304 0314
0357 0358 0584 0585
FATTENING
0130 0306 0315
LEAVES
0310
PELLETS
0581
ROOTS
0122 0128 0131 0132 0310 0587

SYMPTOMATOLOGY
DISEASES AND PATHOGENS
0058 0059 0060 0061 0067 0068 0071
0073 0263 0499 0500 0502 0508 0510
0512

TAIWAN
0071 0298
MARKETING
0176
PRODUCTION
0371 0608
SOCIOECONOMIC ASPECTS
0176
TRADE
0176

TANZANIA
MARKETING
0191
PRODUCTION
0191 0337
TRADE
0191

TAPIOCA MACARONI
0183

TAPIOCA PEARLS
0410

TAPIOCAS
0164
CONSUMPTION
0365
DRYING
0171 0330 0379
INDUSTRIAL MACHINERY
0318
INDUSTRIALIZATION
0171 0176 0318 0379 0407
LEGAL ASPECTS
0176
NUTRITIVE VALUE
0171
PROCESSING
0171 0183 0318 0330 0368 0379 0380
0394 0398 0407 0595
STORAGE
0183 0330 0380 0407 0410
TRADE
0171 0176 0365 0398
USES
0171 0183 0318 0330 0365 0368 0379
0380 0394 0407 0410 0595

TAXONOMY
0206 0207 0237 0259

TECHNOLOGY
0172 0173 0178 0185 0290 0326 0331
0350 0395 0396 0399 0416 0614 0626
TECHNOLOGICAL PACKAG
0055 0143 0181 0292 0294 0378 0384
0397
TECHNOLOGY EVALUATIO
0143 0168 0171 0378

TECHNOLOGY TRANSFER
0614 0626

TEMPERATURE
0007 0009 0013 0020 0029 0033 0034
0036 0038 0048 0049 0060 0069 0078
0081 0087 0088 0102 0152 0152 0153
0157 0167 0182 0183 0216 0220 0232
0271 0353 0355 0382 0438 0439 0445
0459 0462 0467 0469 0508 0527 0540
0547 0549 0565 0569 0623

TETRANYCHUS
0465 0544

TETRANYCHUS CINNABARINUS
0098 0174 0379 0507 0535 0616
INSECT CONTROL
0246

TETRANYCHUS LAMBI
0533 0534

TETRANYCHUS MARIANAE
0533 0534

TETRANYCHUS NEOCALEDONICUS
0098 0534
INSECT CONTROL
0246

TETRANYCHUS URTICAE
0007 0167 0203 0237 0374 0384 0401
0534 0640 0646
INSECT CONTROL
BIOLOGICAL CONTROL
0370
INSECTICIDES
0370 0632

TEXTILES
0143 0144 0414 0647

THAILAND
0231 0308
GERMPLASM
0235
MARKETING
0163 0194 0385 0404 0414 0417 0631
0647
PRODUCTION
0163 0385 0404 0408 0414 0417 0625
TRADE
0163 0367 0385 0404 0414 0417 0647

THIOCYANATES
0132 0575 0576 0577 0578 0579 0654

THRIPS
0007 0167 0174 0497 0507 0537 0548
0616
INSECT CONTROL
BIOLOGICAL CONTROL
0079 0276 0370
INSECTICIDES
0079 0289 0370 0479 0536 0632
RESISTANCE
0289 0544

TISSUE CULTURE
0008 0009 0030 0031 0045 0108 0174
0290 0432 0435 0437 0438 0440 0444
0445 0481 0508 0511 0546 0547 0548
0550 0565 0611 0616 0617

TOGO
0076 0095
MARKETING
0385 0394
PRODUCTION
0385 0394
TRADE
0385

TONGA
0447

TOXICITY
0077 0116 0119 0120 0167 0171 0174
0303 0310 0342 0408 0409 0589 0590
0594

TOXICOLOGY
0338 0575 0576 0577 0578 0579

TRADE
0166 0186 0187 0188 0194 0348 0357
0367 0399 0405 0621 0625 0631 0645
CASSAVA CHIPS
0116 0163 0165 0171 0185 0193 0364
0365 0381 0383 0385 0404 0409 0414
0417 0612 0635 0647
CASSAVA FLOUR
0163 0165 0176 0185 0191 0365 0385
0398 0404 0417 0612
CASSAVA MEAL
0163 0165 0185 0385
CASSAVA STARCH
0142 0144 0161 0165 0171 0176 0192
0193 0364 0365 0374 0381 0383 0385
0390 0398 0404 0414 0416 0592 0612
0620 0647
GARI
0171 0193 0385 0416
PELLETS
0116 0161 0163 0171 0383 0385 0404
0409 0414 0417 0620 0635 0647
ROOTS
0116 0165 0185
TAPIOCAS
0171 0176 0365 0398

TRANSPIRATION
0007 0211 0212 0216 0232 0428

TRINIDAD TOBAGO
0096

UNASPIS CITRI
0465

UNITED KINGDOM
0010 0056 0253 0262 0266 0311 0513
0572 0586

UROMYCES MANIHOTIS
0259 0370

USA
0007 0045 0137 0139 0159 0303 0449
0488 0589 0590 0605

VASCULAR STREAKING
0174 0254

VATIGA ILLUDENS
0544 0632

VATIGA MANIHOTAE
0544 0632

VENEZUELA
0001 0002 0003 0004 0005 0039 0117
0129 0145 0150 0151 0279 0305 0322
0436 0437 0440 0485 0500 0557 0652
MARKETING
0147 0347 0618
PRODUCTION
0147 0237 0347 0618
SOCIOECONOMIC ASPECTS
0147 0347 0618
TRADE
0186 0187

VIETNAM
0578

VISCOSITY
0570
CASSAVA STARCH
0137 0321 0323 0324 0325

VITAMIN A
0115 0349

VITAMIN CONTENT
0035 0115 0167 0349

WASTE UTILIZATION
0126 0136 0163 0183 0342 0376 0381
0410 0601

WASTES
0136 0156 0353 0401 0601

WATER CONTENT
0012 0152 0152 0218 0447 0478
CASSAVA CHIPS
0153 0409
CASSAVA FLOUR
0300 0570
CASSAVA MEAL
0122 0157 0306 0310 0334
CASSAVA STARCH
0324 0325
GARI
0118 0302
LEAVES
0014 0310
ROOTS
0052 0053 0122 0310

WATER REQUIREMENTS (PLANT)
0007 0167 0212 0242 0427 0428 0434
0463 0527 0549 0623

WATER REQUIREMENTS (PROCESSING)
0144 0333 0353 0372 0376 0601

WATER STRESS
0007 0014 0103 0211 0520

WEEDING
0007 0023 0026 0027 0033 0034 0036
0037 0068 0107 0167 0168 0172 0179
0182 0183 0195 0200 0204 0228 0237
0240 0243 0244 0289 0362 0363 0364
0370 0376 0382 0391 0401 0419 0463
0549 0613 0632 0643 0644 0646
HOEING
0022 0040 0235 0250

WEEDS
0022 0033 0037 0237 0243 0250 0329

XANTHOMONAS CAMPESTRIS PV. CASSAVAE
0063 0497 0498
DISEASE CONTROL
0058 0059 0060 0499 0503 0633
DISEASE TRANSMISSION
0060
RESISTANCE
0503
SYMPTOMATOLOGY
0058 0059 0060 0499

XANTHOMONAS CAMPESTRIS PV. MANIHOTIS
0062 0064 0065 0066 0167 0183 0203
0235 0237 0255 0257 0364 0370 0374
0379 0384 0401 0498 0507 0555 0632
0640 0646
DISEASE CONTROL
0058 0060 0240
DISEASE TRANSMISSION
0060
INOCULATION
0026 0061
RESISTANCE
0026 0256 0285 0288 0296 0297 0486
0500 0617 0636
SYMPTOMATOLOGY
0058 0060 0071

YAMS
0012 0040 0075 0245 0389 0572

ZAIRE
0029 0071 0080 0096 0265 0470 0484
MARKETING
0622
SOCIOECONOMIC ASPECTS
0354

ZIMBABWE
0522

ZINC
0012 0017 0018 0020 0048 0183 0235
0237 0240 0246 0255 0256 0257 0285
0288 0296 0297 0364 0370 0374 0379
0384 0401 0449 0454

ZONOCERUS VARIEGATUS
0273 0380
RESISTANCE
0085

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