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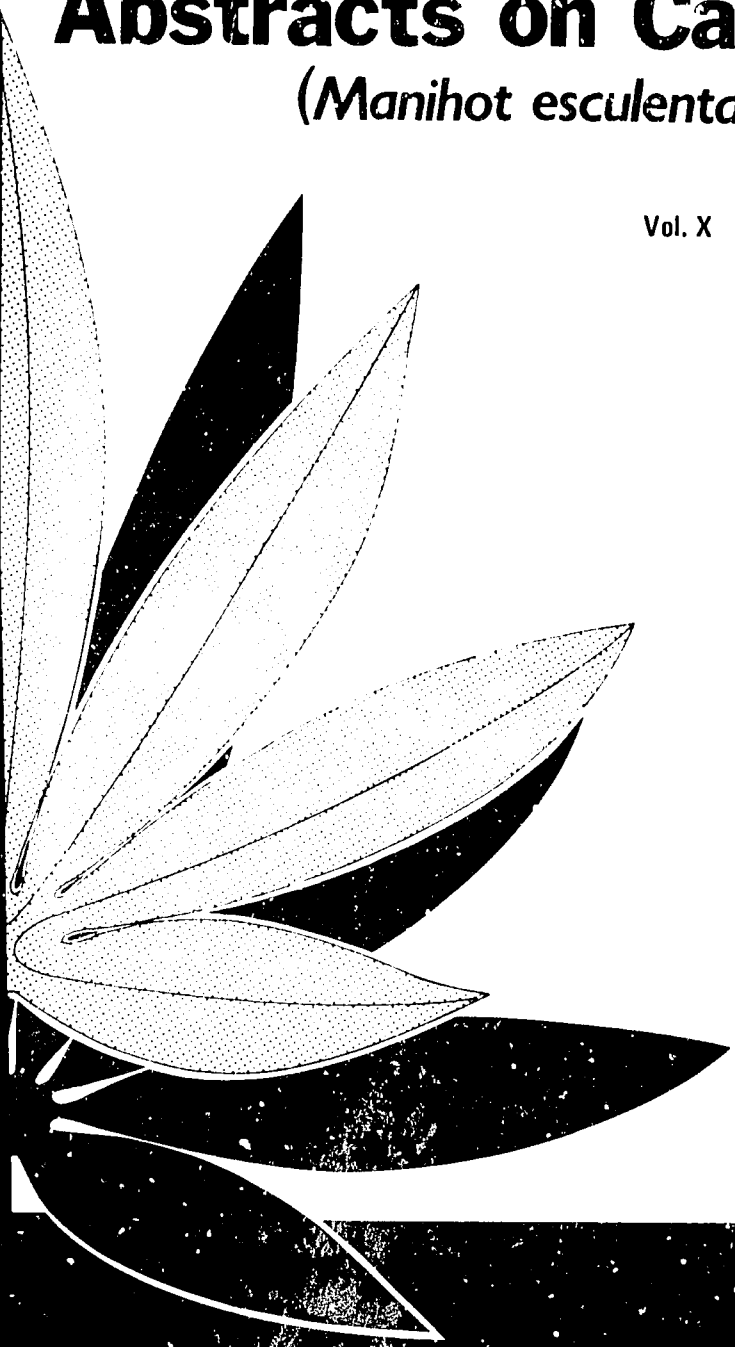
Abstracts on Cassava
(*Manihot esculenta* Crantz)

Vol. X No. 2 August, 1984



Centro Internacional de Agricultura Tropical

ABSTRACTS ON CASSAVA

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Vol. X No. 2 August, 1984

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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

Accession number (for photocopy requests)

Authors

Sequential number in the journal (for use of indexes)

Year of publication

Original title

Author address

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]

Additional notes

Source

Pages

Language of paper

Language of summary

Keywords

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

Abstract

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 (Author's summary) 102

Abstractor and/or translator

Subject categories

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.

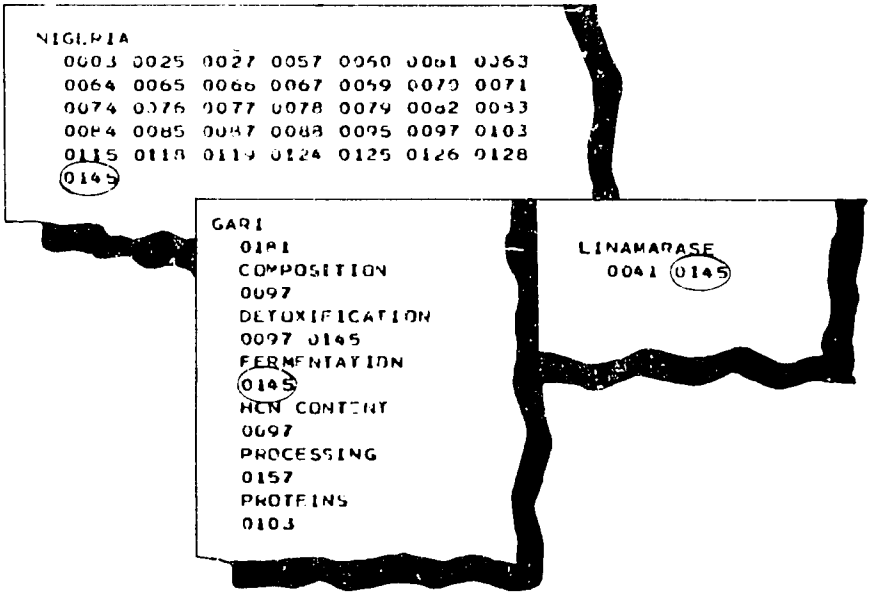
The last issue of the year contains cumulative author and subject indexes for the year.

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

0195

20111 SILVA, P.H.S. DA; PEREIRA FILHO, J.E.; RIBEIRO, J.L.; SILVA, V.V. DA 1981. Alguns caracteres botanicos de 23 cultivares de mandioca (Manihot esculenta Crantz) no Piauí. (Some botanical characteristics of 23 cassava cultivars in Piauí). In Seminario de Pesquisa Agropecuária do Piauí, 2o., Teresina-PI, Brasil, 1980. Anais. Teresina, Unidade de Execucao de Pesquisa de Ambito Estadual de Teresina. pp.99-104. Port., Sum. Port., 8 Refs. [Unidade de Execucao de Pesquisa de Ambito Estadual de Teresina, Caixa Postal 01, 64.000 Teresina-PI, Brasil]

Cassava. Plant anatomy. Roots. Cortex. Starch content. Plant height. Timing. Cultivars. Brazil.

An expt. was carried out at the headquarters of the Unidade de Execucao de Pesquisa de Ambito Estadual in Teresina (Piauí, Brazil) in 1978 to differentiate 23 cassava cv. Each cv. was planted on 500 m^2 (spaced at 1 x 6 m), 1 cutting/site, without fertilization, on sandy, red-yellow podzolic soil. DM and starch contents, av. height of plants at 6 and 12 mo., and the color of the cortex, phelloderm, and pulp were determined. The ease of separation of the subereous film was also determined by rubbing roots in a tank filled with water at room temp. Cv. Rio Grande, Engana Ladrao, Macaxeira Preta, and Sutinga had industrial characteristics (more than 30% starch and easy separation of subereous film). Cv. Olho de Peixe had characteristics necessary for table use: brown-colored subereous film, purple cortex, and white pulp. In white-pulped cv. it was easier to detach the subereous film than in brown-pulped cv. (Summary by I.B. Trans. by L.M.F.) A00

See also 0217 0289

B00 PLANT ANATOMY AND MORPHOLOGY

0196

20180 SILVA, S. DE O. F 1981. Estudo comparativo de cultivares de mandioca com o mesmo nome comum. (Comparative study of cassava cultivars with the same common name). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Boletim de Pesquisa no.05. 16p. Port., 14 Refs. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cultivars. Identification. Plant anatomy. Roots. Leaves. Stems. Petioles. Flowers. Fruits. Root system. Harvest index. Mycoses. Cercospora henningsii. Cercospora vicosae. Injurious insects. Injurious mites. Resistance. Brazil.

A botanical-agronomic study of 54 cassava cv. selected from a total of 288 and with the same common name was conducted to identify possible differences among them. The trial was established in 1977-78 on meseta soils and fertilizers (80 kg urea and 200 kg simple superphosphate/ha) were applied. Forty-one characteristics were studied and of these, 17 were used, among principal and secondary ones, to compare the groups. In 1979-80 the 54 cv. were planted at the same site and a comparative morphological study was carried out. The following names designate different cv.: Aipim Batata (2 groups of cv.), Aipinzinho (2), Branquinha

(2), Jacare (2), Jacobina (2), Mangue (3), Manteiga (2), Milagrosa (2), Palmeira Preta (2), Pretinha (3), Riqueza (2), Roxinha (2), Santa Catarina (2), Sao Joao (3), Saracura (3), Var. 15 (2). Cv. from the groups Aipim Grande, Bom Jardin, Boticuda, Cambraia, Cidade Branca, Clon 448-54-1, IAC 5-5, Mangue (Mangue I), Prissi, and Sutinga were not differentiated. The differential characteristics studied in literature are briefly reviewed. (Summary by I.B. Trans. by L.M.F.) B00

See also 0236 0283

C00 PLANT PHYSIOLOGY

0197

20134 BAJAJ, Y.P.S. 1983. Cassava plants from meristem cultures freeze-preserved for three years. Field Crops Research 7:161-167. Engl., Sum. Engl., 12 Refs., Illus. [Tissue Culture Laboratory, Punjab Agricultural Univ., Ludhiana, Punjab, India]

Cassava. Tissue culture. Apical meristems. Cryopreservation. Timing. Culture media. Growth. Germplasm. Storage. India.

Complete cassava plants and callus tissues were obtained from excised meristems freeze-preserved in liquid N (-196°C) for 3 yr. These plants were successfully established in the soil and grown to maturity. A combination of 5% each of dimethylsulfoxide, sucrose, and glycerol, used as a cryoprotectant, proved superior to any of these chemicals used singly. Cryopreservation of meristems is a novel approach to the conservation and international exchange of germplasm of vegetatively propagated crops. This method would obviate the necessity of the regular multiplication and maintenance of stocks in nurseries, and would also prevent the loss of germplasm from the inherent hazards of pathogens and pests. (Author's summary) C00

0198

18434 BAJAJ, Y.P.S. 1978. In vitro clonal propagation of cassava. Current Science 47(24):971-972. Engl., 9 Refs., Illus.

Cassava. Plant tissues. Apical meristems. Propagation. Laboratory experiments. Culture media. India.

An in vitro method for the clonal propagation of cassava plants from 1-cm stem segments, buds from cuttings 6-8 days after planting, and meristem tips (0.5-1.5 mm) from excised buds is summarized. Cuttings from cassava cv. M-4, 10 cm long, were planted in pots and the buds and segments from the young shoots were surfaced sterilized with 12% solution of Clorox for 15-20 min and washed with sterilized water. The cultures were developed on agar solidified modified Murashige and Skoog's and White's media, supplemented with various concn. of IAA, NAA, 2,4-D, GA, and kinetin. The addition of IAA (1 mg/l) + kinetin (0.1 mg/l) stimulated the formation of clusters of roots while the addition of 2,4-D induced a mass of callus. In general, the segments taken from the shoot tip showed better growth and regeneration compared with ones taken from the basal portion. On Murashige and Skoog's medium containing NAA (1 mg/l) + kinetin (0.2 mg/l) + GA (0.5 mg/l) callus formation was induced at the cut end of the segments and on the base of the bud and meristem. It is suggested that meristem tips be used as a source of primary inoculum, while the segments of young shoots be employed for large-scale clonal multiplication. In vitro propagation would also facilitate the international exchange of material by eliminating quarantine inspection. (Summary by I.B. Trans. by L.M.F.) C00

0199

19544 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Tissue culture: cassava. In _____. Annual Report 1982. Ibadan, Nigeria. pp.113-114. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Tissue culture. Nigeria.

Research work carried out by the tissue culture unit of the International Institute of Tropical Agriculture during 1982 is briefly reported. Regarding cassava, the major focus was meristem culture for elimination of diseases and international distribution of material. Six var. with resistance to the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa) were successfully regenerated by the meristem culture method in combination with thermotherapy. In Ibadan (1982) 4 cassava var. regenerated from meristem culture in 1981 were indexed and then certified. These var. carry sources of resistance to the mealybug and the green spider mite and are low in cyanide content. These and the 8 var. previously certified are now available for distribution. A total of 26 consignments of disease-free cassava in tissue culture form were delivered to 19 countries, 18 of them in Africa. The handling of these materials in recipient countries has improved as a result of a tissue culture training course in 1981. These materials are either being multiplied or are still being evaluated. (Summary by I.B. Trans. by L.M.F.) C00

0200

20173 PALTA, J.A. 1983. Photosynthesis, transpiration, and leaf diffusive conductance of the cassava leaf in response to water stress. Canadian Journal of Botany 61:373-376. Engl., Sum. Engl., Fr., 18 Refs. [School of Agriculture, La Trobe Univ., Bundoora, Victoria 3083, Australia]

Cassava. Photosynthesis. Transpiration. Carbon dioxide. Water stress. Water potential. Leaves. Plant physiology. Colombia.

The effects of short periods of water shortage on the CO_2 and water vapor exchange of attached cassava leaves of var. M Col 72 were measured. Gas-exchange and leaf water potential measurements were made in outdoor grown plants previously subjected to varying periods without water. Leaf water potentials fell to between -0.61 and -1.06 MPa and net photosynthesis and transpiration rates declined as leaf water potential decreased. Estimations of the leaf internal CO_2 conductance indicated that the linear relationship established between leaf water potential and net photosynthesis is dominated by, but not completely explained by, stomatal closure. (Author's summary) C00

0201

20140 TANG, A.F.; CAPPADOCIA, M.; BYRNE, D. 1983. In vitro flowering in cassava (Manihot esculenta Crantz). Plant Cell Tissue Organ Culture 2(3):199-206. Engl., Sum. Engl., 19 Refs., Illus. [International Plant Research Inst., Inc., 830 Bransten Rd., San Carlos, CA 94070, USA]

Cassava. Laboratory experiments. Flowering. Apical meristems. Tissue culture. Culture media. Cultivars. Cytogenetics.

Meristem-derived plantlets of cassava were induced to flower in vitro. Five genotypes out of 13 (M PAN 12A, Secundina, M COL 22, Cerro Azul 3-4, and Cerro Azul SN6) consistently responded to culture conditions giving rise to male or female flowers. Male flowers contained anthers in which meiosis occurred and apparently normal pollen grains were formed. (Author's summary) C00

C01 Plant Development

0202

19542 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Agronomy. In _____. Annual Report 1982. Ibadan, Nigeria. pp.103-105. Engl. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Cuttings. Selection. Germination. Timing. Root development. Root system. Shoots. Root productivity. Photoperiod. Flowering. Cultivars. Nigeria.

The effect of the age of the basal, intermediate, and upper portions of plants and the size of cuttings of cassava cv. TMS 30595 (10, 20, and 30 cm) on tuberization and initial plant growth was studied. A randomized block design was used with 3 replications and anatomical studies were carried out on thin root transections to identify tuberous root initiation. Higher sprouting rate, no. of stems/stand, no. of tuberous roots, tuberous root diameter, and shoot and root dry wt. corresponded to stem cuttings taken from basal portions and having a length of 20 or 30 cm and a diameter of 2-3 cm. The highest tuberous root no. at final harvest, 5.9/plant, was achieved by 30-cm cuttings from basal portions. Tuberization was delayed in plants from upper cuttings (70 days after planting). An expt. was set up to study the effects of daylength on tuberous roots, flowering, and other plant characteristics. Five treatments (8, 12, 16, 8/16, and 16/8 h) were used in early flowering, intermediate, and late flowering var. Early flowering var., 58308 and TMS 30395, produced a significantly larger no. of tuberous roots and higher root wt. under the 8-h daylength. Late flowering var., TMS 50395 and Isunikankiyan, produced more roots under the 8-h and natural (12 h) daylengths; highest root wt. were obtained with natural daylength. The 2 intermediate var. used, TMS 30001 and TMS 30572, were insensitive to daylength. The associations between root yield and 21 important agronomic characters were studied. Root yield had significant and genotypic correlations with the no. of tuberous roots/plant, tuberous root size, stem girth, canopy width, total no. of branches/plant, and plant height at harvest. (Summary by I.B. Trans. by L.M.F.) C01

See also 0220 0221 0222 0228 0237

C03 Chemical Composition, Methodology and Analyses

0203

20185 MAINI, S.B.; LAKSHMI, K.R.; HRISHI, N. 1981. Correlation coefficient & regression equation for dry matter & starch content in different tuber crops. Agricultural Science Digest 1(4):225-226. Engl., Sum. Engl. [Central Tuber Crops Research Inst., Trivandrum-17, Kerala, India]

Cassava. Starch content. Dry matter. Roots. Analysis. India.

A study was undertaken to correlate DM with starch content of 4 tuber crops, cassava, sweet potato, yam, and tannia (*Xanthosoma* sp.). It was shown that DM % have positive correlation with starch % on a fresh wt. basis and that a regression equation can be used to find the % of starch. (Summary by Abstracts on Tropical Agriculture) C03

0204

18436 MUTHUSWAMY, P.; GOVINDASWAMY, M. 1980. Tapioca (Manihot esculenta Crantz) leaf protein. Cheiron 9(6):357-359. Engl., 9 Refs.

Cassava. Leaves. Proteins. Analysis. Protein content. HCN content. India.

The water extractability of cassava leaf protein in a pilot plant is briefly reported and the presence of HCN in the different products determined. Leaves with intact petioles, 100 kg wet wt., from a 10-mo.-old cassava crop were used. The leaves were macerated and the resulting slurry was pressed to remove the protein-rich liquor from the leaf residue. The protein was precipitated with steam and then filtered. Total N content of the leaf and of the leaf protein concentrate (LPC) was estimated. CP content was calculated as N x 6.25 and HCN content by the method of Indira and Sinha (1969). It was observed that nearly 7.0% of the total N present could be extracted in the juice while crushing the macerated leaf with water. The effluent had the highest HCN while LPC on hydrolysis with 2 N HCL only yielded 11.3 ppm. On the other hand, in the absence of linamarase, the glucoside linamarin is not toxic; the accompanying enzyme is probably inactivated by the heat produced by steam precipitation. (Summary by I.B. Trans. by L.M.F.) C03

0205

19996 SANTAMARIA H., E. 1983. Estudio sobre la variación del contenido de ácido cianhídrico, almidón, materia seca, fibra y sabor en la raíz de seis variedades de yuca (Manihot esculenta Crantz) en distintas etapas de desarrollo. (Study of the variation of HCN, starch, dry matter, and fiber contents and root flavor of six cassava varieties at different growth stages). Tesis Químico Agrícola. Orizaba, México, Universidad Veracruzana. 62p. Span., 34 Refs., Illus.

Cassava. Cultivars. HCN content. Starch content. Dry matter. Fibre content. Organoleptic examination. Timing. Roots. Mexico.

The HCN content and toxicity of roots of 6 cassava var. [Cubana, Guaxupe, Criolla, Smalling Santa Cruz, Señora está en la mesa (SEELM), and Itú] were determined at 4 stages of development (7, 9, 11, and 13 mo. of age). DM, starch, and crude fiber contents were also determined as well as the flavor of the roots based on the HCN content and the stage of development. Aspects of root morphology, physiology, ecology, chemical composition and toxicity factors are included, among others. In general, DM and starch contents increased with plant age with values ranging from 24.64 to 36.26% for DM and from 22.04 to 33.74% for starch in the 6 var. Var. SEELM showed the highest values for these 2 parameters and var. Criolla, the lowest. The best crude fiber contents were observed in var. Cubana (1.51, 1.60, 1.60, and 18.4% at 7, 9, 11, and 13 mo., resp.) while Itú showed the lowest value (0.59, 0.63, 0.64, and 0.72%, resp.). The flavor was sweet and slightly sweet in var. Cubana, Criolla, and Itú, while the rest ranged between slightly bitter to slightly sweet according to their age. Best harvesting date was estimated between 9-11 mo. The var. studied can be used for human consumption and for animal feed. (Summary by EDITEC) C03

0206

18934 SCHULTZ, E.; GUTIERREZ, B. 1982. Resultados parciales obtenidos en investigaciones sobre harina y almidón de diferentes variedades de yuca amarga cultivada en Venezuela (Raíces). [Partial results of research on flour and starch of different bitter cassava varieties grown in Venezuela (Roots)]. In Seminario Nacional de Yuca, Maracay, Venezuela,

1980. Revista de la Facultad de Agronomía. Alcance no.31:515-518. Span. [Inst. de Química y Tecnología, Facultad de Agronomía, Univ. Central de Venezuela, Maracay, Venezuela]

Cassava. Cassava flour. Cassava starch. Starch content. Water content. Analysis. Cultivars. Venezuela.

Partial results of research on flour and starch obtained from bitter cassava var. grown in Venezuela are given. The MC and starch content of flour from different cassava var. were determined; flour was dried at temp. of 45, 60, and 100°C for 24 h on air-ventilated stoves. Relative amylose and amylopectin contents were also determined. Var. UCV 2078 and 2221 showed 0% MC at 100°C and did not show significant differences regarding the relative amylose content in starch obtained at different harvest times and at different drying temp. UCV 2106 had the highest MC, 5.78%. Starch content in flour from different cassava var. dried at 60°C was highest in UCV 2112 harvested at 12 mo. (76.66%) and lowest in UCV 2106 harvested also at 12 mo. (67.96%). Fresh cassava starch determined by Hassid's method had a purity of 97.2% and a yield of 65%. Var. 2062 had a starch content of 77.27% at 45°C, 70.15% at 60°C, and 68.40% at 100°C. UCV 2062 and 2106 had the highest % of amylose, 31.72% at a drying temp. of 40°C and harvested at 12 mo. (Summary by I.B. Trans. by L.M.F.) C03

See also 0207 0209 0219 0222 0231 0237 0243 0283 0284 0285 0291 0292 0296 0299 0348

C04 Plant Nutrition

0207

20120 HOWELER, R.H.; CADAVID, L.F. 1983. Accumulation and distribution of dry matter and nutrients during a 12-month growth cycle of cassava. Field Crops Research 7:123-139. Engl., Sum. Engl., 12 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Nutrient uptake. Dry matter. Roots. Leaves. Petioles. Stems. Timing. Plant tissues. Mineral content. Analysis. N. P. K. Ca. Mg. S. B. Cu. Fe. Mn. Zn. Cultivars. Soil analysis. Colombia.

Two cassava cv. were planted in fertilized and nonfertilized plots in CIAT-Quilichao to determine the accumulation and distribution of DM and nutrients in the plant and the effect on soil fertility. At monthly intervals 8 plants were harvested and separated into 4 parts, the upper, middle, and lower thirds of the aerial growth, and the roots, while each aerial part was divided into leaf blades, petioles, and stem. These samples were analyzed for DM and nutrient content. Soil samples were also taken at monthly intervals and analyzed. Results indicated that in cassava DM accumulation was slow during the 1st 2 mo., increased rapidly during the next 4 mo., and slowed down during the final 6 mo. as DM production was partly offset by leaf fall. At harvest (12 mo.) DM was present mainly in roots, followed by stem, leaves, and petioles. Nutrient concn. varied among plant parts and with the age of both the tissue and the plant. The concn. of most nutrients was highest between 2-3 mo. and then declined. Each nutrient had its own particular concn. profile within the plant. Thus, N, P, and S concn. tended to be high in the leaves, while those of K, Ca, and Mg were high in petioles and stem; the Mn concn. was particularly high in petioles, whereas Fe concn. was low in petioles but high in roots. B and Cu were evently distributed within the plant. Most nutrients accumulated initially in leaves and stem, but were translocated to roots in

the latter part of the growth cycle. Only Ca, Mg, and Mn accumulated more in stems than roots. Removal of accumulated nutrients in the root harvest can seriously deplete nutrient reserves in the soil, particularly that of K, and to a lesser extent for N. Soil pH, exchangeable Al, Ca, Mg as well as available P were not greatly affected by plant growth, while exchangeable K decreased markedly during the crop cycle. (Author's summary) C04

0208

20161 HOWELER, R.H. 1983. Análisis del tejido vegetal en el diagnóstico de problemas nutricionales: algunos cultivos tropicales. (Plant tissue analysis to diagnose nutritional problems in some tropical crops). Cali, Colombia, Centro Internacional de Agricultura Tropical. 28p. Span., 23 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Nutritional requirements. Plant tissues. Analysis. Roots. Leaves. Fe. Cu. Mn. Zn. Mg. Dry matter. Timing. N. P. K. Ca. Laboratory experiments. Mineral content. Colombia.

The different steps involved in tissue analysis to diagnose nutritional problems in rice, beans, soybeans, maize, cassava, and pastures and forages are presented. Variations in nutrient contents of different parts of the cassava plant are studied and factors affecting this content are analyzed. The concept of critical level is defined and 3 methods for its determination are indicated. The procedures for sample taking, washing, drying, and preparation are explained. The best sampling method, the critical levels for nutrient concn. and some observations on the interpretation of the results of the analyses are indicated for each crop. In cassava, the critical levels for N, P, K, Ca, Mg, and S are 4.7, 0.3, 1.0, 0.65, 0.27, and 0.24%, resp. The sampling method suggested should be carried out at 3-4 mo. of age or 1 mo. after the onset of rains following summer and the part of the plant to be sampled is the leaf blade of the youngest completely expanded leaves. (Summary by EDITEC. Trans. by L.M.F.) C04

0209

20175 OKEKE, J.E.; EANG, B.T.; OBIGBESAN, G.O. 1983. Effects of fertilizers and plant age on distribution of nutrients in Nigerian cassava (Manihot esculenta). Experimental Agriculture 18(4):403-411. Engl., Sum. Engl., 17 Refs., Illus. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Fertilizers. N. P. K. Nutrient uptake. Leaves. Petioles. Stems. Analysis. Mineral content. Timing. Dry matter. Cultivars. Root productivity. Nigeria.

The effects of soil fertilization and plant age on the nutrient composition of various parts of 5 Nigerian cassava var. were studied to identify suitable index plant tissue(s), sensitive growth stage(s), and optimum nutrient concn., to develop better fertilizer practices for the crop. The 3rd mo. from planting was the most sensitive stage for diagnostic sampling, when N status was best reflected in leaf blades and K in petioles. N and P were most concentrated in leaf blades and least in roots. The largest root yields after 12 mo. were associated with leaf blade analyses of 5% N, 0.4% P, and 2% K at 3 mo. after planting. (Author's summary) C04

0210

20168 SANTOS, Z.G. DOS; TUPINAMBA, F.A. 1983. Clorose das folhas da mandioca. (Chlorosis of cassava leaves). Aracaju-SE, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de

Ambito Estadual de Aracaju. Comunicado Técnico no.12. 6p. Port., Illus. [Unidade de Execucao de Pesquisa de Ambito Estadual de Aracaju, Caixa Postal 44, 49.000 Aracaju-SE, brasil]

Cassava. Leaves. Chlorosis. Nutritional requirements. Mineral deficiencies. Soil analysis. Mn. Mineral content. Soil requirements. Brazil.

A symptom of nutritional deficiency affecting cassava crops in some areas of the state of Sergipe, Brazil, is discussed. It is characterized by interveinal chlorosis of older leaves. To determine its origin, different micronutrients were applied in different affected zones and plant recovery was observed when Mn was applied. In later studies, the relationship between the chlorosis, the nutritional status of the plant, and the soil conditions was established. Chlorosis appears in plants with a leaf Mn content less than 20 ppm. It also occurs in soils with pH values higher than 5.8 and Ca and Ca + Mg levels over 3.8 and 5.2 meq/100 g soil. To control the deficiency it is recommended to use a soil chemical analysis and weekly applications of 0.2% Mn sulphate until symptoms disappear. Three applications is generally enough for a 95% recovery of affected plants. (Summary by EDITEC) C04

D00 CULTIVATION

0211

18997 ANANDAJAYASEKERAM, P. 1982. Farming systems and farming systems research in Morogoro. Summary. In Keswani, C.L.; Ndunguru, B.J., eds. Symposium on Intercropping in Semi-Arid Areas, 2nd., Morogoro, Tanzania, 1980. Proceedings. Ottawa, Canada, International Development Research Centre. IDRC-186e. pp.155-157. Engl., Illus. [Dept. of Rural Economy, Faculty of Agriculture, Forestry & Veterinary Science, Univ. of Dar es Salaam, Morogoro, Tanzania]

Cassava. Cultivation. Tanzania.

The importance of agriculture in the district of Morogoro, Tanzania, is highlighted. There it generates 80% of the foreign exchange earnings and 40% of the gross national product. The recent decline in agricultural productivity is attributed to the single commodity approach toward research and development. Currently research is focussed on the existing farming systems and preliminary analyses indicate that the rainfall distribution is bimodal and that the area lacks adequate transport. The objective of most farmers is to produce sufficient food for the whole year. Major crops are coffee, cocoyam, banana, cassava, maize, pineapple, paddy, beans, pigeon peas, etc. Cassava is grown as a dual-purpose crop, for subsistence and for commercialization, as are cocoyam and banana. Fire is used in land preparation to reduce labor and control pests and diseases. Intercropping is a common method. Fertility is maintained through the bush fallow system. Fertilizers and insecticides are not used. Some small livestock, such as goats, sheep, and poultry, are kept. Family labor is mostly used and land is scarce and scattered. Cash is used for the purchase of seed and for hiring labor. Weather, pests and diseases, and the level of prices create risks. Grain is stored by farmers in their own households. Technologies available in Tanzania will be compared to later identify components for adaptive experimentation. The multidisciplinary approach is essential. A brief discussion is included on the level of acceptance of innovations by farmers (30% yield increase or a cost:benefit ratio of 2.5:4). (Summary by I.B. Trans. by L.M.F.) D00

0212

20195 EMPRESA BRASILEIRA DE ASSISTENCIA TECNICA E EXTENSAO RURAL. 1981. Sistemas de producao para mandioca. Ribeira do Pombal-Bahia. (Cassava production systems. Ribeira do Pombal-Bahia). Ribeira do Pombal-BA, Brasil. Série Sistemas de Producao. Boletim no.296. 33p. Port.

Cassava. Technological package. Cultivation. Brazil.

Two cassava production systems are described developed at a meeting held in 1981 among producers, extension agents, and researchers, in Ribeira do Pombal, Brazil, to recommend new cropping techniques. The 1st is for farmers cultivating areas larger than 10 ha and the 2nd for farmers with less than 10 ha. The description of each system includes: (1) farmer characterization; (2) operations of the system such as land selection, soil preparation, fertilization, planting, cultural and phytosanitary practices, harvesting, crop rotation, and marketing; (3) technical recommendations for max. efficiency of the abovementioned operations. Information on the chemical control of pests, namely, Erinnyis ello, mites, and ants is given. Technical coefficients are presented for each production system. (Summary by EDITEC) DOO

0213

19262 EMPRESA DE ASSISTENCIA TECNICA E EXTENSAO RURAL DO ESTADO DE ALAGOAS. UNIDADE DE EXECUCAO DE PESQUISA DE AMBITO ESTADUAL DE PENEDO. 1981. Sistema de producao para a cultura da mandioca. (Cassava production system). Maceió-AL, Brasil. Série Sistemas de Producao. Boletim no.208. 22p. Port.

Cassava. Cultivation. Technological package. Brazil.

A cassava production system, resulting from a meeting in which researchers, technicians, extension workers, and producers participated, is presented. This production system is exclusive for the state of Alagoas, Brazil. The cassava producer and the cassava growing region are characterized, the latter basically consisting of small family subsistence farms that mainly commercialize surplus cassava in the community marketplace. The area planted to cassava was reduced from 45,000 ha in 1978 to 34,000 ha in 1979-80 possibly due to irregular rainfall and to the focal points of bacteriosis present in cv. with low levels of resistance. The system does not use modern inputs and an av. productivity of 18 t/ha can hopefully be obtained. The system consists of the following operations: land selection, collection of soil samples for analysis, land clearance, soil preparation and conservation, planting (cv., branch selection and collection, branch preparation and conservation, preparation of seed-cuttings, planting distance, sowing), fertilization, cultural practices (weed and phytosanitary control), harvesting, and crop rotation. (Summary by I.B. Trans. by L.M.F.) DOO

0214

18926 LEON C., J.B. 1982. Experiencias en el cultivo de yuca en la Sabana de San Antonio (Estado Trujillo). (Aspects of cassava cultivation in the area of Sabana de San Antonio in the state of Trujillo, Venezuela). In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomía. Alcance no.31:319-322. Span. [Agropecuaria El Yucatal, C.A., Hacien El Ingenio, Distrito Rafael Rangel, Trujillo, Venezuela]

Cassava. Cultivation. Harvesting. Cultivars. Venezuela.

A series of measures employed to overcome some natural problems occurring in bitter cassava cultivation in the region of Sabana de San Antonio, Trujillo, Venezuela, is described. Yields of 20 t roots/ha were achieved by increasing soil pH (3.7-4.2) with applications of 1000 kg 80% agricultural lime/ha. Soil fertility was also enhanced with split applications of the following formulas, 50% at planting and 50% during the crop cycle: 15-15-15, 12-12-17-2, and 13-13-21, all at 500 kg/ha. N deficiency was amended with 46% urea, supplemented with chopped cassava foliage. Weeds were controlled with selective preemergence herbicides. Cultural practices used are described, namely, plowing, liming, harrowing, seed conditioning for planting, planting, var. used (Cacho e'toro or UCV 2078, Chapapotera, and Branca de Santa Catarina with starch yields of 23-32, 19-23, and 12-14%, resp.), sprinkler irrigation, weed control, and harvest. (Summary by I.B. Trans. by I.M.F.) D00

0215

20159 PHILIPPINE COUNCIL FOR AGRICULTURE AND RESOURCES RESEARCH AND DEVELOPMENT. BOHOL TECHNOPACK PROJECT. 1983. Bohol technoguide for cassava. Manila. 68p. Engl., 13 Refs., Illus.

Cassava. Cultivation. Technological package. Cultivars. Selection. Cuttings. Land preparation. Planting. Harvesting. N. P. K. Fertilizers. Soil erosion. Soil analysis. Marketing. Costs. Philippines.

A technological manual containing recommendations for cassava cultivation, production, and industrialization in Bohol, Philippines, is presented. The manual includes aspects on cassava adaptation regarding climatic and soil requirements; seeds and var. selection; description of native var. and var. for starch production; cultural management practices such as seed preparation, planting, and fertilization; cropping systems with legumes, rice, maize, and coconuts; and harvesting and storage. Starch production at the family level and chip production and utilization in swine feeding are discussed. Different market outlets for cassava, credit and financing are indicated. Various appendices are included on (1) glossary of related terms, (2) description of a rapid propagation technique for cassava, (3) fertilizer recommendations according to the region, (4) control of soil erosion, (5) credit criteria and procedures, (6) recipes using cassava, and (7) list of names of extension agents in different municipalities of the region. (Summary by EDITEC) D00

0216

20178 SIMWAMBANA, M.S.C. 1982. Cassava: production and management. Lusaka, Zambia, Mansa Regional Research Station. 12p. Engl., 2 Refs. [Mansa Regional Research Station, Lusaka, Zambia]

Cassava. Cultivation. Intercropping. Harvesting. Mononychellus tanajoa. Phenacoccus manihoti. Cassava African mosaic virus. Zambia.

Aspects are presented related to cassava production and management in Africa, including ecology, nutritive value, ways of propagation, land preparation, planting methods, fertilizer requirements, crop association, planting and harvesting dates, and insect pests and diseases. Cassava is grown in areas with 500-5000 mm rainfall/yr and can tolerate dry periods, except at planting. The best planting material is obtained from crops 12-18 mo. of age. The optimum plant population is considered to be 10,000-15,000 plants/ha according to the cv. and branching habit. Cassava is highly tolerant to low soil pH and some authors report negative responses to liming in Ghana. Crops that are associated with cassava include vegetables, cocoyams, sweet potato, muskmelon, maize, rice, and legumes;

the pattern depends on the environmental conditions and preferences in each of the regions. The biology and control of Mononychellus tanajoa and Phenacoccus manihoti, the most important economic pests, are discussed. Major diseases that affect the crop are CAMD and CBB (Xanthomonas manihoti) which are controlled by planting resistant var. or clones. (Summary by EDITEC) D00

0217

20177 SIMWAMBANA, M.S.C. 1980. Cassava collection: a familiarization tour of Misamfu Regional Research Station and other cassava producing areas in Northern Province. Lusaka, Zambia, Mansa Regional Research Station. 8p. Engl.

Cassava. Cultivars. Cultivation. Zambia.

A report is presented on the visit to different cassava production areas in Luapula, Zambia, to observe the germplasm collections and to evaluate and coordinate some program activities. At the research station of Misamfu, var. Lunzuwa, Lubemba, Kilishi, Mansaka, Kasofu, and Matutumushi were found with mosaic symptoms. Other diseases detected were dieback and CBB. Visits were made to market places to make a survey on cassava prices and cassava products. In regions like East Kasama, cassava is produced in association with maize or peanuts. On the Musonda farm, east of Mukosa Scheme, var. Chapamutwe, Nyanta, and Kabange had weed problems due to the planting density that was used. The most important limiting factors affecting cassava growers are a lack of germplasm resistant to mosaic, the use of adequate cultural practices, and an improved marketing system for their products. (Summary by EDITEC) D00

See also J331 0337

D01 Soil, Water, Climate and Fertilization

0218

18981 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. CENTRO DE PESQUISA AGROPECUARIA DOS CERRADOS. 1982. Fertilidade do solo: efeito da calagem e nutrientes na cultura da mandioca. (Soil fertility: effect of liming and nutrients in cassava cultivation). In _____. Relatório técnico anual do Centro de Pesquisa Agropecuária dos Cerrados 1980-1981. Planaltina-DF, Brasil. v.6,pp.59-61. Port., Illus. [Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Agricultural lime. Fertilizers. P. K. Zn. Mn. Mo. Cu. S. B. Root productivity. Starch productivity. Foliage. Brazil.

Several expt. were carried out on LE soil to evaluate the effect of liming and nutrients on cassava yield. In one expt. 12 treatments were used: complete with Ca, N, P, K, S, B, Mn, Mo, and Zn; 10 treatments that omitted one of these nutrients each time; and a check. In the 1st crop, with cv. Branca de Santa Catarina, dolomitic limestone was applied to the furrow at 2.0 t/ha in addition to 100, 60, 60, 4, 1, 0.3, 4, and 3 kg, resp., of P, K, S, Zn, B, Mo, Cu, and Mn/ha. In the 2nd crop with IAC 195.66, 60 kg N/ha was applied as mulch and 50, 60, and 2 kg, resp., of P, K, and Zn were applied per hectare to the furrow, except in the treatments in which these elements were omitted. The check had the lowest root, canopy, and starch production in relation to the complete treatment, followed by the treat-

ments that omitted P, K, or Zn. The omission of N reduced root production by 21% in the 1st harvest and 32% in the 2nd. (Summary by I.B. Trans. by L.M.F.) D01

0219

20150 RAMOS, B.B.; MOJICA, P.S. 1982. Productivity of cassava, Manihot esculenta Crantz, in a clayey, kaolinitic, isohyperthermic, paleudult (Antipolo clay). Philippine Journal of Crop Science 7(2):123-127. Engl., Sum. Engl., 10 Refs., Illus. [Bureau of Plant Industry, San Andres, Manila, Philippines]

Cassava. Soil analysis. Soil requirements. Fertilizers. Agricultural lime. N. P. K. Plant height. Root productivity. Roots. Starch content. Costs. Economics. Income. Philippines.

Field expt. were conducted to determine the effects of lime, fertilizer, and different lime-fertilizer combinations on the yield of cassava roots grown in an Ultisol, Antipolo clay in the Rizal area of the Philippines. The no. of roots increased significantly in lime-treated plots, but not plant height and root wt. The application of NPK (60-45-120) fertilizer alone resulted in a significant root yield increase of 34.8 t/ha as compared with the control of 17.7 t/ha in 1979 and 3.9 t/ha in 1980. No significant response was noted between means of the lime-fertilizer combinations. The difference in yields of the control plots for 1979 and 1980 was attributed to better climatic conditions in 1979. Plants grown on plots previously treated with 3 t lime/ha and fertilizer-lime combinations produced root yields 60-90% that of the 1st crop. Application of lime alone increased yields over control but not significantly. Percent starch content of the roots was not significantly affected by the different treatments although total starch content (kg/ha) increased due to increase in yield. Economic analysis indicated that cassava grown in a soil treated with NPK (60-45-120) alone gave significantly higher net returns. Combination of fertilizer and lime did not further increase the yield and hence, net returns. (Author's summary) D01

See also 0207 0209 0210 0229 0283

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

0220

20188 ALGUACIL B., J.L.; LEIHNER, D.E. 1983. Efecto de la edad de la planta sobre calidad y cantidad de material de siembra producida en un período de 10 meses. (Effect of plant age on the quality and quantity of planting material produced in a 10-month period). Cali, Colombia, Centro Internacional de Agricultura Tropical. 23p. Span., Illus.

Cassava. Plant development. Timing. Cuttings. Propagation materials. Cultivars. Shoots. Germination. Root productivity. Dry matter. Roots. Starch content. Harvest index. Colombia.

The effect of plant age on maturity and cutting quality and quantity of 4 cassava var. (M Col 22, M Mex 59, CM 516-7, CM 849-1), without commercial root deterioration, was studied. A split-plot design was used with the var. as the 4 main plots and subplots as the age at harvest (6, 8, 10, 12, 14, and 16 mo.) with 4 replications each and a plant population of 10,000/ha. The parameters evaluated were, among others, germination %, no.

of usable cuttings selected on the basis of vigor, maturity, and sanitary conditions, av. wt. of cuttings, height, no. of shoots and wt. of the aerial part/plant, root yield, cutting production index, and HI. At 6 mo. of age var. M Mex 59, CM 516-7, CM 849-1, and M Col 22 produced 4.3, 3.5, 3.8, and 1.8 cuttings/plant, resp. Root yields were 14.2, 21.0, 27.2, and 22.4 t/ha, resp. At 8 mo. of age, var. CM 849-1 was outstanding in cutting production, fresh root yield, and starch content. At 10 mo. of age all var. produced 6.7-8.9 cuttings/plant; at this age, the best var. was CM 516-7 with 56.0 t roots/ha and 32.5% starch. At 12 mo. of age, root and cutting yields increased, but starch content decreased for all var. At 14 mo., root yields continued to increase; CM 516-7 was outstanding with 82 t/ha and 97% commercial roots; var. M Mex 59 and CM 849-1 showed root rot. It is concluded that cuttings for planting can be obtained from plants ranging from 6 to 14 mo. of age. (Summary by EDITEC) DO2

0221

19565 AKOBUNDU, I.O. 1983. Weed control in no-tillage cassava in the subhumid and humid tropics. In _____.; Deutsch, A.E., eds. No-tillage Crop Production in the Tropics. Monrovia, Liberia, 1981. Proceedings. Corvallis, Oregon State University. International Plant Protection Center. IPPC document 46-B-83. pp.119-126. Engl., 9 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Weeding. Herbicides. Cultivation. Plant height. Root productivity. Nigeria.

Weed control was evaluated in no-tillage cassava, with a previous application of paraquat in an Alfisol that had been fallowed for 2 yr. A split-plot design was used with tillage as the main plot and weed control treatments as subplots. Treatments were replicated 3 times and weed dry wt. and cassava root yield were determined. In another expt. conducted on an Ultisol, glyphosate (3.0 kg/ha) was applied to bush regrowth (fallowed for 2 yr) at the onset of rains. Land preparation (main plots) consisted of no-tillage; plowing and harrowing; plowing, harrowing, and ridging. Treatments were replicated 5 times and cassava plant height was taken at 10 wk. after planting, weed wt. at 16 wk. after planting, and cassava root yield at 12 mo. after planting. Cassava root yield was found to be lower in no-tillage plots compared with conventional tillage (on the flat and in ridges). The need to reduce erosion makes it necessary to use tied ridges rather than planting cassava on the flat in conventionally cultivated fields. Within each tillage method, yield reduction caused by weeds was not significantly lower when weeds were not controlled than when weeds were controlled by herbicides or by hoe weeding. However, the yield difference between unweeded plots and those treated with insecticides (and conventional tillage) suggest that the herbicides effectively reduced weed interference during the early growth period of the plant. Plant height measurements showed that there were significant differences among planting cassava on the flat, ridges, and in no-tillage plots. (Summary by I.B. Trans. by L.M.F.) DO2

0222

16694 ALCANTARA, E.N. DE; CARVALHO, J.E.B.; LIMA, P.C. 1982. Determinacao do periodo critico de competicao das plantas daninhas com a cultura da mandioca (Manihot esculenta Crantz). (Determination of the critical period of competition of weeds in cassava crops). In Projeto mandioca, relatório 76/79. Belo Horizonte-MG, Brasil, Empresa de Pesquisa Agropecuária de Minas Gerais. pp.127-129. Port., Illus. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 515, 30.000 Belo Horizonte-MG, Brasil]

Cassava. Weeds. Timing. Plant height. Starch content. Root productivity. Brazil.

The results of a trial carried out on the Veragro farm in Felixlandia, MT, Brazil, in 1978 to determine the critical period of competition of weeds with cassava are given. Eleven treatments were used: weed-free during the 1st 30, 60, 90, 120, and 150 days or during the entire cycle (control); weedy during the 1st 60, 90, 120, and 150 days or during the entire growth cycle. Plant diameter and height (cm), no. of plants at 30, 60 days and at harvest, starch content, and root wt. were determined. A randomized block design was used with 3 replications. Major weeds were Runchelytrum roseum, Digitaria sanguinalis, Cenchrus echinatus, Melinis minutiflora, Sida sp., among others. The competition with weeds was found to influence plant diameter and height at 180 days and reduced yields by 83.75%. The highest yield, compared with the check, was obtained when weeds competed with cassava only during the 1st 60 days. The critical period of competition would be between 60 and 150 days after emergence. (Summary by I.B. Trans. by L.M.F.) D02

0223

19549 BESSA, J.M.G. 1974. Projeto experimental sobre método de conservacao de manivas de mandioca (Manihot esculenta, Crantz). (Experimental project on the method of conservation of cassava cuttings). Recife-PE, Brasil, Instituto de Pesquisas Agronomicas. 7p. Port., 2 Refs.

Paper presented at Curso de Especializacao para Pesquisadores de Mandioca, 1o., Cali, Colombia, 1974.

Cassava. Cuttings. Storage. Timing. Cassava programs. Brazil.

A project to assess the effects of the methods of conservation of cassava cuttings used by cassava growers in the state of Pernambuco and other states of NE Brazil is described. The germination, vigor, and yield of recently harvested cuttings, stored in the shade for 1, 2, 3, 4, 5, and 6 mo., are to be compared with those of cuttings directly from the field in a randomized block design with 7 treatments and 5 replications. (Summary by L.M.F.) D02

0224

18993 BUENO, A. 1982. Efeito de bordadura em experimentos para avaliacao de cultivares de mandioca. (Border effect in experiments evaluating cassava cultivars). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Pesquisa em Andamento no.07. 4p. Port., 6 Refs. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cassava programs. Field experiments. Genotypes. Root productivity. Brazil.

The influence of one cassava genotype on another when planted in adjacent plots was determined and the variation of these effects was observed regarding different genotypes and environments. Root production data of 2 expt. established at the Centro Nacional de Pesquisa de Mandioca e Fruticultura are discussed. In the 1st expt. 15 cv. were evaluated in a randomized block design with 2 replications and fertilization consisting of 40 kg each of N, P, and K/ha. Plots consisted of four 4.8-m-long rows with plants spaced at 1.0 x 0.6 m, the useful plot area being the 2 center rows. The 2nd expt. was similar but without fertilization. In the 1st expt.

intergenotypic competition was higher than intragenotypic competition since yields of the useful plot area were higher than those of the borders. In the 2nd expt. the contrary occurred; the highest yields were obtained in border areas. Not all of the cv. had the same response and several (BGM 574, 378, and 488) had higher yields in the border areas. The arrangement of the cv. was modified when border area yields were measured. The C.V. of productivity, based on the border area, was twice that estimated for the useful plot area, due not to the increased mean but to the increase of the exptl. error (expt. without fertilization). It was concluded that genotypes modify their capacities in different environments, nullifying genotypic screening in expt. conducted on borderless plots. (Summary by I.B. Trans. by L.M.F.) D02

0225

20160 CUNHA, H.M.P. DA 1979. Plantas invasoras e herbicidas na cultura da mandioca (Manihot esculenta Crantz). (Weeds and herbicides in cassava). Salvador-BA, Brasil, Empresa de Pesquisa Agropecuária da Bahia. Comunicado Técnico no.008. 12p. Port., 14 Refs.

Cassava. Weeds. Herbicides. Brazil.

In the exptl. area of the Escuela de Agronomía of the U. Federal da Bahía, Cruz das Almas, Brazil, several trials were carried out to study the climatic and soil conditions, and herbicide selectivity for cassava. The herbicides were applied to a Colonia Latosol, tertiary sediment, of the Barreiras series. Only 1 preemergence application was made in a randomized block design with 19 treatments and 4 replications. Diuron, ametryn, atrazine, simazine, bromacil, and fluometuron at 80% concn. were applied at rates of 1.0, 2.0, and 3.0 kg a.i./ha. All treatments produced a considerable no. of chlorotic cassava plants and some plants died in plots treated with atrazine and bromacil. The rate 2.0 kg a.i./ha showed good results for diuron, simazine, ametryn, and fluometuron. Diuron and fluometuron were classified as highly selective, while atrazine and bromacil were nonselective. Ametryn and simazine showed marginal selectivity. (Summary by EDITEC) D02

0226

20192 DANTAS, J.L.L.; CUNHA, M.A.P. DA 1981. Harvest and post-harvest of cassava in Brasil: a case study. Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Documents no.3. 31p. Port., 9 Refs., Illus. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Harvesting. Timing. Cuttings. Storage. Roots. Deterioration. Processing. Post-harvest technology. Brazil.

Harvest and postharvest conditions of cassava in Brazil and research advances are reviewed, focussing on research results that should be applied for max. efficiency in the 2 crop stages. The main harvesting aspects dealt with are growth cycle, indices for productivity evaluation, effect of planting system on harvesting efficiency, harvesting dates and methods (manual and mechanical), and transportation. The possibility of producing protein through the action of microorganisms on processing residues is being studied for small, intermediate, and large industries. Cassava provides important products for animal and human consumption, as well as for industrial purposes, especially for different types of alcohol, glycerol, organic acid, organic esters, and aldehyde production. Issues on postharvest management are examined such as storage of planting material,

storage systems for cassava stems (vertical and horizontal), storage period, and systems for the conservation of the product in the form of chips or flour. It is considered that the harvest and postharvest stages of cassava should be studied and improved in order to increase yields and reduce losses that decrease its utilization in the alcohol industry. (Summary by EDITEC) D02

0227

16619 EMPRESA BRASILEIRA DE ASSISTENCIA TECNICA E EXTENSAO RURAL. 1981?. Mandioca: sistema de plantio em fileiras duplas. (Cassava: planting in double rows). Brasilia. Serie Técnica para Producao Vegetal. EMBRATER T 17. 3p. Port., 3 Refs., Illus. [Av. W/3 Norte - Q.515 - Bl. "C" - Lote 03, Brasilia-DF, Brasil]

Cassava. Planting. Spacing. Brazil.

A cropping system of cassava in double rows (2.00 x 0.60 x 0.60 m) is described and recommended. In an expt. carried out at the Centro Nacional de Pesquisa de Mandioca e Fruticultura, it increased productivity by 25% compared with the check (1.00 x 0.60 m). The double row cropping system offers the following advantages: allows intercropping (maize, beans, rice, sorghum); the same area can be used successively by rotating rows; production and productivity are increased by improved use of light and CO_2 (border effect); easier mechanization and pest and disease control; use of plant canopy; reduced weeding requirements and improved control of erosion. (Summary by I.B. Trans. by L.M.F.) D02

0228

20183 FILGUEIRA, M.A. 1980. Comportamento de tres cultivares de mandioca (Manihot esculenta Crantz) em relacao ao comprimento do tolete e profundidade de plantio. (Performance of three cassava cultivars in relation to the length of the cutting and planting depth). Tese Mestrado. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 57p. Port., Sum. Port., Engl., 50 Refs., Illus.

Cassava. Planting. Cuttings. Selection. Plant height. Stems. Cultivars. Root productivity. Starch productivity. Foliage. Starch content. Dry matter. Roots. Brazil.

From Nov. 1977 to June 1979 research was carried out under field conditions at the Escola Superior de Agricultura de Lavras, MG, Brazil, to determine the effects of the length of cutting (15, 25, and 35 cm) and the depth of planting (5, 10, 15, and 20 cm) on cassava cv. Branca de Santa Catarina, Sonora, and Riqueza. The following characteristics were assessed: plant height; av. stem diameter and no.; root, starch, and foliage yield; % of starch and DM; and av. no. of storage roots. A randomized block design was used in a split-split plot arrangement with 4 replicates. Under these conditions cutting length, planting depth, and cv. affected the different characteristics analyzed, although the differences were not always significant. Root yield was higher with 25-cm-long cuttings and at the 10-cm planting depth. Cv. Sonora had higher yields than Branca de Santa Catarina and Riqueza. Root no. were higher with 25-cm-long cuttings. Foliage yield was higher with 35-cm-long cuttings and cv. Riqueza presented the highest production. The av. no. of shoots increased with increasing cutting length. No cutting x cv. interaction was observed, but the former factor interacted significantly with planting depth in relation to root and starch yield, and root no.; best results were reached at the 10-cm planting depth and with cv. Sonora in all cases. (Author's summary) D02

0229

20117 HARRIS, N.V.; TLASKAL, J.G. 1981. Ethanol from cassava for transport fuel: Agronomy. Energy Research, Development and Demonstration Project 78/2458. Final Report. Bundaberg, Australian Cassava Products Pty. Ltd. 20p. Engl., Sum. Engl., 11 Refs. [Australian Cassava Products Pty. Ltd., P.O. Box 1034, Bundaberg, Qld. 4670, Australia]

Cassava. Cassava programs. Cultivation. Climatic requirements. Rainfall data. Cultivars. Root productivity. Dry matter. Sugar content. Harvest index. Planting. Spacing. Harvesting. Timing. Australia.

Cassava was grown in several expt. in 2 regions in Australia where the climates were considered marginal for ethanol production to study field potential and carbohydrate accumulation patterns in 8 leading cassava var. and to determine agronomic requirements. Highest yielding cv. was M Aus 7. On the far north coast of New South Wales, the yield of fermentable sugars after 9 and 21 mo., resp., was: Grafton, expt. 1, 6.4 and 8.2 t/ha; Grafton, expt. 2, 5.8 and 7.0 t/ha; Duck Creek, 9.8 and 10.3 t/ha; Wollongbar, 8.6 and 10.6 t/ha. Cool winter and spring temp. restricted growth in the 2nd season and it is unlikely that potential production areas would extend south of Grafton. On the central coast hinterland of Queensland, M Aus 7 in 1 expt. produced fermentable sugar yields at 8 mo. of 8.9 t/ha, at 17 mo. 12.1 t/ha, and at 25 mo. 8.9 t/ha. In another expt. it was showed that there was no yield benefit in growing the cv. studied at plant populations greater than 10,000 plants/ha and M Aus 7 produced mean fermentable sugar yields of 8.6 t/ha at 18 mo. and of 5.3 t/ha at 25 mo. The reasons for the yield depression at 25 mo. are discussed. During these expt. the cumulative rainfall was 471 mm at 8 mo., 969 mm at 17 mo., 988 mm at 18 mo., and 1158 mm at 25 mo. The fermentable sugar yields obtained with M Aus 7 were at least as good as those that could have been obtained with sugar cane under similar growing conditions. (Author's summary) D02

0230

20189 LOPEZ M., A.J.; LEIHNER, D.E. 1983. Evaluación preliminar de tres nuevos herbicidas posemergentes en yuca (Manihot esculenta Crantz). (Preliminary evaluation of three new postemergent herbicides for cassava). Cali, Colombia, Centro Internacional de Agricultura Tropical. 47p. Span., 10 Refs., Illus.

Cassava. Weeding. Herbicides. Timing. Colombia.

The selectivity and efficiency of control of grasses and broadleaf weeds of 3 herbicides (ethyl-phenoxaprop, gluphosinate, and mefluidide), and the mixture of paraquat + oxyfluorfen were evaluated in cassava var. Mexico 11. Predominant weeds were Leptocloa filiformis, Eleusine indica, Portulaca oleracea, Euphorbia hypericifolia, Eu. hirta, Borreria laevis, Amaranthus dubius, Corchoris orinosensis, Ipomoea sp., Phyllanthus amarus, and Cyperus spp. The damage index (DI) was estimated using a scale from 0 to 10, where 0 = no damage and 10 = dead plants. A split-split plot design was used with 3 replications to evaluate both the application date (21, 36, and 51 days after planting) and application rate of each product. The highest DI were obtained when products were applied at 51 days; no significant difference was observed at 21 and 36 days after planting. Mefluidide caused the lowest DI at both rates and for the 3 application dates, especially at 21 and 36 days, with 1360 g a.i./ha. Paraquat + oxyfluorfen produced the highest DI (2.5, 3.0, and 3.2) for the different dates at rates of 960 + 960 g a.i./ha. Of the 4 treatments, gluphosinate, ethyl-phenoxaprop, and mefluidide caused no considerable damage to the crop when applied at 21 and 36 days after planting. Good control of grasses and broadleaf weeds was achieved with 800 g a.i. gluphosinate/ha at 36 days,

while at 21 days the mixture paraquat + oxyfluorfen at 480 + 480 g a.i./ha performed best. Cyperus spp. control with 800 g a.i. gluphosinate/ha reached levels of 63%. (Summary by EDITEC) D02

0231

20170 MONDARDO, E.; MORAES, O. DE; FROSI, J.F.; TERNES, M. 1983. Mandioca em fila dupla consorciada com leguminosas no sul de Santa Catarina. (Cassava in double rows in association with legumes in southern Santa Catarina). Florianópolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Comunicado Técnico no.63. 7p. Port., 6 Refs. [Empresa Catarinense de Pesquisa Agropecuária, Estacao Experimental de Urussanga, Caixa Postal 49, 88.840 Urussanga-SC, Brasil]

Cassava. Planting. Intercropping. Groundnut. Root productivity. Starch content. Roots. Brazil.

An expt. was carried out in the municipality of Jaguaruna, Brazil, in the exptl. field of the Empresa Catarinense de Pesquisa Agropecuária, to determine the feasibility of cultivating cassava in double rows in association with legumes. The exptl. design was randomized blocks with 7 treatments and 5 replications as follows: (1) cassava with Stizolobium niveum, (2) cassava with Vigna unguiculata var. Sempre Verde, (3) cassava with V. unguiculata var. Pitiúba, (4) cassava with Crotalaria spectabilis, (5) cassava with groundnut cv. Tutu Vermelho. In treatment 6, cassava was planted in double rows as in the abovementioned treatments but in monoculture; in treatment 7, cassava was planted using the traditional system. This latter treatment produced 6611 kg/ha and in treatment 6, 5200 kg/ha. The best combination was cassava/groundnut, where cassava produced 3800 kg roots/ha and 1272 kg groundnut seeds/ha. The production of green material from Stizolobium, Sempre Verde cowpea, Pitiúba cowpea, Crotalaria, and groundnut was 9040, 17,985, 12,450, 11,210, and 2500 kg/ha, resp. (Summary by EDITEC) D02

0232

20171 TERNES, M.; ISHIY, T. 1978. Herbicidas em mandioca. (Herbicides in cassava). Florianópolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuária. Comunicado Técnico no.11. 2p. Port.

Cassava. Herbicides. Brazil.

In the state of Santa Catarina, Brazil, weeding cassava crops consists of activities taking 42-56 days/man and 2-3 days/animal to maintain the crop clean during the entire growth cycle. Trials carried out during 1977-78 at the Itajaí Exptl. Station confirmed the results obtained at other sites. The use of diuron and alachlor recommended for clay, clay loam, and sandy soils is 1.60 and 1.29, 1.20 and 1.08, and 0.80 and 0.86 kg a.i./ha, resp. (Summary by EMBRAPA. Trans. by L.M.F.) D02

0233

20190 TONGGUM, A.; LEIHNER, D.E. 1983. Weed control in cassava. Screening of new chemicals used as pre-emergent herbicides for cassava and efficiency of weed control. Cali, Colombia, Centro Internacional de Agricultura Tropical. 38p. Engl., Illus.

Cassava. Weeding. Herbicides. Colombia.

An expt. was carried out at CIAT with cassava var. CM 849-1 to characterize the selectivity and efficiency of preemergence herbicides. A split-plot

design was used, with 6 x 5 m-plots and ridges spaced 1 m for a population of 10,000 plants/ha. Besides the weedy check and manual weed control, 6 herbicides and a check mixture (diuron + alachlor) applied at 3 rates (1, 2 and 4 times the commercial rate recommended for the product) were included as treatments. Three replications/treatment were used. The damage index (DI) was determined at 14, 21, 28, 35, 42, and 49 days after planting using a 0-10 scale (0 = no damage; 10 = dead plants); other parameters measured were % weed control, plant height and development, and no. of dead plants after 1 mo. At the commercial rates all herbicides showed lower % weed control (21.6-56.6%) compared with the check mixture (81.6%), 49 days after application. Treatments with twice the commercial rates showed that oxyfluorfen and NC 20484 (Fbc Ltd) had more efficient weed control (68.3-70%, resp.), while the check mixture was the best (83.3%). At 4 times the commercial rate, oxyfluorfen at 2 kg a.i./ha showed the highest % weed control at 49 days. Herbicides NC 20484 (Schering Ag) and NC 20484 (Fbc Ltd) are nonselective for cassava while mefluidide 2-S and oxyfluorfen are moderately selective, and MBR 23709 2-S and MBR 20457 2-S are highly selective. (Summary by EDITEC) D02

0234

19252 VILLAMAYOR JUNIOR, F.G.; DISTREZA, T. 1981. Pruning as a method for rapid stem production. Radix 3(2):10-11. Engl., 1 Ref., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Pruning. Stems. Production. Root productivity. Income. Philippines.

A study was undertaken to determine the effect of pruning on tuber and stem production of cassava cv. Golden Yellow. Stem cuttings were planted at 1.0 x 0.75 m and 60-60-60 kg NPK were applied per hectare. Plants were pruned by cutting stems 30 cm above the ground 6 mo. after planting or not pruned (control). A randomized complete block design was used with 3 replications. Only the 5 inner rows were used for data collection. One row of 18 plants was harvested every mo. Data for the 10th mo. was used for income analysis. An interaction between pruning and age of harvest in terms of yield was observed. Yield of pruned plants increased progressively after a decline (15.6%) during the 6th-7th mo., possibly due to the utilization of root reserves for production of new shoots. Root yield of pruned plants was 35.9 kg/ha whereas control plants yielded 49.7 kg/ha. Pruned plants had a higher % of soluble solids, starting from the 5th day until the 3rd wk. after pruning. After this period the difference was not noted. Canopy closure in pruned plants was almost 100% 1 mo. after pruning. Pruning produced almost twice as much planting material compared with control material and cuttings were of higher quality, due to the lodging of control plants at 10 mo. Pruning is not economically profitable, except for planting material. New research on the topic is suggested. (Summary by I.B. Trans. by L.M.F.) D02

0235

19253 VILLAMAYOR JUNIOR, F.G. 1981. Ring weeding: a labor saving management practice. Radix 3(2):12. Engl. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Weeding. Root productivity. Harvest index. Philippines.

To determine whether or not ring weeding was better than traditional weeding (2-3 times until canopy closure), an expt. was conducted with ring

weeding at 20, 30, 40, and 50 cm radii, r s a control (no weeding). Cuttings of cassava cv. Golden Yellow about 50 cm long were planted on ridges 1 m apart (1.5 m between hills), and urea (50 kg N/ha) was applied at planting. A randomized complete block design was used with 4 replications/treatment. Varying the radius of ring weeding did not produce significant differences in harvest parameters (root no., economic and biological yield, HI). A 30-cm radius of ring weeding instead of 50 cm would result in saving about 270% in space to be weeded. The parameters for these 2 radii were: root no., 20.0 and 18.2; yield (kg/plant), 10.4 and 10.5; HI, 0.47 and 0.48, resp. There will probably be less weeds to cut by adopting a planting distance of 1.0 x 0.75 or 1.0 x 1.0 m. (Summary by I.B.) D02

0236

20149 VILLAMAYOR JUNIOR, F.G.; APILAR, E.G. 1981. Root and stem production of two cassava varieties at different population. Philippine Journal of Crop Science 6(1-2):21-23. Engl., Sum. Engl., 6 Refs., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Cultivars. Plant height. Stems. Roots. Root productivity. Planting. Spacing. Harvest index. Cuttings. Philippines.

A split-plot expt. was conducted to determine the response of 2 cassava var. recommended in the Philippines, Golden Yellow and Kadabao, to varying population levels (13,333, 20,000, and 40,000 plants/ha). Golden Yellow had a higher yield compared with Kadabao at 8-mo. harvest (25.9 and 17.8 t/ha, resp.). High plant population lowered root yield of Kadabao but not that of Golden Yellow. However, Kadabao produced more 25-cm-long stem cuttings than Golden Yellow (440,000 and 240,000/ha, resp.). The no. of stem cuttings generally increased with increasing population. The effect of the treatments on HI, biological yield, plant wt., stem diameter, and node no. is discussed. (Author's summary) D02

See also 0346

D03 Energy Productivity and Yields

0237

20167 AZEVEDO, J.N. DE; SILVA, P.H.S. DA; RIBEIRO, V.Q. 1982. Avaliacao de cultivares de mandioca na microrregiao do Medio Gurguéia-Piauí. (Assessment of cassava cultivars in the Medio-Gurguéia-Piauí microregion). Teresina-PI, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execução de Pesquisa de Ambito Estadual. Pesquisa em Andamento no.22. 3p. Port. [Unidade de Execucao de Pesquisa de Ambito Estadual de Teresina, Caixa Postal 01, 64.000 Teresina-PI, Brasil]

Cassava. Cultivars. Root productivity. Foliage. Plant height. Starch content. Brazil.

Preliminary results of a study of the situation of cassava cultivation in the state of Piauí, Brazil, are given. In this state, cassava is the main crop cultivated for both human and animal nutrition. Between 1976-81 area planted to cassava increased 63.35%. However, yields obtained in Piauí are lower than the national av. (8.7 and 12.0 t/ha, resp.), due to inadequate cropping systems and to the difficulty in obtaining cuttings. A competitive

trial was carried out with cv. in Cristino Castro in Jan. 1981 to evaluate productivity and starch content. A sandy soil (5 ppm P, 12 ppm K, 0.7 meq Ca + Mg, 0.6 meq Al, and pH 4.9) was used in a randomized block design with 4 replications. Harvesting took place at 14 mo. The highest yields corresponded to cv. Maria dos Anjos (18.7 t/ha), Amansa Burro (18.2 t/ha), and Jaboti (18.1 t/ha). Casteliana, with the lowest yield (7.5 t/ha), had the highest foliage yield and final stand. Highest starch yields corresponded to Serrana (31.25%) and Jabuti (30.69%), although in general starch yields were adequate. (Summary by I.B. Trans. by L.M.F.) D03

See also 0209 0218 0219 0221 0222 0224 0228 0229 0231 0234 0235 0236 0283 0284 0285 0287 0288 0289 0292 0346 0348 0352

D04 Postharvest Studies

0238

18496 CENTRE FOR AGRICULTURAL RESEARCH. 1981. Post-harvest technology: cassava drying. In _____. The permanent cultivation of rainfed annual crops on the loamy soils of the Zanderij formation. Joint Project of the Agricultural University Wageningen and the University of Suriname. Project no.LH/UvS 02. Annual Report 1979. Suriname. pp.53-54. Engl.

Cassava. Post-harvest technology. Drying. Temperature. Surinam.

Expt. on circulated through drying of cassava on band driers with different air flow rates (0.02, 0.03, 0.04, 0.05, 0.06 m^3/s) and at different temp. (34, 43, 50, 60, and 70°C), carried out during 1978-79 in Surinam, are reported. A temp. of 70°C and an air flow rate of 0.02 m^3/s allows 300 kg dried cassava to be obtained per hour on a band drier of 40 m^2. The thickness of the layer should be chosen so that an efficient loading and unloading of the batch is possible and that the difference in MC between the top and bottom layer is smaller and drying time moreless the same. (Summary by I.B. Trans. by L.M.F.) D04

0239

19250 DATA, E.S.; ARRIENDA II, F.Q.; ESTEBES, E.S. 1983. Proper use of transport materials for root crops to minimize losses. Radix 3(2):7-8. Engl., 1 Ref., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Roots. Distribution. Packaging. Vascular streaking. Timing. Philippines.

Different transport methods of tubers of cassava cv. Golden Yellow and of sweet potato were assessed: (1) tubers packed in locally made baskets (kaing); (2) wooden crates; (3) sacks; and (4) no container (control). Tubers were then transported through 2 km of rough roads from Barrio Patag, Baybay, Leyte to the Philippine Root Crop Research and Training Center. Vascular streaking was evaluated every other day for 1 wk. Immediately after transport the control tubers showed the least % of damage, followed by those transported in crates, kaing, and sacks. However, in the succeeding days of storage tubers packed in crates showed the lowest % of damage followed by control tubers. Tubers transported in crates also showed the lowest % of vascular streaking (18% at 72 h) compared with those transported in kaing, which showed the highest (40.5%). This suggests

there is a direct relationship between the degree of damage and vascular streaking. (Summary by I.B. Trans. by L.M.F.) D04

See also 0226

E00 PLANT PATHOLOGY

0240

18935 PINEDA, B.; JAYASINGHE, U.V.; LOZANO, J.C. 1983. La enfermedad cuero de sapo en yuca (Manihot esculenta Crantz). (Frog skin disease in cassava). ASIAVA(Colombia) 4:10-12. Span., 12 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Frog skin disease. Etiology. Disease control. Colombia.

The importance, symptomatology, and etiology of the frog skin disease in cassava are briefly described. This disease has caused losses up to 90% or more in Quilcacé, Tambo (Cauca) and other municipalities of Colombia. The 1st symptoms of the disease appear 50-60 days after planting in cuttings taken from diseased plants. Small, longitudinal, deep fissures resulting in lip-shaped lesions, generally in the callus region, are detected. Storing parenchyma is reduced as well as starch grains. The no. of well-developed xylem vessels increases and there is degradation of the phloem cell which appears to be blocked by massive inclusions. The periderm is thick and corky. The disease can be diagnosed 50 days after planting with a magnifying glass, later on at simple sight, especially on recently harvested roots. A technique to detect the disease by electrophoresis has been developed. In endemic regions cuttings from the most severely affected, vigorous plants (thickest stems) are selected. Other methods of dissemination have been studied. Etiologically it seems to be a pathogenic disease with viral characteristics. The causal agent is currently being characterized. The following control measures are recommended: removal of all sources of inoculum, crop residues, or diseased plants, and elimination of weeds; use of disease-free material from healthy plantations, preferably meristems; disinfestation of tools with water and detergent; quarantine measures. (Summary by I.B. Trans. by L.M.F.) E00

0241

19558 TERRY, E.R. 1982. A review of cassava and sweet potato diseases and their relation to germplasm exchange. IITA Research Briefs 3(4):1-4. Engl., 33 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava African mosaic virus. Xanthomonas cassavae. Xanthomonas manihotis. Erwinia carotovora. Agrobacterium. Sphaceloma manihoticola. Glomerella. Fusarium. Sclerotium rolfsii. Frog skin disease.

Cassava and sweet potato diseases caused by various pathogens are reviewed; eradication methods in germplasm materials for exchange are included. The main cassava viral diseases are mosaic, brown streak, common mosaic, venial mosaic latent virus, witches' broom, and frog skin disease which can be eradicated from propagation material through meristem culture. Among the most important bacterial pathogens are Xanthomonas campestris pv. cassavae, X. campestris pv. manihotis, Erwinia carotovora, and Agrobacterium spp. Some fungi such as Sphaceloma manihoticola, Glomerella sp., Fusarium sp., Sclerotium rolfsii, and Botryodiplodia sp. are basically pathogens attacking cassava stems. The International Institute of Tropical Agriculture in Nigeria has undertaken basic research on the etiology of viral

diseases of root crops to develop more rapid, efficient, and safer procedures of transferring clonal and true seed genetic material. (Summary by EDITEC) E00

See also 0287

E02 Bacterioses

0242

20147 ATHAYDE, J.T.; ROMEIRO, R. DA S. 1983. Tetrazólio para detectar virulencia em Xanthomonas campestris pv. manihotis. (Tetrazolium to detect virulence in Xanthomonas campestris pv. manihotis). Fitopatologia Brasileira 8(2):283-290. Port., Sum. Port., Engl., 21 Refs. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 391, 29.000 Vitória-ES, Brasil]

Cassava. Xanthomonas manihotis. Isolation. Brazil.

The possibility of using 2,3,5-triphenyltetrazolium chloride to detect virulent colonies of Xanthomonas campestris pv. manihotis was examined. Four bacterial isolates were cultured in a medium containing 10 ml 2,3,5-triphenyltetrazolium chloride and 6 plants each of cassava cv. Chagas and Branquinha were inoculated per treatment under greenhouse conditions; plants were watered twice a day. Plants inoculated with sterile water served as checks. Four types of colonies were observed: type A, large colonies with a red-colored center, large white borders, and the diameter of the center corresponding to half of the diameter of the colony; type B, small colonies almost entirely red-colored with small 0.5-mm-wide white borders and with a diameter 1/3 that of type A colonies; type C, tiny, entirely white colonies; type D, colonies varying in the red/white color proportion from a tiny point in the center of the colony to the color of type B colonies and with a diameter between those of type A and type C. Type A colonies were predominant. Evaluation of pathogenicity of the colonies showed that types A, C, and D were virulent. Type B colonies were weakly virulent or avirulent. Serological tests confirmed that the 4 types of colonies belonged to the same species. (Author's summary) E02

0243

20145 FUKUDA, C.; ROMEIRO, R. DA S.; TELES, F.F.F. 1983. Quantificacao de fenóis totais em variedades de mandioca apresentando diferentes graus de resistencia a bacteriose (Xanthomonas campestris pv. manihotis). [Quantification of total phenols in cassava varieties with different levels of resistance to bacteriosis (Xanthomonas campestris pv. manihotis)] Fitopatologia Brasileira 8(1):179-184. Port., Sum. Port., Engl., 6 Refs. [Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil]

Cassava. Cultivars. Resistance. Xanthomonas manihotis. Phenols. Composition. Leaves. Stems. Petioles. Brazil.

Total phenol content in leaves, petioles, and stems of 26 cassava var. (5 resistant, 10 moderately resistant, and 11 susceptible to Xanthomonas campestris pv. manihotis) was determined. Resistance was evaluated under field conditions for 3 yr. Folin-Denis reagent was used for total phenol quantification. No correlation was found between phenol content in cassava tissues and resistance to the bacterial pathogen. (Author's summary) E02

0244

20146 IKOTUN, T. 1983. Histopathology of cassava leaf infected by Xanthomonas campestris pathovar cassavae. Fitopatologia Brasileira 8(2):215-221. Engl., Sum. Engl., Port., 13 Refs., Illus. [Phytopathology Unit, Dept. of Agricultural Biology, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Plant tissues. Leaves. Xanthomonas cassavae. Xanthomonas manihotis. Analysis. Nigeria.

Histopathology of cassava plant tissue infected by Xanthomonas campestris pv. cassavae is reviewed. Seventy healthy plants of var. Valluna were inoculated with the bacterium in different ways. Only plants inoculated by leaf puncture with contaminated needles by leaf rubbing with cotton wool soaked in a suspension of X. campestris pv. cassavae in sterile distilled water and by leaf spraying with a suspension of the bacterium produced symptoms typical of the disease. Plants inoculated by stem swabbing with cotton wool dipped in a suspension of the bacterium developed no symptoms. However, stems inoculated with mounted needle contaminated with the bacterium and those inoculated with the bacterial suspension through a syringe gave atypical symptoms. X. campestris pv. cassavae was found to invade leaf tissues through wounds and stomates, multiplying in the intercellular spaces of the spongy mesophyll and causing cellular disorganization. There was ample evidence of cellular plasmolysis, the plasmalemma being removed from the cell wall and cellular contents concentrated in the center of the cell. Cell walls were degraded enzymatically but xylem vessels were not invaded. Unlike X. campestris pv. manihotis, X. campestris pv. cassavae was unable to invade cassava stems and thus did not cause wilting, and the angular leaf spots induced by it were surrounded by a chlorotic halo. (Author's summary) E02

0245

20103 INSTITUT DE SCIENCES AGRONOMIQUES DU RWANDA. 1982. Tubercules et racines: propagation de la nécrose bactérienne du manioc. (Tubers and roots: propagation of cassava bacterial blight). In _____. Compte rendu des travaux du Departement Amenagement du Milieu et du Departement des Laboratoires en 1981. Rubona. pp.21-22. Fr.

Cassava. Disease transmission. Xanthomonas manihotis. Xanthomonas cassavae. Rwanda.

An expt. was carried out to determine if vegetative multiplication of cassava var. Eala amer 07 propagates bacterial blight caused by Xanthomonas cassavae when cuttings from an infected site (Nsuki, Rwanda) were planted in an uninfected site. Thirty-six healthy cuttings were taken from the mature, lower portions of plants presenting disease symptoms (dark green watersoaked areas and stem blight). These cuttings were planted in the greenhouse in pots with fertile soil and watered regularly. It was concluded that the use of healthy cuttings from diseased plants did not propagate the disease; 85.6% of the plants of the 1st group were healthy, without disease symptoms. Neither did the accidental use of diseased parts propagate the disease due to the low germination %, 8.4%. X. cassavae seems to be propagated through the air, differing from X. manihotis. (Summary by I.B. Trans. by L.M.F.) E02

0246

20163 KIMURA, O.; DIANESE, J.C. 1983. Caracterizacao protéica e isoenzimática das patovares de Xanthomonas campestris que atacam a mandioca. (Protein isoenzymatic characterization of pathovars of Xanthomonas

campestris that attack cassava). Pesquisa Agropecuária Brasileira 18(11):1215-1228. Port., Sum. Port., Engl., 45 Refs., Illus. [Depto. de Fitopatologia, Univ. Federal Rural do Rio de Janeiro, 23.560 Seropédica-RJ, Brasil]

Cassava. Xanthomonas manihotis. Xanthomonas cassavae. Isolation. Biochemistry. Enzymes. Brazil.

Electrophoretic profiles of soluble protein, esterase, acid and alkaline phosphatase, and glucose-6-phosphate dehydrogenase were determined for 11 isolates of Xanthomonas campestris pv. manihotis, 3 isolates of X. campestris pv. cassavae, and 1 isolate of X. campestris pv. campestris. Esterase and acid phosphatase were more precise in characterizing the pathovars of X. campestris from cassava. Phylogenic relationships were established, differentiating a South American isolate from 2 African strains of X. campestris pv. cassavae. The similarity in isozymic patterns of the South American isolate of X. campestris pv. cassavae and those of some isolates of X. campestris pv. manihotis suggests that the former could be a yellow strain of X. campestris pv. manihotis. The isolates of X. campestris pv. manihotis could be grouped according to pathogenicity by analyzing their profiles of acid phosphatase. (Author's summary) E02

0247

13033 SOUZA FILHO, B.F. DE; TUPINAMBA, E.A. 1979. Ocorrencia da prodridao mole das raízes de mandioca (Manihot esculenta Crantz) em Sergipe. (Soft root rot in cassava in Sergipe). Aracaju-SE, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Amb.ito Estadual de Quissamã. Comunicado Técnico no.04. 4p. Port., Illus.

Cassava. Phytophthora. Phytophthora drechsleri. Disease control. Cuttings. Brazil.

A disease causing rot in the stem area and roots, irreversible wilting of the canopy, and leaf shed of cassava plants was reported in the state of Sergipe, Brazil, during 1976-79. The disease affects both young and adult plants in poorly drained soils, cultivated with cassava over a long period. The causal agent was isolated in tissues of the stem region and was identified as Phytophthora drechsleri. Differences in var. susceptibility were observed; cv. Caravela was one of the most resistant and in Paraiba, cv. Cedinha and Osso Duro. Crop rotation and fungicidal treatment of cuttings were used to control the disease. In a preliminary trial carried out in Ribeirópolis the fungicides mancozeb, Distreptine 20, benomyl, captafol, propineb + zineb, and PCNB did not control rotting. (Summary by I.B. Trans. by L.M.F.) E02

See also 0248 0283 0284 0285 0289

E03 Mycoses

0248

19540 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Pathology. In _____. Annual Report 1982. Ibadan, Nigeria. pp.100-102. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Colletrotrichum manihotis. Etiology. Pseudotheraptus devastans. Plant damage. Resistance. Selection. Cultivars. Inoculation. Xanthomonas manihotis. Nigeria.

To determine the role of Pseudotheraptus devastans and of Colletotrichum gloeosporioides f. sp. manihotis in severe outbreaks of cassava anthracnose, 5 treatments were applied to 1-mo.-old plants of cassava clone TMS 30001: (1) inoculation by spraying (1×10^4 spores/ml); (2) inoculation followed by P. devastans feeding (4 bugs/plant); (3) P. devastans feeding followed by inoculation; (4) P. devastans feeding; and (5) control, no feeding or inoculation. A completely randomized block design was used with 4 replications (5 plants/treatment). Control plants remained healthy throughout the observation period. Treatments (2) and (3) showed a significantly higher % of cankers to be colonized by the fungus. Treatment (1) showed no typical anthracnose cankers. Treatment (3) had longer cankers than (2) and (4). Defoliation was significantly higher in (1), (2), and (3) with 80.5, 80.8, and 81.5%, resp., than in (4) and the control (3.9 and 0%, resp.). In vitro inoculation conditions for a reliable and rapid method of screening cassava for resistance to anthracnose were defined. Green cassava stem pieces (8 cm long) cut from plants in the field were sterilized by dipping them in 95% ethyl alcohol for 1 min and inoculated by depositing 4-mm discs of an actively growing colony of the fungus on a group of 3 punctures made in the internodal region with a needle heated to red. A variability expt. was also conducted, in vivo and in vitro, with 22 and 21 isolates, resp., on TMS 30001, 30572, and 30555 in a split-split plot design. Lesions were longer in TMS 30572 (7.1 mm), the size varying significantly among clones. In another expt. to measure inoculum levels of Xanthomonas campestris pv. manihotis (72 h old), the min. inoculum level to produce symptom expression was found to be 10^4 cells/ml. Wilt and defoliation above the point of inoculation can be used in screening for resistance to CBB under controlled conditions. (Summary by I.B. Trans. by L.M.F.) E03

0249

20121 LANGUIDEY, P. 1983. Enfermedades de la yuca observadas en el departamento de Santa Cruz durante la gestión agrícola 1979/80. [Cassava diseases observed in Santa Cruz (Bolivia) during the 1979/80 crop year). Revista Boliviana de Investigación 1:43-44. Span., Sum. Span., 4 Refs. [Inst. de Investigaciones Agrícolas El Vallecito, Univ. Gabriel René Moreno, Casilla 702, Santa Cruz, Bolivia]

Cassava. Cercospora henningsii. Cercospora vicosae. Cercospora caribaea. Uromyces. Oidium. Bolivia.

The most common cassava diseases observed in the dept. of Santa Cruz, Bolivia, during 1979-80 were, in order of importance: brown leaf spot (Cercosporidium henningsii), blight leaf spot (Cercospora vicosae), and white leaf spot (Cercospora caribaea). Of lesser importance were rust (Uromyces spp.) and cassava ash (Oidium manihotis), restricted to the dry season and winter. (Author's summary) E03

0250

20154 MENDOZA A., A. 1980. Reconocimiento e identificación de organismos fungosos de la yuca (Manihot esculenta Crantz) en la zona de Moniquirá (Boyacá). [Study and identification of fungal organisms in cassava in the zone of Moniquirá (Boyacá)]. Tesis Ing.Agr. Tunja, Universidad Pedagógica y Tecnológica de Colombia. Facultad de Agronomía. 175p. Span., Sum. Span., 51 Refs., Illus.

Cassava. Phoma. Botryodiplodia. Rosellinia necatrix. Cercospora vicosae. Cercospora henningsii. Cercospora caribaea. Oidium manihotis. Erysiphe manihotis. Colombia.

Fungal microorganisms that cause diseases in cassava were studied and identified during the 1st 6 mo. of 1980 on material collected in the zone of Moniquirá, Boyacá, Colombia. Isolates were made from the different cassava plant organs affected using 3 culture media. Seven fungal diseases were identified: (1) concentric ring leaf spot and dieback (Phoma sp.) with damage evaluated as very severe with a % above 15%. (2) Stem and branch blight (in storage), caused by Botryodiplodia sp., is very characteristic of areas where no precaution or care is taken in cutting handling. In Moniquirá, cuttings are left under trees offering little shade and unprotected from rain in addition to the dehydration caused by solar radiation. Within a short time deterioration reaches levels of damage above 25%. (3) Root rot, caused by the fungus known as Rosellinia necatrix in its sexual stage and as Graphium necator in its asexual form, is found in low flooded areas with a certain OM content or in areas previously planted to woody perennial species. Its incidence was moderate and only in the aforementioned circumstances did it occur with focal severity. (4) Three species of the genus Cercospora occurred affecting cassava foliage, the most severe being blight leaf spot (Cercospora vicosae) due to the defoliation caused. Damage % was assessed at 15%. (5) and (6) Brown and white leaf spots, caused, resp., by Cercosporidium henningsii and Cercospora caribaea, had similar characteristics and the % of damage was assessed as 10% for both. (7) Cassava ash was the less important disease as to damage caused and severity. It is caused by Oidium manihotis in its asexual stage and in its perfect form, Erysiphe manihotis. Environmental conditions of the zone were unfavorable during most of the time. Control measures eradicate all fungal diseases since root rot, blight, and in advanced stages, dieback can not be controlled due to the nature and severity of their symptoms. (Author's summary. Trans. by L.M.F.) E03

0251

20186 MORENO, R. 1979. Algunos estudios epidemiológicos de enfermedades en sistemas mixtos de producción de cultivos. (Some epidemiological studies of diseases in mixed cropping systems). Turrialba, Costa Rica, Centro Agronómico Tropical de Investigación y Enseñanza. Programa de Cultivos Anuales. 33p. Span., 9 Refs., Illus.

Cassava. Intercropping. Maize. Sweet-potato. Beans. Epidemiology. Oidium manihotis. Sphaceloma. Costa Rica.

The incidence and severity of some diseases occurring in cassava in monoculture and in cassava/maize, cassava/beans, cassava/sweet potato, cassava/maize/sweet potato/bean intercropping were investigated at the exptl. station of the Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica. The following diseases were detected: (1) in cassava, cassava ash (Oidium manihotis) and Sphaceloma sp.; (2) in beans, angular leaf spot (Isariopsis griseola) and rust (Uromyces phaseoli var. typica); and (3) in cowpea, Ascochyta leaf spot. The incidence and severity of Oidium manihotis was higher in cassava and maize, whereas the disease initiation was delayed and less severe in the cassava/bean association. Angular leaf spot severity in beans was evaluated both in monoculture as well as in association with other crops; treatments including maize showed higher disease incidence, while bean/sweet potato and bean/cassava intercrops were less affected. (Summary by EDITEC) E03

0252

20144 ZEIGLER, R.S.; LOZANO, J.C. 1983. Relaciones patogénicas entre algunas especies de Elsinoe y Sphaceloma afectando la yuca (Manihot esculenta) y a otras euphorbiáceas en Centro y Sur América. (Pathogenic relationships among some species of Elsinoe and Sphaceloma affecting

cassava and some other euphorbiaceae in Central and South America). Fitopatologia Brasileira 8(1):153-171. Span , Sum. Span., Engl., 18 Refs. [Inst. des Sciences Agricoles du Burundi, Bujamburra, Burundi]

Cassava. Sphaceloma manihoticola. Elsinoe brasiliensis. Colombia.

Isolates of Sphaceloma and Elsinoe spp. were collected from Euphorbia brasiliensis, Eu. heterophylla, Eu. pulcherrima, Jatropha aconitifolia var. papaya, Manihot carthaginensis, and M. esculenta in Mexico, Costa Rica, the Dominican Republic, and Colombia. M. carthaginensis and J. aconitifolia var. papaya have not been reported previously as Sphaceloma hosts, and cassava has not been previously reported as a host of Elsinoe spp. A connection between the Elsinoe from cassava with S. manihoticola is established. Cross inoculations demonstrated that some isolates were pathogenic on several euphorbiaceous species. Pathogenicity on cassava of an isolate of E. brasiliensis from Eu. brasiliensis was enhanced by reisolation and reinoculation from cassava. Cultural characteristics on PDA were not sufficiently different to aid in separating the species. Conidial dimensions on PDA were not significantly different among isolates from Eu. brasiliensis, M. esculenta, M. carthaginensis and J. aconitifolia var. papaya. There were no significant differences between isolates from Eu. pulcherrima and Eu. heterophylla, but each was different from the other 4. S. krugii and S. poinsettiae both produced large, pigmented, spindle-shaped spores in addition to the more typical small, hyaline Sphaceloma conidia. In the light of these studies, a combination of several species is proposed. S. poinsettiae and S. krugii are combined under S. poinsettiae. E. jatrophae, E. brasiliensis, and the Elsinoe found on cassava are combined under the name E. brasiliensis. (Author's summary) E03

See also 0196 0283 0288

E04 Viroses

0253

19541 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Virology. In _____. Annual Report 1982. Ibadan, Nigeria. pp.102-103. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Viroses. Nigeria.

Pure and concentrated preparations of a geminivirus purified on Nicotiana benthamiana, which was previously infected by mechanical inoculation, were obtained. Leaf tissue of N. benthamiana was homogenized in a 0.2 M phosphate buffer (pH 7.8) with EDTA and mercaptoethanol and clarified with chloroform. After precipitation with ammonium sulfate and one centrifugation cycle, the virus was further purified by centrifuging twice on a 10-40% linear sucrose gradient. Small quantities of antiserum were obtained in rabbit immunization with a titer of 1/128 in agar gel diffusion tests with purified virus (0.9%) agarose in 0.01 M ammonium molybdate, pH 7.8, with 0.001 M EDTA, and 0.1% NaN_3. The same results were obtained using infected N. benthamiana tissue. However, there was no reaction when an extract of infected cassava plants was used. All attempts to transmit the geminivirus from N. benthamiana to healthy cassava plants failed. Only 1 out of 10 seedlings showed symptoms when inoculated or injected with an extract of diseased cassava plants. The geminivirus could not be purified from diseased cassava; fractions obtained showed infectivity when tested on N. benthamiana. A fraction with short, rod-shaped particles with a diameter of approx. 10 nm and a coarse substructure was obtained. These particles have been reported on both diseased and healthy plants. In one

purification attempt, using infected cassava material, particles of 800-2000 nm in length and with a diameter of 18 nm, coarse in structure, were observed. (Summary by I.B. Trans. by L.M.F.) E04

0254

18442 SANTOS, A.A. DOS; SILVA, P.H.S. DA 1982. Ocorrencia do virus do mosaico das nervuras da mandioca no Estado do Piauí. (Presence of the leaf vein mosaic in cassava 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.14. 3p. Port. [Unidade de Execucao de Pesquisa de Ambito Estadual de Teresina, Caixa Postal 01, 64.000 Teresina-PI, Brasil]

Cassava. Cassava vein mosaic virus. Symptomatology. Cultivars. Brazil.

Data on the incidence of the leaf vein mosaic in the state of Piauí, recorded at the Unidade de Execucao de Pesquisa de Ambito Estadual in Teresina during May 1981, are given. After serological identification with antiserum and based on disease symptoms, the disease was monitored on test plants. All the plants of cv. Sutinga presented disease symptoms and cv. Goela de Jacu, Curvela, Joao Vaz Preta, and Branca de Agricolandia had no diseased plants, possibly due to their origin (healthy cuttings). Possible immunity or resistance should be verified in the greenhouse by grafting diseased plants to healthy plants. (Summary by I.B. Trans. by L.M.F.) E04

0255

20164 STANLEY, J.; GAY, M.R. 1983. Nucleotide sequence of cassava latent virus DNA. Nature 301(5897):260-262. Engl., 10 Refs., Illus. [Dept. of Virus Research, John Innes Inst., Colney Lane, Norwich NR4 7UH, England]

Cassava. Cassava latent virus.

The derivation of the nucleotide sequence of CLV is described, as a fundamental step towards investigation of the mode of replication of this group of viruses. Results show that virus DNA comprises 2 similar-sized molecular species with a common region encompassing almost 200 nucleotides. The organization of the genome is discussed. (Summary by Review of Plant Pathology) E04

See also 0216 0285

E06 Nematodes

0256

20123 McSORLEY, R.; O'HAIR, S.K.; PARRADO, J.L. 1983. Nematodes of cassava, *Manihot esculenta* Crantz. Nematropical 13(2):261-287. Engl., Sum. Engl., Span., 90 Refs., Illus. [Agricultural Research & Education Center, 18905 S.W. 280 St., Homestead, FL 33031, USA]

Cassava. Nematodes. Productivity. Cultivars. Resistance. USA.

The plant parasitic nematodes most frequently found associated with cassava throughout the world are *Pratylenchus brachyurus*, *Rotylenchulus reniformis*, *Helicotylenchus* spp., *Scutellonema* spp., and *Meloidogyne* spp. Only *P. brachyurus* and *Meloidogyne* spp. are considered economically damaging to the

crop, with root knot nematodes the most widespread. Damage from Meloidogyne spp. usually depends on the population level; however, the many differences in responses of various cassava cv. to Meloidogyne species suggest that use of resistant or tolerant cv. may be the most practical method for managing root knot nematodes on this crop. Data are presented relating yield of the cassava cv. Señorita in southern Florida (USA) directly to wt. of the seed piece and inversely to high populations of M. incognita. Marketable yield of the cv. Señorita and Mantiqueira were similar in plots having subthreshold levels of M. incognita, but Señorita showed more galling than Mantiqueira, HMC-2, or CMC-92. The latter cv. was poorly adapted to southern Florida conditions, and had the lowest yields of the cv. tested. (Author's summary) E06

0257

18919 STONE, A.; MEREDITH, J.; MONTALDO, A. 1982. Reconocimiento de nemátodos fitoparásitos de yuca en Venezuela. (Survey of plant parasite nematodes in cassava in Venezuela). In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomía. Alcance no.31:241-246. Span., 21 Refs. [Depto. de Nematología, Estación Experimental de Rothamsted, Inglaterra]

Cassava. Nematodes. Venezuela.

Bibliographic references on different species of plant parasite nematodes in cassava in Venezuela and other American countries are reviewed, namely, Rotylenchulus reniformis (Puerto Rico, Jamaica), Helicotylenchus (Trinidad, Brazil), Criconemoides (Trinidad), Ditylenchus (Brazil, USA), Pratylenchus (Dominican Republic, Trinidad, Brazil), Meloidogyne (Dominican Republic, Trinidad, Peru, Brazil), Aphelenchus (Trinidad). In the scarce background information existing, neither the index of crop damage nor if their presence is occasional due to host plants or weeds are indicated. A survey of cassava growing areas was carried out in 1974, giving localities, date, soil type, and symptoms of nematode presence of an area from Araguita, in the state of Miranda, to Chaguaramas, state of Guárico. Few nematodes and no plant parasites were found but in 1980 at the Escuela Práctica de Agricultura, Turmero, state of Aragua, strong root knot nematode (Meloidogyne) attacks were observed. These caused abundant leaf and root growth, but storage roots did not thicken. The most susceptible var. were Mex-59, CMC-76, SM1-150, HMC-4, and M-Ven 218. This new information makes a new survey necessary to update existing data. (Summary by I.B. Trans. by L.M.F.) E06

F00 PEST CONTROL AND ENTOMOLOGY

F01 Injurious Insects and their Control

0258

20196 BHATNAGAR, V.S.; NDOYE, M.; PIERRARD, G. 1982. Current status of entomological studies on cassava in Senegal, likely future developments and suggested collaborative research and developmental needs. Bambey, Senegal, Institut Senegalais de Recherches Agricoles. 6p. Engl., 3 Refs. [Inst. Senegalais de Recherches Agricoles, B.P. 51, Bambey, Senegal]

Cassava. Entomology. Research. Phenacoccus manihoti. Cassava programs. Senegal.

In 1982 a preliminary study was initiated in Senegal to identify the various insect pests attacking cassava, with special emphasis on the mealybug Phenacoccus manihoti and its natural parasites, predators, or pathogens. In low rainfall areas, such as in Louga and Thies, a high pest incidence was observed (up to 85% of plants were attacked). The oldest plants are generally the most affected. In samples collected 2 hymenopteran (Encyritidae), 1 coccinellid, and 1 spider species were found as parasites/predators, the identification of which is pending. The need to search for new beneficial insect species in the different ecological zones is emphasized as well as the implementation of cropping systems, the use of resistant cv. or insecticide treatments for an integrated pest control. To find proper solutions for farmers it is also necessary to strengthen the collaboration between researchers and technicians. (Summary by EDITEC) F01

0259

18915 BOLIVAR, P.; BOSCAN, N. 1982. Alguna información bibliográfica sobre Anastrepha spp (Diptera: Trypetidae) y Lonchaea chalybea (Diptera: Lonchaeidae) en yuca. [Bibliographic information on Anastrepa spp. (Diptera: Trypetidae) and Lonchaea chalybea (Diptera: Lonchaeidae) in cassava]. In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomía. Alcance no.31:207-211. Span., 10 Refs. [CENIAP-FONAIAP, Maracay, Venezuela]

Cassava. Anastrepha pickeli. Anastrepha manihoti. Anastrepha striata. Carpolonchaea chalybea.

Bibliographic information on the background, damage caused, life cycle, appearance, and habits of the fruit fly Anastrepha spp. and the shoot fly Carpolonchaea chalybea is reviewed. A. pickeli causes damage to sweet and bitter cassava clones in Venezuela, Brazil, and Panama and likewise in Peru, Argentina, and Colombia. A. manihoti has been observed in Venezuela, Peru, Brazil, Panama, and Colombia. A. striata is found in all these countries and also in the USA, Mexico, Honduras, Costa Rica, Ecuador, Bolivia, Surinam, Trinidad and Tobago. A. montei is found in Costa Rica, Panama, Brazil, and Paraguay. When Anastrepha spp. oviposits on the fruit, it destroys the developing seed, boring tunnels into the pith region of the stem, and in association with Erwinia carotovora var. carotovora, can cause severe stem rot. Young plants suffer more damage. Shoot flies have been observed in most cassava growing areas of the Americas; however, they have not been reported in Africa or Asia. Data are given on their synonymy. This pest is detected by the presence of a whitish to brown exudate flowing from the growing points, which die. It also delays plant growth, destroys stem dominance, and causes lateral buds to germinate. These buds can also be attacked. Young plants are more susceptible. In Colombia, dry seasons favor high populations of C. chalybea. (Summary by I.B. Trans. by L.M.F.) F01

0260

20158 BRITO, C. 1981. Strategies in the control of the principal pests of Cape Verde. In International Conference on Biological Control of Pests: Its Potential in West Africa, Dakar, Senegal, 1981. Proceedings. Dakar, USAID Regional Food Crop Protection Project. pp.216-217c. Engl.

Cassava. Aonidomytilus albus. Pinnaspis strachani. Tetranychus. Predators and parasites. Cape Verde.

The potential of biological pest control in West Africa is discussed. Several interinstitutional strategies, namely GTZ, FAO, USAID, ORSTOM, to control pests of major food crops in Cape Verde are described. Biological control measures, especially the distribution of natural enemies of the pests, are included. Regarding cassava, the following entomophage families are mentioned: Aphytis dispidis, Pharoseymus exiguus, and Cybocephalus nitens, predators of Aonidomytilus albus; Arrenophagus chionaspidis, predator of Pinnaspis strachani; and Nematoscelis filipes, predator of Tetranychus spp. The Crop Protection Department has developed a plan of integrated pest management. (Summary by I.B. Trans. by L.M.F.) F01

0261

19586 EZEABASILI, N. 1982. Cassava mealybug: is biological control the answer? In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National [illegible]t Crops Research Institute. p.118. Engl. [African Science & Agric. [illegible].) Limited, P.O. Box 2402, Enugu, Nigeria]

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

The biological control of the cassava mealybug (Phenacoccus manihoti) in Nigeria is recommended instead of the present emphasis placed by the Four Year Plan, 1981-85, on fertilizers which can be substituted by manures made from urban waste, tractors that deplete tropical soils, and pesticides which have limited use in subsistence agriculture and are useless in view of certain biological aspects of the pest. Recommended predators for massive multiplication include lepidopterans, Spalgis lemolea, and the coccinellids Hyperaspis spp. and Exochomus spp. (Summary by I.B. Trans. by L.M.F.) F01

0262

19222 FABRES, G.; NKOUKA, N. 1982. The cassava mealybug: research on cassava pests and diseases in the Congo. Cassava Newsletter 10:12-13. Engl., 6 Refs. [Office de la Recherche Scientifique et Technique Outre-Mer, Centre de Brazzaville, B.P. 181, Brazzaville, Congo]

Also in Spanish.

Cassava. Phenacoccus manihoti. Predators and parasites. Biological control. Congo.

Field and lab. research on several aspects of Phenacoccus manihoti, a South American species introduced into West and Central Africa where it is now causing severe damage to cassava crops, is reported. Its life cycle has been studied through several generations. Research has been conducted on its population dynamics and outbreak mechanisms, as well as factors involved in its regulation, particularly rainfall and entomophagous agents. The occurrence of several predators, parasites, and hyperparasites has been reported, among them a new species of Anagyrus, several Coccinellids and Cecidomyiids. Morphological studies of such beneficial insects are also in progress. Knowledge of the biotic potential and of natural mechanisms involved in the periodic outbreak will help in selecting the best methods for integrated control of this pest. (Summary by I.B.) F01

0263

19573 HAHN, S.K. 1982. A preliminary report of cassava mealybug (Phenacoccus manihoti Mat-Ferr) research at IITA. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.33-34. Engl. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Cassava programs. Cultivars. Resistance. Entomology. Nigeria.

A brief report is given on the research carried out by the International Institute of Tropical Agriculture (IITA) on the cassava mealybug (Phenacoccus manihoti). An international workshop was carried out in Zaire in June 1977 and recommendations included research on the biology and ecology of the pest, sources of resistance, emphasis on biological control, cultural and chemical control methods (only for planting material). Considerable advances have been made on the biology and ecology of the African mealybug; the Commonwealth Institute of Biological Control is conducting active searches in America to find predators and parasites and the IITA is seeking natural enemies of the pest in Central America, sponsored by the International Fund of Agricultural Development. Anagyrus sp., introduced from Paraguay, is promising. Clonal differences in the severity of infestation and a relationship between pubescence (no. of hairs along the mid-rib of the leaf undersurface) and pest resistance were observed. Var. TMS 4(2)1425 and 60142 showed resistance to the mealybug and also to the green spider mite (Mononychellus tanajoa) and are now being multiplied. IITA directs all of its research efforts toward breeding for resistance to both of these pests and toward biological control, with emphasis on the cassava mealybug. (Summary by I.B. Trans. by L.M.F.) F01

0264

19581 HAHN, S.K. 1982. Pubescence in cassava and resistance to both cassava mealybug and green spider mite. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. p.76. Engl. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Resistance. Clones. Nigeria.

The relationship between leaf pubescence of cassava plants and resistance to the cassava mealybug (Phenacoccus manihoti) and to the green spider mite (Mononychellus tanajoa) is briefly discussed. The International Institute of Tropical Agriculture (IITA) has adopted 2 major approaches in Nigeria, breeding for resistance and biological control, to find means of controlling these pests. Sixty cassava clones were tested for resistance to these pests during 1980-81. Field infestation was uniform and significant differences were found in av. clonal resistance. TMS 60142, 30017, 61342, 60741, and 40764 were resistant to M. tanajoa; TMS 6177, 42025, 60142, 61324, and 4(2)1425 were resistant to P. manihoti. TMS 60142 was resistant and TMS 4(2)1425 moderately resistant to both pests. These 2 clones produced relatively high yields (15-25 t/ha) under IITA conditions and their quality was acceptable. The no. of hairs/1 cm length along the mid-rib of leaf undersurface correlated significantly with resistance to P. manihoti and M. tanajoa. There was a relationship between these 2

resistances, suggesting that improvement of cassava for further resistance is feasible. (Summary by I.B. Trans. by L.M.F.) F01

0265

20157 HERREN, H.R. 1981. Current biological control research at IITA, with special emphasis on the cassava mealybug (Phenaccocus manihoti Mat-Fer). In International Conference on Biological Control of Pests: Its Potential in West Africa, Dakar, Senegal, 1981. Proceedings. Dakar, USAID Regional Food Crop Protection Project. pp.92-97. Engl., Sum. Engl., 6 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

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

Soon after its accidental introduction from Latin America into Africa, the cassava mealybug, Phenacoccus manihoti, has developed into a major pest, threatening cassava production in most of the Central and West African countries. Since chemical control is not feasible for ecological, as well as practical reasons, the International Institute of Tropical Agriculture (IITA) has given priority to research on biological control. Research is currently being carried out on the biology, ecology, and population dynamics of the cassava mealybug and the already available natural enemies (Hyperaspis sp. and Nephus biluceruarius), in collaboration with national and other international institutes. New methods for mass cultures and releases are being developed. Courses for special training in biological control practices will be organized by IITA. (Author's summary) F01

0266

19593 HERREN, H.R. 1982. IITA's role in integrated control of cassava mealybug (Phenacoccus manihoti Mat-Ferr) and green spider mite (Mononychellus tanajoa Bondar) In Africa. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.154-157. Engl., 8 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Insect control. Phenacoccus manihoti. Mononychellus tanajoa. Nigeria.

In 1980 the International Institute of Tropical Agriculture (IITA) started a biological control program of the cassava mealybug (Phenacoccus manihoti), introduced accidentally into Africa, where it has caused great damage due to the absence of natural enemies. However, the greatest hopes are for integrated control which would mean a lasting solution for control not only of P. manihoti but also of other pests and diseases. Since ecological conditions vary, the solution needs a built-in variation capacity. One of the objectives of IITA's program is to provide specially tailored solutions for each country, taking into account their research facilities, availability of funds, and ecological conditions. Training is also offered in addition to the export of natural enemies, free of charge, to interested countries. The selection and release of these enemies is optimized through the system analysis method. Trips to several countries in search of natural enemies and parasitoids of this pest are reported. Insects have been sent to quarantine stations of the Commonwealth Institute of Biological Control, from where they are sent to Nigeria for detailed bionomic studies and further multiplication. So far Hyperaspis sp. has been released for field expt. and results will be available at the end of the dry season, 1981-82. Different methods of releases of predators are

mentioned and the importance of timing the release before P. manihoti multiplication is highlighted. Alternate host plants (8) were also found for P. manihoti. Population dynamics of the cassava mealybug is studied using the life table technique; expt. on the influence of pubescence on predator and parasitoid behavior are underway. Preliminary studies on the influence of saliva toxin on plant growth have been carried out. For 1982 plans include studies on bionomics and population dynamics of the green spider mite; currently taxonomic, biological, and ecological studies are underway as well as studies on host plant resistance. (Summary by I.B. Trans. by L.M.F.) F01

0267

20174 HODGES, R.J.; DUNSTAN, W.R.; MAGAZINI, I.; GOLOB, P. 1983. An outbreak of Prostephanus truncatus (Horn) (Coleoptera:Bostrichidae) in East Africa. Protection Ecology 5(2):183-194. Engl., Sum. Engl., 23 Refs., Illus. [Storage Dept., Tropical Development & Research Inst., London Rd., Slough, Berks SL3 7HL, England]

Cassava. Storage. Processed products. Prostephanus truncatus. Tanzania.

In 1980, farm-stored maize and cassava in the Tabora region of Tanzania were heavily infested by Prostephanus truncatus, a beetle previously known only in Central America, where it is an occasionally severe pest of stored maize, the southern USA, and northern South America. A survey in Sept. 1981 showed that it was present over much of the Tabora region and had spread to a few other parts of the country. The hot dry conditions in Tabora seemed particularly suitable for the beetle, and there was some evidence that it is favored by traditional st rage practice. P. truncatus was found for the 1st time breeding in dried cassava, which was consistently and heavily infested. Groundnuts, wooden implements and storage structures showed signs of having been bored, but rice, sorghum, and beans were apparently not attacked. This pest appears capable of spreading to other countries in Africa and every precaution should be taken to prevent this. (Summary by Review of Applied Entomology) F01

0268

18489 INGRAM, W.R. 1970. Pests of cassava. In Jameson, J.D., ed. Agriculture in Uganda. London, Oxford University Press. p.250. Engl.

Cassava. Bemisia. Aonidomytilus albus. Zonocerus variegatus. Uganda.

Cassava pests in Uganda are briefly reported. Cassava scale, Aonidomytilus albus, was probably introduced from Amani, on var. resistant to Bemisia sp., in the 1940s. In 1953-54 the pest was already widespread and although it does not affect tuber yield in Uganda, it is considered to be important in Tanzania. Infested plants should be burnt and only clean material planted. Zonocerus variegatus, a leaf-eating insect, can be controlled with dieldrin sprays. (Summary by I.B. Trans. by L.M.F.) F01

0269

19539 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Entomology. In _____. Annual Report 1982. Ibadan, Nigeria. pp.94-100. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Entomology. Phenacoccus manihoti. Predators and parasites. Maps. Biological control. Insect control. Nigeria.

The research highlights of the Cassava Entomology Program of the International Institute of Tropical Agriculture (IITA) are presented. The program concentrated on the biological control of the cassava mealybug, Phenacoccus manihoti. Releases of natural enemies of the pest continued, new species that can be natural enemies were studied, host plant-insect interactions were investigated, and an Africa-Wide Project for the Biological Control of Cassava Mites and Insect Pests was prepared. Three predator species (Hyperaspis notata, H. jucunda, and Scymnus sp.) and a parasitoid species, Apoanagyrus lopezi, were mass reared. Some of the natural enemies that were found and identified include Anagyrus sp., Acerophagus sp., Olla V-nigrum, Hyperaspis notata, Nephus sp., Chrysopa sp., Sympherobius sp., Ocyptamus sp., and Diomus sp. Aspects related to the influence of constant temp. on the population growth of P. manihoti, the bionomics of H. notata and Sympherobius notata and host plant-pest interactions are also discussed. (Summary by EDITEC) F01

0270

19967 KIYINDOU, A. 1982. Caracteristiques biologiques d'Hyperaspis senegalensis hottentotta et d'Exochomus flaviventris (Col. Coccinellidae) principaux predateurs de la cochenille du manioc Phenacoccus manihoti (Hom. Pseudococcidae) en Republique Populaire du Congo. [Biological characteristics of Hyperaspis senegalensis hottentotta and of Exochomus flaviventris (Col. Coccinellidae), major predators of Phenacoccus manihoti (Hom. Pseudococcidae) in Congo]. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 29p. Fr., Sum. Fr., 15 Refs., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, Centre de Brazzaville, B.P. 181, Brazzaville, Congo]

Cassava. Phenacoccus manihoti. Predators and parasites. Biological control. Entomology. Congo.

The biology of 2 important insects belonging to the family Coccinellidae, predators of Phenacoccus manihoti, was compared, namely (1) Hyperaspis senegalensis hottentotta and (2) Exochomus flaviventris. Data on systematics and economic importance are included. The evolutional cycle and biological parameters of the 2 predators were studied under lab. conditions in dishes covered with fine mesh and with controlled thermo-higrometric conditions, based on previous research. The % of egg hatching was 88.3% for (1) and 100% for (2). Incubation time for both insects was almost the same; however, the mean developmental time for larval and nymphal stages was longer for (2). Under exptl. conditions all of the larvae survived and reached the adult stage. The male:female ratio was 4:3 for (1) and 2:3 for (2). Sexual maturity lasted 3-16 days for (1) and 9-21 days for (2). For both (1) and (2), the presence of the prey (P. manihoti) stimulated oviposition. Female H. senegalensis hottentotta had a life cycle of 172.3 days (76.36 days of oviposition) and female E. flaviventris had a life cycle of 112.2 days (56.4 days of oviposition). The influence of different substrates on reproduction potential of (1) was studied. Oviposition preference was 0% in sand, 14.2% on blotting paper, 26.5% on dry, shrivelled branches infested with P. manihoti and 8% on uninfected branches, and 51% on green, smooth branches. Biological data are summarized. (Summary by I.B. Trans. by L.M.F.) F01

0271

19965 KIYINDOU, A. 1983. Etude des parametres biologiques et comportementaux d'Hyperaspis sp. (Col. Coccinellidae) predateur exotique de la cochenille du manioc Phenacoccus manihoti (Hom. Pseudococcidae) en Republique Populaire du Congo. [Study of biological parameters and

behavior of Hyperaspis sp. (Col. Coccinellidae), exotic predator of Phenacoccus manihoti (Hom. Pseudococcidae), in Congo]. Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. 43p. Fr., 22 Refs., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, Centre de Brazzaville, B.P. 181, Brazzaville, Congo]

Cassava. Phenacoccus manihoti. Predators and parasites. Biological control. Entomology. Congo.

The evolutional cycle and biological parameters of Hyperaspis sp. were determined under lab. conditions using a strain from Guyana and covered systematic position, morphology, developmental stages (% of eggs hatched, survival rate), male:female ratio, sexual maturity, longevity, and fecundity. The influence of temp. and RH and the presence of the prey, Phenacoccus manihoti, on the behavior of Hyperaspis sp. was also determined. Results were compared with those obtained with H. senegalensis hottentotta in Congo. The % of eggs hatched was 74%; causes of embryonal mortality were not established and atypical eggs were not observed. Larval survival was excellent. A male:female ratio of 1:1 was observed. Total life cycle lasted an av. of 95.9 days (preadult); ovipositional period lasted 10 days with 4.7 eggs/female/day at 27°C and 71-99% RH. Preadult development was fairly synchronic. The most favorable temp. for prey development was 25°C. Under exptl. conditions the most favorable RH for survival was 75%. The abnormally long duration of one stage is corrected by the subsequent rapid development of the next. Development rate increases with increasing temp. Female development is quicker with a high RH (95%). Heat constants for temp. of 20, 25, and 30°C were calculated at 250, 310, and 389, resp., for a C relationship (C, heat constant = (T-K)X where T is the exptl. temp., K the development threshold, and X the duration of the stage at temp. T). Hyperaspis sp. has a populational increase potential almost half that of H. senegalensis hottentotta, although its value as predator depends on physical environmental factors. The highest daily consumption of the prey by Hyperaspis occurs during larval stages 3 and 4 (3.1 and 6.4 young female P. manihoti, resp.). Abundant available prey (eggs) is essential for the survival of young larvae. (Summary by I.B. Trans. by L.M.F.) FOI

0272

19966 KIYINDOU, A. 1982. Quantification des variations d'abondance de la cochenille du manioc (Phenacoccus manihoti Hom. Pseudococcidae). (Quantification and variation of the Phenacoccus manihoti Hom. Pseudococcidae populations). Brazzaville, Congo, Office de la Recherche Scientifique et Technique Outre-Mer. Serie Techniques et Methodes no.2. 9p. Fr., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, Centre de Brazzaville, B.P. 181, Brazzaville, Congo]

Cassava. Phenacoccus manihoti. Entomology. Congo.

A gradation profile of Phenacoccus manihoti populations was determined according to seasonal rates, after quantifying the amount of phytophagous insects. Visual countings were made of P. manihoti on 3 stems selected from cassava plants located in 10 areas delimited along an imaginary line that crossed the crop diagonally. The insects on the 30 stem apices and on the leaves (5 young leaves nearest to the apex and 5 aged leaves nearest to the base) were counted. During the young female stage, all the insects present on 10 apices, selected from the 30 under study, were systematically counted with magnifying glasses. It was verified that during the rainy season there was a low % of infestation (10-15%); juvenile stages were observed to prefer tender leaves. During the dry season, juvenile stages infested 100% of the plants. P. manihoti density varied from one season to

another: 0-3 and 70-80 insects/apex during the rainy and dry seasons, resp. Density decreased again with the arrival of winter. The % of mature females increases during the wet season while the % of juvenile stages decreases. (Summary by I.B. Trans. by L.M.F.) F01

0273

19964 LUNDBORG, G. 1982. Tropici: la coccinigliа della manioca. (The cassava mealybug in the tropics). Terra e Vita 23(45):51-52. Ital., Illus.

Cassava. Phenacoccus manihoti. Predators and parasites. Biological control. Entomology. Africa.

The severe damage produced by Phenacoccus manihoti in tropical Africa and the efforts of scientists to identify and control this pest, originating from South America and introduced into Zaire in 1973 and currently extended to Senegal, are reported. Genetic and biological control measures should be used. P. manihoti has destroyed up to 50% of the cassava cultivated, which in 1979 reached 45 million tons. During its extension the insect has found no natural enemies, which should be identified in their original environment. To date 4 predators (Hyperaspis quinquenotata, Scymnus sp., Exochomus sp., and Hyperaspis sp.) and one Paraguayan parasite, Apoanagyrus lopezy, are known and have been introduced into Africa for their respective multiplication in cooperation with other institutions. Another grave concern for Africans is the green spider mite (Mononychellus tanajoa), introduced into Uganda in 1972. Pubescence of cassava leaves is an important characteristic in the selection of resistant var., since this is advantageous for pest parasites. Clones TMS 4(2)1425 and 60142 have this characteristic. Data are given on cassava cultivation and the damage symptoms caused by the cassava mealybug. Social aspects of the problem are emphasized. (Summary by I.B. Trans. by L.M.F.) F01

0274

19577 LUTALADIO, N.B. 1982. Status of research on the control of cassava mealybug and green spider mite in Zaire. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.43-46. Engl., 9 Refs. [Programme National Manioc. Zaire]

Cassava. Phenacoccus manihoti. Insect control. Biological control Predators and parasites. Insecticides. Resistance. Plant breeding. Cassava programs. Zaire.

Research carried out by the Programme National Manioc (PRONAM, 1974) to control the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa) in Zaire is reported. Regarding the mealybug, breeding for resistance and biological control are considered long-term solutions and cultural practices and chemical control as short-term methods. Screening of materials introduced from Brazil and the resulting hybridization program were not very successful due to the poor level of germination. The level of resistance of 123 plants from seeds introduced from the International Institute of Tropical Agriculture was confirmed. Dipping cassava cuttings in a solution of dimethoate (500 g a.i./l water) reduces the infestation by crawlers but chemical control is not recommended in Zaire since fresh cassava leaves are consumed as vegetable and the costs of chemical products and equipment are high. Planting cassava early in the rainy season is recommended as well as the use of mulching, predators, and

parasites. A concerted research strategy is being used to control the green spider mite. Results have indicated that resistance to the green spider mite is more frequent than it is for the mealybug. Removing cassava tops once a month in the dry season helps to reduce the damage caused by the mite. Observations are being made on local predators or parasites since unfortunately Oligota minuta, imported from the Commonwealth Institute of Biological Control in 1978, died during the transportation. (Summary by I.B. Trans. by L.M.F.) F01

0275

19598 NWIGWE, J.C. 1982. Economic and sociological effects of cassava mealybug and green spider mite pests in Nigeria. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.185-186. Engl. [Alvan Ikoku College of Education, Umuahia Campus, Nigeria]

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Socioeconomic aspects. Nigeria.

The economic and social consequences of the shortage of traditional foodstuffs based on cassava, the staple food of more than 80% of the population of southern Nigeria, are briefly described, in particular those affecting commercial and industrial enterprises, public health and social welfare which are currently being threatened by the incidence of the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa). Massive importations of rice have adversely affected the local production and moreover, do not satisfy nutritional habits of the population, since gari and especially foofoo play an important role in many social ceremonies. It is suggested that all governmental institutions, commercial firms, and farmers join forces (money, manpower, and materials) to control these pests, give standing priority to agriculture and establish concerted measures to overcome any crisis situation, increase the production of other root crops (yams, cocoyam, and Irish potato), and preserve the noninfested areas so that they can serve as sources of clean planting materials. (Summary by I.B. Trans. by L.M.F.) F01

0276

19597 OKEREKE, H.E.; ENYINNIA, T.; ILOKA, A.W.; IWUEKE, C.C. 1982. The role of agricultural extension services in the control of cassava mealybug and green spider mite. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.178-184. Engl. 4 Refs. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Phenacoccus manihoti. Insect control. Cassava programs. Extension services. Nigeria.

The different levels of agricultural extension services in Nigeria are described, as part of a strategic implementation plan of an overall research effort for the region. Five levels were identified, these being: (1) Agricultural Extension Research Liaison Services, which serve as a link between research and production, collect, interpret, and adapt research information for use by farmers, carry out adaptive research, formulate integrated control packages, and disseminate the recommended control

measures. They are also responsible for the multiplication and distribution of basic planting material. (2) State Extension Services, which administer a field organization of technical agricultural personnel, provide logistic support, monitor total research progress, and are responsible for locating and distributing inputs (fertilizers, chemicals, subsidies, and credit), training, method demonstrations, campaigns, reports, and cooperation and liaison activities. (3) Local Government Extension Services form part of the State Extension Services. (4) Federal Extension Services, including water resources, sponsor emergency research projects, training programs, scholarships, and finance production and distribution of farmers' bulletins. They also undertake the large-scale multiplication of seed stock and cooperate with the other levels in the transfer of new technologies. (5) Extension services by private organizations, limited but important, operate project approach extension services and offer financial support, training, and cooperation. The primary role of all these services is to satisfy an already existing demand for control of the green spider mite (Mononychellus tanajoa) and the cassava mealybug (Phenacoccus manihoti). (Summary by I.B. Trans. by L.M.F.) F01

0277

19600 OKOLI, O.O.; ENYINNIA, T.; IGBOKWE, M.C.; ODURUKWE, S.O.; OKEKE, J.E.; OKEREKE, H.E. 1982. Recommendations of the International Workshop on Control of Cassava Mealybug and Green Spider Mite. In _____., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.192-194. Engl.

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Insect control. Mite control. Biological control. Insecticides. Nigeria.

Measures for immediate, intermediate, and long term implementation for the control of the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa) are recommended. These pests have caused a yield reduction of 60% during the 1980-81 season in Nigeria, country in which they are reported in at least 12 of the 19 states. (Summary by I.B. Trans. by L.M.F.) F01

0278

19599 OKOLI, O.O.; ENYINNIA, T.; IGBOKWE, M.C.; ODURUKWE, S.O.; OKEKE, J.E.; OKEREKE, H.E. 1982. Reports of mealybug and green spider mite incidence and their control in states of Nigeria. In _____., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.188-191. Engl.

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Insect control. Mite control. Nigeria.

Various reports on the incidence and control of the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa) in the states of Anambra, Imo, Plateau, Cross River, Benue, Kwara, and Niger in Nigeria, are presented. Area infested by these insect pests increased dramatically in the state of Anambra from 30,000 ha in 1979 to 65,000 ha in 1980. In some areas, yield losses were as high as 80% for roots and 100% for leaves and stems. An integrated control program was initiated in 1980 to prevent the spreading of insect pests. The 2 pests were detected in Imo State causing 60% damage in cassava plantations. In Cross River, cassava multiplication for distribution is conducted in the region of Akamkpa which

is free of the pests. In the remaining states, except for Niger, the presence of both insect pests was reported. Chemical control methods and rates recommended in some states are presented. (Summary by EDITEC) F01

0279

20179 SIMWAMBANA, M.S.C. 1982. Cassava pests in Luapula Province. Lukasa, Zambia, Mansa Regional Research Station. 3p. Engl. [Mansa Regional Research Station, Lukasa, Zambia]

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Pest damage. Insect control. Mite control. Zambia.

Two cassava pests recently disseminated in Zaire are reported: the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa). The symptoms, economic damage, and control measures are included. Both pests attack cassava shoots. P. manihoti sucks the sap and possibly introduces some saliva-related chemical that causes shoot stunting, short internodes, little or no new leaf growth, and curling of the leaves, and in severe cases dieback may occur. Yield losses depend on severity of attack, plant age, soil fertility, and duration of the dry season and the planting season. Late planting can cause the destruction of the crop attacked by this pest. Early planting is recommended and the cuttings should be treated with 0.1% dimethoate or methidathion solution. The green spider mite can cause yield losses of 30-40%, produces yellow spots similar to mosaic and progressive downward leaf shedding. Early planting is also recommended, as well as miticides to prevent cutting infestation, and breeding for resistance. Care should be taken with insecticides and all chemical products in general due to the possible effects on the natural enemies of mites and to the high reproductive potential of the mite to be extensively disseminated by the wind. (Summary by I.B. Trans. by L.M.F.) F01

See also 0196 0216 0281 0283 0285

F03 Injurious Mites and their Control

0280

20122 GORDON, R.D. 1982. New species and new synonymy in neotropical Stethorus Weise (Coleoptera:Coccinellidae). Coleopterists Bulletin 36(1):121-126. Engl., Sum. Engl., 5 Refs., Illus. [Systematic Entomology Laboratory, USDA, c/o Entomology Dept., Smithsonian Institution, Washington, D.C. 20560, USA]

Cassava. Tetranychus urticae. Tetranychus cinnabarinus. Predators and parasites. Colombia.

The new species here described include Stethorus tridens sp.n., which is described from examples collected in Honduras. This coccinellid has also been collected in Nicaragua and on several occasions on cassava in Colombia in association with Tetranychus urticae and T. cinnabarinus; it has also been found preying on tetranychid mites on eggplant in Colombia. A key is given to the 5 species of this genus now known to occur in Central and South America. They include S. ogloblini, which is considered to be a junior synonym of S. darwini. (Summary by Review of Applied Entomology) F03

0281

19575 OBADOFIN, A.A. 1982. Green spider mite (GSM) and cassava mealybug (CMB) in Nigeria: the Federal Department of Pest Control Services

(FDPCS) efforts to control them. In Okoli, O.O.; Enyinnia, T.; Igbokwe, M.C.; Odurukwe, S.O.; Okeke, J.E.; Okereke, H.E., eds. International Workshop on Control of Cassava Mealybug and Green Spider Mite, Umudike, Nigeria, 1981. Proceedings. Nigeria, National Root Crops Research Institute. pp.37-39. Engl. [Federal Dept. of Pest Control Services, Moor Plantation, Ibadan, Nigeria]

Cassava. Mononychellus tanajoa. Phenacoccus manihoti. Insect control. Mite control. Cassava programs. Nigeria.

Efforts carried out in Nigeria to control the cassava mealybug (Phenacoccus manihoti) and the green spider mite (Mononychellus tanajoa) are briefly reported. A task force was established to study the problem and make recommendations, leading to the creation of the Federal Department of Pest Control Services (FDPCS), in Kaduna, with the responsibility of controlling these new pests. Recommendations include: (1) research on pest biology and ecology, breeding for resistance, biological control, evaluation of pesticides, and cultural control; (2) training workshop; (3) nationwide survey to determine the area of distribution and the extent of their infestation; (4) distribution of agrochemicals in disaster areas; (5) publicity campaigns that include the utilization of mass media and the distribution of advisory bulletins for the use of extension agents. (Summary by I.B. Trans. by L.M.F.) F03

See also 0196 0216 0260 0264 0266 0275 0276 0277 0278 0279 0283 0285

G00 GENETICS AND PLANT BREEDING

G01 Breeding, Germplasm, Varieties and Clones, Selection

0282

20152 BECWAR, M.R.; STANWOOD, P.C.; LEONHARDT, K.W. 1983. Dehydration effects on freezing characteristics and survival in liquid nitrogen of desiccation-tolerant and desiccation-sensitive seeds. Journal of the American Society for Horticultural Science 108(4):613-618. Engl., Sum. Engl., 20 Refs., Illus. [Dept. of Botany & Plant Pathology, Purdue Univ., West Lafayette, IN 47907, USA]

Manihot glaziovii. Seed. Storage. Germplasm.

Dehydration effects on freezing characteristics and survival in liquid N were studied in 11 species of tropical seeds and in Acer saccharinum seeds. Differential thermal analysis was used to determine the threshold moisture level below which seed tissue water was in an unfreezable state. Desiccation-sensitive seeds (Chrysalidocarpus lutescens and A. saccharinum) did not survive either dehydration below the threshold moisture level or exposure to liquid N. Nine of 10 desiccation-tolerant seeds (Psidium cattleianum, Passiflora edulis f. flavicarpa, Manihot glaziovii, Schefflera arboricola, Psidium guajava, Carica papaya, Solanum sodomeum, Argemone glauca, and Sabal parviflora) survived dehydration to as low as 2-12% MC (below the threshold moisture levels determined) and in the dehydrated state survived exposure to liquid N. (Author's summary) G01

0283

19977 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1983. Elite cassava germplasm from CIAT. Cali, Colombia. 20p. Engl. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Also in Spanish.

Cassava. Germplasm. Selection. Cultivars. Adaptation. Soil requirements. Climatic requirements. Root productivity. Dry matter. HCN content. Uses. Human nutrition. Animal nutrition. Plant anatomy. Identification. Roots. Stems. Branching. Leaves. Xanthomonas manihotis. Sphaceloma manihoticola. Phoma. Colletotrichum. Glomerella. Thrips. Mononychellus. Oligonychus. Phenacoccus herreni. Vatiga manihotae. Aleurotrachelus socialis. Colombia.

A list of cassava clones with improved performance from CIAT is presented; these can be requested for multiplication through CIAT's Genetic Resources Unit. The following aspects are described for each: (1) origin or cross parents, common name; (2) adaptation to the different edaphoclimatic zones: I, lowland tropics with long dry seasons; II, acid soil savannas; III, lowland humid tropics; IV, middle alt. tropics; V, highland tropics of 1440-2000 m.a.s.l.; VI, subtropics; (3) yield and quality characteristics (yield, DM, HCN, and ease of harvest); (4) general potential use namely, fresh consumption, animal feed, starch extraction or flour, and industrial alcohol production; (5) morphological traits including root shape and color, stem, leaf apex and petiole color, plant height, branching habit, and leaf pubescence; (6) resistance/tolerance to Xanthomonas campestris pv. manihotis, Elsinoe brasiliensis, Phoma sp., Colletotrichum spp. and insects such as Frankliniella williamsi, Corynothrips stenopterus, Mononychellus, Oligonychus sp., Phenacoccus herreni, Vatiga manihotae, Aleurotrachelus socialis, and other problems related to soil acidity and low P. (Summary by EDITEC) G01

0284

19979 COSTA, I.R.S.; PERIM, S. 1983. Variedades de mandioca-brava, resistentes a bacteriose, para a regiao geoeconomica de Brasília. (Bitter cassava varieties, resistant to bacteriosis, for the geoeconomic region of Brasilia). Planaltina-DF, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária dos Cerrados. Comunicado Técnico no.31. 6p. Port. [Centro de Pesquisa Agropecuária dos Cerrados, Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Bitter cassava. Cultivars. Roots. Root productivity. Starch content. Xanthomonas manihotis. Resistance. Brazil.

The economic importance of the cassava crop in Brazil for human and animal nutrition and as a source of raw material for industrial purposes of direct transformation and enzymatic fermentation is highlighted. By eliminating wheat subsidies, cassava chip flour and cassava starch are the most adequate substitutes. Of 702 materials introduced from several regions of Brazil and from Colombia, 140 var. were selected for their characteristics of adaptation. Bitter var. recommended are: IAC 12-829, yielding 34 t roots and 18 t foliage/ha and with a starch content of 33%; IAC 7-127 (Iracema), yielding 27 t roots and 22 t foliage/ha and a starch content of 33%; Sonora, yielding 23 t roots and 18 t foliage/ha, and with a starch content of 33%. Technical recommendations are given regarding soil preparation, selection and preparation of cuttings, fertilization, planting distance, planting time, planting, weed control, pests, crop rotation, and harvest. (Summary by I.B. Trans. by L.M.F.) G01

0285

19538 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Genetic improvement. In _____. Annual Report 1982. Ibadan, Nigeria. pp.91-94. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Genetics. Plant breeding. Cultivars. Resistance. Cassava African mosaic virus. Xanthomonas manihotis. Phenacoccus manihoti. Mononychellus tanajoa. Root productivity. Gari. Productivity. Dry matter. Nigeria. Sierra Leone. Zaire. Gabon. Rwanda. Liberia. Cameroon.

Progress made by the genetic improvement program of the International Institute of Tropical Agriculture (IITA) is reported. Yield trials of 12 improved var. were conducted without fertilization at Onne, IITA, and Mokwa (Nigeria) that represent a wide range of environmental conditions. TMS 50395 performed outstandingly at all locations with an av. fresh yield of 26 t/ha, yielding more than 4.6 times that of the standard var., 60506. It also showed resistance to CAMD and CBB and tolerance to the green spider mite (Mononychellus tanajoa) and the cassava mealybug (Phenacoccus manihoti). The total dry yield of this var. was the highest and the quality of gari made from its roots was rated as good. TMS 50207, TMS 30572, and TMS 4(2)1443 had very good gari quality and the highest garification rates corresponded to TMS 30001 (low HCN content), TMS 4(2)1443, and TMS 4(2)0267, ranging from 20 to 21%. Multiplication and distribution activities of improved var. in Nigeria, Sierra Leone, Zaire, Gabon, Rwanda, Liberia, and Cameroon are reported. In order to clarify the relationship between the pubescence character and resistance to the green spider mite, 9 crosses were made between pubescent types, between nonpubescent and pubescent types, and between nonpubescent types. The x^2 values were highly significant for all crosses involving pubescent types, except the cross TMS 30572 x TMS 4(2)1425, indicating that mite resistance is associated with the pubescence character which is considered hereditary. A subjecrive rating of 20 samples (5 plants each) showed that the damage caused by mites was related to drought stress ratings (r = 0.76), indicating that drought stress increased mite damage. (Summary by I.B. Trans. by L.M.F.) G01

0286

20198 MENDES, R.A. 1977. Genetics and breeding of cassava. Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. 17p. Port., 17 Refs.

Cassava. Genetics. Plant breeding.

General aspects are presented on botanical and morphological characteristics of cassava, its nutritional role, and its uses and consumption levels in different countries; major morphological and phytosanitary problems for cassava breeding are indicated and some strategies for research in these fields are presented. Breeding efforts are carried out in different parts of the world through institutions like CIAT in Colombia, the International Institute of Tropical Agriculture in Nigeria, the Central Tuber Crops Research Institute (CTCRI) in India, and the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), which carry out cassava collaborative research programs with the International Development Research Centre. Long-term breeding objectives include the determination of inheritance patterns of characteristics present in var. and wild types, combining ability, and mass selection. The main objectives that should be taken into account in cassava introduction and breeding programs are indicated as well as aspects of cassava marketing and demand. (Summary by EDITEC) G01

0287

19247 NUNES, F.E.C.; LAMEIRA, O.A. 1983. Comparacao de cultivares de mandioca em Roraima. (Comparison of cassava cultivars in Roraima). Boa Vista-T.F. Roraima, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Territorial de Boa Vista. Pesquisa em Andamento no.01. 3p. Port. [Unidade de Execucao de Pesquisa de Ambito Territorial de Boa Vista, Caixa Postal 133, 69.300 Boa Vista-T.F. Roraima, Brasil]

Cassava. Cassava programs. Cultivars. Identification. Pests. Lodging. Root productivity. Foliage. Harvest index. Brazil.

Fifteen cassava cv. from the Centro de Pesquisa Agropecuária do Trópico Umido (CPATU) were introduced and assessed in order to determine cv. with a higher productivity than the local cv. Seis Meses (12 t/ha). The expt. was carried out on a red yellow podzolic soil, sandy texture and of low fertility (P, 1 ppm; K, 20 ppm; Ca^{++} + Mg^{++}, 0.2 meq; Al, 0.5 meq; pH 4.6). Plants were spaced at 1.0 x 1.0 m and each treatment consisted of a 30-m-long row. No fertilizers were applied and plants were harvested at 12 mo. Cv. Pretinha had the highest root yield (53.7 t/ha) but was susceptible to lodging. It was observed that 80% of the introduced cv. outyielded the check Seis Meses, with Aciolina, EAB 707, 411, and 898 showing outstanding performance with more than 30 t/ha. All of the cv. had HI above 60%. (Summary by I.B. Trans. by L.M.F.) G01

0288

20136 OZUNA, D.T. 1979. Introducción y evaluación de 16 variedades de yuca. (Introduction and evaluation of 16 cassava varieties). Proceedings of the Caribbean Food Crops Society 16:251-259. Span., Sum. Engl., 8 Refs.

Cassava. Cultivars. Root productivity. Resistance. Cercospora henningsii. Cercospora vicosae. Cercospora caribaea. Oidium manihotis. Selection. Dominican Republic.

Sixteen cassava var. from CIAT were evaluated against 2 local checks on a clay loam soil at the Centro Nacional de Investigaciones Agropecuarias, San Cristóbal, Dominican Republic, in a randomized block design with 18 treatments and 4 replications. Selected cuttings, previously treated with a mixture of mancozeb, maneb, copper oxychloride, malathion, and zinc sulfate, were planted at a density of 10,000/ha. Yields of all var. were superior to the national av. Var. CMC-40, ICA-HMC-2, CM-305-41, CM-323-375, ICA-HMC-7, and CM-308-197 produced 4 times more than the national av. No significant damage to the plants caused by pests and diseases was registered. (Author's summary) G01

0289

19980 PERIM, S.; COSTA, I.R.S. 1983. Variedades de mandioca mansa, resistentes a bacteriose, para a regiao geoeconomica de Brasília. (Sweet cassava varieties, resistant to bacteriosis, for the geoeconomic region of Brasilia). Planaltina-DF, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária dos Cerrados. Comunicado Técnico no.28. 6p. Port. [Centro de Pesquisa Agropecuária dos Cerrados, Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Sweet cassava. Cultivars. Resistance. Xanthomonas manihotis. Plant anatomy. Roots. Root productivity. Foliage. Brazil.

New cassava var., resistant to bacteriosis, in the region of Brasilia, Brazil, are briefly described. Of the 140 var. selected for their charac-

teristic of adaptability to cerrado soils in 1976, the following var. are recommended for table use: IAC 24-2 or Mantiqueira (20 t roots and 16 t foliage/ha at 14 mo. after planting) and IAC 14-18. Var. IAC 352-6 (19 t roots and 17 t foliage/ha) and IAC 352-7 or Jacaná (17 t roots and 18 t foliage/ha) are also recommended. Technical recommendations are given regarding soil preparation, selection and preparation of cuttings, fertilization, planting distance, planting time, planting, weed and pest control, crop rotation, and harvesting. (Summary by I.B. Trans. by L.M.F.) G01

See also 0195 0197 0201

G02 Cytogenetics

0290

19545 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Cytogenetics: cassava. In _____. Annual Report 1982. Ibadan, Nigeria. pp.114-116. Engl., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cassava programs. Cytogenetics. Manihot dichotoma. Crossbreeding. Chromosomes. Plant fertility. Anthers. Tissue culture. Nigeria.

Crosses were made between Manihot esculenta and M. dichotoma. Seeds obtained were grown and morphological characteristics of these hybrids were recorded, namely, leaf shape, stem node characteristics, height at 1st branching, branching habit, and flowering. The meiosis in both plants was normal with production of fertile pollen; the chromosome no. in the hybrids was 2x = 36. However, some hybrids resulted in 100% sterile pollen whose chromosomes remain univalents. These plants exhibited asynapsis and the subsequent stages of meiosis were irregular. Hybrids with 5-50% pollen fertility at metaphase I were observed with 18 bivalents. The av. chiasma frequency/pollen mother cell varied between 21.1-24.4. The gradation observed in pairing frequency from a regular bivalent formation to complete asynapsis is probably due to a gene dosage effect. The production of polyploids and anther culture are briefly described. (Summary by EDITEC) G02

H00 NUTRITION

H01 Cassava Foods and Nutritive Value

0291

20115 DOUGAN, J.; ROBINSON, J.M.; SUMAR, S.; HOWARD, G.E.; COURSEY, D.G. 1983. Some flavouring constituents of cassava and of processed cassava products. Journal of the Science of Food and Agriculture 34:874-884. Engl. Sum. Engl., 25 Refs., Illus. [Tropical Development & Research Inst., 56/62 Gray's Inn Road, London WC1X 8LU, England]

Cassava. Roots. Cassava meal. Gari. Analysis. Composition. Flavouring constituents.

Flavoring constituents of fresh cassava, Nigerian gari, and farine from the Caribbean (St. Lucia) were analyzed and compared. The characteristic compounds of gari were identified as pyrazines and lactic acid. Farine, which is either unfermented or fermented for a much shorter time than gari, was qualitatively similar but had fewer volatiles, present in small amounts. Pyrazines and lactic acid were absent from cassava, the flavoring

constituents of which were fewer and qualitatively different from those of gari and farine. The characteristic flavor of gari and farine was largely due to the fermentation and roasting processes. (Author's summary) H01

0292

19543 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1983. Quality evaluation. In _____. Annual Report 1982. Ibadan, Nigeria. pp.105-106. Engl. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Atieke. Chickwangue. Foofoo. Gari. Cassava leaves (vegetable). Cassava pastes. HCN content. Processing. Analysis. Cultivars. Tuber productivity. Cassava programs. Nigeria.

Tuberous roots of 4 improved var. of the International Institute of Tropical Agriculture, TMS 50395, 30572, 30555, and 30001, which vary widely in their HCN content, were harvested and 5-kg samples of each var. were processed to make several products of popular consumption in Africa and to evaluate their HCN content. Pondu was made from 800-g samples of leaves. The preparation of these products is explained. HCN content was determined by the automated enzymatic assay method. Results are given in table form. In general, total HCN in the products was reduced by 70-100%, but in some products free HCN increased as in fresh gari (98%) and oyoko (5%). In cassava products that had undergone fermentation before being processed (chickwangue, foofoo, ntuka), both total and free HCN were almost totally eliminated. Total HCN was reduced by 83-96% in such products such as gari, atieke, plakali, and oyoko that had been peeled and grated before processing. When gari was stored for 4 mo. under ambient conditions, total HCN was reduced by 83-98% and in eba, a cooked form of gari, by almost 100%. Boiling roots did not reduce HCN sufficiently. Therefore this method should only be used with low HCN var. In foofoo total HCN was reduced by 96% (roots being soaked for one day followed by steaming and pounding), the same occurring in konkonde (soaking, sun-drying, milling, and cooking of roots). Pondu had about 96% less total and no free HCN. (Summary by I.B. Trans. by L.M.F.) H01

0293

20156 JOAO, W. DA S.J. 1976. El uso de fríjol caupí (Vigna sinensis) y harina de yuca como fuente protéico-energético en la alimentación humana y animal. (Use of cowpea and cassava flour as protein-energy sources in human and animal nutrition). Tesis Mag.Sc. Guatemala, Universidad de San Carlos. Facultad de Medicina Veterinaria y Zootecnia/INCAP. 63p. Span., Sum. Span., 51 Refs., Illus.

Cassava. Cowpea. Cassava meal. Uses. Human nutrition. Animal nutrition. Swine. Protein enrichment. Supplements. Guatemala.

Cowpea and CF were used as protein energy sources in human and animal nutrition. Several chemical and biological trials were carried out. Proximal chemical analysis and amino acid HCN, and trypsin inhibitor contents had normal values. Available lysine content for fresh and cooked cowpea flour was lower than that formerly recorded, possibly due to variations existing among different samples. Rats fed mixtures based on soybean-maize, cowpea-soybean, soybean-cassava, and cowpea-cassava had satisfactory PER. However, a relatively lower protein quality was observed in mixtures based on soybean-cassava and cowpea-cassava due to the met. deficiency in these mixtures. The amounts of essential amino acids were also lower in soybean-maize and cowpea-maize mixtures. Improved protein quality was obtained when cowpea-maize and cowpea-cassava mixtures were extruded. The heat treatment occurring during the extrusion process could

have possibly induced changes in the carbohydrate fraction of this legume, favoring a better protein utilization. A beneficial effect of met. addition was observed in both extruded and fresh mixtures. Improved protein quality was found in extruded cowpea-maize mixtures, not supplemented with met. compared with cowpea-cassava mixtures treated the same, possibly due to a better essential amino acid pattern of the former mixture. In studies carried out with pigs with soybean-maize, cowpea-maize, soybean-cassava, and cowpea-cassava mixtures, there was less response to protein quality in comparison with rats. The soybean-cassava diet gave a better response in comparison with that of cowpea-cassava. Results of free-choice biological trials with cowpea-cassava indicated that without added met., the ratio of cassava-cowpea intake was 1.21, with 3.35 usable protein. The addition of nutrients significantly increased legume consumption and therefore increased usable protein and wt. gain, whereas met. only favored consumption when added with other nutrients. Increased legume consumption is advantageous for populations that subsist on tubers-legumes; it is better to supplement the legume instead of using tubers to fulfill nutrient requirements in this type of diet. When the soybean-cassava mixture is used, a similar trend to that of cowpea-cassava was noted; however, the quality of the former mixture was superior to that of the latter. When different amounts of cassava-cowpea were studied results indicated that improved protein quality was obtained when the diet contained 50/50 CF/cowpea. The addition of met. was efficient only when 70/30 and 50/50 CF/cowpea were used. (Extracted from author's summary. Trans. by L.M.F.) H01

0294

20191 LIE, G.-H. 1980. The comparative nutritional roles of sago and cassava in Indonesia. In Stanton, W.R.; Flach, M., eds. Sago: The Equatorial Swamp as a Natural Resource. International Sago Symposium, 2nd., Kuala Lumpur, Malaysia, 1979. Proceedings. The Hague, Martinus Nijhoff. World crops: production, utilization, and description, v.1. pp.43-45. Engl., 15 Refs., Illus.

Cassava. Uses. Human nutrition. Socioeconomic aspects. Nutritive value. Indonesia.

A brief examination is made of the production and utilization of cassava and sago (Metroxilon spp.) in Indonesia. In 1976 the highest productions of dry and peeled cassava were obtained in Indonesia and Java-Madura with 3717 and 2734 thousand tons, resp. Estimates are presented on av. daily consumption of energy and protein per capita, for cereals, non-cereals, and palm sugar. Among the nutritional considerations that are taken into account for the use of CF and sago as main staples, is their possible negative effect due to their protein deficiency which should be overcome by consuming other supplemental foods; however, CF and sago represent a valuable source to alleviate the food energy crisis in Indonesia. (Summary by EDITEC) H01

0295

19534 MACIEL, I.T. 1981. Participacao da mandioca na dieta do brasileiro. (The role of cassava in the Brazilian diet). In Congresso Brasileiro de Mandioca, 1o., Cruz das Almas-BA, 1979. Anais. Bahia, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Departamento de Informacao e Documentacao. v.2,pp.119-125. Port., 1 Ref.

Cassava. Food energy. Socioeconomic aspects. Human nutrition. Brazil.

The functions of the Superintendencia Nacional de Abastecimento (SUNAB) are summarized and the principal problems of malnutrition worldwide, and particularly in Brazil, are analyzed. Deficiency anemia is present in spite of advanced technologies. In Brazil, 80% of breast-fed children suffer from protein-caloric malnutrition, considered to be the most severe problem and the hardest to eradicate. Factors affecting nutrition are: income, distribution of food in the family unit, nutritional habits, and availability of foods. Cassava, one of major sources of calories in the Brazilian diet, has the risk of undergoing an intense modification as a result of its transformation and conversion for alcohol production purposes. The need to reconcile the interests of the industry and those of rural populations is emphasized. (Summary by I.B. Trans. by L.M.F.) H01

0296

20118 RAVINDRAN, V.; KORNEGAY, E.T.; WEBB JUNIOR, K.E. 1982. Nutrient characterization of some feedstuffs of Sri Lanka. Journal of the National Agricultural Society of Ceylon 19:19-32. Engl., Sum. Engl., 33 Refs. [Dept. of Animal Science, Virginia Polytechnic Inst. & State Univ., Blacksburg, VA 24061, USA]

Cassava. Cassava meal. Leaves. Dry matter. Protein content. Fibre content. Fat content. Ash content. Food energy. Mineral content. Amino acids. Sri Lanka.

Six Sri Lankan feedstuffs (cassava root, sesame oil, coconut oil, rubber seed, cassava leaf, and sweet potato leaf meals) were analyzed for proximate composition, Van Soest components, mineral contents, and amino acid composition. Cassava root meal was low in CP (2.9%), ash (2.3%), and minerals but rich in N-free extract (88.4%). CLM had a CP content of 20.2% and was particularly rich in Mn (252 ppm) and Zn (249 ppm). The corresponding values for acid detergent fiber were 5.0 and 35.0% for cassava root meal and CLM, resp. Lysine content of CLM was relatively high (77%). The amino acid profile of CLM was found to be similar to that of coconut oil meal and compared favorably with that of sweet potato meal, with few exceptions. The need for strict quality control of livestock feeds in Sri Lanka is emphasized. (Summary by L.M.F.) H01

See also 0205 0283 0314 0328 0334

H02 Nutritive Disorders in Humans

0297

20138 BULATAO-JAYME, J.; ALMERO, E.M.; CASTRO, M.C.A.; JARDELEZA, M.T.R.; SALAMAT, L.A. 1982. A case-control dietary study of primary liver cancer risk from aflatoxin exposure. International Journal of Epidemiology 11(2):112-119. Engl., Sum. Engl., 25 Refs. [Food & Nutrition Research Inst., P.O. Box EA 467, Ermita, Manila 2801, Philippines]

Cassava. Toxicology. Aflatoxins. Hepatic disorders. Human health. Philippines.

A possible relationship in humans between aflatoxin ingestion and the development of primary liver cancer was examined as well as the effect of alcohol consumption in this respect. The dietary intakes of 90 confirmed primary liver cancer cases were compared against 90 age-sex matched controls. Dietary recall obtained by the same nutritionist was taken for

each change of residence lasting 1 yr or more. The frequency and amounts of food items consumed were calculated into units of aflatoxin load/day using a Philippine table of aflatoxin values of these items. Of the total subjects' aflatoxin load, 51.2% came from cassava, 20.3% from maize, 6.8% from peanuts, and 5.8% from sweet potato. The mean aflatoxin load/day of the cases was 440% that of the controls. Upon grouping dietary aflatoxin loads (and alcohol intakes) into heavy and light and upon comparing cases vs. controls, the relative risk (RR) of developing primary liver cancer was statistically significant in the following order of rank: cassava, peanuts, sweet potato, maize, and alcohol. Boiled rice which had negligible aflatoxin content gave no difference in risk. Combining aflatoxin load and alcohol intake gave a synergistic and a statistically significant effect on RR with light aflatoxin, light alcohol as RR = 1. The results were as follows: light aflatoxin, heavy alcohol RR = 3.9; heavy aflatoxin, light alcohol RR = 17.5; heavy aflatoxin, heavy alcohol RR = 35.0. (Author's summary) H02

H03 Animal Feeding

0298

20172 CARVALHO, J.L.H. DE 1983. A mandioca; raíz e parte aérea na alimentacao animal. (Cassava: roots and aerial parts for animal nutrition). Brasilia-DF, Brasil, Empresa Brasileira de Assistencia Técnica e Extensao Rural. Série Articulacao Pesquisa e Extensao no.2. 44p. Port., 26 Refs., Illus. [Centro de Pesquisa Agropecuária dos Cerrados, Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Roots. Foliage. Uses. Animal nutrition. Silage. Feeds and feeding. Calves. Beef cattle. Swine. Poultry. Goat. Sheep. Brazil.

Practical recommendations are presented which resulted from research on the use of cassava in animal feeding. Various aspects on the use of cassava roots and aerial parts of the plant in nutrition of polygastric and monogastric animals are examined. Aspects considered include the nutritional value and toxicity, ways of preparing the roots, root utilization (fresh, sun dehydrated, ensilaged), and ration formulation based on cassava roots. Mixtures based on cassava are described for yearling bulls, fattening steers, dairy cattle, ovines and caprines, as well as for swine and poultry. The aerial part of the plant (in sweet var.) has a high nutritive value (approx. 16% protein, 45% carbohydrates); its use is similar to that of roots and is employed in bovine, swine, and poultry nutrition. (Summary by EDITEC) H03

0299

19981 CARVALHO, J.L.H. DE; PERIM, S.; COSTA, I.R.S. 1983. Parte aérea da mandioca na alimentacao animal. 1. Valor nutritivo e qualidade da silagem. (Cassava foliage in animal nutrition. 1. Nutritive value and quality of silage). Planaltina-DF, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária dos Cerrados. Comunicado Técnico no.29. 6p. Port., Illus. [Centro de Pesquisa Agropecuária dos Cerrados, Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Foliage. Silage. Nutritive value. Protein content. Fibre content. Carbohydrate content. Fat content. Minerals. Animal nutrition. Brazil.

The use of cassava silage in animal nutrition as an alternative to the seasonal shortage of forages is discussed. The use of maize is recommended

for monogastric animals and cassava foliage can be used in the preparation of silage for ruminants due to its excellent characteristics. The nutritive value of cassava foliage, at the end of the 1st cycle, is 25.0, 16.0, 7.5, 45.0, 14.5, 12.0, 0.63, and 0.44%, resp., of DM, CP, fats, carbohydrates, fiber, ash, Ca, and P. Ensiled cassava has the following nutritional characteristics: 31.99, 11.50, 48.85, 21.88, 2.96, 1.21, 0.14, and 14.03%, resp., of DM, CP, NDF, cellulose, fat, Ca, P, and soluble carbohydrates. A better quality silage is obtained with good quality forage and quickness in carrying out harvesting, chipping, pressing, filling and closing the silo. A ratio of 25% cassava foliage is recommended for silage with Pennisetum purpureum. Cows weighing 400 kg can consume up to 22 kg pure silage/day since the silage process eliminates up to 65% of the HCN of cassava foliage and therefore does not constitute a risk for the animals. Cassava foliage production can reach 30 t/ha at 16-18 mo. after planting. (Summary by I.B. Trans. by L.M.F.) H03

0300

19982 CARVALHO, J.L.H. DE; PEREIRA, E.A.; COSTA, I.R.S. 1983. Parte aérea da mandioca na alimentacao animal. 2. O farelo da parte aérea na silagem do capim-elefante. (Cassava foliage in animal nutrition. 2. Foliage bran in Pennisetum purpureum silage). Planaltina-DF, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária dos Cerrados. Comunicado Técnico no.30. 5p. Port., Illus. [Centro de Pesquisa Agropecuária dos Cerrados, Caixa Postal 70-0023, 73.300 Planaltina-DF, Brasil]

Cassava. Foliage. Silage. Feeds and feeding. Uses. Animal nutrition. Brazil.

To improve DM contents of Pennisetum purpureum silage, increase animal consumption, and promote good product fermentation, several investigations were conducted by the Centro de Pesquisa Agropecuária dos Cerrados, using bran made from the foliage of the cassava plant. Satisfactory results were obtained: DM and CP increased (20 and 10%, resp.); acetic fermentation decreased, improving palatability and animal acceptance; lactic fermentation increased; and butyric fermentation was prevented. Processing operations for meal from the cassava foliage are presented, as well as the nutritive value of the product (DM, 89.78%; CP, 13.90%; NDF, 58.31%; fat, 2.44%; insoluble carbohydrates, 14.74%; ash, 0.25%; Ca, 0.81%; and P, 0.17%). Silage operations are described and the rapid implementation of harvesting, chipping, filling, pressing, and silo closing operations are emphasized for a good quality product. Up to 8000 kg bran/ha can be obtained from the foliage at 16-18 mo. after planting; this can be ensiled with 160,000 kg P. purpureum. (Summary by I.B.) H03

0301

20162 CASTAGNETTI, G.B. 1982. Caratteristiche della manioca e sue possibilita di impiego nel razionamento dei suini. (Characteristics of cassava and possibilities of use in pig rations). Suinicoltura 23(3):27-32. Ital., 1' Refs., Illus. [Istituto di Microbiologia e Industrie, Facolta di Agraria, Universita di Bologna, Bologna, Italia]

Cassava. Nutritive value. Uses. Swine. Feeds and feeding. Animal nutrition.

The characteristics and composition of cassava, problems related to its use in feeding animals, and exptl. data on its use in pig diets are reviewed. (Summary by Nutrition Abstracts and Reviews) H03

0302

20143 COLEMAN, G.S. 1981. Cultivos de protozoo entodiniomorfos del rumen en alimentos tropicales. (Culture of rumen entodiniomorphid protozoa on tropical foods). Producción Animal Tropical 6(1):1-4. Span., Sum. Span., 9 Refs. [Biochemistry Dept., Agricultural Research Council, Inst. of Animal Physiology, Babraham, Cambridge CB2 4AT, England]

Cassava. Uses. Forage. Feeds and feeding. Biochemistry. Feed constituents. Animal nutrition.

The effect of some ruminant feedstuffs available in Mexico on the in vitro growth of 4 rumen entodiniomorphid protozoa (Entodinium caudatum, Epidinium ecaudatum caudatum, Eudiplodinium maggii, and Ophryoscolex caudatus) of Clun Forest yearling sheep was examined. Plantain flour, dried plantain leaves, and rice polishings did not replace the usual materials such as rice flour, grinded wheat, and dried grass for the growth of these protozoa and did not stimulate growth when added as supplements to these substances. On the other hand, CF allowed E. caudatum and E. ecaudatum caudatum to grow for more than 9 mo. at densities comparable with those usually found. The possible significance of these results in ruminant nutrition is discussed. CF is preferred to plantain flour since it is less likely to cause acidosis due to the rapid degradation of starch by bacteria. (Author's summary. Trans. by L.M.F.) H03

0303

20155 DAVILA C., W. 1978. Efecto de la sustitución de la harina de pescado por diferentes niveles de urea en vacas lecheras alimentadas con yuca (Manihot esculenta Grantz) en el trópico. (Effect of the substitution of fish meal with different levels of urea in dairy cows fed with cassava in the tropics). Tesis Ing. Zootecnista. Tingo María, Perú, Universidad Nacional Agraria de la Selva. 47p. Span., Sum. Span., 31 Refs., Illus.

Cassava. Cassava roots (vegetable). Dairy cattle. Feeds and feeding. Fish meal. Proteins. Feed constituents. Nutritive value. Animal nutrition. Peru.

At the Zootechnical Farm of the U. Nacional Agraria de la Selva, Tingo María, Peru, 20 producing cows of the race Brown-Swiss and its crosses were used to determine the most adequate levels of urea for dairy cows. Rations in which 0, 15, 30, and 45% of the protein was substituted with urea were supplied; fresh cassava was used as the main energy source. A replicated Latin square design was used with 4 treatments, 4 periods (rows), and 5 replications; the animals were the columns. Significant differences were found between the check treatment and that with 45% substitution regarding feed consumption on dry basis. DM consumption was 5.16 and 5.04 kg DM, resp. Milk production did not show significant differences among treatments, being 6.99 and 6.89 l, resp., for the check and the treatment with 45% protein substitution. Body wt. had highly significant differences, with a higher wt. gain at the 15% level of substitution with an av. of 422.75 kg. At the 45% level of substitution av. wt. gain was the lowest, 414.10 kg. The highest economic value reached (114%) was at the 45% level of substitution. (Author's summary. Trans. by L.M.F.) H03

0304

20127 DEVENDRA, C. 1981. The utilisation of forages from cassava, pigeon pea, leucaena and groundnut by goats and sheep in Malaysia. In Morand-Fehr, P.; Bourbouze, A.; Simiane, M. de, eds. Nutrition et Systemes d'Alimentation de la Chevre. Symposium International, Tours, France, 1981. Paris, Institut Technique de l'Elevage Ovin et Caprin.

v.1,pp.338-345. Engl., Sum. Engl., Fr., 11 Refs. [Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Forage. Uses. Goats. Sheep. Feeds and feeding. Digestibility. Dietary value. Leaves. Animal nutrition. Malaysia.

The comparative intake and utilization by adult goats and sheep is presented regarding 4 important forages in the tropics: cassava leaves, pigeon pea forage, leucaena forage, and groundnut vines. Animals were fed each forage ad libitum consecutively twice/day during which the amounts fed and residue were determined. CP contents (on DM basis) were 21.0, 20.0, 20.8, and 17.4% and crude fiber content, 22.2, 25.3, 32.9, and 24.0%, resp. Daily DM intakes for goats range from 33.0 to 64.0 g/$W^{0.75}$ kg, and for sheep from 27.8 to 53.7 g/$W^{0.75}$ kg. Significant differences between species ($P < 0.05$) were only noted for leucaena. Statistically significant differences ($P < 0.05$) between goats and sheep, with higher values for goats, were noted for the apparent digestibility of DM, OM, and crude fiber. Goats also had a significantly higher ($P < 0.05$) N retention utilizing cassava leaves, pigeon pea forage, and leucaena. An assessment of nutritive value gave generally higher values for goats compared with sheep, with digestible CP values ranging from 9.3 to 13.0% compared with 8.4-11.7% and ME values of 7.35-13.0 MJ/kg compared with 6.23-8.00 MJ/kg for goats and sheep, resp. Cassava leaves are increasingly being used in Latin America and SE Asia as sources of dietary N. However, extending this advantage to goats, will also require the removal of cyanogenic glucosides and tannins that have deleterious effects on animal performance. (Author's summary) H03

0305

20166 GEOFFROY, F.; BARRETO-VELEZ, F. 1983. Revue sur le manioc (Manihot esculenta Crantz) dans l'alimentation des ruminants: 1. Composition chimique, valeur alimentaire, toxicite et conditionnement. (Review on the use of cassava in ruminant nutrition: 1. Chemical composition, nutritive value, toxicity, and conditioning). Turrialba 33(3):231-241. Fr., Sum. Engl., Fr., Span., 53 Refs. [Station de Recherches Zootechniques, Centre I.N.R.A. Antilles-Guyane, 97170 Petit-Bourg, Guadeloupe]

Cassava. Roots. Leaves. Stems. Dry matter. Protein content. Fat content. Cellulose. Amino acids. Digestibility. Cattle. Toxicity. Detoxification. Cassava meal. Cassava chips. Pellets. Feeds and feeding. Animal nutrition. Guadeloupe.

Research carried out on the chemical composition and nutritive value of cassava, its utilization in ruminant nutrition, especially regarding toxicity and conditioning, is reviewed. Characteristics of world cassava production are given: 105,000,000 t produced on 11,551 ha; 90% destined to human consumption; an increase of 5-6 fold in EEC imports destined to cattle nutrition between 1970-80. Roots contain a mean 30% DM with 70-90% starch and have a coefficient of digestive utilization of 72-91%. Foliage has between 15-25% protein (leaves and stems), 13-24% crude cellulose, with a coefficient of digestive utilization of 66.5%. Cassava can yield 300-6200 of nitrogenous material/ha/yr. Almost all the cyanogenic glucosides present in cassava are eliminated through industrial treatments allowing its use as cattle feed. Cassava is used in different forms: cassava chips (5 cm), 12-15 cm fragments, pellets, semola, residual wastes or pulp, leaf and/or stem meal. Cassava silage has good perspectives for its conservation: pH of approx. 4.0, 9-10 g lactic acid/kg silage, 35-43.70% DM. (Summary by I.B. Trans. by L.M.F.) H03

0306

20139 GEOFFROY, F.; BARRETO-VELEZ, F. 1983. Revue sur le manioc (Manihot esculenta Crantz) dans l'alimentation des ruminants: 2. Utilisation par les ruminants. (Review on the use of cassava in ruminant nutrition. 2. Use by ruminants). Turrialba 33(3):245-256. Fr., Sum. Span., Engl., 67 Refs. [Station de Recherches Zootechniques, Centre I.N.R.A. Antilles-Guyane, 97170 Petit-Bourg, Guadeloupe]

Cassava. Uses. Animal nutrition. Calves. Beef cattle. Dairy cattle. Sheep. Cassava starch. Cassava meal. Cassava chips. Leaves. Forage.

A literature review is given on the use of cassava in nutrition of calves (weaned and unweaned), beef and dairy cattle, and sheep in different forms: starch, root or leaf meal, chips, and the canopy as forage. Tables are included with information on research work by author, type of animal used, ration supplied, use given to cassava, and results. (Summary by J.L.S. Trans. by L.M.F.) H03

0307

17588 IMPORTANCIA DA folha da mandioca para a alimentacao animal. (Importance of the cassava leaf for animal nutrition). Lavoura Pecuária 1(4):20-22. 1978. Port., Illus.

Cassava. Leaves. Uses. Animal nutrition. Brazil.

Data on the importance of cassava in Brazil, especially in Rio Grande do Sul, over the years are given. The importance of cassava leaves and green material (canopy, branches, and leaves) in animal nutrition is highlighted. Results of chemical analyses of the leaves and leaf bran are given; in several expt. carried out, these presented high protein and carotene contents and low fiber content compared with other forages. An increase of 54.6% in egg production was obtained in layers fed cassava leaf meal. Exptl. research carried out in Sao Sebastiao do Caí and Taquari are reported and the investigations currently in process are listed. Positive results were obtained in KP fertilization trials and in amendment of soil acidity (54 t/ha). Var. S6-118, M. Pernambucana, Pe-11, and Taquara R-13 had the highest green material yields. The best planting distance for green material production is 30 x 80 x 50 cm. Several new var. are listed. (Summary by I.B. Trans. by L.M.F.) H03

0308

18458 KIRILOVA, N.I. 1981. Influence of tapioca on digestive processes in hogs. Soviet Agricultural Sciences 6:43-44. Engl., 4 Refs.

Also in Doklady Vsesoyuznoi Lenina Akademii Sel'skokhozyaistvennykh Nauk Im. V.I. Lenina no.6:29-30. 1981.

Cassava. Uses. Swine. Digestibility. Proteins. N. Animal physiology. Animal nutrition. Russia.

Feeding trials were conducted with 20 three-mo.-old piglets, 8 with chronic gastric fistulas and 4 with fistulas of duodenal anastomosis, to provide a physiological basis for the rational use of cassava in swine nutrition. The animals were divided into 4 groups: check (standard complete bulk feed), and 20, 40, and 60% of the grain components substituted with cassava. The characteristics of gastric and intestinal digestion and nutrient digestibility and utilization were studied during 2 periods of fattening (for live wt. up to 70 and up to 120 kg). The incorporation of 20 and 40% cassava caused no severe changes in the concn. of hydrochloric or organic

acids. The ration containing 60% cassava, however, increased the total acidity of the gastric contents, due to an intensification of the fermentation processes and consequently, a rise in the levels of lactic and volatile fatty acids in the stomach. Only 9.5-16.4% of the starch ingested reached the duodenum. The sugar content rose by a factor of 18 (in relation to the amount ingested) in animals receiving the check ration and by a factor of 17, 16, and 10.5 in the other 3 groups, resp. The inclusion of cassava promoted an increase in the activity of chyme amylase and lipase in the duodenum, although 60% cassava reduced the activity of chyme trypsin by 29.5%. A tendency toward a decrease in protein digestibility was observed. Coefficients of utilization of N were 49.5, 51.4, 49.4, and 45.3%, resp., for the 4 groups. The mean daily wt. gains were 819, 782, 752, and 737 g for the 4 groups, resp. (Summary by I.B. Trans. by L.M.F.) H03

0309

19546 PETRZIK, J. 1981. Cassava (Manihot esculenta Cranz.), a tropical crop with promising future. Agricultura Tropica et Subtropica 14:147-158. Engl., Sum. Russ., Czech., 11 Refs. [Inst. of Livestock Physiology & Genetics, Czechoslovak Academy of Sciences, 25161, Prague 10, Uhrineves, Czechoslovakia]

Cassava. Cassava meal. Leaves. Uses. Swine. Animal nutrition. Feeds and feeding.

An expt. conducted in Western Samoa showed that a pig feed based on cassava (45% cassava root meal, 17% CLM, 30% coconut meal extracted, 75% fish meal, and 0.5% mineralized salt) was even better than the imported commercial feed mixture. It is concluded that with adequate organization and international cooperation, cassava may help to increase food production for the starving population of the world, while excess output can be exported to other countries to the economic advantage of the producer regions, manifested as increased employment and better living standards for the local population. (Summary by Abstracts on Tropical Agriculture) H03

0310

20181 SANTANA C., D.A. 1979. Efecto de la suplementación de metionina y zinc en dietas con alto contenido de harina de yuca en la alimentación de aves, cerdos y conejos. (Effect of supplementation of methionine and zinc in diets with a high cassava flour content in nutrition of poultry, pigs, and rabbits). Tesis Mag.Sc. Chapingo, México, Colegio de Postgraduados. 81p. Span., Sum. Span., 75 Refs., 11lus.

Cassava. Cassava meal. Pellets. Supplements. Methionine. Zn. Swine. Poultry. Rabbits. Nutritive value. Feed constituents. Animal nutrition. Mexico.

Four expt. were carried out to observe the effect of met. and Zn supplementation in rations that used CM as the principal source of energy in poultry, swine, and rabbit nutrition. Ninety 7-day-old broiler chicks of the commercial line Vantress-Cross were used in the 1st expt. that lasted 35 days. The animals were fed with a sorghum-starch based diet as the main source of energy and diets with total substitution of the starch-sorghum with CM, with or without supplementation of met., Zn, or both. Treatments were supplied 3 times with 6 fowls/replication. Results indicated that there were no significant differences ($P < 0.05$) among treatments regarding wt. gain, feed intake or conversion. The effect of the addition of met. and Zn, as well as pellets, to diets that included CM as the main source of energy was observed in the 2nd expt. Thirty piglets (20 castrated males and 8 females) of the commercial cross Duroc-Yorkshire with an av. wt. of 25 kg were used over a period of 12 wk. Treatments consisted in diets with

or without supplementation of met., Zn, or both in addition to a pelleted diet without supplementation. Animals were randomly distributed in different treatments with 2 replicates and 3 animals/replication. Results indicated that there were no significant differences ($P < 0.05$) for wt. gain nor feed conversion. However, there were significant differences regarding feed intake, the non-supplemented group presenting the highest intake. Treatments with pelleted diets and with met. and Zn supplementation were statistically similar to the aforementioned treatments. A 3rd expt. was carried out to determine the appropriate level of CM in diets for growing rabbits and the effect of met. and Zn supplementation. Treatments consisted in rations that included 2 levels of cassava (20 and 40%), with or without met. (0.25) and Zn (50 ppm) supplementation. A basal diet that included maize without any type of supplementation was also used. Fifty-four white New Zealand rabbits, weaned at 6 wk. of age, were randomly distributed in treatments with 3 replications and 3 rabbits/replicate. After 6 wk. of experimentation, no significant treatments ($P < 0.05$) were found for any of the parameters measured. Increasing met. supplementation (0, 0.1, 0.2, and 0.3%) in diets for growing rabbits with a high CM content (40%) was studied in detail in the 4th expt. Thirty-six weaned New Zealand rabbits, 35 days old, were randomly distributed in treatments with 3 replications with 3 rabbits/replication. The expt. lasted 35 days and no significant differences were found for the parameters studied. These results show that the CM used, obtained from a local var. of the state of Veracruz (Mexico), is a good source of carbohydrates and can be used as the main energy source in the species studied; it is not necessary to add supplemental met. or Zn. In swine nutrition, pelleting did not improve wt. gain, but it is convenient for easier feed handling. (Author's summary. Trans. by L.M.F.) H03

0311

20135 UFODIKE, E.B.C.; MATTY, A.J. 1983. Growth responses and nutrient digestibility in mirror carp (Cyprinus carpio) fed different levels of cassava and rice. Aquaculture 31(1):41-50. Engl., Sum. Engl., 17 Refs., Illus. [Fisheries & Hydrobiology Research Unit, Dept. of Zoology, Univ. of Jos, Nigeria]

Cassava. Feeds and feeding. Fish. Dietary value. Digestibility. Animal physiology. Animal nutrition.

Mirror carp (Cyprinus carpio) fingerlings were fed for 10 wk. on diets of equal N content with 15, 30, or 45% of either cassava or rice and a control diet with neither carbohydrate. Fish grew best on the 45% rice diet. Carbohydrate digestibility when cassava or rice was added to diet was high and ranged between 86-97%, but was very low, 17%, when no cassava or rice was added. Protein digestibility was slightly raised from 76% in the control to between 83.5-88% with the addition of cassava or rice to the diets. Absence of appreciable quantity of digestible carbohydrate from diet probably led to the fish metabolizing more fat for energy. Slight hypoglycemia resulted when fish were fed on diets with no digestible carbohydrate. Energy as carbohydrate is well utilized by mirror carp. (Author's summary) H03

0312

19993 VIANA, L. DE S.; BARBOSA, A.S.; SANTOS, E.C. DOS; ALBUQUERQUE FILHO, G.C. DE; ANDRADE, V.J. DE 1982. Farinha, mandioca integral dessecada e raspa de mandioca em racoes de suínos em crescimento-terminacao. (Cassava flour, dried cassava root meal, and cassava chips in diets for growing and finishing pigs). Arquivos da Escola de Veterinária da Universidade Federal de Minas Gerais 34(3):529-536. Port., Sum. Port., Engl., 13 Refs. [Empresa de Pesquisa Agropecuária de Minas Gerais, Caixa Postal 515, 30.000 Belo Horizonte-MG, Brasil]

Cassava. Cassava meal. Dried roots. Wastes. Waste utilization. Fattening. Finishing. Swine. Animal physiology. Animal nutrition. Brazil.

The efficiency of the use of CM, dried, chopped whole cassava roots, and cassava residues ("crueira") in growing and finishing pig rations was compared. Daily wt. gain, feed intake and conversion, and some carcass characteristics were measured. Eighty-four piglets were randomly assigned to 7 treatments, with 3 replicates, 4 piglets/lot. Feed mixtures contained maize, soybean meal, vitamins, and minerals. The isoprotein and isocaloric treatments replaced 50 and 100% maize with CM, dried, chopped whole cassava roots, or cassava residues. All treatments within stages were equal in energy and, by adjustment of soybean content, were equal in CP. Maize oil and met. were added to all feeds containing cassava. It was concluded that 50 or 100% of maize could be successfully replaced by dried, chopped whole cassava roots or cassava residues and, to a lesser extent, by CM. Differences among the products were sometimes significant during growing stages, but, except for feed conversion, not during finishing. Conversion tended to be most efficient throughout with 50% dried, chopped whole root. Carcass length was least with CM, especially at 100%, but back fat thickness and meat:fat ratio did not differ significantly among treatments. (Summary by Nutrition Abstracts and Reviews) H03

0313

19265 ZILIANI, C. 1981. La manioca: da alimento per gli schiavi a prodotto zootecnico. (Cassava: from a food for slaves to a zootechnical product). Avvenire Agricolo 89(5):23-25. Ital.

Cassava. Uses. Animal nutrition.

Roots of the Euphorbiaceae family, such as cassava, helped the slaves brought to the American coasts survive. Its tuberous roots are an important foodstuff for different populations in tropical areas; from its use by Indian tribes, cassava was used as a source of starch for industrial purposes, especially for animal feed, due to its low prices. In Holland studies are being carried out to determine alternate products for cattle nutrition in view of the prices of traditional grains. Imports reach 5 million tons/yr. West Germany is another important importer of cassava. New areas are being sought for cassava cultivation, including China, in view of the increasing demand. Nutritional characteristics of this product with high starch content (94.4%), that should be complemented with protein-rich elements, are given. In northern Europe cassava is mainly used for swine nutrition, substituting 30-40% of the cereals; some problems occur regarding meat consistency. An amount of 10-20% cassava, with protein supplementation is considered adequate for bovine-cattle. Due to problems caused by this foodstuff, the Consorzio Agrario Provinciale of Parma has prohibited its inclusion in animal feed formulas. (Summary by I.B. Trans. by L.M.F.) H03

See also 0283 0293 0328 0332 0334 0335 0338 0339 0343 0344 0345

100 PROCESSING, PRODUCTS AND USES

102 Uses, Industrialization, Processing and Storage

0314

19254 DATA, E.S.; ESTEBES, E.S. 1981. Drying cassava cubes at the village level. Radix 3(2):13-14. Engl., Illus. [Philippine Root Crop Research

& Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Drying. Small-scale processing. Cooking. Timing. Storage. Organoleptic examination. Philippines.

Village-level research was carried out to evaluate the acceptability of dried cassava cubes, to identify optimum cube size (1.5 or 1.0 cm^3), determine the rate of dehydration, and the optimum storage period. Two lots were prepared for each size. One lot was blanched for 7 min and washed before sun-drying; the other was directly sun-dried. Cooking time increased as the storage period was prolonged. Smaller cubes required shorter cooking time up to 1 mo. storage; beyond this period, big cubes were cooked faster. Big cassava cubes dried slower (50-75 h) and blanched, big cubes were the slowest to dry due to the formation of gel at the surface which limited the movement of moisture from the cube to the environment. Sensory evaluation showed that small, blanched cubes are acceptable. Blanching allowed cubes to be stored for 2 mo. During 3 mo. of storage, no mold or insect infestation was observed; however, as storage was prolonged the quality decreased. Therefore drying cassava cubes and storage should be within the 2 mo. period recommended. (Summary by I.B. Trans. by L.M.F.) I02

0315

19248 DATA, E.S.; TULIN, E.E. 1981. Effect of delayed processing of fresh cassava tubers on alcohol recovery. Radix 3(2):1-2. Engl., 4 Refs., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Processing. Timing. Alcohol. Productivity. Fermentation. Philippines.

The alcohol yield of tubers of cassava cv. Golden Yellow, whose processing had been delayed for 1, 2, 3, 4, and 5 days, resp., was determined in addition to that of an initial sample of tubers processed immediately after harvest. The relationship between sugar and starch contents and alcohol yield was also determined and the optimum length of time of delaying cassava processing for max. alcohol yields was identified. Tubers were washed, peeled, grated, and cooked for 30 min. These samples were 1st inoculated with Aspergillus oryzae followed by incubation for 48 h at room temp.; 72 h after saccharification, samples were inoculated with Saccharomyces cerevisiae. Generally, vascular streaking became more intense when tubers were stored prior to processing. The % of soluble solids increased after 24 h of saccharification and levelled off during fermentation. The highest % of soluble solids was observed when the tubers were processed 4 days after harvest suggesting a better saccharification compared with roots processed after 2 days. The highest % of alcohol was also obtained with tubers processed 4 days after harvest and the lowest when tubers were processed at 2 days. Sugar concn. increased after saccharification; however, there was a reduction in total sugar content after fermentation. The quality of alcohol produced from tubers whose processing was delayed is still comparable with that obtained from fresh samples. (Summary by I.B. Trans. by L.M.F.) I02

0316

18920 FERREROSA, R. 1983. La yuca entra al mercado de la alimentación animal en Colombia. (Cassava enters the animal feed market in Colombia). CIAT Internacional 2(1-2):204. Span., 4 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Also in English.

Cassava. Solar drying. Colombia.

A successful natural drying project of cassava on the north coast of Colombia (Betulia), carried out in cooperation with the Integrated Rural Development Program (DRI), the Canadian International Development Agency (CIDA), and CIAT, is reported. This success has originated an expansion in plant floor capacity from 300 m^2 to 1000 m^2 and the purchase of a tractor. Effective marketing systems must be established to increase cassava production, the best alternative being animal feed manufacturing. Cassava could replace at least 20% of the sorghum used in poultry and pig feed. The traditional process of drying cassava is described: use of a chipper with a disc, powered by a 3-HP gasoline engine and placement of chips under hot sun for 2-3 days on a cement surface, turning chips over 6-8 times to obtain 14% MC; about 7.5 man-hours/t cassava are required. The background of the Betulia project is given, this information being valuable for establishing similar projets in Panama and Mexico. The plant is economically feasible and the purchase of future production by Purina is assured. CIAT is investigating the development of solar collectors to improve drying efficiency and assists in technical aspects, design and execution of studies. The role of other institutions and the optimism of farmers are highlighted. (Summary by I.B. Trans. by L.M.F.) I02

0317

19536 GOAD, K.C.; FLAHERTY, J.M. 1980. Processing cassava into gari. West African Farming 1980 (Sept./Oct.):39,41. Engl., Illus.

Cassava. Gari. Processing. Industrialization. Nigeria.

The history and changes in the production of gari, a dry granular meal derived from tubers of bitter cassava var., are described along with the 1st establishments for industrialization of this product in West Africa. The system of mechanized gari production consists of root preparation, fermentation and dewatering, garification, drying, milling and packaging. This system ensures the characteristics desired by the consumer and produces 18 or 6 kg gari/h/person, depending on the size of the equipment installed, compared with the traditional method that produces 1.75 kg/h/person. Furthermore, gari produced with the mechanized system can be stored for more than 6 mo. and is advantageous to satisfy the needs of feeding an evergrowing population. Main considerations that should be taken into account to establish a gari factory are mentioned: potential consumer market, capital involvement and financial support, and location. The growing institutional interest in the industrial processing of gari is highlighted. (Summary by I.B. Trans. by L.M.F.) I02

0318

20116 KALLEMURRAHMAN, M.; RAJ, S.P. 1982. Nitrogen balance of Eri silkworm (Philosamia cynthia ricini Boisduval) reared on tapioca (Manihot utilissima Pohl) leaves. Proceedings of the Indian National Science Academy 48(1):55-58. Engl. Sum. Engl., 13 Refs. [Tamil Nadu Agricultural Univ., Coimbatore 641003, India]

Cassava. Leaves. Uses. India.

N balance of eri silk worm (Philosamia cynthia ricini) reared on leaves of cassava var. ME 116 was determined. Larvae were fed ad libitum every 4 h between 6 a.m. and 6 p.m. in rearing rooms with temp. from 27 to 30°C and 80-82% RH. The 1st stage larvae were fed with 2nd and 3rd leaves from the

top and the 2nd, 3rd, and 4th stage larvae were fed with successive leaves below each and the final stage larvae with the rest of the matured leaves. For the formation of silk and other biochemical changes there was a reduction of 9677.6 g N/ha from the final larval stage. From the pupal to moth stage and from moth to egg laying stage the N sink was 5760.7 g and 4479.1 g/ha, resp. N trapped in stage 2 and metabolized at stage 4 was comparatively low. (Author's summary) I02

0319

20130 KHALID, N.M.; MARKAKIS, P. 1981. Production of high-fructose syrup from cassava starch. In The quality of foods and beverages: chemistry and technology. New York, Academic Press. pp.319-326. Engl., Sum. Engl., 14 Refs. [Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Cassava starch. Confectioneries.

Cassava starch was hydrolyzed by alpha-amylase and amyloglucosidase. The carbohydrate content of the resulting syrup was 97.6% glucose and 2.4% maltose and higher saccharides. After purification, the syrup was isomerized by an immobilized glucose isomerase to a product with the following carbohydrate composition: 36.9% fructose, 60.7% glucose, and 2.4% maltose and higher saccharides. This fructose-containing syrup, diluted to 13.0% solids, was judged by a taste panel to have sweetness equivalent to an 11.4% sucrose solution, and a commercial high-fructose corn syrup diluted to 12.8% solids. The panel was unable to find any taste differences between the corn high-fructose syrup and the cassava high-fructose syrup when they were used to prepare a lemonade drink at equivalent sweetness. (Author's summary) I02

0320

20109 LEON A., M.; MARTINEZ B., M. 1974. Cálculo y diseño de una trizadora y pulverizadora para producir almidones a partir de la yuca. (Design of a chipper and pulverizer to produce cassava starch). Tesis Ing.Agr. Bucaramanga, Colombia, Universidad Industrial de Santander. 208p. Span., Sum. Span., 15 Refs., Illus.

Cassava. Cassava starch. Industrialization. Factories. Industrial machinery. Development. Colombia.

A chipping and pulverizing plant to manufacture starch from cassava, following a continuous process, was designed. Some of its parameters can vary when put into practice depending on the requirements determined by the amount of product and the type of raw material (cassava, potato, sweet potato, plantain). These parameters are the vol. of supply, working speed, and fineness of product. Size reduction takes place in 2 stages. The 1st stage, chipping or primary reduction to an intermediate size appropriate for pulverization, consists of a conveyor belt feeding device that receives cassava in its original size and deposits it in the chipper. Chips of approx. 18 mm are selected. Other sizes can be obtained depending on the turning speed of the machine, feeding rate, and the no. of blades. The 2nd stage or pulverization uses an exchangeable hammer mill, easily assembled, and replacement due to wear is economical. The mill has a capacity to produce fine grains (0.75-0.10 mm or more). A conveyor belt is also included to feed the material supplied by the dryer, together with the recycled material. A screen placed at the outlet of the mill classifies the material of a smaller size than the screen mesh, leading it directly to the cyclone. Larger-sized particles return to the mill for their total pulverization. The cyclone makes the final size selection, separating

larger-sized material from the desired-sized particles. (Author's summary. Trans. by L.M.F.) I02

0321

19535 LIMA, T.B. DE S. 1981. Significado da usina de Curvelo no Programa Nacional do Alcool. (Importance of the Curvelo factory for the Programa Nacional do Alcool). In Congresso Brasileiro de Mandioca, 1o., Cruz das Almas-BA, 1979. Anais. Bahia, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Departamento de Informacao e Documentacao. v.2,pp.211-239. Port., 37 Refs.

Cassava. Alcohol. Uses. Factories. Cassava programs. Brazil.

The historicogeographical background of the utilization of different fuel sources is given, highlighting the need to find alternate sources that replace petroleum, which still occupies a high % of the world energy demand and represents 42% in Brazil. The trends of Brazilian energy policies are described; these are given high priority by the government in order to minimize external dependence and find renewable energy sources. The history of the utilization of alcohol as energy source is analyzed as well as the efforts of international cooperation to this respect, the evolution of its use in Brazil, different studies and trials that have been carried out. As of 1973, after the world energy crisis, the use of alcohol as a source of energy has been studied systematically. The bases of the Programa Nacional do Alcool are given and outstanding aspects of the establishment of the factory in Curvelo-USAC, a joint effort of PETROBRAS, the Secretaría de Tecnología Industrial (STI), and the Instituto Nacional de Tecnología (INT), are described in detail. This factory has the main objective of developing an alcohol production technology capable of being tested at an industrial scale (60,000 l/day). The role of the different institutions that carry out research work in agriculture, especially that related to cassava, is highlighted. Objectives of the exptl. factory of USAC include the development of a new energy source of plant origin, the opening of agricultural frontiers, and the use of starchy crops, giving priority to cassava and sorghum. Social advantages of using cassava at an industrial scale are mentioned. To date more than 8 million liters of alcohol have been produced; operational efficiency is now being sought in addition to increased agricultural productivity (cassava representing approx. 61% of the total costs) and the compatibility of by-product commercialization. (Summary by I.B. Trans. by L.M.F.) I02

0322

20105 PINTO, R. 1978. Extracción de almidón de yuca en rallanderías. (Cassava starch extraction in small-scale factories). ICA Informa 12(9):3-6. Span., Illus.

Cassava. Cassava starch. Processing. Colombia.

The situation and problems of cassava starch extraction in small-scale factories in Colombia are reported. In 1975, 256,700 ha were planted to cassava; 150 small-scale factories existed, located mainly in Antioquia, Valle, and Cauca, with an installed capacity of 500-2500 kg/day and an extraction efficiency of 63%. In 1974, 2324 t of cassava starch were produced, 7.84% above the total of starch manufactured of the different species. Stages involved in starch processing are described and improvements are suggested: washing (rotary drums with pressurized water supply); rasping (raspers with steel rasping blades); screening (steel-meshed screens); sedimentation (tables or troughs where the cassava starch milk is in movement); fermentation, the Instituto Colombiano

Agropecuario is trying to isolate causal microorganisms of fermentation to quicken this process; drying, this process should be quicken to promote cassava cultivation since its rapid postharvest deterioration makes marketing difficult. (Summary by I.B. Trans. by L.M.F.) I02

0323

20184 TAMBURINI, E.R. 1981. Obtencao de álcool do resíduo celulósico de mendioca por diferentes processos deslignificantes e hidrolíticos. (Obtention of alcohol from cellulosic cassava residues through different delignification and hydrolytic treatments). Tese Mestrado. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 79p. Port., Sum. Port., Engl., 51 Refs., Illus.

Cassava. Alcohol. Waste utilization. Factories. Wastes. Analysis. Starch content. Sugars. Hydrolysis. Fermentation. Productivity. Cellulose. Brazil.

Research conducted at lab. of the Food Science Department of the Escola Superior de Agricultura de Lavras studied the possibilities of using the cellulosic waste of cassava obtained before the fermentation process to determine the physical and chemical constitution of the residue obtained at different times during the year and the effects of 2 delignification treatments applied and their consequences in the variation of the compositions of the residue. Chemical substances present during the delignification processes were screened to define possible changes in the composition of the residue at each stage of the process. As a consequence of the delignification there was an increase in the cellulose content and a reduction in the other constituents, in particular the lignin content. Sulfuric acid was the best hydrolytic agent, giving the greatest value of saccharification of the cellulosic materials. The best sugar consumption by yeast was observed in the extract from the process in which delignification was made with alkali followed by acid hydrolysis. (Author's summary) I02

0324

20110 URIBE M., H. 1956. Proyecto para una planta de glucosa a partir del almidón de la yuca. (Project for a glucose processing plant based on cassava starch). Tesis Ing.Quim. Bucaramanga, Colombia, Universidad Industrial de Santander. 143p. Span., 29 Refs., Illus.

Cassava. Cassava starch. Uses. Glucose industry. Factories. Industrialization. Processing. Costs. Industrial machinery. Colombia.

General aspects are presented on the types, properties, structure, sources and uses of starch; production and commercial forms of glucose; and types of starch hydrolysis. Aspects of the crop (classification, toxicity, planting) are described and the chemical composition of cassava is analyzed. A project was developed to establish a glucose processing plant, based on cassava starch, in Santander, Colombia, for which the methodology and analysis of the glucose production process are described. An economic analysis was also carried out to determine specific characteristics of the mill such as capacity, operation, products and by-products, types of materials, machinery and equipment, and no. and types of motors to be used in the different sections. Charts are provided indicating the distribution of the facilities and equipment. (Summary by EDITEC) I02

0325

19249 VILLAMAYOR JUNIOR, F.G. 1981. Cassava stems as potential firewood. Radix 3(2):3-4. Engl., Illus. [Philippine Root Crop Research & Training

Center, Visayas State College of Agriculture, Baybay, Leyte 7127, Philippines]

Cassava. Stems. Uses. Cultivars. Productivity. Wood. Philippines.

Expt. carried out in the Philippines to determine the potential of using cassava stems, left in the field after harvest, as fuel for cooking are briefly reported. At the exptl. station of the Philippine Root Crop Research and Training Center, their efficiency in boiling 1 l of water was compared with those of Leucaena leucocephala and bamboo. Cassava stems are only 63% as efficient as L. leucocephala. The stump is the most efficient part, and is also the part of the plant that causes most problems when left as residue in the field. Var. differences were found in terms of wood production but there was no relationship between % dry wt. and wood wt. needed to boil water. The stems of 6 var. were divided into 6 equal parts to determine which part was most efficient as fuel; no relationship was evident. When cassava stems were split, debarked, split and debarked, or left intact, split and debarked stems were observed to dry quicker and could be used as fuel on the 5th day. Intact stems were dry on the 20th day, the others on the 12th. It is not necessary to completely dry the stems before using them as fuel. General recommendations are given on their use. (Summary by I.B. Trans. by L.M.F.) 102

See also 0206 0215 0238 0239 0267 0283 0285 0328 0331 0333 0334 0335 0337 0344

I03 Industrial Microbiology

0326

20142 SEDGWICK, J.A.D. 1976. Factors affecting protein and spore formation by Aspergillus fumigatus I-21 in submerged fermentation with cassava starch. Mag.Sc.Thesis. Ontario, University of Guelph. 155p. Engl., Sum. Engl., 239 Refs., Illus.

Cassava. Cassava starch. Fermentation. Aspergillus. Industrial microbiology. Protein enrichment. Analysis.

The effects of temp., agitation, pH, and mineral supplements on protein production by Aspergillus fumigatus I-21 in submerged fermentations with cassava starch, and the effects of medium composition on spore formation in such fermentations, were investigated. The max. growth rate of A. fumigatus I-21 occurred between 35-40°C. An agitation rate of 400 rpm was optimum for the growth of I-21 on 2% (w/v) cassava starch. Although the minerals present in the cassava starch partially fulfilled the mineral requirements of I-21, an additional source of KH_2PO_4, $MgSO_4$, $FeSO_4$, and $ZnSO_4$ was required to supplement cassava starch for max. protein production. When urea was used as the N source for the fermentation of cassava starch, the pH of the medium began to increase from 3.5 at approx. 20 h. This increase was undesirable from a contamination standpoint if the everall process was to operate as a nonaseptic one. By using a combination of urea and $(NH_4)_2SO_4$ as N sources, the pH of the cassava starch liquid medium was maintained between 3.0-3.25 throughout the fermentation. Decreasing the initial N concn. in the cassava liquid medium induced the submerged sporulation of I-21. Sporulation occurred in the presence of $NaNO_3$ and urea but not with $(NH_4)_2SO_4$ or NH_4NO_3. This difference was shown to be due to the decrease in pH associated with use of ammonium salts, not to the nature of the N source. (Author's summary) I03

0327

18912 ARIAS G., C.M. 1982. Políticas de investigación y extensión en yuca. (Research and extension policies regarding cassava). In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomía. Alcance no.31:167-170. Span., 8 Refs. [FONAIAP-CENIAP, Apartado 4653, Maracay 200, Edo. Aragua, Venezuela]

Cassava. Cassava programs. Venezuela.

The importance of cassava in Venezuela is briefly analyzed along with research and extension policies of the crop. Through adequate cultural practices and necessary technology, the av. yield (40 t roots/ha) should be increased. The Fondo Nacional de Investigaciones Agropecuarias of the Ministry of Agriculture and Husbandry directs part of its investigations toward the solution of problems limiting cassava production. (Summary by I.B. Trans. by L.M.F.) J00

0328

20126 BLARCOM, B. VAN 1983. Economic analysis and nutritional considerations of the cassava industry in Jamaica. Washington, D.C., United States Department of Agriculture. Office of International Cooperation and Development. Nutrition Economics Group. 77p. Engl., Sum. Engl., 13 Refs.

Cassava. Cassava programs. Production. Root productivity. Statistical data. Costs. Cultivation. Income. Factories. Cassava flour. Cassava starch. Marketing. Trade. Nutritive value. Consumption. Food energy. Labour. Uses. Jamaica.

The viability of the cassava industry in Jamaica in terms of productivity using investment, and the possibility of using cassava to increase small farmers' income were evaluated. The report is divided into 4 sections that analyze different facets of the industry. Section 1 examines the supply of cassava, discussing acreage, yield, farm size, cost of production, and remuneration to the farmer. Section 2 discusses both the domestic and the international demand for cassava. Demand originating from flour production, home consumption, starch and livestock chip production are examined and quantified. The CF factory is explored in detail: capacity, plant usage, cost of flour production, and reasons for its failure. The international market for cassava is discussed as well as constraints for entering the market. Section 3 discusses past, present, and possible future government policies regarding the industry. Section 4 looks at the nutritional effects of cassava consumption, examining cassava's contribution to the diet and the comparative cost of nutrition from cassava. It was concluded that at current levels of technology, practices of cassava cultivation, and farm gate prices, the production of cassava is not seen as a viable means for raising farmers' incomes. Jamaica is not able to compete for the existing market as the demand is only for cassava pellets and not chips. Also, its cost of production is too high, making cassava products not competitive. Considering the low marketability of cassava and its nature as an inferior good for home consumption, cassava production should not be encouraged in Jamaica. The government should continue research efforts, particularly aiming at increasing yields, to enable farmers to maintain their current levels of consumption, while using their land to produce more profitable crops. It is clear that although cassava can play an important part in balanced diets as a source of food energy, it is not the solution to Jamaica's goal of providing an adequate diet for its citizens. (Summary by L.M.F.) J00

0329

20193 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. CENTRO NACIONAL DE PESQUISA DE MANDIOCA E FRUTICULTURA. 1981. Encontro de administradores e pesquisadores de órgaos do Estado da Bahia que estudam os produtos abacaxi, banana, citros, mandioca e manga. (Meeting of administrators and researchers of Bahia state institutions studying pineapple, banana, citrus fruits, cassava, and mango). Cruz das Almas-BA, Brasil. Documentos no.5. 52p. Port. [Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cassava programs. Research. Brazil.

Different reports given by the coordinators of the pineapple, banana, citrus fruits, mango, and cassava programs of the Centro Nacional de Pesquisa de Mandioca e Fruticultura, during the 1st meeting of researchers held in Cruz das Almas, BA, Brazil, are summarized. Research priorities are defined in relation to diseases, pests, and some limiting production factors for each one of the crops. The influence of Programa Nacional do Alcool (PROALCOOL) on cassava development was emphasized; research priorities concentrate on cropping, production, and commercialization systems, adaptation to different ecosystems, low fertility soils, soil management and conservation, bacteriosis, mites, the cassava hornworm (Erinnyis ello), root rots, and superelongation (Sphaceloma manihoticola). (Summary by EDITEC) J00

0330

20194 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. CENTRO NACIONAL DE PESQUISA DE MANDIOCA E FRUTICULTURA. 1982. II Encontro de administradores e pesquisadores de órgaos do Estado da Bahia que estudam os produtos abacaxi, banana, citros, mandioca e manga. (II Meeting of administrators and researchers of Bahía state institutions studying pineapple, banana, citrus fruits, cassava, and mango). Cruz das Almas-BA, Brasil. Documentos no.02. 25p. Port. [Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cassava programs. Research. Brazil.

In November 1981 the II meeting of administrators and researchers of different institutions attached to the Centro Nacional de Pesquisa de Mandioca e Fruticultura was held at headquarters in Cruz das Almas, BA, Brazil. The main objective was to integrate research and extension activities, as well as reduce the use of some inputs by using biological control methods, green manures, and other measures. An increased production area was noted for cassava, together with a lack of credit facilities, increased price of flour, and enhanced commercialization of cassava roots with other Brazilian states. The objectives of agricultural extension were oriented toward increasing productivity through an analysis of production systems, dissemination of production technology through demonstration plots, training of technicians and labor, seminars, and other activities. The main targets projected and reached are presented for each institution. (Summary by EDITEC) J00

0331

20114 EZETA, F.N.; SOUZA, J. DA S.; MATTOS, P.L.P. DE 1981. A mandioca como matéria prima na producao de álcool. (Cassava as raw material for alcohol production). Cruz das Almas-BA, Brasil. Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Documentos no.4. 36p. Port., 9 Refs. [Centro Nacional de

Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cultivation. Cultivars. Production. Statistical data. Alcohol. Brazil.

The situation of cassava in relation to its inclusion as a raw material in the Programa Nacional do Alcool (PROALCOOL), its economic and social importance in Brazil, and the impact its inclusion would have on the program is analyzed. An increase of 10,184,912 t is expected in NE Brazil only, if productivity (without increasing the area planted) is raised to 20 t/ha. This would produce 1.7 billion liters of alcohol (10% current use of gasoline), create jobs, and raise the purchasing power. Technological aspects are included on advantages of cassava, major cv. (Peru Branca, Jaburu, BGM005, BGM118), cutting size, spacing, planting systems, mechanization, fertilization, diseases and pests, and tercropping. Two production systems for Reconcavo da Bahia are given. The need to increase cassava productivity in Brazil is emphasize , since up to 30-42 t roots/ha/yr have been obtained in exptl. areas. The causes of low productivity are listed; these are generally related to the lack of appropriate technology. By regions, the NE has 54% of the total production, the South 18%, the SE 13%, the North 11%, and the Central West region 4%. Sao Paulo and Paraná had the highest yields, 19.9 and 18.9 t/ha, resp. (Summary by I.B. Trans. by L.M.F.) JOO

0332

20176 FERREIRA, C.H.G. 1981. A mandioca e a indústria de racoes. (Cassava and animal feed industry). Vida Rural 3(106):33-34. Port., Illus.

Cassava. Trade. Feeds and feeding. Animal nutrition. Portugal.

The problems faced by Portugal regarding the manufacture of rations for animal nutrition, especially pig, the competition with producers of other countries (EEC), and the possibilities of cassava production in different exporter countries (mainly Thailand and Brazil) are analyzed. It is suggested that due to the monetary and production crisis in Portugal the industries should manufacture rations only based on cassava or use industrial subproducts such as residues of sugar beet, orange peels, tomatoes, grapes, beer residues, sugar cane liquor bagasse. The 1st stage consists in the organization of its commercialization. (Summary by I.B. Trans. by L.M.F.) JOO

0333

20169 FURTADO, M.J. 1980. Sugestoes de alternativas para utilizacao de raízes de mandioca no Estado do Espírito Santo. (Suggested alternatives of use of cassava roots in the state of Espirito Santo). Cariacica-ES, Brasil, Empresa Capixaba de Pesquisa Agropecuária. Comunicado EMCAPA no.01. 6p. Port., Illus.

Cassava. Production. Processing. Socioeconomic aspects. Statistical data. Brazil.

The situation of cassava cultivation in the state of Espirito Santo, Brazil, is analyzed. Production alternatives tending to promote this crop, reduce the competition in CF marketing, cover the deficiency of maize in the state, and eliminate losses up to 34% of the current production due to the lack of markets are included. For low-income farmers (farms less than 3 ha), the simple manufacture of cassava chips using family labor, of low costs and compatible with the farmers' needs is suggested. For cassava

growers with farms from 3 to 12 ha in size, the manufacture of table flour is suggested using traditional methods and the existing infrastructure. For cassava growers with farm larger than 12 ha, the manufacture of fuel alcohol is suggested since these farmers have access to credit, use advanced technologies, and the area allows mechanization. A study to determine plant capacity and localization of a distillery to meet the needs of the state is necessary. (Summary by I.B. Trans. by L.M.F.) J00

0334

19515 LYNAM, J.K. 1983. Cassava in Asia. In Centro Internacional de Agricultura Tropiocal. Trends in CIAT commodities. Cali, Colombia. Internal Document Economics 1.8. pp.65-146, Data Appendix 7. 6p. Engl., 34 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Marketing. Trade. Consumption. Production. Costs. Uses. Cassava starch. Gaplek. Cassava roots (vegetable). Cassava chips. Pellets. Tapioca pearls. Maps. Intercropping. Human nutrition. Animal nutrition. Prices. Statistical data. Cultivation. Thailand. Indonesia. India. Malaysia. Philippines.

Economic aspects of cassava production in Asia are described, including production, internal use for human consumption, starch, animal feed, domestic market situation, and exportation levels in Thailand, Indonesia, India, the Philippines, and Malaysia. Cassava markets in tropical Asia are diverse but, in general, they are well developed. Although cassava is not as important a crop as rice in the region, it occupies a top position and has alternative markets that vary according to the agricultural policies of each country. Thailand is the 1st producer and exporter with 13,554 x 10^3 t/yr, of which 73% is exported. Indonesia produces 12,191 x 10^3 t/yr and exports only 7% followed by India, the Philippines, and Malaysia with 4189, 436, and 432 x 10^3 t/yr, resp. Tables and graphs on the different aspects analyzed for each country are included, as well as an appendix on production estimates, relative importance of each one of the producer countries in the world, and production level per capita. (Summary by EDITEC) J00

0335

16664 MANDIOCA. (Cassava). Acompanhamento da Situacao Agropecuária do Paraná 4(4):39-40. 1978. Port.

Cassava. Cassava meal. Trade. Marketing. Production. Brazil. Europe.

A general report is given on the situation of cassava in relation to world demand and demand in Brazil, especially for animal nutrition. After cassava production rose from an av. of 76 million tons in 1961-65, it reached an av. of 96 million tons in 1970, and stabilized at 107 million tons in 1976-77. Brazil's international trade with the EEC has increased considerably, and in late 1977 cassava was included at 14% in the preparation of balanced feed rations compared with 8% in 1970-71. This inclusion is expected to increase to 20% in the future and cassava will have a greater utilization in human nutrition. The demand for cassava starch is also expected to increase for cold-storage plants, textile, paper, cellulose, and explosives industries, due to the low maize production in 1977-78. (Summary by I.B. Trans. by L.M.F.) J00

0336

16662 MANDIOCA. (Cassava). Acompanhamento da Situacao Agropecuária do Paraná 4(9):41-43. 1978. Port.

Cassava. Trade. Marketing. Statistical data. Brazil. Europe.

The situation of cassava production is briefly discussed. Its demand for animal feed industries continues to grow; however, its production is stagnant. Av. world yield of cassava in 1977 was 8.9 t/ha and in Brazil, Colombia, India, and other countries improved var. exceeded this yield. The effects of measures undertaken by the EEC to exert greater control on the importation of this product to substitute cereals are mentioned. Cassava cultivation in Paraná (Brazil) is briefly mentioned. In Jacarenzinho the area planted to cassava is expected to increase and in Umuarama and Paranavaí this should decrease since there is almost no market for starch. (Summary by I.B. Trans. by L.M.F.) J00

0337

19986 MARTIN, F.W. 1981. Cassava: Manihot esculenta. CRC Handbook of Biosolar Resources 2:183-191. Engl., 15 Refs., Illus.

Cassava. Cultivation. Root productivity. Production. Statistical data. Economics. Marketing. Composition. Uses.

Different aspects of the production, economic importance, and composition of cassava are examined. A description of the plant is given as well as climatic and soil requirements and planting distances frequently used. The main phytosanitary problems are the mosaic virus, Xanthomonas, mites, and Erinnyis ello. Different var. allow for harvests ranging from 10 mo. to 3 yr., while yields range from 10 to 12 t/ha with the use of low level technology to 25-30 t/ha if improved var. and advanced technology is used. The principal producing countries are indicated, including world production during 1977 and the different products obtained from cassava. Root, leaf, and stem composition on a dry wt. basis is 1.45, 6.7, and 4.7% fiber; 1.25, 26.6, and 14.7% protein; 30.8, 52.1 and 41.2% N-free extract; and 1.43, 1.8, and 7.3% ashes, resp. Flour obtained from cassava stems of different var. and alfalfa flour were compared. (Summary by EDITEC) J00

0338

20129 NELSON, G.C. 1983. Time for tapioca, 1970 to 1980: European demand and world supply of dried cassava. Food Research Institute Studies 19(1):25-49. Engl., Sum. Engl., 26 Refs., Illus. [Univ. of the Philippines at Los Baños, Laguna, Philippines]

Cassava. Consumption. Processed products. Cassava products. Trade. Prices. Statistical data. Legal aspects. Feeds and feeding. Animal nutrition. Swine. Europe. Thailand. Indonesia.

The use of cassava in livestock feed rations, the impact of EEC agricultural price and trade policies, especially towards grains, on that use, and the distribution of animals and the animal feeding industry in the Community were examined to explain the rapid growth in imports in the 1970s and the current demand for cassava. In addition, factors responsible for the enormous difference in supply response between Thailand and Indonesia are discussed. The reasons for complaints regarding the growth of cassava imports are discussed and recent efforts at control are reviewed. (Summary by L.M.F.) J00

0339

20151 PACHICO, D.; JANSSEN, W.; LYNAM, J.K. 1983. Ex ante analysis of new technology: a comparison of cassava for the feed and fresh markets in

Colombia. Agricultural Systems 11:131-142. Engl., Sum. Engl., 27 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Technology. Research. Fresh products. Feeds and feeding. Economics. Marketing. Prices. Costs. Statistical analysis. Colombia.

The expected economic benefits of investment in 2 alternative research programs to improve yields of cassava in Colombia are estimated. The benefits from an industrial cassava var. for the animal feed market are compared with those from a higher quality cassava suitable for the fresh food market. A linear programming least-cost feed mix model is used to calculate the cost reduction in poultry feed due to new cassava technology. The impact of this cost reduction is traced through single equation models of poultry supply and demand in order to estimate social benefits in an ex ante consumer surplus framework. Costs of the alternative research programs are projected and internal rates of return are calculated. (Author's summary) J00

0340

20137 PONGSRIHADULCHAI, A. 1981. Supply analysis of important crops in Thailand. Ph.D. Thesis. Ames, Iowa State University. 170p. Engl., Sum. Engl., 39 Refs., Illus.

Cassava. Consumption. Prices. Statistical analysis. Rice. Maize. Sugar cane. Kenaf. Thailand.

Seventy-two provinces in Thailand were grouped into 19 agroeconomic zones. The statistical analysis was primarily at the zone level of aggregation, although a national aggregate model was also estimated. The period under study was 1969-77 and the crops included rice, maize, cassava, sugar cane, and kenaf. The Nerlovian supply function, where the planted area of crop under study is a function of expected price and a time trend, was used. In general, it was found that Thai farmers were very price responsive except for rice producers. Cassava was analyzed in 4 zones, accounting for approx. 70% of the 5 yr av. of the total area planted to cassava in Thailand. Estimated elasticities for cassava ranged from 0.28 to 3.18 with mean and median equal to 1.66 and 1.77, resp. In one zone maize and sugar cane were competitive crops for cassava; in 2 others, kenaf price was found to influence the area planted to cassava; and in the oldest zone in terms of cassava growing, no competitive crop was found. (Summary by World Agricultural Economics and Rural Sociology Abstracts) J00

0341

19968 PORTO, M.C.M.; MATTOS, P.L.P. DE; ALMEIDA, P.A. DE; SILVA, M.A.A.A. DA; SILVA, G.A. DA; MACEDO, M.C.M. 1979. Limitacoes, pesquisa e potencialidades da cultura da mandioca no Brasil. (Constraints, research, and potential of cassava in Brazil). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. 19p. Port.

Paper presented at Reuniao Anual da Sociedade Brasileira de Zootecnia, Curitiba-PR, Brasil, 1979.

Cassava. Cassava programs. Research. Brazil.

The present situation of cassava in Brazil is described. Among the main problems of the crop are the socioeconomic ones, such as commercialization and the adoption of improved technology. The av. national production is 12.6 t/ha while av. exptl. yields range between 22-28 t/ha and with the use

of modern inputs, especially fertilizers, productions of 30-42 t/ha can be obtained in a 12-mo. period. The principal institutions participating in cassava research in collaboration with the Centro Nacional de Pesquisa de Mandioca e Fruticultura, responsible for coordinating the expt. in the different regions of the country, are indicated. Biological control studies of the cassava hornworm, Erinnyis ello, the mites Mononychellus and Tetranychus, and the lace bug, Vatiga illudens, are conducted; crop physiology is also studied as well as management practices that can benefit the farmer. The crop is considered to have great potential in Brazil as there are adequate lands for its cultivation, considerable demand for consumption, and possibilities for its use in alcohol production and animal feed industries. Research priorities are indicated in genetics and improvement, ecophysiology, soils and nutrition, plant pathology, entomology, technology, and economics. (Summary by EDITEC) J00

0342

20125 RANKINE, L.B.; HEE HOUNG, M. 1971. A preliminary view of cassava (Manihot esculenta) production in Jamaica. St. Augustine, Trinidad, University of the West Indies. 18p. Engl., Sum. Engl., 4 Refs.

Cassava. Production. Statistical data. Root productivity. Cultivation. Costs. Income. Labour. Sweet cassava. Bitter cassava. Jamaica.

Preliminary data collected on cassava in some of the major producing areas of Jamaica are highlighted, and a brief review of uses for cassava is presented. It was found that the present system of production in Jamaica was not highly developed. Very little monoculture was practiced and the amount of crop produced was influenced largely by the amount of land available and by the small size of market for farmers' produce. Despite these limitations it was found that cassava production in Jamaica could be profitable. Farmers producing the bitter var. in the Mandeville area made approx. J$77/ac, net, while those producing the sweet var. made on the av. about J$360/ac. Farmers in the Santa Cruz area made an av. of J$104/ac on the bitter var. and lost an estimated J$38/ac on the sweet var. It appears that the wide disparity in results between the 2 areas was largely due to the yields obtained. Cassava production is labor intensive and farmers generally utilize between 200-1000 h in producing the crop over a 10-mo. period. Family labor contributed significantly to the production of both types of cassava. Labor productivity (amount of produce obtained for every hour of labor used) was higher in the Mandeville area than in the Santa Cruz area, ratios ranging from 6.5 to 25 lb/h. Yields obtained in both areas studied compared favorably with the national av. yield in 1968; saleable yields obtained varied between 5-6 short tons for the bitter var. and about 8 short tons for the sweet var. Favorable comparisons can also be made for yields obtained in other cassava producing areas. By relating the max. calorific value/ha (de Vries et al., 1967) to the Jamaican situation, approx. 300,000 calories/day can be obtained from a 10-mo. crop at relatively low cost levels. Attempts to establish or expand cassava production in Jamaica or any other Caribbean territory should be supplemented by exhaustive studies on the crop both from the demand and supply point of view. (Extracted from author's summary) J00

0343

20132 UNITED KINGDOM. HOUSE OF LORDS, SELECT COMMITTEE ON THE EUROPEAN COMMUNITIES. 1981. Imports of cereal substitutes for use as animal feedingstuffs. Recommendation for a council decision authorising negotiations for a co-operation agreement between Thailand and the Community on the production, marketing of, and trade in manioc. With

minutes of evidence. House of Lords Report, Select Committee on the European Communities, Session 1980-81 no.42. 63p. Engl.

Cassava. Cassava products. Trade. Legal aspects. Uses. Feeds and feeding. Statistical data. United Kingdom. Europe. Thailand. Indonesia.

Proposals of the European Communities (EC) on the restrictions of imports of cassava taking evidence from the National Farmers' Union, the Grain and Feed Trade Association, the UK Agricultural Supply Trade Association, the Ministry of Agriculture, and the Overseas Development Institute are discussed. Their conclusions are that EC Commission proposals to restrict imports of cassava are wrong. Imports have been artificially stimulated by situations to do with green exchange rates which have made cassava cheap in national currencies compared with support prices of cereals. Restriction of imports would be disadvantageous to producers and consumers of meat, whose interests should at present take precedence over those of cereal producers. In addition any benefit to EC cereal producers from import restrictions would only be at the expense of damage to developing countries and to the EC's general trade relations. (Summary by World Agricultural Economics and Rural Sociology Abstracts) J00

0344

20133 WALTERS, P.R. 1983. Cassava's markets — where next? World Crops 35(4):130-132,134. Engl. [Tropical Development & Research Inst., 56-62 Gray's Inn Rd., London WC1X 8LU, England]

Cassava. Trade. Cassava chips. Cassava starch. Pellets. Statistical data. Uses. Feeds and feeding. Europe.

The international trade in cassava products (pellets, starch) is described, and the implications of the international trade situation are discussed. International cassava markets are unlikely to experience any significant growth at present price levels. Possibilities in domestic markets point to the use of cassava as starch or as animal feeds. However, cassava is often not competitive with other raw materials (maize, sugar cane). Sufficient yield increases to enable cassava to compete economically in both international and domestic markets are required. (Summary by L.M.F.) J00

0345

18190 WARREN, C. 1982. Manioc - Indonesia's hope but compounders worry. Milling Feed and Fertiliser 165(6):18-19. Engl., Illus.

Cassava. Trade. Europe. Indonesia. Thailand.

The production and industrialization of cassava and other products exported by Indonesia to Europe for animal feed industry are briefly described. Increased demand for cassava in the EEC for animal nutrition resulted in increased cultivation and the share of exportation to the EEC rose from 2.8 to 10% in the past years. Most of the production is directed to markets in France and the Netherlands, while the remainder is sold to local mills for processing into flour. Thailand is the main competitor, with sales to Europe totalling 5 million tons annually, representing about 80% of the overall market. However, Indonesia's share is growing gradually. (Summary by EDITEC. Trans. by L.M.F.) J00

See also 0215 0234 0275 0294 0295 0350 0351

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0346

19246 ALMEIDA, I.F. DE; PEREIRA, A.V. 1983. Mandioca, no sistema de fileiras duplas, em consórcio com feijao - avaliacao de espacamentos. (Evaluation of spacing in cassava planted in double rows and intercropped with beans). Campo Grande, Cariacica-ES, Brasil, Empresa Capixaba de Pesquisa Agropecuária. Pesquisa em Andamento no.13. 4p. Port., Illus. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 125, 29.154 Campo Grande, Cariacica-ES, Brasil]

Cassava. Cassava programs. Planting. Spacing. Intercropping. Beans. Productivity. Brazil.

Partial results are given of 2 expt., one in the municipality of Pinheiro where cassava cv. Manjari (branched growth habit with harvest at 17 mo.) was planted on a red-yellow distrophic Latosol, and the other in Conceicao da Barra, where cassava cv. Pao do Chile (erect, with harvest at 12 mo.) was planted on a red-yellow podzolic soil. A randomized block design was used with 12 treatments and 3 replications. In both trials bean cv. Rio Tibaji was used, spaced at 0.5 m between rows, 5 plants/m. Cassava was planted in Jan. and beans in March, 1982. In Pinheiro soil was amended by liming. NPK (40-80-60) was applied to the bean row. Results of the bean harvest are given; however, cassava has not yet been harvested. Yields of 679.67 kg beans were obtained per hectare in Pinheiro with 5 rows inserted in double rows of cassava spaced at 3.0 x 0.7 x 0.7 m. In Conceicao da Barra, the highest yields were 597.67 kg beans/ha with 5 rows of bean inserted in cassava spaced at 3.0 x 0.5 x 0.5 m. A tendency of increasing bean productivity as the no. of inserted rows increased was observed. (Summary by I.B. Trans. by L.M.F.) K01

0347

20153 FINLAY, J.R. 1981. The use of tacca and cassava as intercrops with coconuts on a calcereous sand. Fiji Agricultural Journal 43(1):23-26. Engl., Sum. Engl., 4 Refs. [Univ. of the South Pacific, School of Agriculture, Alafua, Western Samoa]

Cassava. Coconut. Intercropping. Tacca. Cooke Islands.

Tacca (Tacca leontopetaloides) and cassava were compared as intercrops with coconuts at 2 locations of calcareous sand at Mitiaro, Cook Islands. At both areas the cassava did not survive the 12 mo. to harvest. At the drier area, the tacca yielded 250 kg/ha without fertilizer and 1000 kg/ha with fertilizer. At the other location, the tacca yielded 10,666 kg/ha without fertilizer and 12,500 kg/ha with fertilizer, this being 2.5 times the wt. of planted tubers. The trial shows the tuber yields obtained from tacca in typical atoll conditions where cassava can not grow. Using a simple method of extraction, 22% starch was recovered from the tacca tubers. (Author's summary) K01

0348

20148 FONSECA P., D.; LEIHNER, D.E. 1983. Efecto de poblaciones y arreglos espaciales de caupí (Vigna unguiculata) y maní (Arachis hypogea) en asociación con yuca (Manihot esculenta) sobre producción e intensidad del uso de la tierra. (Effect of plant populations and spatial arrangements of cowpea and groundnut in association with cassava on production and

land use intensity). Acta Agronómica 33(2):17-27. Span., Sum. Span., Engl., 7 Refs., Illus.

Cassava. Cowpea. Groundnut. Intercropping. Spacing. Statistical analysis. Root productivity. Dry matter. Starch productivity. Harvest index. Land use. Colombia.

An expt. was carried out on an acid infertile soil in Quilichao (Cauca, Colombia) to determine optimal plant density and best spatial arrangement of 2 legumes (cowpea and groundnut) in association with cassava. Three plant densities were used for cowpea (80,000, 110,000, and 140,000 plants/ha) and 3 spatial arrangements (45/2, 70/2, and 60/3). Four plant densities were used for groundnut (150,000, 200,000, 250,000, and 300,000 plants/ha) and 2 spatial arrangements (70/2 and 60/3). Cassava density did not vary in either trial (9259 plants/ha). Cassava root yield was reduced when planted with over 80,000 cowpea plants/ha; however, cowpea yields were not affected. Treatments did not affect the wt. of 100 seeds nor the chemical composition of cowpea grains. Higher cassava and groundnut yields were obtained with 300,000 groundnut plants/ha in a 70/2 spatial arrangement. Food quality of legumes was not affected by planting density or spatial arrangement. HI was higher in associated planting than in sole cropping. (Author's summary) K01

0349

20124 MASON, S.C. 1983. Land use efficiency, canopy development, dry matter production and plant nutrition of cassava-grain legume intercropping. Ph.D. Thesis. West Lafayette, Purdue University. 179p. Engl., Sum. Engl., 124 Refs., Illus.

Cassava. Intercropping. Cowpea. Groundnut. Land use. Dry matter. Leaf area. Root productivity. Stems. Leaves. Roots. Mineral content. P. Nutrient uptake. Plant height. Harvest index. Cuttings. Canopy. Root development. Colombia.

A 2-yr field study was conducted to evaluate land use, and interspecific competition effects on canopy development, DM production, and nutrient status in cassava/cowpea and cassava/peanut intercropping systems. The influence of varying P application rates on interspecific competition in a cassava/cowpea intercropping system was also studied. Intercropping cassava with either cowpea or peanut resulted in approx. 25% greater land use efficiency for the 11-mo. growing season than did sole cropped cassava and sole cropped cowpea or peanut. The greater land use efficiency when intercropped was associated with significantly greater leaf area and DM production during early growth than for those of sole cropped cassava, although at harvest the total leaf area and DM produced were similar for these cropping systems. Cassava yields were reduced from 0 to 35% when intercropped with cowpea or peanut. These yield reductions were associated with production of fewer storage roots/plant and lower LAI between 50-100 days after planting, when storage root initiation occurs. Intercropping with cowpea or peanut reduced cassava DM production by 200-600 g/m^2 in both years, which accounted for most yield differences between sole cropped and intercropped cassava. However, in 1982 when intercropped with peanut, cassava yield was further reduced, apparently due to sink size limitations caused by production of only 8.8 storage roots/plant. Nutrient concn. of intercropped cassava leaves were reduced when cowpea and peanut were growing most rapidly. Both cowpea and peanut seed yields and DM production were reduced 26-40% when these crops were intercropped with cassava, while LAI were reduced 10-30%. Increasing the P application rate from 0 to 44 kg/ha in intercropped cassava and cowpeas resulted in increased cowpea seed yield both years, and increased cassava yield in 1981. No further cassava

or cowpea yield increases occurred at P application rates greater than 44 kg/ha. Leaf area and DM production, and nutrient uptake were more responsive to P application for cowpea than cassava. (Author's summary) K01

0350

20128 MENESES R., R.; NAVARRO, L.A.; MORENO, R.A. 1983. Efecto de diferentes poblaciones de maíz (Manihot esculenta) al cultivarlos en asocio: 2. Aspectos económicos. (Effect of different maize populations on cassava root production in associated cropping: 2. Economic aspects). Turrialba 33(3):291-296. Span., Sum. Span., Engl., 12 Refs., Illus. [Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica]

Cassava. Maize. Intercropping. Spacing. Minerals. Fertilizers. Costs. Labour. Economics. Income. Costa Rica.

The economic efficiency and price sensitivity of cassava intercropped with maize at 6 different plant densities (0, 1, 3, 4, and 5 maize plants/m^2 intercropped with 1 cassava plant/m^2) and 2 fertilization treatments (90, 200, and 75 kg/ha of N, P, and K, resp.; 120, 200, and 150 kg/ha of N, P, and K, resp.) were evaluated as part of an expt. conducted in Turrialba, Costa Rica. The economic evaluation was based on the general factor-factor and product-product models, assuming different decision-making circumstances. They included simple and combined restrictions on the availability of land, labor, and cash, and the objective functions of maximizing food production and total economic efficiency. The prices used in the analysis were those available in Turrialba during May 1978 (US$ 1 = ₡ 8.60). The prices for cassava and maize/t were $75.50 and $241.90, resp. Results under the different situations assumed for the analysis indicate a lower price sensitivity and higher economic efficiency for cassava intercropped with maize at the lower fertilization treatment included in the test. The higher fertilization treatment tends to be more efficient in cassava monocrop or cassava intercropped with maize at the lowest density, particularly when cassava price tends to increase. One plant of cassava intercropped with 2 maize plants/m^2 and fertilization of 90, 200, and 75 kg/ha of N, P, and K, resp., was the best evaluated option in terms of economic efficiency under all circumstances given for the analysis. The low sensitivity of this crop mixture to changes in the prices of maize, cassava, and labor was also remarkable. Only when the cassava price decreases by 61% is it justified to intercrop 4 plants of maize/m^2, provided the maize price does not decrease. (Author's summary) K01

0351

19300 THOMAS, P.K.; MOHAN KUMAR, C.R.; PRABHAKAR, M. 1982. Intercropping cassava with French beans. Indian Farming 32(4):5. Engl. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, India]

Cassava. Beans. Intercropping. Income. India.

Management practices of cassava intercropped with snap bean var. Contender are given. This intercropping system represents an additional income for farmers in India. Cassava cuttings should be planted in the 1st half of June on well-drained and plowed soil. A basal dose of 12.5 t FYM and 50, 100, and 50 kg N, P, and K were applied per hectare. Cuttings are spaced at 90 x 90 cm. Fertilizers are top dressed after harvesting the intercrop, with slight hoeing and earthing up. Snap beans are dribbled at 30 cm between rows and 20 cm within the row, between 2 rows of cassava, at a rate of 1 seed/hill (25-30 kg seed/ha). Three weeks after germination, 20, 30, and 40 kg N, P, and K are applied per hectare. Flowering commences 30-35

days after planting and 1 wk. after flowering, weekly sprays of malathion are given. The 1st harvest of green pods can be done at 45-50 days after planting and the other 2 at 10-15 days. Crop residues are then incorporated into the soil and cassava is given a top dressing of 50 kg of both N and P. Cassava is harvested at 10 mo. (Summary by I.B. Trans. by L.M.F.) K01

0352

18998 WILSON, G.F.; LAWSON, T.L. 1982. Increased resource exploitation through intercropping with cassava. Summary. In Keswani, C.L.; Ndunguru, B.J., eds. Symposium on Intercropping in Semi-Arid Areas, 2nd., Morogoro, Tanzania, 1980. Proceedings. Ottawa, Canada, International Development Research Centre. IDRC-186e. pp.74-75. Engl. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Intercropping. Maize. Root productivity. Nigeria.

The results of intercropping expt. of cassava with maize and other crops are summarized. Cassava did not adversely affect maize yield and vice versa when maize was planted at 30,000 and 40,000 plants/ha and cassava at 10,000 plants/ha. In both cases the LER showed a high efficiency and intercropping was found to be superior to monoculture. Cassava did not affect 1st season maize and produced more energy than 2nd season maize. The maize/cassava intercrop required only 1 fertilizer application, whereas 2 were required for maize in monoculture. Maize reached higher photosynthetic peaks than cassava in both seasons but photosynthesis of cassava lasted longer. Competition occurred when maize reached its peak demand on resources and cassava, suppressed by maize in early growth, recovers rapidly after the pressure has been removed. The long postcompetition growth period allows for high tuber yield. Cassava yields were low in rotational cropping patterns with cowpea. It was concluded that cassava is an ideal plant for tropical environments and that the association of maize and cassava is efficient although its full potential is unknown. (Summary by I.B. Trans. by L.M.F.) K01

See also 0216 0251

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
CAMV	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
concd.	Concentrated
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
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
govt.	Government
govtl.	Governmental
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
IAA	Indoleacetic acid
IBA	Indolebutyric acid
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 from
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	Probability
Pa.	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
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
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	Tobbaco mosaic virus
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
UMS	Unmodified cassava starch
UV	Ultraviolet
var.	Variety(ies), varietal
VFA	Volatile fatty acids
vol.	Volume
VPD	Vapor pressure deficit
vpm	Volume per million
W	West
wk.	Week
WP	Wettable powder
wt.	Weight
YFEL	Youngest fully expanded leaves
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

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