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(*Manihot esculenta* Crantz)

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

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Vol. XI | No. 1 | April, 1985

CONTENTS

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.

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COMPONENTS OF AN ABSTRACT

Sequential number in the journal (for use of indexes)

Authors

Year of publication

Accesion number (for photocopy requests)

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

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

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. (Author's summary) I02

Abstract

Abstractor and/or translator

Subject categories

12

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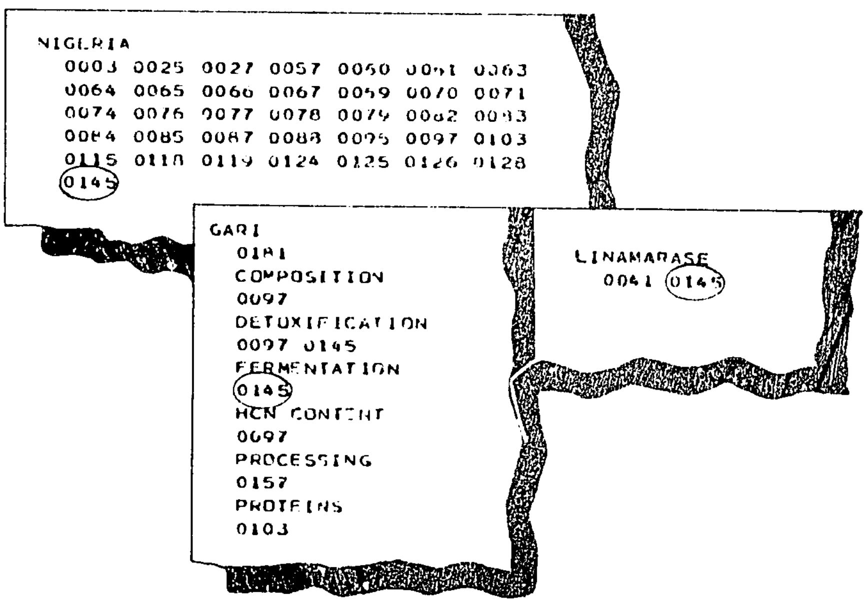

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A00 BOTANY, TAXONOMY AND GEOGRAPHICAL DISTRIBUTION

See 0111 0114

B00 PLANT ANATOMY AND MORPHOLOGY

See 0001 0002 0048 0062

C00 PLANT PHYSIOLOGY

0001

22075 OKA, M.; MATSUDA, T. 1983. Some findings in leaf characters of cassava varieties. Japan Agricultural Research Quarterly 17(1):69-72. Engl., 11 Refs., Illus. [Tropical Agriculture Research Center, Yatabe, Ibaraki 305, Japan]

Cassava. Cultivars. Plant physiology. Plant anatomy. Leaves. Leaf area. Stomata. Transpiration. Carbon dioxide. Photosynthesis. Plant pigments. Composition. Indonesia.

Leaf characteristics of Indonesian cassava cv. were studied. Stomatal resistance to water diffusion (r_s) on both surfaces and chlorophyll content were measured; the distribution and density of stomata in fully expanded leaves in the upper canopy were observed. The r_s.ad (adaxial surface) gave an infinite value while the r_s.ab (abaxial surface) was lower. These results are related to the no. of stomata observed on both surfaces: very few on the adaxial surface and located on both sides of large veins, and a large no. highly distributed on the abaxial surface. The size of the stomata was similar on both sides having the guard cells an av. length of 28 microns. There was a significant var. difference in r_s.ab; there were also large significant var. differences in chlorophyll content at the 1% level, but it was not affected by the leaf position. The low adaxial stomatal density and the compact arrangement of the palisade cells appear to restrict CO_2 diffusion. (Summary by M. de W.) C00

C01 Plant Development

0002

22093 INDIRA, P. 1978. Photoperiodic effect on flowering in cassava (Manihot esculenta Crantz). Journal of Root Crops 4(2):65-66. Engl., 1 Ref., Illus.

Cassava. Cultivars. Photoperiod. Flowering. Flowers. Shoots. Branching. Plant height. Root productivity. India.

The effect of 4 different photoperiods (8, 12, 16, and 24 h light; 12 h normal sunlight), given from 3 mo. after planting for 1 mo., on flowering in cassava var. S 1315 was studied under field conditions in Trivandrum, India. Two replications were made and the extra light source was from 60 watts incandescent bulbs. For each treatment 28 uniform plants were selected. Observations on flowering and mode of branching were recorded daily and plants were harvested at 8 mo. Data on height, tuberous root no. and yield, and shoot yield were recorded. Within 1 wk. following the 16 h light treatment, 28% of the plants started flowering preceded by primary branching; by day 30, 56% were flowered (10% in control). In the 8 h treatment 20% of the plants had flowered by day 14 and 32% by day 30. Flowers did not open in any of the treatments, only flower buds were formed. Treatments did not affect tuberous root yield, except the 24 h treatment in which plants showed increased height, long internodal distance, wider leaves, and reduced yield (1.22 and 0.64 kg/plant for the check and the 24 h light treatments, resp.). (Summary by M. de W. Trans. by L.M.F.) C01

0003

22058 NAIR, N.G. 1984. Tissue culture for the multiplication of disease-free planting material. Indian Farming 33(12):45-46. Engl., Illus.

Cassava. Tissue culture. Apical meristems. Disease control. India.

The basic tissue culture, employed at the Central Tuber Crops Research Institute, Trivandrum, India, for the production of disease-free planting material of cassava and other tuber crops, is presented. The procedure is used for the rehabilitation of infected cassava germplasm and the mass multiplication of desirable genotypes and cv. Tissue culture is a useful tool for the international exchange of seedlings and the in vitro maintenance of germplasm collections. (Summary by I.B. Trans. by M. de W.) C01

See also 0018

C02 Cyanogenesis

0004

22304 AGUINALDO, M.A.M.; GUEVARA, B.Q. 1982. Isolation of a cyanoglycoside from the outer cortex of *Manihot esculenta* Crantz (Euphorbiaceae). Acta Manilana 21:14-25. Engl., Sum. Engl., 12 Refs., Illus.

Cassava. Cyanogenic glucosides. Analysis. Isolation. Roots. Cortex. Composition.

A hydrophobic cyanoglycoside was isolated from the outer cortex of cassava roots. Extraction was done in hot ethanol. A mixture of hydrophobic and hydrophilic cyanoglycosides was obtained by column chromatography of the crude ethanol extract in silica gel. The impure hydrophobic cyanoglycoside was separated further by column chromatography and purified by preparative TLC using silica gel. The pure cyanoglycoside obtained was acetylated and its hRf was compared with that of the unacetylated compound. The hRf of the cyanoglycoside relative to standard linamarin was determined. A value of 4.0 was obtained. (Author's summary) C02

See also 0096

C03 Chemical Composition, Methodology and Analyses

0005

22305 NAMBISAN, B.; SUNDARESAN, S. 1984. Spectrophotometric determination of cyanoglucosides in cassava. Journal of the Association of Official Analytical Chemists 67(3):641-643. Engl., Sum. Engl., 9 Refs., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, India]

Cassava. Analysis. Cyanogenic glucosides. Linamarase. Linamarin. Cyanides.

A new method is reported for determination of cyanoglucosides in cassava. The method is simple, rapid, and sensitive. Ten g cassava root are homogenized with warm (65-70°C) 80% ethanol (1 + 6, wt./vol.) to extract cyanoglucosides. The ethanol is evaporated, and an aliquot of the extract (0.1-0.2 ml) is incubated with linamarase in pH 6.0 phosphate buffer for 15 min at 30°C. The reaction is stopped by adding 0.2N sodium hydroxide, the solution is neutralized, and cyanide is estimated by adding chloramine T and barbituric acid-pyridine reagent and measuring the absorbance at 570 nm. Complete cyanoglucoside extraction and rapid inactivation of endogenous linamarase is possible with 80% ethanol. There is no interference from extractives in the linamarase reaction or in the estimation of cyanide. Recovery of linamarin (as cyanide) is 98% by this assay. The min. detection limit of cyanide in the assay is 0.1 microgram/ml. (Author's summary) C03

See also 0004 0062 0064 0082 0111

C04 Plant Nutrition

0006

21194 HOWELER, R.H. 1983. La función de las micorrizas vesiculo-arbusculares en la nutrición fosfórica de yuca. (The role of vesicular-arbuscular mycorrhizae on phosphorus nutrition of cassava). Suelos Ecuatoriales 13(2):51-61. Span., 18 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Mineral deficiencies. Mycorrhizae. Strains. P. Absorption. Inoculation. Laboratory experiments. Field experiments. Colombia.

The effects of vesicular-arbuscular (VA) mycorrhizae on P requirements and nutrition of cassava are analyzed. Their role in increasing the area of P absorption by the roots is sketched. A table on fungus species. (Glomus, Sclerocystis, Gigaspora, Acaulospora, and Entrophospora) found in Colombia is presented. Soils used in greenhouse and field expt. at Quilichao, Carimagua-Reserva, Carimagua-Yopare, and Carimagua-Alegria, are characterized, and exptl. results are given. Intermediate levels of applied P (50-100 kg/ha) produced higher yields in field trials and were economically feasible for farmers. Mycorrhizal inoculum can be produced from a wide range of plant species. A low grade of host specificity was found in some strains (Quilichao C-1-1). The efficiency of P absorption by different plant species. (cassava, beans, cowpea, Stylosanthes, Andropogon, maize, and rice) and fungus strains is analyzed. Cassava and Stylosanthes were highly dependent (av. ratio of DM production with and without inoculum) on mycorrhizal association. The production of inoculum (only on live plant roots) is explained. Individual spores, infected roots, or soil can be used as inoculum. Host infection rate depends on the amount of infecting

organisms. For cassava, a mixture of infected roots and soil is recommended for field inoculation. The response of cassava to field inoculation is described. In general, inoculation in nonsterilized soil did not significantly affect yield because of the high efficiency of native mycorrhizae in the soil. (Summary by I.B.) C04

See also 0012

D00 CULTIVATION

See 0063 0129 0137 0145

D01 Soil, Water, Climate and Fertilization

0007

20197 BLOMER, E. 1983. Erosión y yuca. Resultados de un estudio de campo sobre el sistema de cultivo de la yuca y la erosión en Monción. (Erosion and cassava. Results of a field study on cropping system and erosion in cassava in Moncion). Santiago de los Caballeros, República Dominicana, Centro Norte de Desarrollo Agropecuario. 31p. Span., 6 Refs., Illus. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Erosion. Cultivation. Land preparation. Weeding. Rainfall data. Soil conservation. Soil conservation practices. Intercropping. Sweet cassava. Bitter cassava. Cover crops. Mulching. Field experiments. Root productivity. Dominican Republic.

A field trial was carried out to determine: (1) the amount of soil lost by erosion in Moncion, Dominican Republic; (2) the relationship between erosion and some cultural practices; (3) farmers' knowledge about erosion problems and solutions. Different exptl. methods for measuring erosion levels were compared on the basis of simplicity, cost, reliability, and presence or absence of a measuring element for erosion. Exptl. plots were considered more reliable but also more expensive. Cultural practices of farmers for soil conservation are explained, and the disadvantages of changing traditional annual crops such as beans, maize, pigeon pea, and cassava for permanent ones, as suggested in the Sierra Plan, are stressed. Cultural practices such as mulching, zero tillage, strip cropping, and intercropping reduce water loss and/or the impact of rain on the soil. In the exptl. plot, soil loss due to erosion was 12.87 t/ha in monocropped cassava, and 17.69 t/ha in cassava/bean intercropping; however, mulching (beans or weeds) reduced the levels of erosion in monocropped cassava. Erosion should be measured over several years or crop cycles to be able to make comparisons. (Summary by I.B.) D01

0008

21134 INSTITUT DE RECHERCHES AGRONOMIQUES TROPICALES ET DES CULTURES VIVRIERES. 1980. Cultures pour l'alimentation des animaux: manioc. (Feed crops: cassava). In ________. Rapport de synthese 1979 sur les activites de la mission G.E.R.D.A.T.-I.R.A.T. en Polynésie Francaise. Paris. pp.86-103. Fr., Illus.

Cassava. Cultivars. Fertilizers. Cu. N. P. K. Mg. Fe. Ca. Zn. Soil analysis. Mineral deficiencies. Root productivity. Harvesting. Timing. Planting. Cuttings. Mechanization. Labour. Costs. French Polynesia.

Trials were conducted in French Polynesia on var. selection (6 CIAT introductions and 5 local var.), fertilization (Zn and Cu on highly acid, low mineral soils on hilly terrains), and planting techniques (mechanical vs. manual sowing; 1-, 2-, or 3-stemed plants; planted vertically or on the flat). Foliar spraying with Zn or a mix of chelated trace elements produced good plant development. When no fertilizer is applied, harvesting at 12 mo. is recommended (39 t/ha). Best economic returns were obtained with 120 kg N, 120 kg P, and 376 kg K/ha, applied at planting or 2 mo. after planting. Higher yields and returns were for hand-sown 2-stemed plants in vertical position. (Summary by I.B.) D01

0009

21163 KRAMER, M. 1983. Labranza mínima en el cultivo de la yuca. (Minimum tillage in cassava cultivation). Santiago de los Caballeros, República Dominicana, Proyecto Investigación Agrosociológica sobre Yuca y Arroz. Centro Norte de Desarrollo Agropecuario. 61p. Span., Sum. Dutch., 14 Refs., Illus. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Bitter cassava. Upland farming. Cultivation. Timing. Land preparation. Weeding. Herbicides. Erosion. Germination. Plant height. Root productivity. Socio-economic aspects. Costs. Income. Dominican Republic.

A collaborative trial (Agrosociological Project on Cassava and Rice-CENDA) was conducted in Mamoncito, near Moncion (Dominican Republic) to determine the use of zero and min. tillage for reducing soil erosion and to find an answer to the shortage of plows (12-15 farmers/oxen) and oxen. A randomized block design was used with 4 treatments (traditional plowing, min. tillage without herbicide, min. tillage with herbicide, and zero tillage with herbicide) and 4 replications. Observations and results cover up to 4 mo. after sowing. Weeding and the use of a preemergence herbicide (glyphosate) were found necessary. The combination of glyphosate and ametryn affected plant development and growth. The cost of herbicides is important for the adoption of min. tillage practices by small farmers. A literature review is included. (Summary by I.B.) D01

0010

22054 MOHANKUMAR, B.; KABEERATHUMMA, S.; NAIR, P.G. 1984. Soil fertility management of tuber crops. Indian Farming 33(12):35-37,49. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Soil physical properties. Drainage. pH. Soil fertility. Soil requirements. Climatic requirements. Nutritional requirements. Manures. Fertilizers. N. P. K. S. Zn. B. Mo. Agricultural lime. Root productivity. Starch content. HCN content. India.

Soil fertility management practices are presented for tuber crops, especially cassava, based on studies made at the Central Tuber Crops Research Institute, Trivandrum, India. Soil and climatic requirements are discussed. It is indicated that well-drained loamy or sandy loam soils, with a pH of 6-7.5, are the best for tuber crops. In India, most of these crops grow in laterite and red acidic soils that respond to fertilization. Data on the nutrient removal by tropical tuber crops are presented; cassava, with a yield of 30 t/ha, removes 180 kg N, 22 kg P, and 160 kg

K/ha. Fertilizer requirements are given and the sources, doses, and responses of the crops to N, P, K, S, and micronutrients are analyzed. (Summary by I.B. Trans. by M. de W.) D01

0011

22021 MPELENDA zi NGIKILA, M. 1980. Problems and prospects of cassava dispersion in Haut-Zaire. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.213-219. Engl., 2 Refs.

Cassava. Climatic requirements. Soil physical properties. Statistical data. Productivity. Socio-economic aspects. Research. Diseases and pathogens. Injurious insects. Injurious mites. Zaire.

Aspects of cassava production in Haut-Zaire, including the description of edaphoclimatic factors important for the obtainment of high yields are mentioned. The land planted to cassava is proportionally smaller in comparison with total cultivated areas due to bad roads that difficult marketing, low population density, food habits (people prefer rice and plantain), and the difficulty to store cassava in a region where the RH is very low. Problems for cassava production include the common mosaic virus, CBB, CAMD, the green spider mite, and storage. It is recommended that the Programme National Manioc (PRONAM) distribute the 10 best clones found in Yangambi in the regional stations of the Institut National por l'Etude et la Recherche Agronomique. (Summary by EDITEC. Trans. by M. de W.) D01

0012

22708 ODURUKWE, S.O.; OJI, U.I. 1984. Response of cassava to fertilizers and town refuse under continuous cropping. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.51-52. Engl., Sum. Engl., 7 Refs., Illus. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Cultivation. Experiment design. Soil physical properties. Soil analysis. Soil fertility. pH. Compost. Fertilizers. N. P. K. Ammonium sulphate. Root productivity. Nigeria.

In Umudike, Nigeria, it was determined whether NPK fertilizer and compost could be used to sustain continuous cropping with cassava; NPK and compost were each tested at 3 levels. Exptl. design was 3^4 factorial arranged in 9 incomplete blocks of 9 treatments. The expt. lasted 4 yr (1974-76 and 1978). Results showed that only K consistently affected root yield significantly. There was a decline in yield with years of continuous cropping: for 1975, 1976, and 1978, resp., 33.8, 45.8, and 49.1%. Yield decline was attributed to depletion of trace elements, proliferation of pests and diseases, and physical deterioration of the soil. Under the heavy rainfall common in the area, the fertility and productivity of the soil could not be maintained by application of fertilizers and refuse. (Author's summary) D01

0013

22056 POTTY, V.P. 1984. Plant microbe inter-relationship in tuber crops. Indian Farming 33(12):41-42,71. Engl., Illus.

Cassava. Mycorrhizae. Soil physical properties. pH. N. Foliage. Green manures. India.

Plant microbe interrelationship in tuber crops is analyzed, particularly the symbiotic association with mycorrhizae, considered as significantly beneficial to the host plant where root systems are restricted and soil nutrient status is low. In alluvial sandy and sandy loam soils of Kerala, India, Glomus sp. and Gaigaspora sp. have been found associated with cassava. Factors affecting mycorrhizal infection are mentioned; low soil humidity as well as low levels of N and P favor infection, and the optimum pH is 5.5-6.0. Studies indicate that a group of gram + bacteria also favor infection in cassava. Other beneficial agents, among them Azotobacter sp., are mentioned. Results of nitrification expt. in soils amended with cassava leaves showed that the nitrification process is reduced. It is recommended to use lignite as a medium to keep the viability of mycorrhizal spores up to 5-6 mo.; alternate hosts like sorghum or Sudan grass can also be used. The lack of host specificity of vesicular-arbuscular fungi and the selection of efficient strains to maximize the benefits from the symbiotic biological agents are highlighted. (Summary by I.B. Trans. by M. de W.) D01

0014

20791 REIS, A.C. 1967. Mandioca. (Cassava). In ________. Zoneamento em bases climaticas das principais plantas cultivadas em Pernambuco. Recife, Superintendencia do desenvolvimento do nordeste. v.4,pp.24-27, 32-35. Port., 35 Refs., Illus.

Cassava. Climatic requirements. Cultivation. Maps. Brazil.

Five geoclimatic zones for cassava cultivation were determined in the state of Pernambuco (Brazil), based on Thornthwaite's moisture index (MI) and annual moisture deficiencies (D): (1) areas of excessive moisture (50 MI, 100 mm/yr), such as Barreiros, Rio Formoso, Serinhaem, Ipojuca, Escada, Ribeirao, and Gameleira, with well drained soils in which var. with high moisture tolerance should be preferred; (2) humid areas with good possibilities for cassava cultivation such as Goiana, Itamaraca, and Igaracu, north of the Zona da Mata, and from Recife to Agua Preta, south of the Zona da Mata; (3) humid and subhumid zones with a well-defined dry season (-10 to 50 MI), covering the area from També and Alianca (north) to Garanhuns and Correntes (south), and presenting the best conditions for cassava cultivation; (4) dry areas but with sufficient moisture for cassava (-35 to -10 MI), covering a large area to the east, as far as Sertania and Itaiba, and the Araripe region, for which supplementary irrigation and var. tolerant to water stress are recommended; (5) a low moisture zone (-35 MI) where cassava cultivation is possible under irrigated conditions. Climatic requirements of cassava are briefly reviewed. (Summary by I.B.) D01

0015

21128 UNIVERSITY OF THE WEST INDIES. FACULTY OF AGRICULTURE. 1980. Root crop programme. In ________. A compendium of research. St. Augustine, Trinidad. pp.15-32. Engl.

Cassava. Cassava programs. Research. Cultivation. Plant breeding. Plant physiology. Trinidad and Tobago.

The root crop program of the West Indies U. included cassava among its crops under study (Dioscorea spp., Ipomoea batatas, Colocasia esculenta, and Xanthosoma sagittifolium) in 1972-75; cv. produced at CIAT were evaluated under Jamaican, Guyanese, and Trinidadian conditions to identify the physiological determinants of yield and select superior cv. for the Caribbean. An agroeconomic survey of cassava production practices was also conducted in Jamaica and Guyana. In the latter study, 3 different systems of cassava harvesting were compared: one completely manual and the use of 2 root lifters, including one designed for potato. Pot expt. showed that root elongation and depth of penetration are reduced with increasing penetration resistance of the potting medium; field expt. on tilled and untilled plots of 3 soil types indicated that: (1) Following removal of severe anaerobic conditions, initiation of root growth can occur as late as 140-180 days after planting, and under very good soil physical conditions the av. no. of roots/plant can be 16. (2) Under adverse soil conditions cassava becomes dormant and resumes growth when conditions become favorable. (3) While both shoot and root wt. were greatly affected by soil conditions, HI was hardly affected. (4) Fresh root wt. was correlated with stem wt.; root yield was correlated with no. of nodes, root av. wt., and root cross-sectional area; root no. and length were correlated with root yield at individual harvests, but in different ways for different harvest times. (5) The beneficial effect of tillage varied with soil type and with rainy and dry seasons. Growth regulator studies indicated that GA_3 increased stem growth with a corresponding reduction in root yield; IAA, Alar, and succinic acid 2,2-dimethyl hydrazide (SADH) increased root yield. It was concluded that Alar might be promising for increasing cassava productivity and could help in basic studies on tuberization. Differences in nitrate reductase activity between cv. might be related to HI. In expt. on the removal of the shoot apex it was found that the selection of a cv. with a low LAI and high LAD may lead to increased HI and yield. In the selection and evaluation of introduced elite cv., the results in Jamaica have not so far shown superiority; in Guyana, M Mex 59 gave the highest yields. (Summary by EDITEC. Trans. by M. de W.) D01

See also 0023 0025 0031 0064 0076 0111 0114 0120
0121 0132 0134 0139 0146

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

0016

22016 AKOBUNDU, I.O. 1980. Strategies for weed control for large-scale cassava production. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.157-170. Engl., 11 Refs.

Cassava. Weeding. Herbicides. Zaire.

Results of research at the International Institute of Tropical Agriculture, Nigeria, on chemical weed control in cassava are presented. Although hand weeding is the traditional weed control method, it is labor intensive and a slow process. Hand weeding is not recommended for large-scale cassava production, except as a complement to other weed control methods. Herbicides that have given good weed control and high crop yields include fluometuron (2.0-3.0 kg/ha), diuron (2.0 kg/ha), mixtures of atrazine + metolachlor (0.8 + 1.7 kg/ha), of diuron + paraquat (2.8 + 2.8 kg/ha), and of alachlor + cyanazine (3.0 + 1.5 kg/ha). The use of pendimethalin (2.0 kg/ha) as a tank mix with either diuron or cyanazine is recommended in locations where *Rottboellia exaltata* is a serious weed. The cost of hand weeding is higher than chemical control provided that the correct amount of the herbicide is used at the right stage of development. (Summary by EDITEC. Trans. by L.M.F.) D02

0017

22307 BALASHANMUGHAM, P.V.; SAMPATHKUMAR, B.; ARUMUGAM, R. 1983. Rapid multiplication of cassava. South Indian Horticulture 31(4-5):196-200. Engl., Sum. Engl., 5 Refs. [Regional Research Station, Vriddhachalam, India)

Cassava. Cuttings. Propagation materials. Cultivation. Propagation. India.

At the Regional Research Station, in Vriddhachalam, India, studies were conducted to assess the suitable length and no. of nodes of cassava propagation material. Trials were laid out with plant spacings of 60 x 60 cm and 75 x 75 cm in a simple randomized block design. Treatments in each plot included: cuttings with 1, 2, and 3 nodes, and vertical or horizontal planting. The plot where cuttings had 3 nodes, which had been planted vertically and were spaced at 75 x 75 cm, was considered to be the most economical planting system to obtain good cassava yields. (Summary by M. de W.) D02

0018

22709 DAHNIYA, M.T.; KALLON, S.N. 1984. Rapid multiplication of cassava by direct planting. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.53-54. Engl., Sum. Engl., 7 Refs., Illus. [Agronomy Dept., Njala Univ. College, Univ. of Sierra Leone, Private Mail Box, Freetown, Sierra Leone]

Cassava. Cultivars. Cuttings. Propagation. Planting. Experiment design. Germination. Plant height. Sierra Leone.

The possibility of rapidly multiplying cassava by planting short, hardwood stakes and soft-stem tops into the field was investigated; var. Nucass 1 was employed. Results suggest 1-, 2-, 3-, and 4-node hardwood stakes could be planted directly into the field under the wet, tropical conditions of Sierra Leone. Young stem tops could also be used, if 2 tops were planted/stand. (Author's summary) D02

0019

20749 EMPRESA BRASILEIRA DE ASSISTENCIA TECNICA E EXTENSAO RURAL. 1981. Sistemas de producao para mandioca Guanambi-BA. (Cassava production systems for Guanambi-BA). Salvador-BA, Brasil. Série Sistemas de Producao. Boletim no.301. 31p. Port.

Cassava. Cultivars. Cultivation. Land preparation. Planting. Weeding. Insect control. Insecticides. Acaricides. Harvesting. Production. Technological package. Brazil.

In 1981, 2 cassava production systems were developed for 18 different municipalities of Bahia (Brazil) for traditional farmers, landowners or tenants, with intermediate to low levels of technical know-how, and a good receptivity to the adoption of new technologies. The following operations are included: site selection, soil preparation, planting, cultural and phytosanitary practices, harvesting, storage of roots and branches, and commercialization (roots and/or flour). Expected av. yields are 25 and 18 t roots/ha, resp. (Summary by I.B.) D02

0020

22007 EZUMAH, H.C. 1980. Agronomic and related work on cassava production in Zaire. In ________., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.51-69. Engl., 13 Refs.

Cassava. Cultivars. Cultivation. Intercropping. Cuttings. Soil requirements. Land preparation. Timing. Planting. Spacing. Weeding. Foliage. Harvesting. Root productivity. Zaire.

Many factors contribute to low cassava yields in Zaire, including the use of low yielding var., diseases (especially CBB, common mosaic, and CAMD), pests (mainly the cassava mealybug and the green spider mite), and poor management practices. Recommendations for overcoming some of these problems include the use of high yielding, disease- and pest-resistant var. and good management practices. Disease-free planting material should be used, especially in the case of common mosaic. On well-managed, mulched, fertile soil, the severity of CBB and the cassava mealybug is reduced; cassava growth is more vigorous in these soils than in highly drained sandy soils. Planting should be done early in the rainy season. Land preparation for cassava is basically the same as for most other arable crops; several recommendations are given for forest and savanna areas. Spacing and population density vary with the cassava cv., its branching habit, its rate of leaf development, soil type, and moisture regime. Different plant densities and distances are discussed for the different regions. Frequent and timely weeding is necessary for good cassava development and yield, particularly during the 1st 12 wk. The use of fast growing cassava cv. at recommended densities can produce sufficient leaf cover to control weeds within the 1st 12 wk. The use of Pueraria and Stylosanthes as mulches for weed control should be considered. Results are given of studies in which different levels of management and treatments of weed control are compared. Planting material 25-30 cm long should be used; cuttings should preferably be from disease- and insect-free fields, and 12-18 mo. old. Older cuttings give higher yields. Cuttings are generally planted with 2/3 of the older end buried obliquely in the soil; when cuttings are planted upside down, root yield and plant establishment are significantly reduced. Given optimum growth conditions, young cuttings are more readily established. To conserve planting materials, they should be stacked upright under shade in a shallow ditch with the base covered with soil. It is also beneficial to plant cassava in association with crops like maize, groundnut, beans, and others. If leaf harvests are limited to once a month, no loss in root yield occurs. When planting on slopes greater than 10%, it is preferable to plow and plant cassava on the flat instead of on ridges. (Summary by EDITEC. Trans. by L.M.F.) D02

0021

20200 HENKES, R.; KERR, B. 1984. La yuca, lista para algo más. (Cassava, ready for something else). El Surco 89(1):6-8. Span., Illus.

Also in Far Eastern Agriculture 1983:22-23,34. September/October 1983.

Cassava. Cultivation. Mechanization. Development.

New developments on cassava growing, harvesting, and processing for industrial and food purposes are presented. The importance of this energy-and protein-producing crop, with high potential yields (34-80 t/ha at CIAT), in acid infertile soils is stressed. Mechanization is one of the main research priorities. Some harvester designs are described, including a one-row unit (Richter, Australia) that mounts on the 3-point linkage of a medium-size tractor and lifts the roots by means of a horizontal blade, mechanically adjusted. Other types of harvesters include a machine that digs, cleans, and elevates roots into a trailing wagon. A rotary chopper cleans away cassava tops before harvest, cutting them into small pieces to aid composting. A cassava planter based on the drop-type, whole-stick sugarcane planter used in Australia, is also referred to. A new 4000-ha project in southern Queensland will use supplemental irrigation on marginal soils and a pilot processing plant converts cassava into starch, animal feed, and a base material for fermentation into alcohol. In Baiyer River (Papua New Guinea) cassava will be grown for ethanol production (2 million l/yr). (Summary by I.B.) D02

0022

22019 HEYS, G. 1980. Large-scale multiplication of cassava at IITA, Ibadan. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.191-201. Engl., 1 Ref.

Cassava. Propagation materials. Cuttings. Stems. Propagation. Nigeria.

At the International Institute of Tropical Agriculture (IITA), Nigeria, simple multiplication methods have been developed to increase the no. of cuttings for planting that can be obtained from a single cassava plant. By combining the use of 2-node cuttings from mature hardwood and semimature hardwood tops, the normal multiplication rate of 10 cuttings/plant can be increased to 60-70 cuttings/plant. Improved multiplication methods for large-scale farmers are described, with which the normal multiplication rate reached by farmers is increased 40-96 times. These include the aforementioned methods, taking cuttings from established plants, use of 1-node cuttings, and the obtainment of a ratoon crop. The form of constructing a humidity chamber to enable the rooting of cuttings under high humidity conditions to reduce transpiration losses is described. To solve rooting problems at cooler times of the year, it is recommended that loamy soil be used as a rooting medium instead of sand. If good results are not obtained with loamy soil and the humidity chamber, water should be used for rooting. The process followed at IITA for the multiplication of breeding material from 2 clones (30211 and 30395) is briefly described. Precautions that should be taken in rapid multiplication include taking care of not infecting the part of the stem inserted into the soil; pruning if plants have developed abundant foliage before being transplanted to the field; allowing shoots to harden in the nursery before planting; ratooning cassava to produce more stems than in the 1st crop; increasing the 2nd fertilizer application if too many shoots sprout after the 1st application; keeping cassava weed-free. (Summary by EDITEC. Trans. by L.M.F.) D02

0023

21458 MATTOS, P.L.P. DE; DANTAS, J.L.L.; SOUZA, A. DA S. 1982. Sistemas de plantio para mandioca no Brasil. (Planting systems for cassava in Brazil). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Circular Técnica no.05. 48p. Port., 26 Refs., Illus. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cultivation. Land preparation. Timing. Planting. Spacing. Weeding. Intercropping. Brazil.

Some of the cassava cropping systems suited for different regions in Brazil are discussed. In the North, cassava is planted on firm ground or lowlands, which are periodically flooded by rivers, as a pure crop or in association. Tables on production are included; cv. Mameluca produced on the av. 67.4 t/ha over 1969-71, with 40 t of organic manure/ha. In the Northeast, where 53% of the national production of cassava comes from, the crop is grown by small farmers in association with beans or maize and 51% is consumed as table flour. The Southeast, with 15% of the national production, has a high level of technification and an alcohol factory has been established in Curvelo, Minas Gerais. Land preparation in recently colonized areas is discussed. In the Central West region, which accounts for 4.9% of the production, the intensification of cassava cultivation is required; data on yields in Mato Grosso are presented. In the southern states, the crop has latent periods; storage systems that protect the cuttings against frost are described. Available technologies for the crop are presented: land preparation; time of planting: planting distance and depth; stake position, mechanical planting, planting in furrows, on ridges, in pits or "covas", in conic mounds or "matumbos", on the flat; and the association with other crops. (Summary by I.B. Trans. by M. de W.) D02

0024

22053 NAIR, G.M.; RAVINDRAN, C.S.; PRASAD, M. 1984. Cultural practices for tuber crops. Indian Farming 33(12):29-33. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Cuttings. Cultivation. Land preparation. Timing. Planting. Spacing. Irrigation. Harvesting. India.

The cultivation practices recommended for cassava, sweet potato, and other tubers in different regions of India are described. Cassava is mostly grown in Kerala and parts of Tamil Nadu. The time of planting is between April-May or Aug.-Sept. For land preparation, soil should be loosened to a depth of 20-25 cm for better rooting. Different planting methods are mentioned such as the use of ridges on slopes to prevent erosion, and for level lands the "pit followed by mound" method, in which a pit is opened and the soil is mixed with cattle manure and reformed into a mound. Although the latter planting method requires more labor, it increases the yield by 10%. The selection and preparation of planting material, and the spacing and plant population, are also presented. Finally weeding, earthing up, irrigation, and harvest are discussed. It is indicated that irrigation at 25% available moisture depletion level doubles root yield, and that harvesting must be done when the plant has reached optimum maturity and not afterwards, to avoid the formation of fiber inside the roots. (Summary by I.B. Trans. by M. de W.) D02

0025

22022 NDAYI, K. 1980. Problems and prospects of cassava dispersion in Kasai and Shaba. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.221-228. Engl.

Cassava. Cultivation. Intercropping. Soil fertility. Climatic requirements. Development. Root productivity. Zaire.

Some reasons for the decrease or stagnation of cassava production in the Kasai and Shaba regions of Zaire are the CBB epidemic in 1970, which was worsened by the presence of the CAMD and common mosaic virus, the low use of inputs in cultural practices, problems in harvesting and processing, low soil fertility, increased population, damage caused to rich farm lands by diamond miners, and governmental agricultural policies. The creation of a PRONAM (Programme National Manioc) extension service to increase cassava production is recommended. Regional climatic factors as well as the most common cultural practices used are described. (Summary by EDITEC. Trans. by M. de V.) D02

0026

22336 PIANG, L.N.; HUSSAIN, K.M. 1982. Field evaluation on the selectivity of nine pre-emergence herbicides to cassava (Manihot esculenta Crantz). In Heong, K.L.; Lee, B.S.; Lim, T.M.; Teoh, C.H.; Ibrahim, Y., eds. International Conference on Plant Protection in the Tropics, Kuala Lumpur, Malaysia, 1982. Proceedings. Kuala Lumpur, Malaysian Plant Protection Society. pp.481-487. Engl., Sum. Engl., 16 Refs. [Field Crop Branch, Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia]

Cassava. Cultivars. Field experiments. Weeding. Herbicides. Plant injuries. Plant height. Root productivity. Malaysia.

Field evaluation was conducted at the Malaysian Agricultural Research and Development Institute on 9 herbicides applied as preemergence at 3 dosages for their selectivity to local cassava clone Black Twig. The effects of the herbicides on the crop were assessed on visible injury symptoms, plant height, and crop yields. Alachlor, chloramben, fluometuron, oryzalin, and trifluralin were highly selective and induced little phytotoxic effects to the crop at double the recommended rates or higher. Oxyfluorfen produced some symptoms at 0.25 kg/ha and above but caused no yield depression. Diuron and atrazine were partially selective and may be used at a rate of less than 2 kg/ha while isouron was nonselective at 1.0 kg/ha. (Author's summary) D02

0027

22707 SAUTI, R.F.N. 1984. Effect of variety and planting time on the yield of cassava in Malawi. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.49-50. Engl., Sum. Engl., 6 Refs. [Makoka Research Station, Ministry of Agriculture, Private Bag 3, Thondwe, Malawi]

Cassava. Cultivars. Sweet cassava. Bitter cassava. Experiment design. Timing. Planting. Root productivity. Malawi.

In trials conducted at Bvumbwe and Baka research stations in Malawi, 3 cassava var. (Chitembwere, Mbundumali, and Gomani) were planted at monthly intervals in an attempt to determine the effect of different planting dates on yields. At both sites, yields were highest for the crop planted during the same time of the year (Jan.). At Bvumbwe there were highly significant differences between var., whereas time of planting had a marked effect at Baka. (Author's summary) D02

0028

22301 VILLAMAYOR JUNIOR, F.G.; LABAYAN, A.L.; PEREZ, R.D. 1982. Effect of plant handling during data collection on the yield of sweet potato and cassava. Radix 4(1):11. Engl. [Philippine Root Crop Research & Training Center, Leyte 7127, Philippines]

Cassava. Cultivars. Field experiments. Plant handling. Plant injuries. Root productivity. Philippines.

The effect of handling was studied in cassava (cv. Golden Yellow) and sweet potato (cv. BNAS-51) compared with a control (not handled); the no. of sample plants was 6 and 8 for cassava and sweet potato, resp. In cassava, there were no significant differences in root no. and yield compared with the control, although the herbage yield of handled plants was much higher. Expt. with larger no. of samples are required to measure real differences between treatments. (Summary by M. de W.) D02

0029

22099 VILLAMAYOR JUNIOR, F.G.; DISTREZA, T. 1982. Yield of cassava at different plant populations and ages of harvest. Radix 4(1):4-5. Engl., 1 Ref. [Philippine Root Crop Research & Training Center, Leyte 7127, Philippines]

Cassava. Cultivars. Cultivation. Field experiments. Planting. Spacing. Timing. Harvesting. Root productivity. Philippines.

Cuttings of cassava cv. Golden Yellow were planted at different densities: 13,000, 15,000, 20,000, and 25,000 plants/ha with 3 replications. Plants were harvested at 6, 7, 8, and 9 mo. Roots were sorted into marketable (at least 3 cm in diameter and 20 cm long) and nonmarketable roots. The root yield was higher as the plants were older and the plant population was smaller; however, only the effect due to the plant age was significant. In other trials with plants spaced at 75, 100, and 125 cm, and harvested after 6 mo., there were no significant yield differences between plant populations. A population of 13,000-15,000 plants/ha is recommended for the cv. Golden Yellow. (Summary by M. de W.) D02

See also	0007	0008	0009	0076	0114	0115	0120	0121
	0122	0125	0132	0134	0143	0146	0148	0150

D03 Energy Productivity and Yields

0030

22029 CENTRO NACIONAL DE DESARROLLO AGROPECUARIO. SANTO DOMINGO. 1979. Resultados de la primera evaluación de variedades de yuca amarga en La Sierra. (Results of the first evaluation of bitter cassava varieties in La Sierra). República Dominicana, Secretaría de Estado de Agricultura. 5p. Span., Illus.

Cassava. Bitter cassava. Cultivars. Timing. Harvesting. Root productivity. Casabe. Dominican Republic.

In 1976 the Centro Nacional de Desarrollo Agropecuario (Dominican Republic) carried out the 1st evaluation of bitter cassava var. in La Sierra. After 10 and 15 mo. of planting, 4 local var. (La Blanca, Facundo, Agria Dulce, and Agua'e Coco) and 3 Brazilian var. (Brava, Blanca de Santa Catalina, and Clara Cema), were evaluated for their root yield, no. of cazabe cakes/quintal of roots, no. of cazabe cakes/tarea (1 tarea = 0.06 ha), and quality of cazabe. Results are presented in table form. In both evaluations local var. exceeded the Brazilian var. (Summary by I.B. Trans. by M. de W.) D03

0031

22020 GILUMBU, M. 1980. Problems and prospects of cassava dispersion in Bandundu. In Ezumah, H.C., eds. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.205-211. Engl., 9 Refs.

Cassava. Climatic requirements. Cultivation. Research. Root productivity. Zaire.

Aspects of cassava production in the region of Bandundu, 1st cassava producer in Zaire, are mentioned. Av. yield of the region is 7 t/ha, and the most important diseases and pests are CBB, common mosaic virus, CAMD, the mealybug, and the green spider mite. The research and extension process from colonization up to the present is briefly described, in 3 periods: from colonization to 1963, from 1963 to 1975, and from 1975 up to now. Though high yielding var. and improved cultural practices exist in the research stations of Bandundu, they are not yet available for farmers. The farmers are traditional but they accept changes depending on the situation. It is recommended to provide training at the extension level. The bad state of the roads discourages traders from going to cassava producing regions. The cooperatives are another way to reach the farmer. The failure of the Programme National Manioc (PRONAM) is partly due to its inability to assure trained extension workers, which would result in greater farmer acceptance of changes. (Summary by EDITEC. Trans. by M. de W.) D03

See also	0008	0021	0023	0027	0029	0062	0064	0102
	0115	0118	0131	0132	0134	0144	0148	0150

D04 Postharvest Studies

0032

22059 BALAGOPALAN, C.; PADMAJA, G. 1984. Storage of tuber crops. Indian Farming 33(12):51-53,71. Engl., Illus.

Cassava. Cultivars. Vascular streaking. Polyphenol oxidase. Post harvest technology. Deterioration. Moulds. Rhodanese. Linamarase. Storage. Roots. India.

At the Central Tuber Crops Research Institute, Trivandrum, India, the postharvest deterioration of cassava roots and other tubers was analyzed. The involvement of cellular and extracellular enzymes in this process was established. Vascular streaking of 6 cassava var.: local var. M-4 and hybrids M-226, H-1687, H-165, H-2304, and H-97, was studied. A reduction of total phenols was observed on the 2nd and 3rd days of storage, followed by a slight increase and the simultaneous occurrence of vascular streaking. A sudden increase in the phenolic values was seen when the deterioration reached 50-60%; the same trend was observed on the titratable acidity. The polyphenol oxidase activity of cassava roots, dipped for 8 h in ascorbic acid (4×10^{-3} M), glutathione (5×10^{-3} M), and potassium cyanide (5×10^{-3} M), was inhibited or inactivated; nontreated roots showed vascular streaking. These results suggest that the polyphenol oxidase is a key enzyme in vascular deterioration. The role played by Rhizopus oryzae in cassava deterioration is indicated; in the course of its growth the microorganism produces macerating enzymes like polyphenol oxidases and peroxidases. Linamarin represses the release of rhodanese by R. oryzae; the linamarase produced by R. oryzae appears to be a beta-glucosidase enzyme. Low cost techniques for the preservation of cassava roots such as the use of saw dust, river sand, soil, and mixtures of these elements, with 40-50% MC, in pits of 2 x 2 x 2 feet, were evaluated. The processing and natural drying of cassava chips were also considered. Physico-chemical and microbiological data of cassava chips available at Kerala markets are given. Sodium hypochlorite at 0.5% prolongs the shelf life of cassava chips and reduces the no. of bacteria. (Summary by I.B. Trans. by M. de W.) D04

0033

22062 NANDA, S.K. 1984. Post-harvest practices of tuber crops. Indian Farming 33(12):64-66. Engl., Illus.

Cassava. Cassava products. Cassava chips. Post harvest technology. Dried roots. Storage. Deterioration. Cassava starch. Tapiocas. Small-scale processing. India.

The postharvest process and concomitant problems of several tuber crops in India are analyzed. Over 25% of the world cassava production is lost in postharvest handling. In India, roots are sliced with hand-knives. Edible cassava chips are of 2 types: (1) white, obtained by removal of the outermost cortex of the roots, slicing and drying; and (2) parboiled in water for 10 min before drying. The development of a cassava chipping machine (62 kg of 5 mm cassava chips/h), by the Central Tuber Crops Research Institute, is mentioned. Sample analysis of cassava chips invariably showed fungi and bacteria; mold-infested chips are generally washed or beaten on the floor to remove the fungus. The most important pest of stored cassava chips is Araeceras fasciculatus. Cassava chips are consumed either cooked or fried. White chips are used to produce CF, starch, dextrin, and glucose. Poor quality chips are used for animal feed. Cassava starch production is small-scale with rudimentary methods; at Trivandrum, 700 t of crude starch are produced per year. The production process of tapioca is mentioned. Small industries recover 20-22% of starch, 5% of thippi, and 1-2% of the outermost cortex. (Summary by I.B. Trans. by M. de W.) D04

See also 0005 0019 0023 0111 0114 0115 0139

E00 PLANT PATHOLOGY

0034

21137 ARRAUDEAU, M. 1981. Mission en Republique Populaire du Benin sur les problemes poses par la culture du manioc (12-18 Septembre 1981). [Phytosanitary survey for evaluating problems of cassava cultivation in the People's Republic of Benin (12-18 September 1981)]. Paris, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. 23p. Fr. [Inst. de Recherches Agronomiques Tropicales et des Cultures Vivrieres, 110 rue de l'Université, 75.007, Paris, France]

Cassava. Productivity. Cultivars. Cultivation. Bacterioses. Cassava African mosaic virus. Injurious insects. Anthracnose. Propagation. Plant breeding. Costs. Benin.

A phytosanitary survey was conducted in Sept. 1981 to evaluate disease and pest problems of cassava crops at Ouedo, Sekou, Niaouli, Bohicon, Abomey, Dassa, Savalou, and Oueme (People's Republic of Benin). CAMD was widely distributed and it is particularly serious in certain clones; however, some clones seem to be resistant or tolerant (TMS 40764) to the disease. CBB was observed only once (translucid leaf spots). No clear distinction between symptoms of anthracnose (Colletotrichum spp.) and CBB was found in some of the fields. The occurrence of Cercospora was frequent but not serious. Mealybugs (Phenacoccus sp.) were common in the SE and occasional mite attacks were recorded. Zonocerus was rarely found. Neither traditional cultural practices nor hydromorphic and obstructed lands favor the crop's phytosanitary conditions. A detailed program for improving cassava production in Benin is proposed. (Summary by 1.B.) E00

0035

22025 DANIEL, J.F.; MAKAMBILA, C.; BOHER, B. 1980. State of art on cassava production in Congo (Brazzaville). In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.249-254. Engl., 1 Ref.

Cassava. Cassava bacterial blight. Cassava African mosaic virus. Phenacoccus. Glomerella manihotis. Roots. Deterioration. Congo.

Cassava, the most important root crop and main source of energy in the Congo, is consumed in form of leaves and roots. Cassava bacterial blight, CAMD, root rots, and the cassava mealybug are major constraints. Several studies carried out by Office de la Recherche Scientifique et Technique Outre-Mer are outlined; these were related to the mealybug and its parasite-predator complex, transmission of bacterial and fungal diseases by insects, role of some sucking bugs (Pseudotheraptus devastans) and of some coleoptera that are not phytophagous in the mechanical transmission of the bacterium, clarification of the epiphytic phase of the CBB pathogen during its life cycle, distribution of CBB, technique for detection of the pathogen, and expt. on transmission of CBB by insects. The studies carried out by the M. Ngauabi U. on Colletotrichum manihotis, artificial inoculations, and histopathology are also outlined. The most widespread root rots are caused by Armillarialla tabescens, Sphaenostilbe repens, and Leptporus. (Summary by E'ITFC. Trans. by L.M.F.) E00

0036

21138 GIRARD, J.C. 1980. Mission en Republique Populaire du Benin sur les problemes phytosanitaires du manioc (5-9 Aout 1980). [Phytosanitary survey for detecting problems of cassava in the People's Republic of Benin (5-9 August 1980)]. Réunion, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. 24p. Fr., Illus.

Cassava. Cultivars. Xanthomonas campestris pv. manihotis. Cassava African mosaic virus. Cercosporidium henningsii. Cercospora caribaea. Cercospora vicosae. Phenacoccus manihoti. Mononychellus tanajoa. Ferrisia virgata. Symptomatology. Pest control. Benin.

The 2nd phytosanitary survey (Aug. 1980) carried out in Benin to determine the extent of disease and pest damage to cassava crops is reviewed in detail. The majority of the crops surveyed in northern Zou Province, Dangbo District at Oueme, and Ouedo, showed serious disease symptoms; however, crops at Niaouli did not. CAMD was extensive but varying levels of resistance to the disease were found. At Niaouli, 11 sweet var. and 11 bitter var. are being tested for CAMD resistance. TMS 30395 presented no symptoms although the disease was homogenously spread. Different levels of CBB were found; some plots were entirely disease-free while others showed serious damage, such as at Attogen, Kpakpassa, and Ouedo; better vegetative growth was noted at these last 2 sites. Other problems observed were related to Cercospora spp., the mealybug (Phenacoccus manihoti), and mites (possibly Mononychellus tanajoa). Attacks seemed to be locally related to important disease damages. Tuber rot was also reported. The possible establishment of a gari production plant in the country justifies the fight against CAMD and CBB. Recommendations for avoiding epidemic outbreaks are stressed, and a strategy is proposed for obtaining clones resistant to both diseases. (Summary by I.B.) E00

0037

21127 KATARY, A.; TACHI, P. 1981. Evaluation du parasitisme sur manioc par regions: cas de la cercosporiose, de la bacteriose, des acariens et des cochenilles au Benin. (Evaluation of parasitism on cassava by regions: case study of Cercospora disease, bacterioses, mites, and mealybugs). Benin, Africa, Ministere de l'Enseignement Superieur et de la Recherche Scientifique. 13p. Fr., 9 Refs.

Cassava. Xanthomonas campestris pv. manihotis. Cercosporidium henningsii. Cercospora caribaea. Injurious mites. Benin.

The origin, incidence, and symptomatology of damage caused by CBB, Cercosporidium henningsii and Cercospora caribaea, mites, and mealybugs (Phenacoccus manihoti) in 4 provinces of the People's Republic of Benin are reviewed. In on-farm observations the presence or absence of diseases and pests was recorded on 5 plants along a diagonal line (10 ft. long), with the following results: CBB, 1, 8, 21, and 17%; Cercospora spp., 95, 64, 98, and 83%; mites, 5, 88, 80, and 85%, and mealybugs, 35, 14, 31, and 29%, for the provinces of Oueme, Mono, Atlantique, and Zou, resp. (Summary by I.B.) E00

0038

21170 LOPES, E.B.; MELO, G.S. DE; MATIAS, E.C. 1984. Problemas fitossanitarios da mandioca (Manihot esculenta Crantz) na Paraíba, e recomendacoes de controle. (Phytosanitary problems of cassava in the state of Paraiba and recommendations for their control). Lagoa Seca-PB, Brasil, Empresa Estadual de Pesquisa Agropecuária da Paraíba. 15p. Port., 11 Refs. [Empresa Estadual de Pesquisa Agropecuária da Paraíba, Lagoa Seca-PB, Brasil]

Cassava. Cultivars. Erinnyis ello. Mononychellus tanajoa. Phenacoccus herreni. Glomerella manihotis. Phytophthora drechsleri. Symptomatology. Pest damage. Insect control. Mite control. Disease control. Brazil.

Technicians of Empresa Estadual de Pesquisa Agropecuária da Paraíba and Empresa de Assistencia Técnica e Extensao Rural de Minas Gerais carried out a phytosanitary survey in 6 microregions comprising 34 cassava producing municipalities in the state of Paraiba, Brazil. Twelve insect pests and 6 diseases were reported. Brief descriptions on symptomatology and control methods are included for the following potentially serious pests and diseases: Erinnyis ello for which the best control method proved to be 300-500 g Bacillus thuringiensis/ha; Mononychellus tanajoa, whose populations are naturally reduced by rains and when serious attacks occur, vamidothion at 800 ml/ha or bromopropylate at 1.0 l/ha, every 2 wk., are recommended; Phenacoccus herreni, best controlled by ethyl parathion at 0.1 a.i., applied directly on infested parts, and termites. Root rot (Phytophthora drechsleri) is the most serious disease in Paraiba, followed by anthracnose (Colletotrichum manihotis). The former is widespread in clayey, poorly drained soils, and appropriate cultural practices and the use of resistant var. (especially cv. Cedinha and Osso Duro) are recommended. (Summary by I.B.) E00

0039

22057 MALATHI, V.G.; SHANTA, P. 1984. Diseases of cassava. Indian Farming 33(12):43-44,46. Engl., Illus.

Cassava. Diseases and pathogens. Cassava African mosaic virus. Symptomatology. Disease transmission. Disease control. Cercosporidium henningsii. Pest damage. Epidemiology. Diplodia natalenses. Roots. Deterioration. Glomerella cingulata. India.

The symptoms, dissemination, and control measures of the principal diseases of cassava in India are presented. At the moment only 14 out of aprox. 30 diseases that attack cassava have been reported. CAMD is the most devastating, causing yield reductions of 60-70%. Hybrids Sri Sahya and Sree Visakham from the Central Tuber Crops Research Institute, Trivandrum, present tolerance in the field; hybrid H-226 presents a 30% spread of the disease. The causal agent appears to be a gemini virus of 18-24 nm in diameter. Among fungal diseases, the one produced by Cercosporidium henningsii is the most important. Popular var. Malayan-4 is highly susceptible to this pathogen that causes premature defoliation and a 30% reduction in the yield. Rain, humidity, and temp. play an important role in the epidemiology of this disease. Excessive application of N and P increased the severity of the disease and the application of K reduced it. Since the use of fungicides is expensive, it is recommended to change the cultural practices and utilize resistant var. Cuttings rot (Diplodia natalenses) and anthracnose (Colletotrichum sp.) are discussed. The danger of dissemination or introduction of new diseases through the exchange of genetic material is highlighted. (Summary by I.B. Trans. by M. de W.) E00

0040

22017 TERRY, E.R. 1980. The production of pathogen-free cassava planting material for distribution. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.173-185. Engl., 15 Refs., Illus.

Cassava. Cultivars. Disease control. Cassava African mosaic virus. Tissue culture. Apical meristems. Hot water treatments. Cassava common mosaic virus. Xanthomonas campestris pv. manihotis. Cuttings. Propagation materials. Propagation. Rooting. Mycoses. Zaire.

The success of a system proposed for the production of pathogen-free cassava planting material depends on the ability to recognize and characterize major diseases of cassava and their causal agents; the development of reliable techniques for eliminating the pathogens and ensuring that propagation materials are pathogen-free; and the development of procedures to maintain on a routine basis pathogen-free planting material. CAMD has been successfully eliminated from 6 improved cv. developed at the International Institute of Tropical Agriculture (TMS 30040, TMS 30211, TMS 30337, TMS 30395, TMS 30555, and TMS 130572) and from 2 cv. from India and Nigeria, using shoot apical meristems cultured at 35°C during 30 days. A reliable method of detecting the presence of CAMD involves sap transmission tests from meristem tip culture plantlets to Nicotiana benthamiana, accompanied by a 6 mo. observation period at

20-25°C. An av. of 83% of TMS 30395 plants, established from CAMD-free cuttings, can maintain their disease-free status throughout their growth cycle, thus providing a more than adequate no. of CAMD-free cuttings for the succeeding crop. The technique for propagation of planting material free from Xanthomonas manihotis (CBB) and X. cassavae is described. In the case of cassava fungal pathogens such as Sphaceloma sp., Glomerella sp., Fusarium sp., Sclerotium rolfsii, and Botryodiplodia sp., it is recommended to select only cuttings from disease-free plantations for distribution. The establishment of a foundation stock for routine distribution to growers is sought. Planting material for multiplication and distribution should only be selected from apparently disease-free plants; cuttings, selected for their vigor and general health, should be treated with thiram. All tools and handling materials should be either heat or chemically sterilized before contact with the stem cuttings. All pathogen-free foundation stock should always be maintained in isolated locations, and plants with recognizable disease symptoms or abnormalities should be eliminated from the foundation stock. (Summary by EDITEC. Trans. by L.M.F.) E00

See also 0076 0111 0143

E02 Bacterioses

0041

22340 ALMANZAR, L.J. 1981. El añublo bacterial de la yuca. (Cassava bacterial blight). Agro (República Dominicana) 10(91):34-35,36. Span., 1 Ref.

Cassava. Xanthomonas campestris pv. manihotis. Dominican Republic.

The literature on CBB is reviewed. The taxonomy, geographic distribution, symptomatology, biochemical characteristics for identification, biological cycle, infection and dissemination of the disease are included. The areas of the Dominican Republic in which the pathogen has been observed are reported. (Summary by I.B. Trans. by M. de W.) E02

0042

22330 CHERIAN, M.T.; MATHEW, J. 1983. Survival studies on the cassava bacterial blight pathogen Xanthomonas campestris pv. manihotis. Indian Phytopathology 36(2):291-293. Engl., Sum. Engl., 3 Refs. [Dept. of Plant Pathology, College of Agriculture, Vellayani, Trivandrum 695 522, India]

Cassava. Xanthomonas campestris pv. manihotis. Laboratory experiments. Research. India.

Survival studies of Xanthomonas campestris pv. manihotis when inoculated to cassava var. H-165 are described. The pathogen was isolated from infected stems up to 3 wk. of storage of the infected material. When infected plant debris was mixed with soil, the pathogen survived 21 days; when a pure culture was inoculated to the soil the bacterium only survived 11 days. (Summary by M. de W.) E02

0043

2:444 CHERIAN, M.T.; MATHEW, J. 1983. Toxin production by Xanthomonas campestris pv. manihotis. The cassava bacterial blight pathogen.

Indian Phytopathology 36(1):156-157. Engl., 3 Refs. [Dept. of Plant Pathology, College of Agriculture, Vellayani, Trivandrum 695 522, India]

Cassava. Xanthomonas campestris pv. manihotis. Toxins. Isolation. India.

The results of injecting bacterial toxin isolated from a culture filtrate of Xanthomonas campestris pv. manihotis into cassava plants are given. The involvement of the bacterial phytotoxin in the pathogenicity of the bacterium as well as in the symptom expression of the disease is indicated. (Summary by M. de W.) E02

0044

22018 DANIEL, J.F.; BOHER, B. 1980. A technique for detection of the causal agent of cassava bacterial blight in vegetative cuttings. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.187-189. Engl., 1 Ref.

Cassava. Xanthomonas campestris pv. manihotis. Disease control. Laboratory experiments. Research. Stems. Isolation. Zaire.

To detect Xanthomonas manihotis, causal agent of CBB, in vegetative material, 2 sections of 5 cm were taken from top parts of cassava stems. These were cut longitudinally into 4 pieces and soaked in 20 ml of water in petri dishes. The preparation was left for 12 h at 5°C to permit the pathogen to come out of the tissues. Three drops of the liquid were then drawn and put on a slide. After drying and allowing the alcohol fixation of the preparation, staining was done by the immunofluorescence technique. This technique allows selective staining of the pathogen by the use of specific antibodies associated with isothiocyanate of fluorescin; microscopic observation was done under U.V. light. Two-thirds of 300 stems of var. Nganfono and M'pember were found with the pathogen using the immunofluorescence technique. The pathogen was recovered in 1/3 of the cases, in the top and bottom parts of the stem. Vegetative material found free of the disease did not show symptoms when planted in pots. This preliminary study indicates that immunofluorescence is a rapid and sure method for the recovery of X. manihotis in vegetative material destined for planting. The method showed that in the case of susceptible var. from highly infected zones, the choice of apparently symptomless bottom parts of the stems for planting is insufficient to prevent the disease from occurring. The detection of the pathogen on the surface of stem cankers indicates that these may serve as survival sites for the pathogen and help in the dissemination of the disease. (Summary by EDITEC. Trans. by L.M.F.) E02

0045

22042 KWAJE, S.L. 1982. Bacterial blight on cassava. FAO Plant Protection Bulletin 30(2):82-83. Engl. [Plant Protection Dept., Regional Ministry of Agriculture & Natural Resources, Southern Region, Juba, Sudan]

Cassava. Xanthomonas campestris pv. manihotis. Symptomatology. Identification. Quarantine measures. Sudan.

The presence of CBB (Xanthomonas campestris pv. manihotis) is reported for the 1st time in Sudan in the regions of Arapi, Torit District (10-15% infection) in May of 1981, and Kajokeji, Yei River District (1% infection) in Dec. of 1981. Symptoms were confirmed by the International Institute of

Tropical Agriculture (Nigeria). Although the plants originated from diseased cuttings revealed different symptoms from those of the parent plants, the presence of the pathogen was confirmed at the National Agricultural Lab. in Nairobi, Kenya. It is suspected that the disease entered Sudan in 1979-80 with the influx of Ugandan refugees into the country carrying all types of seeds and vegetative planting materials. The disease had been previously reported in neighboring countries (Kenya, Uganda, Zaire). (Summary by I.B. Trans. by M. de W.) E02

See also 0011 0025 0031 0067 0074 0114 0115 0120
0121 0128 0130 0134

E03 Mycoses

0046

22034 AQUINO, M. DE L.N. DE; TAVARES, J.A. 1977. Mandioca: estudos sobre doencas da mandioca em Pernambuco. (Cassava: surveys on cassava diseases in Pernambuco). In Instituto de Pesquisas Agronômicas. Brasil. Projeto Fitossanidade. Relatorio técnico, período 1975-1976. Recife-PE, Brasil. pp.112-115. Port., Illus.

Cassava. Mycoses. Diseases and pathogens. Uromyces manihotis. Disease control. Predators and parasites. Cercosporidium henningsii. Oidium. Identification. Brazil.

The importance and symptomatology of cassava rust, probably caused by Uromyces manihotis, and Cercosporidium henningsii, in Pernambuco, Brazil, are described. The fungus Darluca sp. is reported to parasitize the spores of the causal agent of cassava rust and reduce its action. Other identified pathogens are Mycosphaerella manihotis and Oidium manihotis. Illustrations are included. (Summary by I.B. Trans. by M. de W.) E03

0047

22369 LEAL, E.C. 1984. Podridao radicular na mandioca no Estado de Sergipe. 1. Etiologia. (Cassava root rot in the state of Sergipe. 1. Etiology). Aracaju-SE, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual de Aracaju. Pesquisa em Andamento no.23. 3p. Port., 1 Ref. [Unidade de Execucao de Pesquisa de Ambito Estadual de Aracaju, Caixa Postal 44, 49.000 Aracaju-SE, Brasil]

Cassava. Roots. Deterioration. Etiology. Stems. Isolation. Fusarium. Identification. Brazil.

To identify the causal agent of cassava root rot occurring in the state of Sergipe, Brazil, samples of soil and of underground stem bases, stems, and roots of diseased cassava plants, both young and mature, were taken in several municipalities to examine in the lab. The 2 techniques and culture media used are described. Sterilized tomato was used as culture medium in one of the techniques as well as sterilized cassava stems. Fusarium spp. was detected in all the samples analyzed, regardless of the technique used. Further tests are needed to confirm the pathogenicity of Fusarium spp. in root rot. (Summary by M. de W. Trans. by L.M.F.) E03

See also 0067 0114 0115 0120 0128 0130 0132 0134

E04 Viroses

See 001[illegible] 0025 0031 0114 0120 0128 0130 0134

E05 Mycoplasmoses

0048

22316 JAYASINGHE, U.; PINEDA, B.; LOZANO, J.C. 1984. Antholysis in cassava (*Manihot esculenta* Crantz) possibly caused by mycoplasma-like organisms. Phytopathologische Zeitschrift 109(4):295-300. Engl., Sum. Engl., Germ., 17 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Clones. Symptomatology. Flowers. Plant anatomy. Germination. Etiology. Mycoplasmoses. Colombia.

Phyllody and apostasis of cassava plants were frequently observed during recent disease surveys in Valle del Cauca, Colombia. Many valuable cassava clones have been affected, rendering them unsuitable for hybridization. Light and electron microscopic observations have revealed the presence of mycoplasma-like organisms in the diseased phloem tissues. The causal agent is sensitive to tetracycline and streptomycin at 1000 ppm a.i., but not to penicillin. (Author's summary) E05

See also 0120

E06 Nematodes

0049

22009 CAVENESS, F.E. 1980. Plant-parasitic nematodes on cassava. *In* Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.83-106. Engl., 51 Refs.

Cassava. Nematodes. Symptomatology. Pest control.

A list of the nematode species associated with cassava and their locations, reported in literature, is given. Emphasis is placed on *Meloidogyne*, *Pratylenchus* spp., and *Helicotylenchus* spp. Disease symptoms, crop losses, biology, other host plants, distribution, and control of each are reviewed. (Summary by EDITEC. Trans. by L.M.F.) E06

0050

22087 CAVENESS, F.E. 1979. Cowpea, lima bean, cassava, yams and *Meloidogyne* spp. in Nigeria. *In* Lamberti, F.; Taylor, C.E., eds. Root-knot nematodes (*Meloidogyne* species) systematics, biology and control. New York, Academic Press. pp.295-300. Engl., 21 Refs., Illus.

Cassava. *Meloidogyne incognita*. Plant height. Root productivity. Nigeria.

The importance of the damage caused by *Meloidogyne* spp. to cowpea, lima bean, cassava, and yams in Nigeria and the tropics in general is discussed and the objectives of the International Institute of Tropical Agriculture (IITA) nematology subprogram are mentioned. The use of nematode-resistant cv. and crop rotations are considered min.-input methods that would increase and stabilize crop yields. High susceptibility to M. incognita was found in 190 seedlings of Manihot esculenta from IITA, tested in the greenhouse to determine genetic variation in relation to nematode attack. Height of plants receiving 500-1000 eggs/plant increased slightly compared with controls. Mean root wt. increased with inoculations of 500-2000 eggs; however, root tuber wt. decreased at all levels of inoculum used. Higher inoculum levels considerably reduced plant height and fibrous roots and thickened roots wt. (Summary by I.B. Trans. by L.M.F.) E06

F00 PEST CONTROL AND ENTOMOLOGY

0051

22061 PILLAI, K.S.; PALANISWAMI, M.S. 1984. Pests of tuber crops. Indian Farming 33(12):58-61,66. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Pests. Cuttings. Aonidomytilus albus. Saissetia nigra. Odontotermes. Leucopholis coneophora. Foliage. Tetranychus cinnabarinus. Tetranychus neocaledonicus. Eutetranychus orientalis. Oligonychus biharensis. Mite control. Stethorus gilvifrons. Pharoscymnus hornii. Oliogota. Scolothrips indicus. Poecilochroa. Olios. Retithrips syriacus. Roots. Rats. Araecerus fasciculatus. Storage. Pest damage. Pest control. India.

The most important pests that attack cassava and other tuber crops in India are presented. Recently, 36 pests of cassava have been reported. The most important are the pests that attack planting material: Aonidomytilus albus and Saissetia nigra; pests of planted cuttings and young plants: Odontotermes sp. and Leucopholis coneophora; and foliage pests: Tetranychus cinnabarinus, T. neocaledonicus, Eutetranychus orientalis, and Oligonychus biharensis. As natural enemies of the latter pests Stethorus gilvifrons, Pharoscymnus hornii, Oliogota sp., Scolothrips indicus, Poecilochroa sp., and Olios sp., have been reported. Other pests are Retithrips syriacus, that attack the leaves; Bandicota bengalensis and other rats that attack the tubers; and Araecerus fasciculatus that attack stored dried cassava chips. The damage caused by all these pests, as well as the control measures and the chemical products and formulations recommended, are described. (Summary by I.B. Trans. by M. de W.) F00

See also 0076 0111 0143

F01 Injurious Insects and their Control

0052

22011 AKINLOSOTU, T.A. 1980. The control of the cassava mealybug and the green spider mite by the effective use of their natural enemies. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.117-121. Engl., 5 Refs.

Cassava. Phenacoccus manihoti. Mononychellus tanajoa. Insect control. Mite control. Biological control. Predators and parasites. Nigeria.

Following the discovery of the outbreak of the cassava mealybug and the green spider mite in Nigeria, their natural enemies in South America were investigated under a joint program of the International Institute of Tropical Agriculture and the Institute of Agricultural Research and Training, Nigeria. Local predator species already established in the country have not been able to maintain pest populations below injury level. These species for Phenacoccus manihoti are Hyperaspis pumila, H. senegalensis, Exochomus flavipes, Cheilomenes lunata, C. vicina, and Symnus sp., and for Mononychellus tanajoa, an unidentified Syrphid. However, when developing suitable management programs, it should be kept in mind that these local predators can play an important role in the control of these new pests. When chemical control is involved, the effect of such chemicals on the predators should be considered. (Summary by EDITEC. Trans. by L.M.F.) F01

0053

22089 CHAPMAN, R.F.; PAGE, W.W. 1979. Factors affecting the mortality of the grasshopper, Zonocerus variegatus, in southern Nigeria. Journal of Animal Ecology 48(1):271-288. Engl., Sum. Engl., 19 Refs., Illus.

Cassava. Zonocerus variegatus. Insect biology. Mortality. Eggs. Predators and parasites. Nigeria.

Causes of mortality of Zonocerus variegatus were investigated, mainly in one locality near Ibadan, Nigeria, during the 1975-76 dry season. Mortality of eggs and of newly hatched insects was insignificant. The fungus Entomophthora grylli caused extensive mortality of late stage nymphs and immature adults following heavy rain. On some occasions 10% of the population died in one night. Predation by vertebrates was negligible, possibly associated with the aposematic appearance of the insects. First and 2nd instar nymphs were eaten by a range of invertebrate predators, but in these observations their total impact was slight. Army ants sometimes caused dispersal of groups of grasshoppers. Blaesoxipha filipjevi was found to parasitize large no. of mature adults in every locality and in every yr of observation. Many adults also died without any obvious cause after the 1st mating and oviposition. It is suggested that the stress of reproduction in relatively unfavorable conditions causes this premature death. Mortality estimated from caged insects caught in the field at 5-day intervals agreed with estimates of changes in the no. of insects present in the field. Entomophthora caused most deaths before mating and oviposition; reproductive stress and Blaesoxipha accounted for the later mortality. (Author's summary) F01

0054

22014 EZUMAH, H.C.; NWANZE, K.F. 1980. Selections for resistance to the cassava mealybug and effects of some cultural practices on incidence and severity in Bas Zaire. In ________., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.137-144. Engl., 5 Refs.

Cassava. Phenacoccus. Plant breeding. Cultivars. Clones. Cultivation. Mulching. Fertilizers. Root productivity. Resistance. Zaire.

Screening for genetic resistance to the cassava mealybug was started in Zaire in 1975-76. On a 1-5 scale of increasing severity, the best score achieved in multiple germplasm evaluations was 3. Some sources of resistance to the mealybug include wild cassava TMI 6134, TMI 6151, and TMI 6096 from Brazil; hopefully this resistance is highly heritable and easily transferable to cultivated var. Results are given of studies that evaluated the effects of nutrient application and the use of mulches on the incidence and/or severity of the mealybug. Mulching reduced water loss and soil temp., favoring cassava growth and development during the dry season. No direct relationship was observed between the rate of mulching and mealybug incidence. However, incidence was reduced about 55% in mulched plots. A rapid regrowth of cassava leaves and stems, following a serious dry season attack of the mealybug, was observed. (Summary by EDITEC. Trans. by L.M.F.) F01

0055

22066 ONGARELLI, M. DAS G.; SILVA, D.M. DA; CARVALHO, C.F. DE 1980. Virus da granulose em células do mandarová da mandioca (Erinnyis ello L., 1758). [Granulosis virus in cells of the cassava hornworm (Erinnyis ello, 1758)]. Revista de Agricultura (Brasil) 55(3):174. Port., Illus.

Cassava. Erinnyis ello. Predators and parasites. Brazil.

The results are given of observations under the electron microscope of thin sections of tissues of larvae of Erinnyis ello that showed loss of appetite, flaccidity of the integument, and a milky hemolymph while being reared on cassava. The fine sections revealed the presence of virus particles in the fat-body cells and the tracheal epithelium in diseased last-instar larvae. Occluded particles measured 300 x 60 nm, nonoccluded particles 266 x 44 nm, and crystal proteins containing a single virus particle 547 x 291 nm. The presence of the crystal proteins with just one particle suggests that the virus belongs to the granulosis group. The virus is reported for the 1st time in Brazil. (Full text. Trans. by M. de W.) F01

0056

20131 SILVA, A. DE B.; MAGALHAES, B.P.; COSTA, M.S. 1981. Insetos e ácaro nocivos a mandioca na Amazonia. (Insects and mites damaging cassava in the Amazon River region). Belém-PA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária do Trópico Umido. Boletim de Pesquisa no.31. 35p. Port., Sum. Port., Engl., 37 Refs. [Centro de Pesquisa Agropecuária do Trópico Umido, Caixa Postal 48, 66.000 Belém-PA, Brasil]

Cassava. Eutropidacris cristata. Phenacoccus herreni. Pseudococcus obscurus. Aonidomytilus albus. Saisettia nigra. Saissetia oleae. Aleurotrachelus socialis. Taedia bimaculata. Vatiga manihotae. Atta. Silba pendula. Anastrepha. Teleocoma crassipes. Atherigona excisa. Euxesta stigmatias. Corynothrips stenopterus. Anisopodus lignicola. Coelosternus granicollis. Coelosternus rugicollis. Eulechriops manihoti. Sitophilus. Andrector arcuatus. Diabrotica. Nilio. Spodoptera frugiperda. Chilomina clarkei. Erinnyis ello. Mononychellus tanajoa. Condilorrhisa vestigialis. Insect biology. Insecticides. Acaricides. Biological control. Brazil.

Cassava production areas in Belém, Braganca, Altamira, Alenquer, Santarém, Manaus, Porto Velho, and Macapa (Brazil) were surveyed to collect insects and mites present in the crops. Biological and ecological characteristics are given of 61 species, including: Eutropidacris cristata, Phenacoccus herreni, Pseudococcus obscurus, Aonidomytilus albus, Saissetia coffeae and S. oleae, Aleurotrachelus socialis, Taedia bimaculata, Vatiga manihotae, Atta spp., Silba pendula, Anastrepha spp., Teleocoma crassipes, Atherigona excisa, Euxesta stigmatias, Corynothrips stenopterus, Anisopodus lignicola, Coelosternus granicollis and C. rugicollis, Eulechriops manihoti, Sitophilus sp., Andrector arcuatus, Diabrotica atromaculata and D. balteata, Nilio sp., Spodoptera frugiperda, Chilomina clarkei, Erinnyis ello and E. alope, and Mononychellus tanajoa. Species that cause more damage are P. herreni, S. pendula, Anastrepha spp., Condilorrhisa vestigialis, Atta sexdens, and M. tanajoa. Chemical and biological control methods are also presented. (Summary by EDITEC) F01

See also 0019 0031 0034 0035 0036 0037 0038 0057 0060 0074 0110 0114 0115 0118 0120 0130 0146

F03 Injurious Mites and their Control

0057

22013 AKINLOSOTU, T.A. 1980. Incidence of the green spider mite and cassava mealybug in Nigeria. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.129-135. Engl., 2 Refs., Illus.

Cassava. Phenacoccus. Mononychellus tanajoa. Epidemiology. Cultivars. Resistance. Predators and parasites. Insect control. Mite control. Cultivation. Insecticides. Acaricides. Quarantine measures. Nigeria.

Surveys on the extent of distribution of the green spider mite and the cassava mealybug in Nigeria indicate that both pests are found in all the states of the southern part of the country. None of the local cassava cv. have been found resistant to either of the 2 pests. However, preliminary observations indicate that cv. with hairy shoots are less preferred by the green spider mite but more susceptible to the cassava mealybug. Local cv. Odongo seems to be fairly tolerant to the attack of both pests. Predators of the cassava mealybug that have been observed include Exochomus flavipes, Hyperaspis pumila, H. senegalensis, Symnus sp., and Cheilomenes lunata, whereas only a Syrphid larval predator of the green spider mite has been observed. Interim control measures for both cassava pests are discussed in detail. It is recommended that research be carried out on the biology and ecology of the pests, breeding for resistance, biological control, evaluation of pesticides, and cultural control measures. Farmers in the areas affected receive information on interim control measures on a regular basis through mass communication media. (Summary by EDITEC. Trans. by L.M.F.) F03

0058

22088 CHAZEAU, J. 1983. Deux predateurs de Tetranychidae en Nouvelle-Guinee: Stethorus exspectatus n.sp. et Stethorus exsultabilis n.sp. (Col.: Coccinellidae). [Two predators of Tetranychidae in New Guinea: Stethorus exspectatus sp.n. and Stethorus exsultabilis sp.n. (Col: Coccinellidae)]. Entomophaga 28(4):373-378. Fr., Sum. Fr., Engl., 5 Refs., Illus. [Laboratoire de Zoologie Appliquée, Office de la Recherche Scientifique et Technique Outre-Mer, B.P. A5, Nouméa, Nouvelle-Calédonie, France]

Cassava. Tetranychus lambi. Predators and parasites. Papua New Guinea.

Two new species of predacious coccinellids from New Guinea are described. Stethorus exspectatus sp. n. is described from the adults of both sexes found attacking Tetranychus lambi on cassava, Oligonychus coffeae and O. thelytokus on Lagerstroemia, Schizotetranychus sp. on bamboo, T. fijiensis on coconut, and Panonychus sp. on Artocarpus sp. Stethorus exsultabilis sp. n. is described from adults of both sexes found attacking T. lambi on cassava, T. fijiensis on coconut, and O. coffeae and O. thelytokus on Lagerstroemia. (Summary by Review of Applied Entomology) F03

0059

21492 FARIAS, A.R.N.; SILVA, S. DE O.E. 1983. Influencia de fatores climáticos no comportamento de diferentes cultivares de mandioca ao ataque do ácaro verde. (The influence of different climatic factors on the behavior of several cassava cultivars in relation to the green spider mite attack). Revista Brasileira de Mandioca 2(2):87-90. Port., 6 Refs., Illus. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cultivars. Mononychellus tanajoa. Climatic requirements. Rainfall data. Temperature. Water requirements. Resistance. Brazil.

The influence of the pluviometric precipitation, av. RH and temp. on the behavior of 78 cv. was studied in relation to Mononychellus tanajoa attack. Cv. were planted in 24 m² plots at a distance of 1 x 1 m, without replications, and fertilized with NPK at a rate of 60-40-40 kg/ha. The incidence of attack was determined every 2 wk. and the damage caused was measured on a 0-5 scale. Out of the 78 cv. evaluated, 19 were susceptible, 43 tolerant, and 16 were promising for resistance to the mite attack. The latter ones were: BGM 605, 606, 612, 619, 620, 633, 639, 641, 649, 655, 656, 663, 679, 683, 684, and 725. The continuous rain reduced mite populations. The av. HR of 75% and the av. temp. below 24°C did not favor the development of the mite population. However, between the 3rd and 7th evaluations, the HR dropped and the temp. increased; the mite population therefore increased causing the fall of the leaves in most of the cv. Other evaluations should be carried out to confirm the resistance of the promising cv. in different ecosystems. (Summary by I.B. Trans. by M. de W.) F03

0060

22012 LEUSCHNER, K. 1980. Biology, ecology and control of the green spider mite and cassava mealybug. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.123-128. Engl., 2 Refs.

Cassava. Phenacoccus. Mononychellus tanajoa. Insect biology. Plant breeding. Resistance. Biological control. Insect control. Mite control. Cultivation. Timing. Planting. Africa.

Since its appearance in 1971 in Uganda, the green spider mite has also been observed in Kenya, Tanzania, Zanzibar, Zaire, Congo, Republic of Benin, and Nigeria. The cassava mealybug, observed in Zaire in 1972, has spread to Angola, Congo, Gabon, Senegal, Republic of Benin, and Nigeria. Both pests attack young cassava shoots. Economic damage caused by the mealybug is both in the loss of roots and leaves. Both pests occur during the dry season, and yield losses up to 80 and 40%, resp., can occur due to the mealybug and the green spider mite. Biological aspects of both pests are given. The International Institute of Tropical Agriculture and the

Programme National Manioc (PRONAM) are focusing on 5 different control approaches: breeding for resistance, and biological, cultural, chemical, and integrated control. (Summary by EDITEC. Trans. by L.M.F.) F03

0061

22015 MUAKA-TOKO.; LEUSCHNER, K. 1980. Aspects of the biology and control of the green spider mite. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.145-155. Engl., 3 Refs.

Cassava. *Mononychellus tanajoa*. Insect biology. Mite control. Cultivars. Selection. Field experiments. Laboratory experiments. Resistance. Nigeria.

The preoviposition and oviposition period of female green spider mites was determined as well as the no. of eggs laid and no. of eggs that hatched in 3 expt. involving 20 virgin couples at 22, 28, and 35°C, and 20 individual virgin females at the same temp. The effect of light and shade on fecundity and hatchability was also studied. The highest no. of eggs was laid at 28°C; however, hatchability was higher at 22°C. The preoviposition and adult oviposition periods were also longer at 22°C for both mated and unmated females. Shade increased both fecundity and hatchability. The increase in temp. reduced the developmental period. In screening trials of germplasm resistant to the attack of *Mononychellus tanajoa* for further testing in the greenhouse, 16 out of 84 clones were selected in the field on the basis of a 0-5 scale (increasing level of severity). Eight clones sustained very low mite populations (less than 100 mites/leaf) and 8 had moderate mite populations (between 100-200 mites/leaf). Susceptible clones had more than 200 mites/leaf. Fewer eggs were laid on selected clones and the developmental period did not vary for selected or susceptible clones. Only 1/5 of the selected clones that showed evidence of resistance in the field, maintained increasing mite populations in the greenhouse, possibly due to plant age (10-11 mo.) at screening. Results showed that there is a certain level of resistance of cassava cv. to the green spider mite at the International Institute of Tropical Agriculture, Nigeria. (Summary by EDITEC. Trans. by L.M.F.) F03

See also 0011 0019 0031 0034 0036 0037 0038 0052
0056 0074 0110 0115 0120 0130

G00 GENETICS AND PLANT BREEDING

G01 Breeding, Germplasm, Varieties and Clones, Selection

0062

22317 ALBUQUERQUE, M. DE; CARDOSO, E.M.R. 1982. Colecao de cultivares acidófilas de mandioca do CPATU. (The CPATU collection of cassava cultivars). Belem-PA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária do Trópico Umido. Documentos no.3. 24p. Port., Sum. Port., Engl., 8 Refs.

Cassava. Cultivars. Sweet cassava. Bitter cassava. Selection. Plant anatomy. Roots. Root productivity. Harvest index. Starch content. Foliage. Productivity. Brazil.

A brief historical review of the collection of cassava cv., started in 1946 at the Centro de Pesquisa Agropecuária do Trópico Umido, is given. In 1980 it became part of the Banco Ativo de Germoplasma de Mandioca da Regiao Norte Litoral, under the coordination of the Centro Nacional de Recursos Genéticos. The collection was organized and classified on the basis of morphological and physiological characteristics and their correlation. The introduction of Mandiocaba cassava (low starch content), its genetic origin, and the importance of its study are briefly discussed. Cv. M col 873 from CIAT produces a big deep root and could provide a solution to lodging. Var. giving high yields over a short period were studied; 4 were outstanding, among them cv. Mameluca that yielded 17 t roots/ha in 6.5 mo. The most common characteristics of the collection are described and a list of selected cv. is included. (Summary by M. de W.) G01

0063

22702 DOKU, E.V. 1984. Production potentials of major tropical root and tuber crops. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.19-24. Engl., Sum. Engl. [Crop Science Dept., Faculty of Agriculture, Univ. of Ghana, Legon, Accra, Ghana]

Cassava. Root productivity. Climatic requirements. Ecosystems. Research. Plant breeding. Cultivars. Selection. Diseases and pathogens. Resistance. Africa.

In comparison with the temperate regions, the tropical environment has lower solar radiation levels, shorter photoperiods, and, hence, a lower potential productivity. Productivity of cassava, yams, sweet potato, and cocoyams, the 4 most important tropical root and tuber crops, has other constraints as well: inadequate water supply (in arid areas with optimal solar radiation levels); pests and diseases; long maturation; and difficult-to-harvest roots and tubers with poor keeping quality. Research so far has been insufficient to break the numerous bottlenecks, although there is great promise from exploration, conservation, identification, evaluation, and breeding of germplasm and some high-yielding, adaptive, pest- and disease-resistant var. have already been developed for distribution throughout Africa. Although yields of the highest yielding var. currently available are only about 1/3 to 1/2 of estimated potentials, recent research on the continent is rapidly amassing knowledge with a concomitant crop-improvement achievement in the following order of priority: cassava, sweet potato, yam, and cocoyam. By the end of the decade, yield levels of commercial var. of the 4 crops should approach their potential. (Author's summary) G01

0064

21130 INSTITUT DE RECHERCHES AGRONOMIQUES TROPICALES ET DES CULTURES VIVRIERES. 1981. Les cultures pour l'alimentation du bétail: manioc. (Crops for cattle nutrition: cassava). In ________. Rapport de synthese des resultats 1980. Paris. pp.55-56. Fr.

Cassava. Cultivars. Root productivity. Dry matter. Fertilizers. N. P. K. French Polynesia.

Results of research on cassava carried out at Taravao and Papara exptl. stations (French Polynesia) in 1980 are summarized. Two trials were established on planting techniques; both were harvested in 1981. Observations made on fertilization rates of 0-125-250, 0-100-200, and 0-600-1200 kg of N, P, and K/ha, resp., are given in table form. The highest fresh root yield corresponded to the treatment with 125-100-1200 NPK (69.4 t ha) and the highest DM content was obtained with the treatment of 0-100-0 NPK (46.9%). In a 2nd trial carried out at Papara and Taravao, 2 plots were established for the multiplication of local and introduced (CIAT) materials. In Papara, var. M MEX 59 gave the highest yields, 97.35 t/ha; a sweet var. Local Blanc yielded 83.85 t/ha. In Taravao, M MEX 59 yielded 70.0 t/ha. (Summary by I.B. Trans. by L.M.F.) G01

0065

21135 INSTITUT DES SCIENCES AGRONOMIQUES DU BURUNDI. 1983. Plantes a racines et tubercules: manioc. (Root and tuber crops: cassava). In ________. Proposition pour un plan quinquennal (septembre 1983-aout 1988) de la recherche agronomique a l'ISABU. Bujumbura, Burundi. v.1,pp.52-56. Fr., Sum. Fr.

Cassava. Cassava programs. Cultivars. Selection. Burundi.

A 5-yr plan (1983-88) for research on cassava at the Institut des Sciences Agronomiques du Burundi is proposed, aimed at increasing current crop yields of 10-15 t/ha and reducing the area planted to cassava. Three var. have been proposed for release in rural areas: Criolinha, Bitamisi, and Nakarasi. Higher yielding sweet cassava var., tolerant to common diseases, are also sought. The methodology is chronologically outlined. Future research will concentrate on var. improvement and will include initial selection trials and definite var. trials. Genealogical selection will hopefully produce approx. 50 clones/yr, which will enter the collection. The last cycle of advanced trials will end in 1989. (Summary by I.B. Trans. by L.M.F.) G01

0066

21181 INSTITUTO AGRONOMICO DO ESTADO DE SAO PAULO. SECAO DE RAIZES E TUBERCULOS. 1982. Levantamento, introducao e selecao de variedades de mandioca (Manihot esculenta Crantz) cultivadas no Estado de Sao Paulo. (Survey, introduction, and selection of cassava varieties cultivated in the state of Sao Paulo). Campinas-SP, Brasil, Convenio FUNDEPAG/IAC. 21p. Port., 19 Refs., Illus.

Cassava. Cultivars. Selection. Cassava programs. Brazil.

A project is presented for the survey and collection, identification, introduction, and evaluation of cassava var. (mostly for table use) to increase the genetic variability of the germplasm bank and to select, multiply, and release the best var. Justifications, goals, and methodologies used in the project are given; the latter include evaluation for productivity, root type, cooking qualities, toxicity, postharvest enzymatic deterioration, and pest and disease resistance. Data sheets are included. (Summary by I.B.) G01

0067

21462 KAWANO, K.; UMEMURA, Y.; KANO, Y. 1983. Field assessment and inheritance of cassava resistance to superelongation disease. Crop Science 23(2):201-205. Engl., Sum. Engl., 10 Refs., Illus. [Tropical Agriculture Research Center, Ministry of Agriculture, Forestry, & Fishery, Tsukuba, Ibaraki, Japan]

Cassava. Inheritance. Resistance. Elsinoe brasiliensis. Cultivars. Root productivity. Selection. Colombia.

Effects of superelongation disease, caused by the fungus Elsinoe brasiliensis on cassava clones (different genotypes) were studied in fields at CIAT-Carimagua under high natural disease infection to assess value of genetic resistance and efficiency of field selection. The disease caused 20-70% yield reduction on susceptible clones relative to resistant clones depending on planting time and presence of CBB (Xanthomonas campestris pv. manihotis). Susceptible clones could not produce good planting stakes for next plantings. On resistant clones, the disease spread slowly while on susceptible ones it spread rapidly causing abnormal stem elongation and leaf death. Resistance was a quantitative trait controlled largely by additive genetic factors and not negatively correlated with yielding ability per se. Cv. order of resistance was stable over 8 yr of observation. Use of resistant parents in hybridizations combined with simple phenotypic field selection under high natural disease pressure should effectively improve resistance of cassava cv. (Author's summary) G01

0068

21473 LIAN, T.S. 1982. Utilization of genetic resources in cassava breeding programmes. In Singh, R.B.; Chomchalow, N., eds. Genetic resources and the plant breeder. Rome, Italy, International Board for Plant Genetic Resources. Southeast Asian Programme. pp.69-78. Engl., 18 Refs. [Malaysian Agricultural Research & Development Inst., Serdang, Malaysia]

Cassava. Germplasm. Plant anatomy. Agronomic characters. Cassava programs. Plant breeding. Malaysia.

The aspects related to the available cassava genetic resources, and how they can contribute to the breeding programs, are reviewed. The largest cassava collections of the world are at CIAT, International Institute of Tropical Agriculture, and the Institute of Biological Sciences of the Federal U. of Goias, Brazil. Other small ones are at the Central Tuber Crops Research Institute in India, the Dept. of Agriculture in Thailand, and the Malaysian Agricultural Research and Development Institute (MARDI) in Malaysia. MARDI's local collection includes 66 var. and approx. 850 clones introduced from CIAT. Black Twig is the most cultivated var. in Malaysia, both as a subsistence crop as well as for industrialization (starch and chips). However, due to its moderate starch content and late maturation, its genetic improvement is desirable. A major obstacle to hybridization lies in the fact that Black Twig is notoriously unreliable in flowering. Therefore it is necessary to introduce and select germplasm with early and profuse flowering. In order that germplasm be potentially useful to plant breeding programs, 2 basic prerequisites must be satisfied: (1) a system of morphological characterization (root color and shape, leaf lobe shape, plant habit, and the distance between 2 leaf scars) to provide an easy cross-identification; (2) a system of agronomic characterization (indispensable: accession no. and origin, root yield, HI, HCN and starch content, ease of harvest, and incidence/resistance to mosaic disease and CBB; highly valuable: germination, vigor, plant height, branching habit, leaf area retention, % of commercial roots, root perishability, earliness, consumer acceptance, and incidence/resistance to superelongation, thrips, mites, Phoma, Cercospora, stemborer, and shoot flies; valuable: protein content, root no., shape and color, and flowering habit). Direct introduction of plants is not possible because of quarantine restrictions. Three methods for the introduction of genetic material are suggested: pollen, seeds, and meristem cultures. It is also suggested that the international centers keep the large collections and, through computerized means, have the germplasm information available for national programs use, and on request of the latter, conduct crosses between specific var. (Summary by EDITEC. Trans. by M. de W.) G01

0069

22704 MAHUNGU, N.M.; CHHEDA, H.R.; HAHN, S.K.; FATOKUN, C.A. 1984. Genetic parameters of cassava. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.37-40. Engl., Sum. Engl., 5 Refs. [Programme National Manioc, B.P. 11635, Kinshasa, Zaire]

Cassava. Plant breeding. Plant anatomy. Roots. Root productivity. Harvest index. Dry matter. HCN content. Branching. Flowering. Cassava African mosaic virus. Cassava bacterial blight. Resistance. Canopy. Stems. Plant height. Nigeria.

Six diverse cassava populations grown during 1979-80 and 1980-81 were studied at the International Institute of Tropical Agriculture, Ibadan, Nigeria, to estimate genetic parameters for 22 traits of cassava. The data, when analyzed, revealed that: considerable variation existed both within and between the populations for most of the characters; the C.V. for phenotype and genotype were largest for root yield (85 and 62%, resp.), quite large for the roots/plant and root size (60 and 40%), moderate for HI and total no. of branches (45 and 30%, resp.), and low (less than 30 and 15%) for stem girth, canopy width, and plant height at harvest. Heritability estimates as well as expected genetic gain also varied considerably. On av., root yield and no. of roots showed moderately high heritability (50%) and high expected response to selection (88 and 64%, resp.). Relatively high heritability values were obtained for HI (49%) and DM content (52%), but they were associated with expected genetic gains of only 50 and 29%, resp. Agronomic traits such as stem girth, canopy width, and plant height at harvest showed moderate-to-low heritability values (32-42%) associated with low expected genetic advance (15-18%). (Author's summary) G01

0070

22706 MULINDANGABO, J. 1984. Cassava screening in Rwanda. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.45-48. Engl., Sum. Engl., 1 Ref. [Inst. des Sciences Agronomiques du Rwanda, Karama, B.P. 121, Kigali, Rwanda]

Cassava. Cassava programs. Research. Selection. Cultivars. Resistance. Diseases and pathogens. Injurious mites. Rwanda.

Research advances by the Institut des Sciences Agronomiques du Rwanda, in collaboration with the International Institute of Tropical Agriculture (Nigeria), in screening breeding material for resistance to diseases and the green mite are described. Future prospects of cassava research in Rwanda are also discussed. (Extracted from author's summary) G01

0071

21457 MUÑOZ F., J.E. 1983. Metodologías para determinar la estabilidad de genotipos en fríjol y yuca. (Methodologies for determining genotype stability in beans and cassava). Boletín Técnico de la Facultad de Ciencias Agropecuarias (Palmira) 1(2):27-52. Span., 13 Refs., Illus.

Cassava. Genetics. Genotype. Statistical analysis. Colombia.

A bibliographic review on the genotype stability in beans and cassava is presented, highlighting its importance, methodologies for its determination, and the interaction genotype-environment. Terms as stability and adaptability are defined. The procedure for the identification of stable material is outlined, and results and tables are presented on adaptability obtained with 8 cassava var. in 8 different localities of Colombia; results on beans are also given for 8 climbing bean var. and 6 dwarf bean var., in pure culture or in association with maize. (Summary by I.B. Trans. by M. de W.) G01

0072

22051 NAYAR, G.G.; JOS, J.S.; BAI, K.V. 1984. Improved varieties of cassava and sweet potato. Indian Farming 33(12):13-15. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Cultivars. Agronomic characters. Plant anatomy. India.

The importance of cassava (8 millions of t/yr) and sweet potato, and the work of the Central Tuber Crops Research Institute, Trivandrum, India, in the development of improved material are highlighted. The principal characteristics of 5 cassava cv. and 3 sweet potato cv. are described. Cassava cv. H-97, H-165, H-226, Sree Visakam (H-1687), and Sree Sahya (H-2304) yielded 27-32, 33-38, 30-35, 33-38, and 35-40 t/ha, resp.; starch contents were 27-29, 23-25, 28-30, 25-27, and 29-31%. Under irrigated conditions cv. H-226 gives high yields. (Summary by I.B. Trans. by M. de W.) G01

0073

22050 RAJENDRAN, P.G.; NAIR, R.B.; NASKAR, S.K. 1984. Genetic wealth of tuber crops. Indian Farming 33(12):9-12. Engl. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Cassava programs. Plant breeding. Cultivars. India.

The spectrum of genetic variability available among the genetic stock of tropical tuber crops maintained at the Central Tuber Crops Research Institute (CTCRI), Trivandrum, India, is assessed. General considerations about cassava, sweet potato, yam, arrowroot, taro, and others are given. The cassava genetic material of CTCRI, 847 exotic accessions and 480 native, comes from Colombia, Nigeria, Malagasy Republic, Uganda, Ghana, Thailand, Malaya, and Sri Lanka; most of the native material come from the state of Kerala that has 80% of the total area planted to cassava in the country. The cv. are evaluated for their economic importance and quality characteristics. Over 80% of the collection consists of flowering types that produce fruits, especially those from Nigeria and Colombia. The material from Nigeria has higher resistance to the mosaic virus in the field than the material from Colombia. Root yield varies from 0.2 to 7.0 kg/plant; the period of maturity is 6-12 mo.; the starch content, 15-35%; the % of DM varies from 29 to 44, and HCN content from 10 to 350 micrograms/g. The most promising material are Ci-167, Ci-480, Ca-27, Ca-56, Ce-182, Ce-212, Ce-308, and Ce-455 with a high yield potential and low HCN; Ce-36, Ce-185, Ce-401, Ce-451, Ce-528, and Ce-538 with a high starch content; Ci-175, Ci-206, Ci-856, and H-165, early maturing cv. (Summary by I.B. Trans. by M. de W.) G01

0074

22006 SINGH, T.P. 1980. Cassava improvement in Zaire by PRONAM; review of breeding activities. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.37-50. Engl.

Cassava. Cassava programs. Plant breeding. Clones. Cultivars. Hybridizing. Selection. Adaptation. Entomology. Diseases and pathogens. Zaire.

The objectives of the cassava breeding program in Zaire of the long-term project of the Programme National Manioc (PRONAM), are to: identify and develop improved cassava var. with high yield potential suitable for different ecological areas of the country; identify and utilize sources of disease resistance for developing resistant var.; identify and utilize sources of resistance to insects for developing resistant var.; and develop cassava var. with acceptable root quality and protein-rich, palatable cassava leaves. To achieve these objectives, an interdisciplinary approach involving pathology, entomology, agronomy, and breeding was envisaged. The 1st step in breeding is the introduction of material from the International Institute of Tropical Agriculture and other institutions, including several of Latin America. The activities of planting improved clones in nurseries in different parts of the country are summarized. Emphasis has been given to the resistance to CBB, mosaic, the mealybug and the green mite, and yield. Var. 429/7, although it does not give a higher yield than local var. 02864, can be employed as a replacement for the latter in areas with serious cassava mealybug problems. The strategies and future scope activities of PRONAM will include the evaluation of promising clones for their adaptability to varying conditions of soil and management on farmer's fields; the maintenance and distribution of selected cassava var.; continuing search for resistance to the cassava mealybug and green spider mite; utilization of the observed resistance to the green spider mite in some Brazilian wild plants in hybridization programs for the transfer of genes for resistance into locally adapted, high yielding var.; development of clones with higher levels of production arising from the projects of incorporating resistance to the mealybug and the green spider mite; extension of breeding work to other regions of the country; and initiation of special studies to determine the causes of the poor germination of seeds produced locally. (Summary by EDITEC. Trans. by M. de W.) G01

0075

21500 TOLEDO G.P., J. 1970. Estudio de variedades de yuca (nota previa). [Survey of cassava varieties (preliminary note)]. In Moro S., M.; Zaldivar S., R., eds. Cuarto boletín extraordinario. Lima, Perú, Instituto Veterinario de Investigaciones Tropicales y de Altura. Dirección de Investigación. pp.328-330. Span., Illus.

Cassava. Cultivars. Cassava programs. Peru.

The collection of cassava var., initiated at the Instituto Veterinario de Investigaciones Tropicales y de Altura, in Peru, is reported. There are 11 var.: Maleña, Amarillo de Lochín, Manteca China, Pata de Paloma, Pico de Oro, Michica, Rosada T.Z. (Bolivia), all from the La Molina exptl. station; Llanera from CIAT; María Rumo, Arponsillo, and Rosada, from Pucallpa. Var. Llanera, María Rumo, and Rosada are harvested 8 mo. after planting, Arponsillo after 4 mo. The collection will be completed with other var. from Pucallpa and will be evaluated for production/ unit area, nutritional content, disease resistance, and adaptation to the environment. The potential importance of cassava in animal and human nutrition, as well as the survey of cassava var. from the Peruvian Amazon, are highlighted. (Summary by I.B. Trans. by M. de W.) G01

0076

21143 VELASQUEZ, E. 1980. Informe sobre inventario tecnológico del cultivo de la yuca; región nororiental. (Report of a technical inventory of cassava cultivation in northeastern Venezuela). Maturín, Venezuela, Fondo Nacional de Investigaciones Agropecuarias. Estación Experimental Maturín. 15p. Span.

Cassava. Cultivars. Productivity. Planting. Fertilizers. N. P. K. Plant population. Herbicides. Xanthomonas campestris pv. manihotis. Venezuela.

A report is made of a technological inventory of sweet and bitter cassava clones (av. yield, development index) evaluated on savanna soils in NE Venezuela. Best clones at Guanipa were Branca Santa Catarina (22.34 t/ha) and Querepa Blanca (15.31 t/ha). Results are also given for trials evaluating planting method and depth, fertilization, population density, weed, pest, and disease control. In 1974-75 NPK had a positive effect, and low population densities, spaced at 1.20 x 1.20, 1.20 x 1.00, and 1.00 x 1.00 m, resulted in lower production and thicker and longer roots; planting depth between 5-10 cm was the most favorable. Simazine had a toxic effect. Research priorities are included. (Summary by I.B.) G01

See also 0015 0054 0080 0096 0097 0112 0114 0115
0120 0128 0132 0134 0143

H00 NUTRITION

H01 Cassava Foods and Nutritive Value

0077

22086 CALONI, I.B. DE; CRUZ-CAY, J.R. 1984. Elaboration and evaluation of typical Puerto Rican dishes prepared with mixtures of plantain, cassava and tanier flours. Journal of Agriculture of the University of Puerto Rico 68(1):67-74. Engl., Sum. Engl., Span., 20 Refs.

Cassava. Cassava flour. Flours. Banana-plantains. Xanthosoma. Composite flours. Food products. Organoleptic examination. Puerto Rico.

Mixtures of flours from plantain, cassava, and tanier were prepared for the elaboration of typical Puerto Rican dishes. The proportion of flours blended were 50:25:25, 60:20:20, 75:15:10, and 75:10:15 of plantain, cassava, and tanier, resp. Plantain flour was always used as the main flour because of the commercial importance of this crop on the island. The blends were prepared with 454 g of combined flours mixed with 1250 g boiling water, 11.5 g salt, and 36.0 g of annatto seed in oil (achiote). "Pasteles" and "alcapurrias" (a boiled meat pie and turnovers, resp.), were prepared and found acceptable by a trained taste panel. No significant difference in general acceptability was observed among the samples prepared with the mixtures of flours when fresh and after 3 mo. frozen storage. (Author's summary) H01

0078

22323 GOODLAND, R.J.A.; WATSON, C.; LEDEC, G. 1984. Cassava and other root crops. In ________. Environmental management in tropical agriculture. Boulder, Colorado, Westview Press. pp.27-34. Engl., 32 Refs.

Cassava. Root crops. Uses. Cassava products. Human nutrition.

The social, nutritional, and industrial importance of cassava and other root crops is briefly discussed. The calorie content of these foodstuffs is highlighted as well as the high protein content of cassava leaves and stems and improved levels of vitamins and amino acids in fermented cassava starch products such as gari in Nigeria and cassiri in Guyana. Soil management and erosion, weed and pest control, cassava processing and storage, industrialization, ethanol production (2160 vs. 3015 l/ha/yr in sugarcane), and management of stillage are mentioned. (Summary by I.B. Trans. by L.M.F.) H01

0079

22319 LEVIN, S. 1983. Food production and population size in the Lesser Antilles. Human Ecology 11(3):321-338. Engl., Sum. Engl., 39 Refs., Illus. [Faculty of Natural Sciences & Mathematics, Stockton State College, Pomona, New Jersey, USA]

Cassava. Food energy. Carbohydrate content. Dietary value. Protein content. Nutritive value. Human nutrition. Caribbean.

Whether aboriginal population size in the Lesser Antilles was limited by the total calories obtainable from cassava, the amount of protein obtainable from animal sources, or both of these factors is examined. Estimates of cultivable land and productivity show that calories obtainable from cassava are not likely to have limited population size. Estimates of the amount of animal food that would have been needed to provide sufficient protein for populations of varying size, based on studies of faunal remains, indicate that protein is more likely than calories to have been a limiting factor in population size because the amount of animal protein required to support a population of several thousand is unlikely to have been consistently obtainable. A method is suggested for estimating the max. human population supportable by animal protein resources found on Antillean islands. (Author's summary) H01

0080

22705 LUTALADIO, N.B. 1984. Evaluation of cassava clones for leaf production in Zaire. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.41-44. Engl., Sum. Engl., 5 Refs., Illus. [Programme National Manioc, B.P. 11635, Kinshasa, Zaire]

Cassava. Clones. Cassava leaves. Productivity. HCN content. Organoleptic examination. Zaire.

At Mvuazi, Zaire, the tops of 30 cassava clones were harvested periodically, and the production of tender leaves for use as a vegetable was evaluated. Local var. Mpelolongi gave the highest yield (10.2 t/ha) of leaves and in spite of the high HCN content (removed by traditional methods of preparing the leaves), it was rated highest in taste evaluation. Only 2 clones, 93/1 and 344/8, received poor ratings and the majority of the clones proved to be good leaf producers. In most of the clones, harvesting the leaves resulted in the emergence of cassava mosaic. Ways of improving var. for higher leaf and root yields are being studied at the Programme National Manioc (PRONAM). (Summary by M. de W.) H01

0081

22063 NAMBISAN, B.; SUNDARESAN, S.; PADMAJA, G. 1984. Tuber crops in human nutrition. Indian Farming 33(12):67,71, Engl.

Cassava. Uses. Human nutrition. Toxicity. India.

The nutritive value of different tuber crops is analyzed. The chemical composition of cassava roots and leaves is presented. The effects and elimination of the cyanoglucosides are discussed, and several diseases associated with a high consumption of cassava are mentioned. A study carried out at the Central Tuber Crops Research Institute, in collaboration with Medical College, Trivandrum, India, indicated chronic toxicity caused by a prolonged cassava consumption. (Summary by I.B. Trans. by M. de W.) H01

0082

22321 OHOCHUKU, N.S.; BALLANTINE, J.A. 1983. Fermented cassava: odor active components. Journal of Agricultural and Food Chemistry 31(6): 1386-1387. Engl., Sum. Engl., 5 Refs. [Dept. of Chemistry, College of Education, P.M.B. 5047, Port Harcourt, Nigeria]

Cassava. Gari. Foofoo. Fermentation. Biochemistry. Analysis. Composition. Nigeria.

In Nigeria, cassava roots are processed to gari and also fermented in cold water and sieved to give a fermented mass used to prepare fufu. Fermentation of cassava roots in cold water usually imparts an objectionable odor to the fermented mass and the cooked fufu. The compounds responsible for this odor were isolated from the acidic fraction of fermentation liquor and analyzed by combined gas chromatography and mass spectrometry. The acids identified are butanoic acid, propanoic acid, and acetic acid, butanoic acid being responsible for the objectionable odor. (Author's summary) H01

See also 0030 0032 0096 0110 0112 0114 0119 0130
0134 0139

H02 Nutritive Disorders in Humans

0083

22308 MAHONEY, T.A.; LAUBER, E.; CLERC, M. 1983. Urinary volume, creatinine and thiocyanate of Africans of a tropical savanna region. African Journal of Medicine and Medical Sciences 12(2):71-75. Engl., Sum. Engl., Fr., 9 Refs., Illus. [Laboratoire de Biochimie Médicale, Centre Hospitalier Universitaire, 01 B.P.V. 166, Abidjan 01, Ivory Coast]

Cassava. Human physiology. Toxicology. Clinical manifestations. Endemic goitre. Ivory Coast.

For 130 healthy African subjects of the savanna region, the 24 h urine output was 1000 ml. This appears somewhat less than levels found among temperate region peoples. These results permit the gross evaluation of 24 h excretion of substances on rapid field studies. The creatinine urine excretions found confirm the known characteristics, the variability with age, sex, and amount of muscular tissue. The 24 h excretion cannot be accurately measured when calculated on the basis of urine creatinine excretion of a single micturition; therefore for an accurate measure controlled 24-h urine collections are needed. The urine thiocyanate excretion of this nongoitrous population on a low cassava diet is significantly lower than that found in an endemic goitrous population. (Author's summary) H02

See also 0114

H03 Animal Feeding

0084

22040 BALOGUN, O.O.; FETUGA, B.L.A.; OYENUGA, V.A. 1983. The response of the muscles of weanling Large White x Landrace pigs to methionine and palm-oil supplementation to cassava flour-soya-bean meal diet. Journal of Agricultural Science 101(3):757-762. Engl., 12 Refs. [Dept. of Animal Production, Faculty of Agriculture, Univ. of Ilorin, Ilorin, Nigeria]

Cassava. Cassava flour. Soybean flour. Methionine. Feed constituents. Animal nutrition. Swine. Animal physiology. Laboratory experiments. Nigeria.

An expt. was carried out to study whether dietary factors such as increased digestible energy consequent to increasing the amount of palm oil in the diet have any influence on the differential response of muscles to dietary met. concn. when pigs were given CF-SBM diets. Thirty-six 8-wk.-old, Large White x Landrace pigs were allocated to 9 groups of 4 pigs each on the basis of sex, live wt., and litter origin. There were 3 dietary met. concn.: (a) 4.7 g/kg diet (7.3 g met. + cystine/kg diet); (b) 5.5 g/kg diet (8.1 g met. + cystine/kg diet); and (c) 6.3 g/kg diet (8.9 g met. + cystine/kg diet). At each met. concn., 3 supplements of palm oil were added at 30, 63.5, or 97 g/kg diet and gave, on analysis, estimated digestive energy of 14.63, 15.27, and 15.94 MJ/kg diet, resp. The expt. lasted 42 days. After 21 days on the test diets, the pigs were transferred to specialized metabolic cages with facilities for separate collection of feces and urine. Animals were slaughtered on day 42 and dressed; carcasses were halved longitudinally and chilled for 24 h. Ten muscles were sequentially removed from the trunk, hind limb, and fore limb of the left side of each carcass. With met. concn. of 4.7 g/kg diet, there was a decline in muscle wt. when dietary palm oil was increased from 30 to 63.5 or 97 g/kg diet. With total met. of 5.5 g/kg diet, there was a significant ($P < 0.01$) increase in the wt. of individual muscles with increasing palm oil in diet. The max. concn. required in a CF-SBM diet is 6.3 g total met. not only to promote satisfactory body wt. gain and muscle growth but also to provide additional met. (Summary by F.G.) H03

0085

22318 COCKBURN, J.E.; WILLIAMS, A.P. 1984. The simultaneous estimation of the amounts of protozoal, bacterial and dietary nitrogen entering the duodenum of steers. British Journal of Nutrition 51(1):111-132. Engl., Sum. Engl., 93 Refs. [National Inst. for Research in Dairying, Shinfield, Reading, Berkshire RG2 9AT, England]

Cassava. Cattle. Animal nutrition. Feed constituents. Metabolism. Analysis. N. Amino acids.

Four steers were given straw and cassava diets, twice daily, in a 4 x 4 Latin square design. These diets, containing 4.2 g N/kg DM, were further supplemented with either urea, decorticated groundnut meal, untreated casein or formaldehyde-treated casein to give a total of 19.7 g N/kg DM and 10.5 MJ/kg DM daily. Concurrent samples of rumen bacteria and protozoa and abomasal digesta were collected for each period of the expt. and the concn. of 2-aminoethyl phosphonic acid, diamonopimelic acid, total N, total P, amino acids, and hexosamines were determined in the dried preparations. The nature of the dietary supplements had little effect on the concn. of most of these constituents or on the protozoal no. (Extracted from author's summary) H03

0086

20766 EISFELD, VON D. 1982. Stickstoff-Verwertung des Rehes (C. capreolus L.) bei Stickstoff-Mangel. (Nitrogen usage of Capreolus capreolus in conditions of nitrogen deficiency). Zentralblatt fuer Veterinaermedizin (Reihe A) 29(4-5):375-386. Germ., Sum. Germ., Engl., Fr., Span., 43 Refs., Illus. [Forstzoologisches Inst. der Albert-Ludwigs-Universität, Bertoldstr. 17, D-7800, Freiburg i. Br., West Germany]

Cassava. Roe deer. Animal nutrition. Cassava meal. Feed constituents. N. Digestibility. Metabolism.

In N balance studies deer were given feed mixtures based on CM and oat husks, while the N intake was varied by adding soybean protein. To describe the greatest possible utilization of N, the 30 best utilization results in 158 trials were selected as the assessment (N content of dry feed matter, 0.55-1.45%). Considering metabolic body wt., there was a clear linear relationship between N balance and the supply of apparently digestible N: 92% of the apparently digestible N can replace urinary N loss (72 mg/kg body wt.) and only 8% of the N appears in the urine. Urinary loss of N is mainly purines derived from bacterial nucleic acids. Urea N in urine is limited to approx. 2.6% of apparently digestible N (+ 10 mg/kg body wt.). Maximal N utilization results from the most complete usage of N from the body by bacteria in the alimentary tract and can only be attained when there is no surplus of N available, either for the deer or for its rumen bacteria. The literature shows comparatively extreme values for domestic ruminants. (Author's summary) H03

0087

20765 EISFELD, VON D. 1982. Zur Stickstoff-Verdaulichkeit beim Reh (C. capreolus L.) 1. Mitteilung. (Nitrogen digestibility in Capreolus capreolus. 1. Report). Zeitschrift fuer Tierphysiologie, Tierernachrung und Futtermittelkunde 48(1-2):75-89. Germ., Sum. Germ., Engl., 24 Refs., Illus. [Fortzoologisches Inst., Bertoldstr. 17, D-7800, Freiburg i. Br. West Germany]

Cassava. Cassava meal. Feed constituents. Forage. Digestibility. Animal nutrition. Roe deer.

Roe deer, kept in metabolism crates, were fed diets based on CM and cereals. The N content of the diets was varied using soybean products. During 158 trials, N in the feces as well as amount and composition of feed were determined. Regressions of fecal N on 6 variables influencing this parameter were calculated. Two fractions of fecal N were taken into consideration: undigestible dietary N and metabolic fecal N (MFN). The amount of MFN depends on the intake of DM, the intake of digestible OM, and probably, on the metabolic body size ($W^{0.75}$). The true digestibility of N changes with the quality of the feed. In concn. it was 94%. The value for N from resistant roughages (approx. 50%) is less reliable. For forage selected by free-ranging roe deer true N digestibilities between (according to season) 90-60% can be assumed. True N digestibility and metabolic fecal

N allow the calculation of apparently digestible N, which is the starting point for a factorial estimate of requirements. (Author's summary) H03

0088

21479 THE GROWING role of cassava. West African Farming 1984:13,15. January/February 1984. Engl., Illus.

Cassava. Animal nutrition. Feeds and feeding. Trade. Marketing. Legal aspects.

The growing interest of Europe (particularly the Holand, West Germany, and Belgium) in cassava as a cereal substitute in animal feeds is discussed. The high price of cereals and the stimulation of exports due to the agricultural policies of the EEC, will probably increase the demand for cassava in the next few years. The world trade of cassava, in which Thailand is the major exporter (over 7 millions of t in 1983), is analyzed; other exporters are China, Indonesia, and Brazil. The importance of using the potential of production in African countries is highlighted. The Centre for Industrial Development (CID) is promoting the industrial processing of cassava in West Africa. The use of cassava pellets, cyanide content, supplementation, and the advantage of using cassava in animal feeds are discussed. (Summary by I.B. Trans. by M. de W.) H03

0089

22038 GUERRA, P. 1980. Utilización del forraje de yuca como fuente de proteína y fibra. 1. Aspectos agronómicos, composición química, digestibilidad y consumo del forraje integral de yuca. (Utilization of cassava fodder as a source of protein and fiber. 1. Agronomic aspects, chemical composition, digestibility, and consumption of cassava leaf meal). Carta Informativa Pecuaria (Panamá) no.9:9-12. Span., 6 Refs.

Cassava. Forage. Animal nutrition. Toxicity. Composition.

Data from USA, Costa Rica, Peru, Vietnam, Venezuela, and the Dominican Republic, are reviewed; tables on the chemical composition, apparent digestibility, consumption, DM production, and other characteristics of cassava, in relation to its utilization as a source of protein and fiber for cattle nutrition in Panama, are presented. Edaphoclimatic aspects such as temp., humidity, soils, and pH are cussed, as well as the toxicity of the product and the effect of population density on yield. The high protein content of the CLM is highlighted; cassava leaf hay has a higher protein and fat content than alfalfa hay and besides that, it has a low cellulose content which makes it suitable for bovine nutrition. (Summary by I.B. Trans. by M. de W.) H03

0090

22035 KADIRVEL, R. 1980. Tapioca as poultry feed. Poultry Adviser 9(8): 21-24. Engl.

Cassava. Poultry. Animal nutrition. Uses. India.

The characteristics of cassava and its products (chips; CM; thippi, a by-product in the manufacture of cassava starch extensively used in SE Asia for animal feeding; CLM) are analyzed in relation to the poultry feeding in south India. For chicks up to 6 wk. old, 10-15% substitution of maize by cassava is recommended; for chicks from 7 to 12 wk. old, 30%; above that age, 40% substitution is suggested. A level of 25-30% cassava is recommended for layer rations. Contradictory results about egg production have been recorded. To improve yolk color, synthetic carotenoids or CLM should be included. CLM can also replace alfalfa (5%) in cattle and poultry feeds. Factors limiting the extensive use of cassava and cassava products are discussed. The success of cassava utilization depends on the availability of cheap protein sources, levels of incorporation, and precautions taken to prevent possible undesirable effects. (Summary by I.B. Trans. by M. de W.) H03

0091

22303 LE MEUR, D. 1982. Le manioc: une vacherie... qu'il faut utiliser. (Usefulness of cassava in swine nutrition). A la Pointe de l'Elevage no.133:21-24. Fr., Illus.

Cassava. Animal nutrition. Swine. Cassava products. Feeds and feeding. Feed constituents. Composition. Methionine. Lysine. Cystine. Prices. Storage. Distribution. France.

Background information on the use of cassava in swine nutrition in France during 1978-82 is reviewed. Its usefulness is highlighted, proved experimentally by institutions dedicated to research on fattening pigs such as the Institut National de Recherches Agronomiques, the Institut Technique des Céréales et des Fourrages, and the Institut Technique du Porc. Tables are included on the composition of different forms of cassava, composition of feed rations, and animal performance. Based on the forage value (1 forage unit/gross kg of common cassava), several examples of feed formulas with maize, wheat, and oats are given, considering the limiting factors lysine, met., and cystine. For incorporating 20% cassava into the ration, it is not necessary to add met.; for 40% cassava, it is recommended to add only 0.05% met. The limitations to using cassava are discussed as well as its price in relation to that of the other components of the swine ration and the solutions given by pig breeders to the difficulties that the maintenance of cassava presents during reception, storage, recovery, pulverization, and distribution. (Summary by I.B. Trans. by L.M.F.) H03

0092

22310 McALLAN, A.B.; SMITH, R.H. 1983. Factors influencing the digestion of dietary carbohydrates between the mouth and abomasum of steers. British Journal of Nutrition 50(2):445-454. Engl., Sum. Engl., 35 Refs., Illus. [National Inst. for Research in Dairying, Shinfield, Reading RG2 9AT, England]

Cassava. Animal nutrition. Cattle. Feed constituents. Fish meal. Glucose. Cassava starch. Digestibility.

Six protozoa-free steers with simple rumen and abomasal cannulas were given basal diets consisting of a concentrate mixture of flaked maize and cassava with either barley straw or alkali-treated barley straw. Other diets used were supplemented with urea or contained fish meal in place of cassava. The diets were given in a 6 x 6 Latin square design. Diets were isoenergetic and provided sufficient ME to support a growth rate of approx. 0.5 kg/day. Basal diets, urea- and fish meal-supplemented diets had estimated rumen-degradable N:ME values (g/MJ) of 0.5, 1.2, and 0.8, resp. ^{103}Ru and polyethylene glycol were given as flow markers, and flows (g/24 h) as the abomasum of OM and carbohydrate components were calculated. True digestibility coefficients of OM between mouth and abomasum were significantly greater for diets containing alkali-treated straw (approx. 0.63) than for those containing untreated straw (approx. 0.55) but were not significantly affected by N supplementation. Digestibility coefficients of the neutral sugar components of dietary polysaccharides between mouth and abomasum were

0.28, 0.34, 0.31, 0.23, 0.31, and 0.87 for mannose, galactose, arabinose, xylose, cellulose-glucose, and starch-glucose, resp., for the barley straw diet. Corresponding values were 0.37, 0.42, 0.56, 0.51, 0.40, and 0.88 for alkali-treated barley straw diet. All but the mannose and starch-glucose values were significantly greater for the latter diet. N supplementation also led to increases in digestibility of all neutral sugars except mannose and starch-glucose. Fish meal produced a markedly greater effect than urea but only significantly so for cellulose-glucose. The highest digestibilities were seen for the alkali-treated barley straw diet supplemented with fish meal and were 0.68, 0.67, 0.74, and 0.64 g for galactose, arabinose, xylose, and cellulose-glucose, resp. Of all these sugars, xylose consistently showed the greatest response in digestibility to NaOH treatment or N supplementation. (Author's summary) H03

0093

21478 MULLER, H.L.; KIRCHGESSNER, M. 1983. Energetische verwertung von cellulose beim schwein. (Utilization of cellulose as energy source in pigs). Zeitschrift für Tierphysiologie, Tierernährung und Futtermittelkunde 49(3):127-133. Germ., Sum. Germ., Engl., 22 Refs. [Institut für Ernährungsphysiologie der Technischen, Univ. München, D-8050 Freising-Weihenstephan, Germany]

Cassava. Animal nutrition. Swine. Cellulose. Metabolism. Digestibility. N.

A respiration trial with 10 adult sows was conducted as a cross-over design to study the effect of pure cellulose on energy metabolism. The basal ration contained barley, wheat, cassava, SBM, and fish meal. The cellulose ration consisted of 70% basal ration and 30% cellulose. The level of energy intake was slightly above the maintenance requirement. The partial digestibility of the energy of cellulose amounted to 30%. Methane production was 10% of the digested cellulose. This higher methane loss was compensated for by a lower loss of urinary energy, so that the ratio ME/digestible energy was not markedly affected by the treatment. The apparent digestibility of N decreased by the addition of cellulose to the basal diet by 13% units. The partial efficiency of utilization of cellulose ME amounted to 68%. Consequences of the results for energetic feed evaluation are discussed. (Extracted from author's summary) H03

0094

20750 TUDOR, G.D.; NORTON, B.W. 1982. The nutritive value of cassava for cattle. Proceedings of the Australian Society of Animal Production 14:599. Engl., 2 Refs. [Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia]

Cassava. Animal nutrition. Cattle. Cassava chips. Foliage. Sorghum. Composition. Digestibility.

The nutritive value of a cassava diet of dried chipped tubers (3.9% CP in DM) and tops (4.4% CP), was compared with a cereal grain diet of rolled sorghum (11.4% CP) and cottonseed hulls (CSH, 4.4% CP), both given as 80:20 diets in a 4 x 4 Latin square digestibility expt. with periods of 21 days. Four diets (2 cassava and 2 sorghum) were prepared with either 4 or 8% peanut meal (PM) (C4, C8, S4, and S8) plus minerals and urea. The urea was used to balance the diets with different levels of PM. Steers were fed once daily at just above maintenance levels. A diet predominantly of cassava tubers and tops with 4-8% PM as a protein supplement was more highly digested than a diet of sorghum grain and CSH with similar proportions of PM. Cattle given cassava utilized absorbed dietary N with 34% lower efficiency than did steers given sorghum and this may be attributed to the higher levels of urea in the cassava diets compared with the sorghum diets. The isonitrogenous replacement of urea with PM in both diets did not increase N retention or efficiency of N use, suggesting that PM was little better than urea as a protein source. (Summary by Nutrition Abstracts and Reviews) H03

0095

20751 TUDOR, G.D.; McGUIGAN, K.R. 1982. The potential intake and growth rate of young cattle fed a predominantly cassava based diet. Proceedings of the Australian Society of Animal Production 14:600. Engl., 2 Refs. [Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia]

Cassava. Animal nutrition. Cattle. Cassava products. Feed constituents. Pellets. Nutritive value. Digestibility. Australia.

For 89 days Droughmaster steers, mean initial fasted live wt. 173 kg were given pelleted diets of cassava or cereal grain. The cassava tubers (4.7% CP in DM) were supplemented with either nonprotein N (NPN, urea 4%) or true protein (TP, meat-and-bone meal 15%), but the grain was only supplemented with NPN. The cassava (chipped, dried, and rolled) and grain (finely rolled sorghum) were prepared as concentrate mixes with minerals and the necessary N supplement. The concentrate mixture was pelleted with lucerne meal (23.4% CP) in the proportion 90:10. CP content of the grain, cassava + NPN, and cassava + TP diets was 18.2, 19.8, and 18.4%, resp. Steers on the cassava diet + TP had lower rates of gain and lower intakes than those given sorghum, with the steers given cassava + NPN having the lowest growth rate and intake. The apparent digestibilities of OM of the cassava diets were better than for the grain diet but the feed conversion efficiencies were slightly lower. Rumen fluid analyses showed there was a lower ratio of acetate:propionate in animals given grain compared with those given cassava. The concn. of butyric acid in the rumen of steers given cassava was nearly twice that of grain-fed animals. (Summary by Nutrition Abstracts and Reviews) H03

See also 0098 0110 0114 0115 0126

H04 HCN Toxicity and Detoxification

0096

21480 LOW CYANIDE cassava breeding. West African Farming 1984:18-19,22. January/February 1984. Engl., Illus.

Cassava. HCN. Toxicity. Plant breeding. Processing. Chickwangue. Foofoo. Atieke. Cassava products. Gari. Food products. Human nutrition. Africa.

The importance of cassava in West African diets is stressed. Since cyanide can cause serious health problems, breeding expt. for low cyanide cassava var. are being carried out at the International Institute of Tropical Agriculture (IITA), using an automated enzymatic method which enables up to 40 cassava root samples to be tested with the Tecnicon Autoanalyzer per hour for their cyanide content. West African countries have benefitted from receiving these var. through national programs, research institutions, or directly from IITA. Processing steps for the production of various cassava products are included. (Summary by T.F.) H04

0097

22004 LUTALADIO, N.B.; EZUMAH, H.C.; SINGH, T.P. 1980. Evaluation of cassava cultivars in Zaire for cyanogenic content. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.25-31. Engl., 11 Refs.

Cassava. Cultivars. Sweet cassava. Bitter cassava. HCN. Toxicity. Cassava programs. Plant breeding. Zaire.

The HCN content of the Programme National Manioc (PRONAM) cassava collection at its M'vuazi station (Zaire) is being screened. The sodium picrate test used with plants of the collection 10 mo. after planting showed that 10.6% of the material had a very high HCN content in the leaves; 32.3% had a high content; 42.9% a medium level; 10.1% low; 4.1% very low, and 0% negative. Some high yielding var. selected for multiplication and dissemination were also screened for HCN content; var. 70/4 with an av. yield of 20.7 t/ha showed a low HCN content. PRONAM's breeding program will keep in mind the possible role of HCN content in pest and disease resistance. It is important to study the effect of agronomically controllable factors such as time of planting, plant age, and use of fertilizers on HCN content. Special attention should be given to the efficacy of traditional processing methods to free cassava from HCN. It will be determined whether the low levels of HCN as detected with the picric acid test are due to low activity of linamarase or to actually lower levels of HCN and whether unhydrolyzed cyanogenic glucoside is as toxic as the hydrolyzed one and if so, the level of toxicity to be expected from different cassava cv., irrespective of the level of HCN. (Summary by EDITEC. Trans. by M. de W.) H04

See also 0005 0080 0081

100 PROCESSING, PRODUCTS AND USES

101 Cassava Starch and its Properties

See 0114 0125

102 Uses, Industrialization, Processing and Storage

0098

22372 ALBUQUERQUE, M. DE; CARDOSO, E.M.R. 1983. Utilizacao da mandioca na Amazonia. (Cassava utilization in the Amazon region). Belém-PA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro de Pesquisa Agropecuária do Trópico Umido. Documentos no.25. 11p. Port., Sum. Port., Engl. [Centro de Pesquisa Agropecuária do Trópico Umido, Caixa Postal 48, 66.000 Belém-PA, Brasil]

Cassava. Uses. Cassava meal. Cassareep. Processing. Foliage. Costs. Brazil.

Several ways of utilization of cassava in the Amazon region are studied. Procedures for processing cassava tubers for table flour and "tucupi" (cassava juice), as well as the use of cassava leaves for animal feed, are described and discussed. Economic considerations of the main ways of cassava industrialization are also mentioned. It is concluded that presently, the most profitable end product of this crop is tucupi which has a promising potential in the international market. (Author's summary) 102

0099

22324 GOAD, K.C. 1983. A description of the varied activities involved in establishing a cassava farm/gari factory complex in Guinea, West Africa. Surrey, England, N.D. Engineering Limited. 15p. Engl. [N.D. Engineering Limited, Portsmouth Road, Surbiton, Surrey KT6 5QF, England]

Paper presented at the Workshop on Processing Technologies for Cassava and other Tropical Roots and Tubers, 1st., Abidjan, Ivory Coast, 1983.

Cassava. Gari. Cultivation. Processing. Industrialization. Development. Guinea.

The traditional method to convert cassava into gari is described and the need for its mechanization is highlighted. The activities necessary for the establishment of a cassava farm/gari factory complex in Guinea, West Africa, are presented: site selection, agricultural equipment, provision of a workshop for servicing and maintenance, selection of suitable strains of cassava, development of a 200-ha home farm for expansion and supply, and factory facilities. (Summary by M. de W.) 102

0100

21477 HERRERA, C.A.; ARIAS V., C.A.; MUÑOZ, H. 1983. Guía para la construcción de una trozadora de yuca. (Guide for the construction of a cassava chipper). Cali, Colombia, Centro Internacional de Agricultura Tropical. 35p. Span., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Development. Cassava chips. Mechanization. Industrialization. Small-scale equipment. Processing. Colombia.

The instructions, materials, and blue prints of a Thai type cassava chipper processing 2-4 t of cassava/ha are presented. The machine has a general support structure, a hopper feed, a chopper disk, and a motor (3 HP and 1750 rpm). (Summary by EDITEC. Trans. by M. de W.) 102

0101

14566 KOHLI, H.S. 1980. La energía renovable: alcohol a partir de biomasa. (Renewable energy: alcohol from biomass). Finanzas y Desarrollo 17(4):18-22. Span., Sum. Span., Illus.

Cassava. Ethanol. Production. Uses. Costs. Development.

The importance and perspective of ethanol from raw materials like sugarcane, molasses, grains, and cassava, in developing countries are discussed. Main uses of ethanol are given and the production process is described. Economic aspects of production are outlined comparing sugarcane with molasses and cassava as sources of fuel. Finally the problem of competition for land use is posed and the topics that require governmental policies are mentioned. (Summary by M. de W. Trans. by L.M.F.) 102

0102

22309 LIMA, L. DA R. 1980. A mandioca como alternativa de geracao de energia carburante. (Cassava as an alternative to generate fuel energy).

In Simposio Nacional sobre Fontes Convencionais e Alternativas de Energia, Brasilia-DF, Brasil, 1979. Conferencia. Brasilia. pp.173-184. Port.

Cassava. Cultivars. Energy productivity. Alcohol. Production. Waste utilization. Brazil.

The exceptional conditions of Brazil in relation to the alternatives to generate fuel energy from agricultural products, especially sugarcane and cassava, are discussed. Data on the advances achieved after the creation of the Programa Nacional do Alcool, PROALCOOL, are presented; there are 218 proposals for the construction of factories, which would represent 35-40% of the present fuel consumption. The importance of cassava (av. productivity of 15-17 t/ha) as a food and energy source, particularly in southern Brazil and in the Amazon region where mean productivity exceeds 40 t/ha, is highlighted. Cassava is being planted in large extensions; the SINOP group has planted 2500 ha to var. Cuibana and Branca de Santa Catarina in the municipality of Chapada dos Guimaraes, for a future planting of 16,000 ha. The present state of the transformation of cassava into alcohol is briefly related; currently it is viable to obtain 190-195 l alcohol/t of roots with 30% starch. The importance of solving the problem of industrial wastes is emphasized. Comparative data of the production of alcohol from sugarcane or from cassava are presented; the production of the latter would be 73.45 x 10^9 kcal/crop year. (Summary by I.B. Trans. by M. de W.) 102

0103

22060 MOORTHY, S.N. 1984. Cassava as an industrial raw material. Indian Farming 33(12):54-57,70. Engl., Illus.

Cassava. Cassava starch. Cassava flour. Cassava chips. Pellets. Protein enrichment. Ethanol. Fructose. Confectioneries. Cassava products. India.

The industrial use of cassava as a raw material for producing animal feed, starch, flour, and starch-derived products, is discussed. The efforts made by the Central Tuber Crops Research Institute, Trivandrum, India, to improve the quality of the cassava chips and pellets are presented. The physicochemical and microbiological characteristics of cassava chips, and their optimum size for the fastest drying, are described. The SCP process involving Rhizopus, Aspergillus, and Candida sp. is outlined. The inherent stickiness of cassava starch, a drawback in the food industry, can be overcome with the use of orthophosphoric acid at 1%. The acetylation of cassava starch improves its clarity, stability, and viscosity in solution. The production of cassava "rava" and its potential in the food market are mentioned. In the textile and paper industries, unstable viscosity of cassava starch can be stabilized by steam pressure treatment or by oxidation. Starch-derived products like dextrin, liquid glucose, ethyl alcohol, and high fructose syrup, are discussed. (Summary by I.B. Trans. by M. de W.) 102

0104

21131 MULLER, G.J. 1977. Production of bitter cassava for processing. Georgetown, Guyana Agricultural Products Corporation. 7p. Engl.

Paper presented at Seminar on Rationalisation of Research in Agriculture and Related Fields, Demerara, Guyana, 1977.

Cassava. Bitter cassava. Production. Composite flours. Cassava starch. Forage. Development. Guyana.

Different aspects of cassava production in Guyana are presented. The 3 mills installed in Lookout, Charity, and Kaituma have the capacity to process 23,750 t/yr. Plans include the elaboration of a composite flour that has 10-20% cassava. Any production plan must involve simultaneous production by individual farmers, cooperatives, and state farms near to the mills. It is necessary to identify and evaluate cv. with high yield potential, high PC, low HCN content, thin nonadherent cortex, and elongated roots; 40 clones of different origin are listed. Fast propagation of planting material and the development of suitable cultivation, harvesting, and plant protection systems, among others, are also required. With the proposed aims it is pretended to produce 4750 t of CF, 188 t of forage, and 95 t of starch. The need for research on the technology of the process, composite flour fortification, uses, and marketing is highlighted. (Summary by I.B. Trans. by M. de W.) 102

See also 0011 0033 0078 0102 0114 0119 0120 0125 0132

103 Industrial Microbiology

0105

22320 DOIN, P.A.; OLIVO, J.E.; VARELLA, V.L.; COCONE, B.R.; PINTO, A.G. 1984. The effects of the initial cell concentration on the alcoholic fermentation of cassava. Journal of Fermentation Technology 62(2): 195-199. Engl., Sum. Engl., 6 Refs., Illus. [Laboratório de Engenharia Bioquímica e de Alimentos, Inst. Mauá de Tecnologia, Estrada das Lágrimas 2035, 09.500 Sao Paulo-SP, Brasil]

Cassava. Roots. Cassava meal. Ethanol. Fermentation. Productivity. Brazil.

As part of an effort to improve ethanol production technology in Brazil, ethanol fermentations from cassava roots and CM treated with alpha-amylase were carried out using Saccharomyces cerevisiae, as a function of cell concn. ranging from 0.3 to 15.0 g/l. Ethanol productivities and yields were not affected by the cell concn. unless this was below 0.3-0.6 g/l (dry base). Av. ethanol productivities of about 4.0%/h were consistently obtained with ethanol yields ranging from 85 to 90%. Regarding reaction rates, it was found that unless low values of initial cell concn. were used, saccharification became the limiting step of the overall process. (Extracted from author's summary) 103

0106

21167 INSTITUT DES SCIENCES AGRONOMIQUES DU BURUNDI. 1983. L'enrichissement protéiné du manioc. (Cassava protein enrichment). In ______. Proposition pour un plan quinquennal (septembre 1983-aout 1988) de la recherche agronomique a l'ISABU. Bujumbura. v.2,pp.206-210. Fr.

Cassava. Protein enrichment. Fermentation. Moulds. Industrial microbiology. Cassava programs. Development. Burundi.

A simple semisolid fermentation technique for protein enrichment of cassava is described that allows the direct local utilization and conversion of the crop. The substrate consisting of finely ground cassava (2-5 mm) is autoclaved at 120°C for 20 min and is latter mixed with an acidified solution (pH 1.2) of nutritive salts (urea, KH_2PO_4, $MgSO_4$) containing spores of a filamentous fungus. The mixture with 60% moisture and pH

3.5 is left fermenting over a sieve for 2-3 days, then dried and converted into flour with 12-14% protein. The advantages and disadvantages of this technique are discussed. A chronological research plan on cassava protein enrichment in Burundi is included in addition to scientific and logistic support personnel. (Summary by I.B. Trans. by L.M.F.) 103

0107

22073 PARK, W.S.; KOO, Y.J.; SHIN, D.H.; MIN, B.Y. 1983. Study on the pattern of starch assimilation by Sporobolomyces holsaticus. Korean Journal of Food Science and Technology 15(2):177-182. Ko., Sum. Engl., Ko., 18 Refs., Illus. [Food Research Inst./AFDC, Hwasung-Kun Kyunggi-Do, 170-31, S. Korea]

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

The direct conversion of starchy materials to SCP by Sporobolomyces holsaticus FRI Y-5 was investigated. When the effect of yeast extract concn. on cell growth was studied, it was found that more starch could be used in the medium containing 2.5 g/l of yeast extract. Specific growth rate and cell yield of S. holsaticus on soluble starch in a jar fermenter culture were calculated to be 0.14/h and 0.425, resp., and max. cell concn. was 13.4 g/l. After 80 h of incubation, 45.96% of the starch was consumed and 45.1% of the relative blue value was decreased. Reducing sugars in the starch medium increased from 4.06 to 6.08 g/l and then decreased. During fermenter culture the pH of the medium was in the range of 7.0 $\pm$ 0.5. Optimal temp. and pH of S. holsaticus amylase activity were 40°C and 7.5, resp. Optimal concn. of cassava starch for S. holsaticus was found to be lower than that of soluble starch. FRI Y-5 cells settled much slower than S. holsaticus IFO 1032 cells and the relationship of viscosity vs. cell concn. was linear. (Author's summary) 103

0108

21165 SPEICHIM. DEPARTEMENT DE L'INGENIERIE AGROINDUSTRIELLE. High protein cassava. Adour-Speichim process. Bondy, France. s.f. 29p. Engl., Illus.

Also in Spanish.

Cassava. Protein enrichment. Cassava starch. Fermentation. Yeast production. Composition. Processing. Industrial machinery. Economics. Marketing. France.

The Adour-Speichim process that turns cassava, a traditional food of very low nutritional value, into a highly nourishing product, is described in detail. A pilot plant was set up on the campus of Compiegne Technological U. (France) to obtain protein- and vitamin-enriched cassava by combining with food yeast, which allows fermentation without prior hydrolysis. The plant is composed of standard items of equipment and consists of 3 parts: rootstock preparation and grating section, yeast mill, and end product processing section. The agroindustrial complex requires an organized cropping system at both the industrial and village levels. The process uses set levels of the starch and inorganic salts required for yeast growth, and of pH, temp., and aeration to enable the yeast to synthetize an amylase capable of hydrolyzing the starch into simple sugars (50% yeast yield). The concd. and plasmolized solution is then mixed with fresh cassava. All HCN is eliminated during the process. The composition and main properties of the end product are shown in tables; it can be used as flakes, biscuits, snacks, flat loaves, as a basis for baby foods, or in other prepared foodstuffs. Agronomic, industrial, economic, and marketing aspects of cassava growing are considered. A process flow sheet and a specimen layout of the production plant are included. Speichim's industrial experience on fermentation processes and the collaboration of several organizations are stressed. (Summary by I.B.) 103

0109

19230 UEDA, S. 1981. Fungal glucoamylases and raw starch digestion. Trends in Biochemical Sciences 6(3):89-90. Engl., 20 Refs.

Cassava. Cassava starch. Moulds. Biochemistry. Alcohol. Fermentation. Japan.

Aspects discussed are digestion of raw starch by amylase (black mold amylase vs. yellow mold amylase, i.e. Aspergillus awamori vs. A. oryzae); different forms of glucoamylase; the effect of culture conditions on the no. of glucoamylases; relationship between debranching activity, raw starch adsorption, and digestion; digestion of potato starch; and alcoholic fermentation of raw maize or cassava starch by using glucoamylase. (Summary by Food Science and Technology Abstracts) 103

J00 ECONOMICS AND DEVELOPMENT

0110

22027 AKINLOSOTU, T.A.; EZUMAH, H.C. 1980. State of art on cassava production in Nigeria. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.259-263. Engl., 3 Refs.

Cassava. Production. Nigeria.

Cassava is the most important food crop in Nigeria and is the 2nd largest producer in Africa, after Zaire. In Nigeria cassava is only grown for its roots, which are processed into items such as fufu, gari, and lafun; it is also an important source of raw material for the starch industries. Waste products such as the peelings are also used as livestock feed (goats, pigs, and sheep). Several agronomic aspects and production practices in Nigeria are described. Cassava production is limited by lack of capital, low yielding local cv., diseases, and 2 recently introduced pests, the green spider mite and the cassava mealybug. Before these 2 pests, those causing most problems were Zonocerus variegatus, Oligonychus gossypii, Lagria villosa, and Bemisia tabaci. Measures taken by the government to solve these problems are mentioned. (Summary by EDITEC. Trans. by L.M.F.) J00

0111

20772 ANTIOQUIA. SECRETARIA DE AGRICULTURA Y FOMENTO. 1983. Aspectos generales sobre el cultivo de la yuca en el Departamento de Antioquia. (General aspects of cassava cultivation in Antioquia, Colombia). Medellín. 50p. Span., 9 Refs., Illus.

Cassava. Composition. Cultivation. Cultivars. Injurious mites. Injurious insects. Acaricides. Insecticides. Diseases and pathogens. Xanthomonas campestris pv. manihotis. Mycoses. Mycoplasmoses. Disease control.

Harvesting. Storage. Uses. Human nutrition. Animal nutrition. Production. Consumption. Costs. Prices. Marketing. Trade. Economics. Colombia.

Based on agricultural statistics, general aspects of cassava cultivation in Antioquia, Colombia, are presented. In 1981, 15,900 ha were planted to cassava with a production of 174,200 t/yr, 10.9 t/ha. Agronomic considerations such as botany, history, toxicity and chemical composition, climate and soils, var., cropping systems and practices, pests and diseases, harvest, conservation, uses, and yield are discussed in addition to aspects of production, marketing, and consumption (types of exploitation, inputs, costs and prices, marketing and commercialization channels, credit, storage, packing, and quality standards). (Summary by I.B.) J00

0112

22026 BAUBEBET-N'NANG, E. 1980. State of art on cassava production in Gabon. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.255-258. Engl.

Cassava. Cassava programs. Research. Cultivars. Selection. Gabon.

Almost 3/4 of the people in Gabon consume cassava in some way, particularly in the form of leaves and roots. Research priorities include improving the present mode of preparation to reduce production losses in traditional processing, establishing structures for an animal feed industry, developing projects that study different forms of root storage, determining losses during storage, and identifying simple economical storage methods. Results of trials with local materials and introduced germplasm are briefly described. Selected var. from the International Institute of Tropical Agriculture (Nigeria) and from Ivory Coast and some local var. constitute the materials for extension. The next step is to organize and build up an efficient network for the distribution of these materials. (Summary by EDITEC. Trans. by L.M.F.) J00

0113

21154 CHANG, J., ed. 1983. Resolutions: general recommendations. In ________. Agricultural research in Rwanda: assessment and perspectives, Kigali, Rwanda, 1983. Report of a seminar. The Hague, Netherlands, International Service for National Agricultural Research. pp.207-210. Engl.

Cassava. Research. Rwanda.

Recommendations of a seminar carried out on agricultural research in Rwanda are given. Cassava should be included as 7th in order of priority on the list of food crops that must receive research emphasis. Each group of different crops will have a basic research team (plant breeding, agronomy, pathology, and entomology) with support units (agricultural engineering, postharvest technology, microbiology, soil science, economy, extension agronomy, and biometrics); more consideration will be given to the collection, introduction and conservation of germplasm, plant breeding, agronomy, crop protection, postharvest technology, and farm tools. It was recommended to have education, research, and extension more closely integrated; improve seed production and distribution; strengthen the interinstitutional relationships of the Institut des Sciences Agronomiques du Rwanda; and to assign a postharvest researcher for the root and tuber crops group (which includes cassava). (Summary by EDITEC. Trans. by M. de W.) J00

0114

23030 COCK, J.H. 1985. Cassava: new potential for a neglected crop. Boulder, Colorado, Westview Press. 205p. Engl., 74 Refs., Illus.

Cassava. Production. Consumption. Human nutrition. Animal nutrition. Plant anatomy. Feeds and feeding. Cassava products. Uses. Processing. Cultivation. Propagation materials. Timing. Planting. Soil fertility. Soil requirements. Diseases and pathogens. Weeding. Herbicides. Injurious mites. Injurious insects. Harvesting. Technology. Cultivars. Fertilizers. N. P. K. S. Ca. Zn. Pest control. Disease control. Biological control. Quarantine measures. Post harvest technology. Storage. Cassava chips. Pellets. Cassava starch. Alcohol. Cassava programs. Research. Development. India. Colombia. Cuba.

An exhaustive overview of cassava is given. In the 1st part its worldwide nutritional importance is highlighted, and a general description of the crop is presented. The different uses of cassava for human consumption, animal feed, and industrial purposes are then commented. Cassava production, cultivation and relevant technology, and recent developments in postharvest technology are reviewed. Finally case studies of cassava improvement and their impact on cassava development projects are analyzed, as well as features of cassava programs, stressing research and government policies. Illustrations are included, information and technical assistance sources are listed, and annotations are furnished for the literature cited. (Summary by M. de W.) J00

0115

20789 COLORADO D., N.; MENDEZ R., A. 1983. Logros y aportaciones de la investigación agrícola en el cultivo de la yuca. (Advances and contributions of agricultural research to cassava cultivation). México, Instituto Nacional de Investigaciones Agrícolas, Secretaría de Agricultura y Recursos Hidráulicos. Publicación Especial no.108. Span., 21 Refs., Illus. [Campo Agrícola Experimental "Huimanguillo", México]

Cassava. Cassava programs. Plant breeding. Cultivation. Pest control. Post harvest technology. Processing. Animal nutrition. Socio-economic aspects. Mexico.

Results of research on cassava cultivation in Mexico, where 4033 ha were planted to cassava in 1977, are given, with particular emphasis on the states of Tabasco and Chiapas. Several outstanding collections, var., and hybrids are M Pan 51 (45.3 t/ha), Guaxupe (36.6 t/ha), and SG 596 C59-12 (36.6 t/ha) on acid soils, and M Mex 59 (48.1 t/ha), M Mex 60 (45.7 t/ha), and ITU (38.1 t/ha) on nonacid soils. Recommended cultural practices include: (1) dipping of cassava cuttings (2-node cuttings for rapid propagation) in a mixture of oxytetracycline (125 g), maneb (125 g), captafol (125 g), and malathion (100 cc)/100 l water, for 5 min; (2) population densities of 15,000 plants/ha (1 x 0.6 m) for monocropped cassava, and of 13,000 cassava plants/ha (1.20 x 0.65 m) and 80,000 bean plants/ha (0.45 x 0.02 cm) for cassava/grain legume intercropping; (3) fertilization with 60-120-60 in pure stands and with 30-90-00 in associated cropping; (4) use of disease-tolerant var. such as: M Col 617, M Col 953, and M Ven 168, all tolerant to superelongation (Sphaceloma manihoticola); M Pan 51 and M Col 538, both tolerant to bacterial blight (Xanthomonas campestris pv. manihotis); and M Mex 59, tolerant to brown leaf spot (Cercosporidium henningsii). Data are presented on postharvest handling and processing, nutrition (70% ensiled cassava + 30% molasses = 0.69 kg av. daily wt. gain; 4.17 feed efficiency in pig rations), and socioeconomic aspects. (Summary by I.B.) J00

0116

22703 COURSEY, D.G. 1984. Potential utilization of major root crops, with special emphasis on human, animal, and industrial uses. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.25-35. Engl., Sum. Engl., 75 Refs.

Cassava. Root crops. Production. Human nutrition. Toxicity. Animal nutrition. Feeds and feeding. Cassava starch. Uses. Energy productivity.

Root crops in developing countries are mainly used for human food. Most are still grown by small-scale farmers, who operate within the subsistence economy, with only limited off-takes of produce to the market economy supplying the rapidly growing urban centers. With cassava in much of Latin America, yams in West Africa and the Caribbean, and taro in the Pacific, a trend exists, and may be expected to increase with further urbanization, toward semicommercial or commercial production, together with the development of more sophisticated marketing systems. Yams and, in most circumstances, taro, other aroids, and minor root crops command too high a price for significant amounts to be available for uses other than human food, although peelings, waste, etc., are used as animal feed within subsistence economies. Cassava is in a completely different category, the costs of equicaloric amounts being only about 1/5 of those of yam. Similarly, sweet potato, with 2-4 crops/yr, is productive and like cassava is seldom a preferred food. These 2 crops can, therefore, supply substantial surpluses beyond food demands; the former, especially, is already being exploited for animal feed, edible and industrial starch, and other derived products. Although alternative uses of tropical root crops will probably increase, their primary role is likely to remain as human food in producing countries. (Author's summary) JOO

0117

21424 CUNHA, M.A.P. DA 1984. Diretrizes da pesquisa em mandioca e fruticultura no Brasil. (Research guidelines for cassava and the cultivation of fruit trees in Brazil). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Centro Nacional de Pesquisa de Mandioca e Fruticultura. Documentos no.13. 50p. Port., 2 Refs., Illus. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Cassava programs. Research. Brazil.

A synthesis of research implementation and coordination work carried out by Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)/Centro Nacional de Pesquisa de Mandioca e Fruticultura (CNPMF) is presented, and data are provided to answer basic questions concerning research systems on cassava, pineapple, banana, citrus fruits, and mango in Brazil. Current research models are described: the Collaborative System of Agricultural Research; Circular Programming of Research, which includes problem identification and definition, generation of technology and disciplinary interaction, and publication of results; national research programs; and basic activities developed by CNPMF and EMBRAPA/CNPMF. Research priorities and results (1983-84) are presented for the resource center areas (Cerrados, semiarid tropics, and humid tropics). The cassava germplasm bank comprises more than 900 accessions and a breeding program has been established for each different ecosystem. Min. tillage and double-row cropping in association with beans improved land use efficiency and reduced costs. (Summary by I.B.) JOO

0118

21171 DUMONT, R. 1980. Synthese des études sur les tubercules de Haute Volta 1977-1978-1979. (Synthesis of studies on tuber crops in the Upper Volta 1977-1978-1979). Paris, Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres. 97p. Fr., Illus.

Cassava. Cultivation. Climatic requirements. Productivity. Trade. Toxicity. Diseases and pathogens. Pests. Zonocerus variegatus. Upper Volta.

Surveys were conducted to gather information on, and to determine the importance of tuber crops (yam, sweet potato, cassava, rushnut, and Solenostemon rotundifolius) in the Republic of Upper Volta, in 1977-78-79. Cassava, a subsistence crop that is consumed fresh, is the 3rd most important crop after yams and sweet potatoes, and in the areas surveyed, its commercialization was 90%. It is cultivated in Koupela, Ougadougou and certain areas of Pama and Kantchari. Out of 80,000 ha suited for cassava cropping, only 2% are planted to the crop. Some of the problems of the crop are: high HCN content and toxicity; low yields (8-15 t/ha in the SE, 2 kg-3 t/ha in other regions); lack of transportation routes, marketing systems, and of production, processing and conservation techniques. Crops are not protected from animals and rodents, pests (Zonocerus variegatus), and diseases. Recommendations for improving production are given. (Summary by I.B.) J00

0119

22339 EDWARDSON, W.; MacCORMAC, C.W., eds. 1984. Example of a mixture experiment. In ________. Improving small-scale food industries in developing countries. Ottawa, Canada, International Development Research Centre. pp.141-143. Engl., Illus.

Cassava. Cassava flour. Food products. Experiment design. Organoleptic examination. Malaysia.

An example is given of the exptl. formulations required to select a combination of ingredients, and their resp. levels, to produce an acceptable high-protein snack food, similar to the traditional fish cracker keropok. The product designed for the Malaysian market, has a high % of CF, soy flour, and fish. (Summary by M. de W.) J00

0120

21423 EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA. CENTRO NACIONAL DE PESQUISA DE MANDIOCA E FRUTICULTURA. 1984. Inventario tecnológico de mandioca. (Technological inventory of cassava). Cruz das Almas-BA, Brasil, Centro Nacional de Pesquisa de Mandioca e Fruticultura. Documentos no.14. 74p. Port.

Cassava. Cassava programs. Research. Plant breeding. Cultivars. Selection. Root productivity. Starch content. Resistance. Diseases and pathogens. Bacterioses. Xanthomonas campestris pv. manihotis. Glomerella cingulata. Oidium. Uromyces manihotis. Sphaceloma manihoticola. Frog skin disease. Cassava African mosaic virus. Disease control. Entomology. Erinnyis ello. Erinnyis alope. Silba pendula. Insect control. Insecticides. Biological control. Predators and parasites. Anastrepha pickeli. Teleocoma crassipes. Coelosternus granicollis. Coelosternus manihoti. Coelosternus notaticeps. Coelosternus rugicollis. Eudiplosis brasiliensis. Injurious insects. Injurious mites. Thrips. Mononychellus tanajoa. Tetranychus cinnabarinus. Mite control. Acaricides. Cultivation. Mulching. Fertilizers. N. P. K. Soil amendments. Technology. Land preparation. Timing. Planting. Spacing. Propagation materials. Irrigation. Pruning. Harvesting. Post harvest technology. Cassava meal. Protein enrichment. Soybeans. Cassava starch. Uses. Industrial microbiology. Alcohol. Production. Brazil.

Cassava technology available up to 1976 is summarized, representing a historical frame of reference of 2 research eras (creation of Empresa Brasileira de Pesquisa Agropecuária/Centro Nacional de Pesquisa de Mandioca e Fruticultura) on this Euphorbiaceae. Specialists from several institutions, assigned to 5 work groups, worked on the final evaluation of documents. Data are presented on genetic improvement (available technology, research priorities), plant pathology, entomology, plant nutrition and fertilization, cultural practices and industrialization (including the technological program of the National Institute of Technology, INT). (Summary by I.B.) JOO

0121

22048 EMPRESA CATARINENSE DE PESQUISA AGROPECUARIA. 1982. Programa mandioca. (Cassava program). In ________. Relatório técnico anual 1981. Florianópolis-SC, Brasil. pp.151-161. Port.

Cassava. Cassava programs. Cultivars. Selection. Cultivation. Propagation materials. Storage. Disease control. Pest control. Technology transfer. Fertilizers. Brazil.

General considerations about the importance of cassava in the state of Santa Catarina, Brazil, are presented; it is used as starch, industrial and table flour, animal feed, fresh, and for alcohol production. Limitations of the crop and objectives of the research program of Empresa Catarinense de Pesquisa Agropecuária are mentioned and several cassava projects are discussed. In one that studied 2 different ecosystems, Agrolandia (Alto Vale) and Jaguaruna (Litoral Sul), the differential behavior of 14 cv. was confirmed and 5 were selected (Mantiqueira IAC 24-2, IAC 14-18, Aipim Gigante, Vassourinha JC-2, and S. 4-342). In another on cassava/bean intercropping, the cassava yield in double rows was found to be superior to the traditional system. When cassava was intercropped with summer legumes simultaneous planting was impractical; on the other hand, it is necessary to evaluate planting distances. Other studies were conducted on storage and conservation of cassava stakes; var. resistance to bacterioses (so far 113 promising cv. have been selected); pest control; N, P, and K fertilization and liming; and integration of research, extension, and production for dissemination of technologies. Two production systems, that exceed the foreseen cassava root yields (17.6 and 22.2 t/ha, resp.) and are agronomically and economically viable, have been analyzed. Studies on green manuring with legumes in Araranguá soil, during the rainy months showed that it is necessary to find legumes that do not require fertilization. (Summary by I.B. Trans. by M. de W.) JOO

0122

22005 EZUMAH, H.C.; LUTALADIO, N.B. 1980. Organization and conducting of multilocational cassava evaluation including cultural practices. In ________., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.33-36. Engl.

Cassava. Field experiments. Land preparation. Weeding. Plant development. Diseases and pathogens. Pests. Agronomic characters. Africa.

The questions that have to be answered by the researcher when planning multilocational trials are discussed. When organizing the trials, cassava clones selected by the Programme National Manioc (PRONAM) in Zaire are tested at different locations for their reactions to certain variables such as soil type, alt., temp., rainfall, diseases, pests, light intensity, and vegetation. Tests should be limited to a few manageable variables in order to prevent confusion of effects. Standard practices used in the areas should be employed. Early planting, soon after the 1st rains, is recommended. For cassava var. trials a plot area of 6 x 4 m is suggested; if the borders are included then an area of 8 x 6 m should be used. A randomized complete block design with a min. of 4 replications is acceptable. The no. of var. evaluated should not exceed 10. Plant spacing employed by PRONAM is 1 x 1 m. Stakes should have the same age and size (30 cm), and be planted at a 30-45° angle. Weeding must be done according to need but a max. of 3 weedings before the plants are 16 wk. old. Vigor is measured on a 1-5 scale (1 = excellent; 5 = poor). Other parameters that should be measured during plant development are height, no. of leaves and of branches, general ability of the plant to stand environmental and biological stresses, and leaf area. The severity (scale from 1-5, 1 = no symptoms; 5 = death) and incidence (no. of attacked plants as a % of total plants) must be measured to evaluate the diseases and pests of major economic importance such as mosaic, CBB, cassava mealybug, and green spider mite. The recommended procedure to determine yield is given. (Summary by EDITEC. Trans. by M. de W.) JOO

0123

22341 FEDERACION NACIONAL DE CAFETEROS DE COLOMBIA. PROGRAMA DE DESARROLLO Y DIVERSIFICACION DE ZONAS CAFETERAS. 1983. Yuca (Chirosa Armenia). [Cassava (Chirosa Armenia)]. In ________. Productos agrícolas perecederos: bases de análisis, proyecciones 1984. Bogotá, Departamento de Mercadeo. Series de Precios 1979-1983. Boletín no.12. pp.265-272. Span., Illus.

Cassava. Cultivars. Statistical data. Marketing. Prices. Colombia.

Sale price trends of cassava var. Chirosa Armenia in the markets of Bogotá, Cali, and Medellín (Colombia), between 1979-83, are described. The pattern is very similar for the 3 centers: a constant decrease in the price/kg during the 1st 2 yr, a fast increase in the 4th and a decrease in the 5th. Forecasts for 1984 are presented: Bogotá will be the cheapest market because of the highest offer and Medellín will be the most expensive. Areas that supply each market with this var. are mentioned. (Summary by M. de W.) JOO

0124

22342 FEDERACION NACIONAL DE CAFETEROS DE COLOMBIA. PROGRAMA DE DESARROLLO Y DIVERSIFICACION DE ZONAS CAFETERAS. 1983. Yuca (Llanera). [Cassava (Llanera)]. In ________. Productos agrícolas perecederos: bases de análisis, proyecciones 1984. Bogotá, Departamento de Mercadeo. Series de Precios 1979-1983. Boletín no.12. pp.273-276. Span., Illus.

Cassava. Cultivars. Statistical data. Marketing. Prices. Colombia.

Sale price trends of cassava var. Llanera in Bogotá's market (Colombia) between 1979-83 are described; projections and forecasts for 1984 are given. It is suggested that price fluctuations were due to the irregular supply. Areas supplying this var. are mentioned. (Summary by M. de W.) JOO

0125

20182 FERREIRA, L.D. 1980. Análise técnico-economica da producao de mandioca e comercializacao de mandioca e polvilho azedo nos municípios de Conceicao dos Ouros e Cachoeira de Minas. (Technical-economical analysis of production and commercialization of cassava and sour cassava starch in the municipalities of Conceicao dos Ouros and Cachoeira de Minas). Tese Mestrado. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 62p. Port., Sum. Port., Engl., 22 Refs., Illus.

Cassava. Cultivation. Production. Statistical data. Cultivation systems. Land preparation. Timing. Planting. Spacing. Propagation materials. Cuttings. Weeding. Injurious insects. Harvesting. Fertilizers. Labour. Costs. Processing. Factories. Cassava starch. Trade. Marketing. Economics. Brazil.

A survey of 71 cassava producers was conducted in 1977 in the municipalities of Conceicao dos Ouros and Cachoeira de Minas, MG, Brazil, to determine agricultural practices used and production costs, and 17 cassava starch factories were examined to determine the commercialization flow of raw material and the industrialization of the product. Technical and economic factors of the cassava production process were analyzed and the commercialization flow of cassava and sour cassava starch was determined. The influence of the economic results per cassava producer and per kg cassava was examined. The farms surveyed did not present sufficient use of recommended production techniques. It was also observed, with exceptions, that with an increase in the area planted there was a tendency of the farmers to use recommended production practices and techniques. The total fixed cost was estimated at Cr$11,757.98, total variable cost at Cr$47,659.85, and the total cost at Cr$59,417.83. Expenditures on land were found to be the heaviest for the cassava crop, being 73.06% of the total fixed cost. Manual labor was the heaviest item for the total variable cost, representing 42.93%. The mean cost/kg cassava was Cr$0.62; at this cost the mean variable cost was Cr$0.49 and the mean fixed cost was Cr$0.13. It was verified that the mean costs decreased with an increase in the area planted, in hectares, which seems to have a scale economy of the surveyed farms. The survey of cassava starch factories verified that a large part of the cassava roots were acquired within the area studied and in surrounding districts. About 20% of cassava roots were bought in the state of Sao Paulo. Small factories also produce sour cassava starch. There is also an input of sweet cassava starch, which can be mixed with the sour starch. The margin of gross profit, without discounting the cost of industrialization of sour starch, was positive in the 2 municipalities studied. The gross commercialization margen in Cachoeira de Minas was less than that observed in Conceicao dos Ouros. (Author's summary) JOO

0126

22314 GATEL, P. 1980. Les céréales fourrageres en 1980. Faiblesses et remedes. (Feed grains in 1980. Weak points and solutions). Producteur Agricole Francais 56(272):14-16. Fr., Illus.

Cassava. Cereals. Substitutes. Feeds and feeding. Marketing. Trade. France.

The situation of feed grains in France in 1980 is analyzed, and the results of the cereal commercialization campaign of 1979-80 are discussed. During this period the production of compound feed increased by 4.5% and cassava imports decreased from 622,886 to 106,342 t in 8 mo., while its prize stabilized. Therefore, the use of cereals was favored. The policies of laissez-faire regarding cereal substitutes (CS) have been detrimental to cereal producers. In the remaining countries of the EEC, cassava imports have kept their primacy (approx. 5.2 million tons). It is believed that the consumption of CS in the EEC will increase to 22 million tons, which would cause a 30% drop in the market of cereals for animal feed. The proposed solutions (fix an import tariff for cassava; self-limitation of production in supplier countries; control measures on CS) condition the agricultural relationships of France with the Netherlands and Germany. The equilibrium between the cereals such as wheat and oats and maize in 1979-80, the relationship between the animal feed industry and farmers, and the quality of cereals, are also discussed. (Summary by I.B. Trans. by M. de W.) J00

0127

22049 GHOSH, S.P.; NAIR, R.G. 1984. Tuber crops research and development. Indian Farming 33(12):5-8,15. Engl. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum 695017 Kerala, India]

Cassava. Cassava programs. Statistical data. Research. Plant breeding. Technological package. Pest control. Disease control. Cultivation. Post harvest technology. India.

The worldwide importance of tuber crops such as sweet potato, cassava, and yam, particularly in India, is discussed. Research and advances made at the Central Tuber Crops Research Institute, Trivandrum, during the last 2 decades, are summarized for the areas of: (1) germplasm collection, conservation, catalogation, and evaluation (1320 cassava lines/genotypes); (2) var. improvement, with the release of cv. H-97, H-165, and H-226 in 1971, and H-1687 (high carotene content) and H-2304 (29% starch) in 1977; (3) technical packages; (4) pests and diseases; of which 36 and 33, resp., have been reported in the country; (5) intercropping; (6) postharvest utilization, with reports on a procedure to produce alcohol, a chemical treatment of the dried cassava chips to extend shelf life with sodium hypochlorite (0.5%), the storage of roots in moist saw dust or sand, and the development of a chipper; (7) extension and training; and (8) regional studies. The all-India coordinated project for the improvement of tropical tuber crops is reported. Research strategies up to the year 2000 are discussed: areas planted to cassava and productivity should be increased; av. yields of 40 t/ha should be obtained with earlier maturing cv. resistant to drought and diseases. Production constraints are mentioned, as well as possible solutions. (Summary by I.B. Trans. by M. de W.) J00

0128

22003 HAHN, S.K. 1980. Opportunities at IITA for national programs in Africa. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.19-24. Engl.

Cassava. Cassava programs. Development. Technology transfer. Cultivation. Plant breeding. Entomology. Diseases and pathogens. Tissue culture. Africa.

The primary objective of the root and tuber improvement program of International Institute of Tropical Agriculture (IITA) is to develop viable production technologies readily adaptable to all root and tuber crops, principally in terms of improved var. and improved cultural methods suited to the humid and subhumid tropics. It should also assist in developing national root and tuber improvement programs by providing improved breeding materials and advanced technologies that can be handled, used, and understood by local farmers. The program follows an interdisciplinary team approach involving agronomy, breeding, entomology, pathology, nematology, and tissue culture. One of the important aspects of the program are the yearly training courses held for graduate and technically trained members of the national root and tuber improvement programs. The program has the largest cassava breeding program of the world, producing from 100,000 to 200,000 improved cassava genotypes/yr. IITA has been successful in producing improved cassava var. that are highly resistant to CBB, mosaic, and anthracnose, as well as high yielding and acceptable in quality and root shape. The program distributes genetic material of these improved var. to several national cassava programs in Africa and Asia. The Programme National Manioc (PRONAM), a collaborative program between IITA and Zaire, has the following objectives: identification and development of higher yielding cassava var.; identification of sources of resistance to major diseases and pests, incorporating this resistance into high yielding potential var.; development of a package of cultural practices that would allow the optimum economic yield to be reached; and development of high quality cassava var. in terms of both consumer acceptance and nutrition. One of the main achievements of the program has been the identification of sources of resistance to CBB and common mosaic virus. (Summary by EDITEC. Trans. by M. de W.) J00

0129

20786 HUTTON, D.G.; WAHAB, A.H. 1981. Position paper on root crops in Jamaica. Kingston, Ministry of Agriculture. 28p. Engl., 37 Refs.

Cassava. Production. Statistical data. Research. Jamaica.

The findings and recommendations of the Root Crop Commodity Research Committee established in 1979 by the Ministry of Agriculture of Jamaica are reported. Crops deserving immediate attention are Dioscorea spp., Manihot esculenta, Solanum tuberosum, Ipomoea batatas, Colocasia spp., and Xanthosoma spp. The production of root crops in Jamaica between 1970-79 is briefly discussed; cassava production increased from 22.22 to 31.52 thousand short tons, estimated acreage from 5791 to 6250, and av. yield from 3.8 to 5.1 t/ac. Local and export potential of root crops, and production constraints observed are considered, namely, pests and diseases, high costs of fertilizers and pesticides, lack of equipment and implements, scarcity of planting material, labor unavailability, lack of storage facilities and of information, inappropriate agronomic practices, and predial larceny. Research carried out since 1970 on agricultural engineering, agronomy, crop protection, and storage and infestation is briefly reviewed. Cassava research priorities include the control of mites, thrips, and bud maggots (Silba pendula), and the identification of high-yielding local and imported cv., with high DM content, proper root orientation, and acceptable skin thickness. Development priorities are rapid multiplication of planting material (superior cv.) and identification of cropping or rotation systems with cassava as the main or alternate crop. (Summary by I.B.) J00

0130

22023 KANGA, P. 1980. State of art on cassava production in Angola. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.231-232. Engl.

Cassava. Cassava programs. Technology transfer. Diseases and pathogens. Pests. Angola.

Cassava occupies 1/3 of the cultivated land of Angola and constitutes the basic food of its population after maize. Both leaves and roots are consumed. Economic development projects aim at the transfer of advanced technologies to rural populations. It is necessary that cooperatives create conditions that favor the use of the best available technologies in production and diversification of farm products. Large-scale cassava production projects and research are planned. Main diseases and pests in the region include CAMD, Cercospora, CBB, the cassava mealybug, and the green spider mite. (Summary by EDITEC. Trans. by L.M.F.) J00

0131

20199 LORENZI, J.O.; PEREIRA, A.S.; VALLE, T.L.; MARTINEZ, A.A. 1983. Farinha de raspas de mandioca no pao, por que nao? (Cassava chip flour in breadmaking). Casa da Agricultura 5(5):5-9. Port., 11 Refs., Illus. [Inst. Agronomico de Campinas, Av. Barao de Itapur 1481, Campinas-SP, Brasil]

Cassava. Production. Uses. Cassava flour. Cassava bread. Brazil.

The historical trajectory of cassava in Brazil, as both a traditional and an emergency crop for times of crisis, is analyzed. The importance of cassava in the state of Sao Paulo, where highest productivity is attained (20 t/ha and, with appropriate technology, possibly 30 t/ha), is stressed. The crop shows a higher technological level in the south and southeast. A reactivation of this crop and the promotion of cassava as a partial substitute for wheat flour will depend on market expansion of cassava by-products at satisfactory prices. Many factories currently not working could reinitiate activities at a low cost. The advantages of reactivation of cassava cultivation are given. (Summary by I.B.) J00

0132

22024 LYONGA, S.N. 1980. State of art on cassava production in Cameroon. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.233-247. Engl.

Cassava. Cultivation. Root productivity. Intercropping. Cassava programs. Research. Diseases and pathogens. Pests. Cultivars. Selection. Mechanization. Cameroon.

Cassava, the most widespread root crop in Cameroon, is grown on small farms (0.25-1.0 ha). Most of the crop is immediately processed after harvest to enable its preservation. Cropping systems used are briefly described: early cassava + cereals + vegetables, cereals + vegetables + legumes + late cassava, yam + early vegetables + late cassava, cassava in monoculture, and cassava as a catch crop to perennials. Research work carried out by the Cameroon National Root Crops Improvement Program is discussed: root crops survey (1978) which detected the presence of common mosaic, CBB, CAMD, leaf spots (Cercosporidium henningsii, Cercospora vicosae, C. caribaea, and Phyllosticta sp.), and root rots (Rigidoporus lignosus and Phytophthora sp.); collection of germplasm (120 local accessions); cassava selection; and agronomic studies on mixed cropping with maize, planting methods and time. The extensive spread of cassava calls for a larger no. of researchers; an active training program is trying to fill this need. There is also need to mount an educational campaign to convince potential cassava producing communities that cassava does not impoverish the soil more than any other root crop. Materials should be screened in different ecological zones for resistance to common mosaic. Another priority area of research is the mechanization of cassava cultivation, especially harvesting. Research should be conducted on root storage and processing. (Summary by EDITEC. Trans. by L.M.F.) J00

0133

16663 MANDIOCA. (Cassava). Acompanhamento da Situacao Agropecuária do Paraná 4(7):33-36. 1978. Port.

Cassava. Production. Cassava meal. Prices. Brazil.

The importance of cassava in the Brazilian agricultural context is briefly analyzed. During the 1950's, 3% cassava was used in bakery products by federal statute. Later cassava ceased being competitive due to wheat subsidies, especially in the state of Parana. Several limitations to cassava cultivation in the state of Parana are discussed, namely, drought, little commercialization, low available capital of starch factories, low prices considering that several industries pay their suppliers depending on starch content of the product, low harvest rate (50% of harvesting consisting of cassava 1.5 and 2 yr old), low productivity, and poor quality. Suggestions are to subsidize starch exports, use starch in bakery products, enforce favorable policies, adopt support prices, and extend time limit for credits. (Summary by I.B. Trans. by L.M.F.) J00

0134

22028 MULINDAGABO, J. 1980. State of art on cassava production in Rwanda. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.265-271. Engl., 2 Refs.

Cassava. Cassava programs. Cassava common mosaic virus. *Mononychellus tanajoa*. Plant breeding. Resistance. Rwanda.

Cassava is 2nd to sweet potato as human food in Rwanda and is produced in 4 of the 12 different agricultural regions of the country. The Institut des Sciences Agronomiques du Rwanda (ISAR) selected var. EALA 07, which is now being released on a large scale and yields between 10-15 t/ha in 18-24 mo. In Rwanda, roots are preferred for consumption. Several aspects of cassava extension and distribution of planting materials are described. Main constraints to cassava production include the common mosaic, CBB, *Cercospora*, and *Phyllosticta* among diseases, and the green spider mite among pests. To solve the problems created by common mosaic and the green spider mite, a breeding program for resistance is needed. Materials introduced from the International Institute of Tropical Agriculture (IITA), Nigeria, have showed resistance to mosaic under Karema environmental conditions. Rwanda expects collaboration from IITA in building up its breeding program, which will also facilitate exchange of materials and information. ISAR is trying to identify plants tolerant to the green spider mite, make crosses between them and selected clones with the hope of selecting resistant plants. (Summary by EDITEC. Trans. by L.M.F.) J00

0135

21499 NAVAS, J.; MUNEVAR M., F. 1984. Proyecto de investigación en cultivos de ciclo corto. (Research project on short-cycle crops). Lima, Perú, Red de Investigación Agroecológica para la Amazonía. 49p. Span., 10 Refs., Illus.

Cassava. Cassava programs. Development. Plant breeding. Cultivars. Selection. Resistance. Hybrids. Cultivation. Timing. Planting. Spacing. Weeding. Soil conservation. Banana-plantain. Cowpea. Intercropping. Post harvest technology. Cassava chips. Drying. Cassava starch. Cassava flour. Peru.

Cassava was included in the research project on short-cycle crops of the Agroecological Research Network of the Amazon, because of its present importance and great potential in the region. It is the source of carbohydrates in the Indian and colonizers' diet; 4/5 of this population grow 1-2 ha of cassava for domestic use. The proposed patterns for the

Amazonian soils utilization with short-cycle crops include germplasm collection and evaluation, the generation of new genotypes, agronomic studies and production systems. Germplasm will be collected in the Amazonian countries (Colombia, Brazil, Peru, Ecuador, Venezuela, Bolivia). Ten clones will be selected among the best available at the Instituto Colombiano Agropecuario, CIAT, national programs of other countries, and regional var.; these will be planted in randomized blocks, with 3 replications, in plots of 3 rows of 22.5 m separated by 1 m, with plants spaced at 1.5 m. Var. and hybrids will be evaluated in 2 localities on alluvial soils and in 2 on nonalluvial soils. In the agronomic studies different methods of planting cassava, planting and harvest times, population densities, weed control methods, storage, processing, and preservation of cassava will be compared. Regarding production systems, the intercropping of cassava/maize/cowpea will be assessed. Illustrations are included. (Summary by EDITEC. Trans. by M. de W.) J00

0136

20747 ODIGBOH, E.U. 1983. Cassava: production, processing, and utilization. In Chan Junior, H.T., ed. Handbook of tropical foods. New York, Marcel Dekker. pp.145-200. Engl., Sum. Engl., 94 Refs., Illus. [Faculty of Engineering, Univ. of Nigeria, Nsukka, Anambra State, Nigeria]

Cassava. Cultivation. Propagation materials. Cuttings. Planting. Spacing. Weeding. Mechanization. Agricultural equipment. Harvesting. Processing. Human nutrition. Gari. Peeling. Industrial machinery. Fermentation. Screening. Cooking. Cassava products. Feeds and feeding. Cassava roots. Storage. Roots. Cassava starch.

The importance of cassava as a major food crop of the tropics is discussed in terms of the size of the crop and its many food and feed uses. Industrial applications and tertiary processed food potentialities are cursorily discussed for completeness. The need to improve the yield of cassava on the peasant farmers' fields is emphasized as being a problem of both agronomy and engineering. Labor intensity of all aspects of the cassava culture and husbandry is highlighted, and cassava researchers are called upon to intensify work and effort to put on the market viable cassava planters, weeders, and harvesters. Almost all aspects of the traditional processes for producing the various cassava foods manually are shown to be tedious, time-consuming, and largely unwholesome. Cassava research programs and workers should pay more attention to the mechanization of the various unit operations involved in processing cassava into its many food forms. Applied research to quantify the mechanical, rheological, and other engineering properties of cassava and its products is not much in evidence in the literature. The potentials of cassava as food, feed, and industrial raw material are not yet being fully utilized. A great deal more engineering research on all aspects of cassava production and processing is needed to maximize its utilization with less waste and enhanced product quality at lower costs to the family or industrial, domestic, or foreign consumers. (Author's summary) J00

0137

22064 RAMANATHAN, S.; ANANTHARAMAN, M.; GADEWAR, A.U. 1984. Cassava in lab to land programme. Indian Farming 33(12):68-69. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Cassava programs. Development. Technology transfer. India.

A technology transfer program from the lab. to the land is described. In its 1st phase the program covered 50,000 farm families over India. Under this program the Central Tuber Crops Research Institute adopted 200 low-income families. The transfer of technology consisted in the scientific cultivation of the cassava hybrids Sree Vishakam (H. 1687) and Sree Sahya (H. 2304), associated with groundnut. The program was strengthened with interdisciplinary teams that carried out demonstrations, visits, training at the institute, field days, and radio programs, and published pamphlets and circulars. The av. yield of cassava before the program was 12 t/ha; after the program, it was 28 t/ha (the national av. is 17 t/ha). Groundnut represented an economical benefit at 3.5 mo. after planting. The high additional net income is attributed to: (1) the substitution of the local var. by the hybrids; (2) improved management practices; and (3) the intercropping of cassava, traditionally grown as a pure culture, with groundnut. Under real farm conditions, one farmer obtained a 51 t/ha yield. The lessons from this technology transfer are discussed. (Summary by I.B. Trans. by M. de W.) J00

0138

21494 SAO PAULO. SECRETARIA DE AGRICULTURA E ABASTECIMENTO. INSTITUTO DE ECONOMIA AGRICOLA. 1980. Mandioca. Panorama internacional. (Cassava. International view). In ________. Prognóstico regiao Centro-Sul 80/81. Sao Paulo-SP, Brasil. v.7,pp.171-173. Port.

Cassava. Pellets. Marketing. Trade. Brazil.

Both the world cassava market and the domestic cassava market in Brazil, are briefly analyzed for the period 1978-81. At the international level the use and commercialization of pellets (6.5 million tons in 1978) are pointed out. Production fluctuations, especially in Thailand and Indonesia, are discussed. Although Brazilian exports are small, they are well accepted. At the national level the present production in different regions and prospects are discussed. The reasons for the raise of prices in 1979 are mentioned. (Summary by I.B. Trans. by M. de W.) J00

0139

22008 SCHAMPER, J.; BANTU, M. 1980. Some important economic factors in cassava production and reasons of predominance of cassava as food crop in Zaire. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.71-79. Engl., 2 Refs., Illus.

Cassava. Production. Statistical data. Marketing. Prices. Zaire.

Cassava is grown throughout Zaire and represents about 57% of the caloric intake by an av. Zairian. Although cassava is deficient in proteins and vitamins, its roots are an important source of energy. Cassava leaves contain high levels of protein, vitamins, and minerals. The marketing of cassava products and the lack of equilibrium between supply and demand due to governmental policies are discussed. Cassava production constraints in Zaire are given in addition to the advantages the crop has, making it widely cultivated in the country. To improve cassava production it is important to make the production technologies available at the Programme National Manioc and the International Institute of Tropical Agriculture available to farmers. Technology for processing roots must also be improved. Finally marketing channels must be improved for an equitable remuneration to the producer and a better price for the consumer. (Summary by EDITEC. Trans. by L.M.F.) J00

0140

21147 SOSA, M.A.; ARREDONDO, N. 1983. Yuca, batata, ñame y yautía: su importancia económica. (Cassava, sweet potato, yam, and _Xanthosoma sagittifolium_ sp.: their economic importance). Boletín CESDA (República Dominicana) 1983:12-15. Diciembre 1983. Span., Illus.

Cassava. Cultivation. Cassava programs. Dominican Republic.

The economic importance of cassava, sweet potato, yam, and _Xanthosoma sagittifolium_ sp. in the Dominican Republic is stressed. In 1982, 19,020 ha were planted to cassava and 4865 t were exported. Yields av. 7.8 t/ha. Low-cost technologies, improved var., fertilizers, and pest and disease control measures, although available, are not used by farmers. In 1983, 24,960 ha will be planted to cassava (Root and Tuber Crop Program, Centro Sur de Desarrollo Agropecuario). Past and current research works on the 4 crops are listed. (Summary by I.B.) JOO

0141

22002 SWEET, N.L. 1980. Expectations from the cassava outreach project. _In_ Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.15-17. Engl.

Cassava. Cassava programs. Development. Plant breeding. Resistance. Nutritive value. Processing. Pest control. Zaire.

The expectations of the cassava outreach project of USAID in conjunction with International Institute of Tropical Agriculture/Programme National Manioc (PRONAM) in Zaire are briefly related. The project will last 4 yr, during which PRONAM will train intermediate-level research workers and extension supervisors; afterwards, PRONAM will be able to (1) identify high yielding, disease- and insect-resistant cassava var.; (2) multiply improved plant material and establish a system for its distribution; (3) improve cassava's consumer acceptance, nutritional value, and processing characteristics; and (4) exercise a front-line role in the identification and control of economically significant cassava disease and insect problems. PRONAM can contribute to Zaire's objective of meeting basic food needs. (Summary by EDITEC. Trans. by M. de W.) JOO

0142

22701 TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS-AFRICA BRANCH, 2nd., DOUALA, CAMEROON, 1983. Tropical root crops: production and uses in Africa; proceedings. Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Ottawa, Canada, International Development Research Centre. 231p. Engl., Sum. Engl., Fr., Span., 611 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Root crops. Cultivation. Cassava programs. Development. Research. Genetics. Entomology. Diseases and pathogens. Human nutrition. Animal nutrition. Processing. Africa.

Original research papers, updates on procedures, literature reviews, and survey reports, presented at the 2nd symposium of the International Society for Tropical Root Crops-Africa Branch, are given. The focus was on cassava, yams, cocoyams, and sweet potatoes. Papers on cassava presented in the area of cultivation were: production potentials of major tropical root and tuber crops; potential utilization of major root crops, with special emphasis on human, animal, and industrial uses; effect of var. and planting time on the yield of cassava in Malawi; response of cassava to fertilizers and town refuse under continuous cropping; rapid multiplication of cassava by direct planting; effects of shade, N, and K on cassava; weed interference in cassava-maize intercrop in the rain forest of Nigeria; crop performance in complex mixtures: melon and okra in cassava/maize mixture; soil-conserving techniques in cassava and yam production; factors limiting cassava production among peasants in Lukangu, Zaire. In relation to genetics and plant breeding the following papers were presented: genetic parameters of cassava; evaluation of cassava clones for leaf production in Zaire; cassava screening in Rwanda. Plant pathology-related papers were: epidemiology of anthracnose in cassava; cassava yield losses from brown leaf spot induced by Cercosporidium henningsii; susceptibility of cassava to Colletotrichum manihotis; Botryodiplodia stem rot of cassava and methods of selecting var. for resistance; distribution and severity of cassava mosaic in the Congo. The area of pest control and entomology included: the cassava mealybug front hypothesis: role of indigenous natural enemies; comparative bioecology of 2 coccinellids predators of the cassava mealybug in the Congo; effects of fertilizer application on postembryonic development and reproduction of the cassava mealybug; functional response of Amblyseius fustis to increasing density of its prey Mononychellus tanajoa; control of the cassava green mite in Uganda. Finally, concerning the areas of nutrition and processing the papers were: studies on the nutrient content of yellow-pigmented cassava; microbial breakdown of linamarin in fermenting cassava pulp; performance of a cassava peeling machine; an improved technique of processing cassava fufu; cassava-based diets for rabbits; effects of CM on the hatchability of chicken eggs; yellow-pigmented cassava revisited; distribution and utilization of cassava in Malawi. (Summary by M.de W.) JOO

0143

22001 WORKSHOP ON CASSAVA PRODUCTION AND EXTENSION IN CENTRAL AFRICA, MBANZA-NGUNGU, ZAIRE, 1980. Proceedings. Ezumah, H.C., ed. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. 280p. Engl., Sum. Engl., 140 Refs.

Cassava. Pests. Propagation materials. Production. Resistance. Field experiments. Cultivation. Marketing. Africa.

A workshop was carried out on cassava production and extension in Central Africa, to bring together the researchers of the region (Angola, Burundi, Cameroon, Central Africa Republic, Congo, Gabon, Rwanda, and Zaire) to review their problems and formulate recommendations for future work and cooperation. The workshop focused on general and introductory subjects, pests, production of propagation material, problems and perspectives of the production and extension of cassava in Zaire, the present state of production in Central Africa, and recommendations. Four areas were identified as major constraints in cassava production and extension in the region: the screening of cassava for disease and pest resistance and multilocational trials; production and distribution of planting materials; logistics and marketing of farmers' produce; and cultural practices employed. Greatest concerns lie in the lack of trained manpower for research and extension and of materials, inadequate budget, diseases and pests, the need for exchange of information among researchers in the region, bad roads and lack of transportation facilities, and inoperative distribution of trained personnel. The papers presented at this workshop are recorded individually in this publication under the following consecutive no.: 0011, 0016, 0020, 0022, 0025, 0031, 0035, 0040, 0044, 0049, 0052, 0054, 0057, 0060, 0061, 0074, 0097, 0110, 0112, 0122, 0128, 0130, 0132, 0134, 0139, and 0141. (Summary by EDITEC. Trans. by M. de W.) J00

See also 0008 0009 0021 0031 0063 0070 0088 0097 0098

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0144

22074 DEVOS, P.; WILSON, G.F. 1983. Associations du plantain a d'autres plantes vivrieres. 2. Autres combinaisons avec le mais, le taro et le manioc. (Plantain intercropping with other food crops. 2. Other combinations with maize, taro, and cassava). Fruits 38(4):293-299. Fr., Sum. Fr., 5 Refs., Illus. [IITA, P.O. Box 5320, Ibadan, Nigeria]

Cassava. Banana-plantain. Maize. Taro. Intercropping. Root productivity. Productivity. Energy productivity. Nigeria.

At Ibadan (International Institute of Tropical Agriculture) and Onne (near Port Harcourt) in Nigeria, trials were carried out to study the intercropping of plantain with either maize, cassava, and/or cocoyam, using 2 or 3 species, compared with pure crops. Three cropping systems were the best in relation to yield (maize/plantain/cassava), caloric value (any combination including maize), and land utilization (any combination). At Ibadan cassava yield varied between 8.77-20.20 t/ha for the 3-crop combination and the pure crop, resp. At Onne the values were 4.01-11.65 t/ha. (Summary by M. de W.) K01

0145

19012 EMPRESA BRASILEIRA DE ASSISTENCIA TECNICA E EXTENSAO RURAL. 1980. Sistemas de producao para culturas alimentares: arroz, feijao, mandioca e milho. Microrregiao: Bragantina, Guajarina, Salgado e Vizeu. (Rice, bean, cassava, and maize production systems for the microregions of Bragantina, Guajarina, Salgado, and Vizeu). Braganca-PA, Brasil. 31p. Port., Illus.

Cassava. Maize. Beans. Rice. Intercropping. Cultivation. Cultivation systems. Climatic requirements. Soil physical properties. Timing. Planting. Spacing. Fertilizers. Pest control. Insecticides. Brazil.

The production systems for the Brazilian regions of Bragantina, Guajarina, Salgado, and Vizeu are given, taking into account available technology and the farmers' acceptance of innovations: (1) maize + rice (1st phase), cassava + beans (2nd phase); (2) rice (1st phase), cassava + beans (2nd phase); and (3) maize + cassava. Each region is characterized as to soils, temp., RH, rainfall, climate, water balance, and economic importance. Each system is described as to producers' characteristics, operations of the system, and technical recommendations (selection of area, land preparation, planting, cultural practices, harvesting, processing, and commercialization). In the 1st system cassava is planted before beans and selected cuttings should be planted horizontally at 5 and 10 cm depth; cassava should be planted at 1.0 x 1.0 m in double rows spaced at 2.5 m. Chemical pest control, manual harvesting, solar drying, and separation of seeds and pods are included. In the 2nd system the same instructions as in the 1st are followed, differing in that 4 rows of bean are planted between 2 of cassava. In the 3rd system, cassava is planted approx. 2.5 mo. after maize, spaced at 1.0 x 1.0 m in single rows, 1 cassava plant between 2 maize plants. The spatial arrangement, planting and harvesting schedule, and the technical coefficients of the systems are annexed. (Summary by EDITEC. Trans. by L.M.F.) K01

0146

21431 INSTITUT DE RECHERCHES AGRONOMIQUES TROPICALES ET DES CULTURES VIVRIERES. 1981. Cultures associées systématisées (riz + mais + manioc + vigna en succession). (Intercropping systems: rice followed by maize + cassava + *Vigna*). In ________. Rapport analytique études des systemes de production potentiels a base de riz pluvial, 1979-1980. Paris. Convenio EMAPA/IRAT. v.3,pp.486-499. Fr.

Cassava. Statistical analysis. Fertilizers. N. P. K. Cultivars. Rice. Maize. Groundnut. Beans. Intercropping. Herbicides. Insecticides.

The results of expt. on fertilization and use of herbicides carried out in 1979-80 in Maranhao, Brazil, are presented. A factorial split split plot design (Fisher's blocks) was used with 8 treatments (control, total NPK, N, P, K, NP, NK, PK) and 6 replications to determine the optimum fertilization for the association rice + maize and groundnut + cassava + *Vigna* in sequential cropping. Traditional cultural practices were conducted. Traditional cassava var. Carga de Burro and Najazinha and improved var. Najazinha and Rebenta Burro were used. Only rice responded to N fertilization. Var. Rebenta Burro was superior in performance to Najazinha (av. yield of 3000 kg/ha). To assess the damage caused by insects in the association rice + maize + cassava + groundnut, 12 herbicide treatments and one control were tested in a split split plot design (Fisher's blocks) with the insecticides carbofuran, diazinon, carbaryl, and decamethrin. To avoid the effects of protection, the trial was replicated with 3 treatments (carbofuran, dimethoate, and decamethrin), each one with an untreated check. Insects are currently not considered a limiting factor. The cropping system verified its productivity: rice, 3128; maize, 546; cassava, 4169; and *Vigna*, 340 kg/ha, resp. Yields obtained in 1980 agreed with these results. The exptl. design was not appropriate; it is recommended to increase the useful exptl. area. (Summary by I.B. Trans. by L.M.F.) K01

0147

22084 OBIEFUNA, J.C.; NDUBIZU, T.O.C. 1983. Effet de différentes densités de manioc a plusieurs époques de la croissance et de la production des plantains. (Effect of different cassava densities on the growth and yield of plantains at various periods). Fruits 38(4):284-292. Fr., Sum. Fr., 29 Refs., Illus. [National Horticultural Research Inst. Idi-Ishin, Jericho Reservation Area, P.B.M. 5432, Ibadan, Nigeria]

Cassava. Banana-plantain. Intercropping. Cultivars. Cultivation. Timing. Planting. Weeding. Root productivity. Energy productivity. Nigeria.

Intercropping plantain and cassava, the latter one at densities of 10,000, 15,000, 20,000, and 25,000 plants/ha, was studied. Cassava cv. Otupam, 2-m tall, was used. Two dates for cassava planting were used: the 1st one 2 wk. after the plantain was planted, and the 2nd one immediately after the 1st weeding. High densities of cassava reduced the no. of weedings from 5 to 3/yr. Plantain growth was uniform in all the treatments during the 1st 5 mo.; foliation rhythm was higher in plantain sole cropping. The degree of interspecific competition changed with the time of the cassava seeding and the age of the crops. The flowering period of plantain intercropped with 10,000 and 25,000 cassava plants/ha was delayed by 20 and 35 days, resp. The cassava yield of the late planting surpassed the early planting yield. Likewise, the total yield (plantain + cassava) exceeded the total yield of the plantain in monoculture. The LER higher than one for all the cassava densities indicates that in spite of reduced plantain yield, plantain- cassava intercropping is more efficient than any of its components grown alone. (Summary by M. de W.) K01

0148

22031 OLIVEIRA, E.B. DE; MOURA, G. DE M. 1982. Mandioca consorciada em fileiras duplas com milho ou arroz. (Double row intercropping of cassava with maize or rice). Rio Branco-AC, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Unidade de Execucao de Pesquisa de Ambito Estadual. Comunicado Técnico no.30. 4p. Port. [Unidade de Execucao de Pesquisa de Ambito Estadual de Rio Branco, Caixa Postal 392, 69.900 Rio Branco-AC, Brasil]

Cassava. Maize. Rice. Intercropping. Soil physical properties. Cultivation. Cultivars. Planting. Spacing. Root productivity. Energy productivity. Productivity. Brazil.

Intercropping cassava in double rows with maize or rice was evaluated in 2 field expt. on a sandy clay, red-yellow Latosol, in Rio Branco-AC (Brazil), in Oct. 1982. A randomized block design, with 4 replications was used in 12.5 x 16.0 m plots with planting distances of 2.0 x 0.5 x 0.5 m for cassava cv. Poxiubá and different planting distances for maize cv. Maya XV. Rice cv. IAC-47 was planted in 0.3 m rows, with 40 plants/m. The system was highly efficient for the cassava-rice combination with a LER 1.40-1.61; the highest value corresponded to the treatment consisting of 6 rows of rice between double rows of cassava which gave a 74 and 87% yield, in relation to rice and cassava in monoculture, resp. Maize yields were higher than those of rice, attributed to fertilization. However, the LER values were slightly lower than those of the cassava-rice combination. The best treatment of cassava with maize consisted of 3 rows of maize (0.5 x 1.0 m) between 2 of cassava, although the treatment of 4 rows of maize gave the highest yield in relation to the monocrop (85%). (Summary by I.B. Trans. by M. de W.) K01

0149

22052 PRABHAKAR, M.; PILLAI, N.G. 1984. Multiple cropping systems with tuber crops. Indian Farming 33(12):25-28. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Cultivation. Intercropping. Legume crops. Groundnut. Cowpea. Beans. Maize. Coconut. Productivity. India.

The advantages of multiple cropping in the humid tropics are presented. Promising associations with cassava, developed at the Central Tuber Crops Research Institute (Trivandrum, India) are described: (1) cassava/grain legumes (_Vigna unguiculata_, _Cajanus cajan_, _Phaseolus aureus_, _P. mungo_, _Glycine max_); (2) cassava/oilseeds (_Arachis hypogaea_ and _Helianthus annuus_); (3) cassava/vegetable crops like cucumber, cowpea, okra, and French beans, the latter crop being the most economical; (4) cassava/medicinal plants; and (5) cassava/maize. Data on costs, yields, and incomes are presented. In general, intercropping gives more income than the cassava sole cropping. The most profitable combinations seem to be: cassava/groundnut, cassava/French bean, and cassava/_Catharanthus roseus_. Cassava can also be grown in coconut plantations, either during the 1st yr or when the coconut trees are over 45 yr old, thus allowing sufficient solar radiation to reach the ground. (Summary by I.B. Trans. by M. de W.) K01

0150

22055 RAMANUJAM, T.; INDIRA, P.; NAIR, G.M. 1984. Productivity of cassava under shade. Indian Farming 33(12):39-40,42. Engl., Illus. [Central Tuber Crops Research Inst., Sreekariyam, Trivandrum, 695017 Kerala, India]

Cassava. Intercropping. Coconut. Cultivars. Cultivation. Shading. Resistance. Root productivity. Productivity. Dry matter. Leaf area. Growth. India.

The productivity of the high yielding cassava var., H-97, H-165, H-226, H-1687, and H-2304, from the Central Tuber Crops Research Institute (Trivandrum, India), and the local var. M-4 under shade was evaluated in a coconut plantation 30 yr old. Var. seem to compete better for light in small plots and under older trees. Cassava must be planted in the interspaces of the coconut palms (7.5 x 7.5 m) at a spacing of 90 x 90 cm, with a plant population of 8800 plants/ha. The optimum fertilization level for cassava under these conditions has not been assessed. The rooting and the establishment of the cuttings were normal, but the root formation was delayed 3 wk. compared with the control. Although the canopy size was similar to that of cassava plants in the open, productivity was reduced, leaves were smaller, and the no. of stomata/leaf area unit was reduced. Net photosynthesis was therefore affected. Among var., significant differences were observed in LAI, specific leaf wt., NAR, total biomass production, and distribution of DM. These data are being used to study the effect of the shoot growth on root development. Var. H-165 outyielded all the other var. and produced a 3rd of its normal production (7.04 t/ha). Intercropping is considered superior to sole cropping when compared on an energy output basis and considering the foliage obtained from cassava. Priority should be given to the development of shade-tolerant cassava var. for regions where intercropping with trees is a common practice. (Summary by I.B. Trans. by M. de W.) K01

See also 0007 0020 0025 0114 0115 0117 0121 0132 0134

K02 Descriptive and Comparative Studies

See 0058

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

Author Index

Subject Index

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PN-AAU-515

Abstracts on Cassava
(*Manihot esculenta* Crantz)

Vol. XI | No. 2 | August, 1985

CONTENTS

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.

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COMPONENTS OF AN ABSTRACT

Sequential number in the journal (for use of indexes)

Authors

Year of publication

Accesion number (for photocopy requests)

0145

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

Original title

Author address

Additional notes

Source

Pages

Language of paper

Language of summary

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

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. (Author's summary) 102

Abstract

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.

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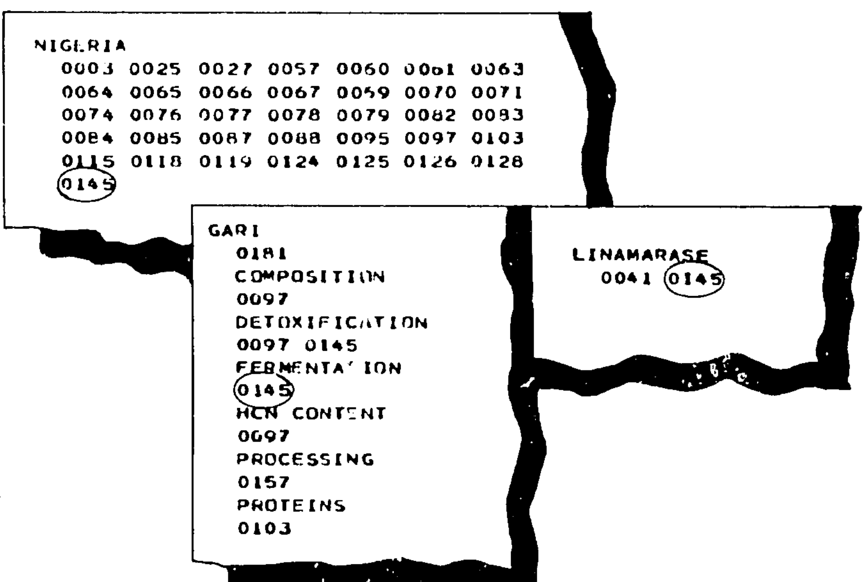
The Subject Index presents an alphabetical list of descriptors used in cassava research, many of which are combined with other descriptors, allowing the identification of more specific topics.



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0151

22980 ALLEM, A.C. 1980. Notas taxonómicas e nov sinonimos em espécies de Manihot. 6. (Euphorbiaceae). [Taxonomic note new synonyms for Manihot species. 6. (Euphorbiaceae)]. Boletim do r. ..eo Botanico Municipal (Brasil) no.40:1-17. Port., Sum. Port., Engl., 5 Refs., Illus.

Cassava. Manihot. Taxonomy. Identification. Manihot maracasensis. Manihot triphylla. Manihot fruticulosa. Manihot procumbens. Manihot violacea. Brazil.

Taxonomic notes are made for Manihot maracasensis Ule, M. triphylla Phol, M. fruticulosa (Pax) Rogers & Appan, and M. procumbens Müll. Arg. (Euphorbiaceae). Taxonomic notes and reductions to synonymy are registered for M. violacea Pohl and several species of the section Heterophyllae Pax emend. Rogers & Appan. (Author's summary) A00

0152

22978 ALLEM, A.C. 1979. Notas taxonómicas e novos sinonimos em espécies de Manihot. 4. (Euphorbiaceae). [Taxonomic notes and new synonyms for Manihot species. 4. (Euphorbiaceae)]. Revista Brasileira de Biologia 39(4):735-738. Port., Sum. Port., Engl., 2 Refs., Illus.

Cassava. Manihot. Taxonomy. Identification. Manihot heptaphylla. Manihot caerulescens. Brazil. Paraguay.

Manihot heptaphylla Ule (Euphorbiaceae) is reduced to the synonymy of M. caerulescens Pohl, a species occurring in Brazil and Paraguay. (Author's summary) A00

0153

22979 ALLEM, A.C. 1979. Notas taxonómicas e novos sinonimos em espécies de Manihot. 5. (Euphorbiaceae). [Taxonomic notes and new synonyms for Manihot species. 5. (Euphorbiaceae)]. Revista Brasileira de Biologia 39(4):891-896. Port., Sum. Port., Engl., 5 Refs., Illus.

Cassava. Manihot. Taxonomy. Identification. Manihot carthaginensis. Manihot anisophylla. Manihot guaranitica. South America. Caribbean.

The taxonomy of Manihot carthaginensis (Jacq.) Müll. Arg. (Euphorbiaceae) is discussed. At least 12 species are synonyms of it, including M. anisophylla (Griseb.) Müll. Arg. and M. guaranitica Chod. & Hassl. It is concluded that M. carthaginensis has a wide geographical dispersion range, occurring in almost all of South America, including Brazil and some Caribbean islands. (Author's summary) A00

0154

22094 NASSAR, N.M.A. 1984. Natural hybrids between Manihot reptans Pax and M. alutacea Rogers and Appan. Canadian Journal of Plant Science 64(2):423-425. Engl., Sum. Engl., Fr., 11 Refs., Illus. [Depto. de Agronomía, Univ. de Brasilia, 70.919 Brasilia-DF, Brasil]

Cassava. Manihot. Hybrids. Ecology. Ecosystems. Phenology. Taxonomy. Plant anatomy. Brazil.

Natural hybrids between Manihot reptans and M. alutacea in the state of Goias, Brazil, are described. Hybridization occurred in disturbed habitats where there is a sympatric distribution of the parental species. There is evidence for progressive introgression of germplasm into M. reptans. (Author's summary) A00

B00 PLANT ANATOMY AND MORPHOLOGY

See 0158 0160 0162

C00 PLANT PHYSIOLOGY

0155

22787 ALVARENGA, A.A. DE; OLIVEIRA, L.E.M. DE; GOMIDE, M.B.; SOUZA, C.A.S. 1983. Selecao de cultivares de mandioca (Manihot esculenta Crantz) resistentes ao deficit hídrico. (Selection of cassava cultivars resistant to water stress). Ciencia e Pratica 7(1):15-22. Port., Sum. Port., Engl., 14 Refs. [Conselho Nacional de Pesquisas, Av. Mar. Camara 350, 4o/6o and., Rio de Janeiro-GB, Brasil]

Cassava. Cultivars. Laboratory experiments. Plant anatomy. Plant physiology. Leaves. Stomata. Water stress. Water content. Brazil.

Cassava cv. were evaluated in a growth chamber (28 + 2°C, approx. 60% RH, and nearly 6000 lux) and in a chamber with variations only in the RH conditions (85-90% RH). Tolerance to and/or prevention of water loss by the cv. were measured. The parameters studied were critical deficit of saturation, relative water content, and stomatal frequency. The 11 cv. were grown under 4 different water potentials and 5 dehydration levels for the relative water content and critical deficit of saturation, resp. Results indicated considerable differences among cv. Pinheira, Vassourinha, and Riqueza were the most resistant cv. and the Amazonia and S.F. 2800, the most susceptible. Water potential of -6 atm can be used with relative efficiency in studies of this nature. (Author's summary) C00

0156

23402 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Physiology. In _______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.5-23. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Physiology. Plant physiology. Photoperiod. Productivity. Root productivity. Roots. Shoots. Growth. Photosynthesis. Nutritional requirements. N. P. K. Nutrient uptake. Plant development. Leaves. Leaf area. Stomata. Water stress. Water requirements (plant). Transpiration. Dry matter. Biomass production. Colombia.

Research activities were focussed on describing cassava growth and development under stress conditions to determine the characteristics associated with high yields in marginal situations. Cassava is sensitive to photoperiod changes during the 1st 6 mo. of growth; long days between 3-6 mo. of age reduced yields markedly. Long days were found to promote top growth at the expense of root growth. During the establishment stage long days can affect root thickening, and these effects remain after the length of the days is shortened. For 4 clones studied, it was found that absorption of the 3 major nutrients NPK was higher between 60-180 days. Absorbed N was uniformly distributed between leaves, stems, and roots; P was mainly distributed to stems and K to roots. The threshold levels under which roots are not formed were 85 kg N, 9.1 kg P, and 69 kg K/ha. These data suggest that it is possible to select clones that produce roots more efficiently in terms of absorbed nutrients. Cassava tends to reduce its LAI and to maintain the leaf nutrient content under nutritional stress. Data on stomatal response to air humidity show that stomatal closure in response to increased VPD is an optimal strategy to conserve water when soil water is deficient; on the other hand, when water is not limiting, the stomatal closure reduces photosynthesis and therefore growth. A close relationship between total DM produced and intercepted photosynthetically active radiation (PAR) was found in 4 clones. No differences were observed between var., and DM was produced at 1.35-1.47 g/MJ; this corresponds to a 2.3-2.5% efficiency in converting the intercepted PAR into biomass. Exptl. data from 4 clones on relative proportions of dry wt. in stems, leaves, and roots, indicate that root factors can influence top growth. Several grafting combinations indicated that the effects of the stock were small but significant on the LAI 6 mo. after planting, while differences between scions were largely independent of the stock and with no scion/stock interaction; the scion was determinant on top growth although the stock had a limited effect. No significant effect of the stock or scion on the DM produced/unit of absorbed PAR was observed. The stock had a marked effect on DM distribution to the roots. The scion appears to determine the level over which root growth occurs. (Summary by EDITEC) COO

0157

23415 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Physiology. In ________. Annual Reports for 1982 and 1983. Cali, Colombia. pp.239-273. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Cultivars. Hybrids. Plant physiology. Water requirements (plant). Planting. Timing. Soil water. Water stress. Leaves. Stomata. Growth. Dry matter. Photosynthesis. Root productivity. Transpiration. Leaf area. Carbon dioxide. Photoperiod. Fertilizers. Colombia.

Research work with cv. M Col 1684 indicated that this type of cv. strongly responds to changes in atmospheric humidity, regardless of soil water conditions. Var. responses to changes in atmospheric humidity are a critical factor in cassava production under different water regimes. Whether or not soil water is limiting, stomatal response to changes in atmospheric humidity is a key limiting factor. In Quilichao during a long dry season, M Col 1684 was compared with hybrid CM 507-37; the hybrid maintained a higher LAI (1.1 vs. 0.), a higher % of intercepted light (70 vs. 43%), a higher leaf water potential (-0.6 vs. -1.0 MPa), a narrower stomatal aperture (2 vs. 3 microns), and lower leaf conductance (2.2 vs. 2.6 mm/s). The hybrid also outyielded M Col 1684 in total DM production (8.0 vs. 6.7 t/ha, resp.). Dry root yield for both cv. was similar: 3.6 and 3.7 t/ha for the hybrid and M Col 1684, resp. The hybrid showed higher stem and leaf dry wt. Data on crop water use indicate that cassava has a low transpiration rate and can produce an av. rate of 25 kg DM/ha/mm of water used. The period of max. water use by the crop ranges between mo. 4-8 of the growth cycle, coinciding with the highest LAI values. Compared with other crops, the CO_2 compensation point of cassava is much lower than the values commonly found in other C_3-type crops and higher than C_4-type crops (22 and 26 ppm for external and internal CO_2, resp.). Crops 6 mo.

old or older do not respond to changes in day length, while at younger ages cassava reduces its HI and hence root yields. Plant types that yield well at high soil fertility can also give relatively good yields under low fertility conditions. Results of fertilization trials suggest that var. giving good yields under low fertility conditions will be highly responsive to fertilization. (Summary by EDITEC) C00

0158

23446 EL-SHARKAWY, M.A.; COCK, J.H.; CADENA, G. DE 1984. Influence of differences in leaf anatomy on net photosynthetic rates of some cultivars of cassava. Photosynthesis Research 5(3):235-242. Engl., Sum. Engl., 19 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Plant anatomy. Leaf area. Plant physiology. Plant physiological processes. Photosynthesis. Carbon dioxide. Colombia.

Gas exchange measurements and leaf anatomy of 10 cassava cv. were conducted to study the interrelationship between the relatively high photosynthetic rates and the factors limiting internal CO_2 diffusion. The internal mesophyll surface area/unit leaf surface area (A^{mes}/A) and the intracellular components of CO_2 diffusion and fixation resistance ($R^{cell}CO_2$) were determined. Among the group of cv. tested, net CO_2 exchange rates were 26 $\pm$ 2.5 micromol $CO_2/m^2/s$ in normal air and intense light and A^{mes}/A ranged from 14 to 38. Estimated $R^{cell}CO_2$ ranged from 4300 to 13,000 s/m. The combined and compensating effects of A^{mes}/A and $R^{cell}CO_2$ accounted for both the high net photosynthetic rates (P_n) and the lack of large differences in P_n among cv. (Author's summary) C00

0159

23445 EL-SHARKAWY, M.A.; COCK, J.H.; HELD, A.A. 1984. Photosynthetic responses of cassava cultivars (Manihot esculenta Crantz) from different habitats to temperature. Photosynthesis Research 5(3):243-250. Engl., Sum. Engl., 14 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Leaves. Carbon dioxide. Photosynthesis. Temperature. Colombia.

Max. photosynthetic CO_2 exchange rates (P_n) of single attached leaves were determined for several cassava cv. selected from different habitats and grown in pots outdoors at CIAT, Colombia. P_n rates were in a narrow range of 22-26 micromol $CO_2/m^2/s$ for all cv. tested when measured at high photon flux density, normal air, optimum temp., and with low leaf air vapor pressure differences. For the 9 cv. tested, there was a broad optimum temp. for P_n between 25-35°C. At temp. below and above this range, P_n declined in all cv. with P_n rates reaching 80% of max. at 20 and 40°C. P_n temp. coefficient (Q_{10}) from 15 to 25°C was 1.6 $\pm$ 0.2 across cv. No consistent relation existed between P_n, optimum temp., and the original habitat. (Author's summary) C00

0160

22302 HOLGUIN H., P.; COLLAZOS C., R. 1984. Fotosíntesis y otros parámetros fisiológicos en plantas de yuca Manihot esculenta Crantz, infectadas con virus. (Photosynthesis and other physiological parameters in virus-infected cassava plants). Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 122p. Span., Sum. Span., Engl., 61 Refs., Illus.

Cassava. Cultivars. Viroses. Frog skin disease. Cassava Caribbean mosaic virus. Cassava latent virus. Pruning. Plant physiology. Plant anatomy.

Leaves. Photosynthesis. Transpiration. Plant pigments. Plant tissues. Colombia.

At CIAT-Palmira in 1983, physiological and anatomical aspects of cassava leaves under virus influence were studied to provide basic information for further research on pathology and plant breeding of disease-resistant plants. A completely randomized design with 4 replications was used and the var. Mcol-22, Secundina, and QPR, infected with the latent, Caribbean mosaic, and frog skin viruses, resp., were studied. Physiological parameters studied were: photosynthesis, transpiration, water use efficiency, vapor pressure resistance, mesophyll resistance to CO_2 uptake, CO_2 concn., and VPD; total chlorophyll content was also determined. In relation to leaf anatomy, the epidermis, spongy and palisade parenchyma, and the diameter of the parenchymatous cells were studied. All these variables were determined on intermediate growth leaves, 45 days after planting, 3 times every 15 days. Results suggest that the variations observed on the photosynthetic mechanism in plants infected with latent virus are due to biochemical alterations of the process. The presence of the virus did not produce anatomical changes in the photosynthetically active area; although symptoms are not observed, the virus may affect the productivity because of its direct effect on photosynthesis. On plants infected with the Caribbean mosaic virus and showing typical symptoms, low photosynthetic rates were observed; the decrease in the photosynthetic rate is directly related to the physical mechanism of the stomatal aperture. Infected plants with no symptoms and healthy plants showed a similar photosynthetic rate. On symptomatic plants a lower total chlorophyll content did not cause any change in mesophyll resistance; therefore it is not a photosynthesis-limiting factor in cassava. While the symptoms developed, the loss of water by transpiration decreased and no water use efficiency increase was observed. Leaves with mosaic symptoms presented distortion areas in the parenchymatous cells, affecting the normal functioning of the stomata. The frog skin virus did not have a direct effect on the photosynthetic apparatus but it affected the relationship between the photosynthetic capacity and the root storage capacity. In infected plants there was a reduction of the roots' ability to store carbohydrates which accumulated in the leaves affecting the normal functioning of the photosynthetic mechanism. Pruned and unpruned plants, and plants with 1 leaf, were observed to detect photosynthetic changes. Infected unpruned plants presented a reduction in photosynthesis up to 50% when compared with the plants with 1 leaf in which no variations in relation to the control were observed. There was a larger total transpiration in unpruned plants than in plants with 1 leaf; the larger the leaf area, the less water flows to each leaf, therefore the water stress created induces a decrease in transpiration and a high stomatal resistance. (Author's summary) COO

0161

22789 PALTA, J.A. 1984. Influence of water deficits on gas-exchange and the leaf area development of cassava cultivars. Journal of Experimental Botany 35(159):1441-1449. Engl., Sum. Engl., 23 Refs., Illus. [School of Agriculture, La Trobe Univ., Bundoora, Victoria 3083, Australia]

Cassava. Cultivars. Field experiments. Temperature. Photoperiod. Water requirements (plant). Water stress. Leaves. Stomata. Plant physiological processes. Transpiration. Carbon dioxide. Photosynthesis. Shoots. Growth. Plant development. Colombia.

Measurements of gas exchange, leaf water potential, and the leaf diffusive conductance of the abaxial leaf surface of 6 cassava cv., M Mex 59, M Ven 218, M Col 1684, M Col 72, M Col 22, and M Col 638, were made at 48 h intervals and between 1200-1500 h, on potted plants, grown outdoors during a 58 day period of withdrawal of irrigation. Rates of net photosynthesis of about 28 mg $CO_2/dm^2/h$ were reduced to zero within the 1st 5 days of the dry cycle, despite the small differences in leaf water potential of 0.15 MPa. Water shortage also caused a reduction in mean conductance to less than 1.0 mm/s at which level the control of transpiration maintained leaf water potential at more than -1.6 MPa. Cv. differences in the response of net photosynthesis and leaf diffusive conductance to water shortage were seen within 2 days of the dry cycle and the leaf water potential was commonly 0.15 MPa lower than in the wet controls. The most vigorous cv. (M Mex 59, M Ven 218, and M Col 1684) reduced their rates of net photosynthesis to zero by day 5 of the dry cycle when the soil water content was depleted by 65%. Less vigorous cv. (M Col 72, M Col 22, and M Col 638) reduced their rates of net photosynthesis to zero by day 30, when the soil water content was depleted by 75%. Measurements are also reported of the leaf production/apex and leaf extension for leaves produced during the dry cycle. (Author's summary) C00

0162

22370 PALTA, J.A. 1983. Evaluation of the hydraulic press for measurement of leaf water potentials in cassava. Journal of Agricultural Science 101(2):407-410. Engl., Sum. Engl., 14 Refs., Illus. [School of Agriculture, La Trobe Univ., Bundoora, Victoria 3083, Australia]

Cassava. Cultivars. Leaves. Water potential. Transpiration. Laboratory experiments. Colombia.

In the application of the Scholander pressure chamber technique in studies on cassava water relationships, the leaf water potential measured on central lobules was initially compared with that measured on entire leaves (including petiole). Measurements made using both a Campbell-Brewster hydraulic press and a pressure chamber of the leaf water potential in 6 different cassava clones were also compared. Although the central lobules showed a greater sensitivity to moisture loss after sampling than entire leaves, their leaf water potential was in close agreement with those measured on the entire leaves ($r^2 = 0.96$). Therefore, for routine and field estimates in cassava, measurements made on the central lobules may be used to avoid the large reduction in total leaf area. The Campbell-Brewster hydraulic press satisfactorily estimated leaf water potential in clone M.Col. 1684, which had the longest and narrowest lobules, but in other clones the leaf water potential was overestimated at high leaf water potential (more than -12.5) and underestimated at low water potentials (less than -12.5). Over a wide range of leaf water potentials, a poor relationship between leaf water potentials estimated with hydraulic press and with the pressure chamber was observed for cassava because press estimates are influenced by lobule length and lobule width. (Author's summary) C00

0163

21427 SANTACRUZ S., D. 1982. Estudios fisiológicos de la hoja de yuca, <u>Manihot esculenta</u> Crantz, bajo condiciones de sequía. (Physiological studies on the cassava leaf under drought conditions). Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 141p. Span., Sum. Span., Engl., 30 Refs., Illus.

Cassava. Leaves. Plant physiology. Plant anatomy. Water stress. Cultivars. Stomata. Photosynthesis. Transpiration. Growth. Carbon dioxide. Water requirements. Plant physiological processes. Colombia.

The morphological, anatomical, and physiological aspects of cassava grown under water stress conditions at CIAT-Palmira, in 1981, were studied. A completely randomized design, with 3 replications, was used. Var. Mcol 90, Mcol 22, and Mcol 113 were grown for 5 mo. with a 3 mo. period of water stress, starting 60 days after planting. Measurements were taken for both the adaxial and abaxial surfaces of the leaves of the lower and upper parts of both stressed and control plants. The changes observed in relation to leaf morphology were stomatal aperture, density, and index. In relation to leaf anatomy, the epidermis, spongy and palisade parenchyma, stomatic chamber, and ratio of the total leaf thickness to the thickness of the palisade and spongy parenchyma, were considered. Finally, in relation to plant physiology, photosynthesis, transpiration, stomatal and mesophyll resistance to CO_2 uptake, stomatal resistance to water loss, water potential, growth and longevity of the leaf, were examined. Results suggest that the stomatal changes observed are the most important water saving mechanisms of the plant under water stress. An increase in stomatal resistance, associated with a decrease in stomatal aperture and a smaller no. of stomata/leaf surface, provides a situation for reduced water loss due to transpiration. Naturally, a negative effect of this strategy is a decrease in photosynthesis not only because of the changes of the stomatal mechanism but because of reductions in the leaf area and of the palisade layer of the parenchyma. This negative relationship between photosynthesis and drought resistance is expected, because of the double role played by the stomata in CO_2 uptake and water loss. Cv. Mcol 113 showed, in the adaxial surface of the leaves of the lower part of the plant, the most pronounced anatomical, morphological, and physiological changes that make it more tolerant to water stress. Under normal conditions, the cassava plant has the majority of its stomata on the abaxial surface; stomata located on the adaxial surface are mostly concentrated along the central vein. The palisade parenchyma is thicker than the spongy parenchyma, and the lower leaves present more intercellular spaces. (Author's summary) C00

See also 0288

C01 Plant Development

0164

23413 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Tissue culture. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.213-228. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Disease control. Shoots. Temperature. Frog skin disease. Cassava common mosaic virus. Cuttings. Apical meristems. Hot water treatments. Virus inhibition. Germplasm. Tissue culture. Storage. Growth. Colombia.

During 1982, work in tissue culture focussed on apical meristem culture techniques to recover healthy clones of systemically infected var., building an in vitro gene bank, and exchanging germplasm with national programs. Thermotherapy of shoot tips in vitro was studied as a means to clean frog skin disease. The use of stem meristems, and not complete shoots, resulted in a cleaning rate increase of 20-30% both at 30°C and 40/35°C. To reach high cleaning rates thermotherapy should be applied to cuttings during sprouting and to small meristem explants. Shoot-tip cultures of plants infected with the frog skin disease and treated with 20-40 ppm Virazole produced symptom-free plants only if the stem tip of each culture was cut prior to potting and if the rooting media was free of Virazole, after 40-80 days of the treatment. Var. CMC 40 showed a 20% yield increase and a 25-30% planting material increase when cuttings were previously immersed in water at 40°C during 5-20 min. Storage at 23°C and 1000 lux provided slow enough in vitro growth accompanied by good viability. Under low temp. storage conditions, low mannitol and sucrose concn. are required to obtain reduced growth and high viability. The use of larger vessels for storing tissue cultures increased growth rate to twice that obtained in test tubes and also its viability. The use of activated charcoal not only reduced root deterioration in tissue cultures, but also the growth rate, and increased viability in terms of shoots formed/culture at high and low temp. The growth rate was also reduced when the level of certain minerals in the culture media was lowered. At 23°C, 40 mM of total N resulted in a growh rate with high viability and at 20°C, the optimum N level was 10-20 mM. Work in germplasm cryopreservation continues. Given the advances in research on min. growth and cryogenics, a dual clonal conservation system is foreseen for the near future: the base gene bank for long-term storage using liquid N and the active gene bank for short-term storage using min. growth conditions. Of a total of 1346 var., over 50% entered storage in 1982 and the rest have been stored for up to 36 mo. and only few for 54 mo. CIAT distributed a total of 80 var. in vitro to 9 countries and received 620 materials from Brazil as meristem cultures. (Summary by EDITEC) C01

0165

23421 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Tissue culture. In ________. Annual Reports for 1982 and 1983. Cali, Colombia. pp.433-443. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Germplasm. Cultivars. Clones. Production. Disease control. Cassava bacterial blight. Frog skin disease. Temperature. Apical meristems. Tissue culture. Planting. Growth. Plant development. Plant height. Leaf area. HCN content. Cuttings. Manihot. Colombia.

In 1983, research in tissue culture focussed on the production of healthy clones from diseased var., international germplasm exchange in clonal form, and long-term preservation of cassava. Materials infected by the frog skin disease and/or CBB were cleaned using thermotherapy followed by meristem culture. Attempts to clean several lines from a new viral disease, called ET, were made. Var. Llanera and CMC 40 were processed through termotherapy and meristem cultures and planted in the field. Compared with the control, yield and plant vigor were recovered (increased stem height, vigor of planting material, leaf dimensions, and HCN content), especially in Llanera. In 1983, a total of 104 cassava var. was sent in vitro to 12 countries. A set of 42 elite var. was made available to the national institutions. A total of 524 var. in vitro were introduced to CIAT. Embryo culture techniques to transfer and multiply wild Manihot spp. are being developed. To conserve germplasm in vitro, research is being conducted to make transfers of materials to fresh medium at intervals every 18-24 mo. Research on phenotypic stability of the material kept in vitro and on cryogenic storage continued. (Summary by EDITEC) C01

0166

21186 COCK, J.H. 1983. Cassava. In Smith, W.H.; Banta, S.J., eds. Symposium on Potential Productivity of Field Crops under Different Environments, Los Baños, Philippines, 1980. [Proceedings]. Manila, International Rice Research Institute. pp.341-359. Engl., Sum. Engl., 55 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Plant physiology. Temperature. Rainfall data. Water requirements. Climatic requirements. Photosynthesis. Leaves. Leaf area. Carbon dioxide.

Growth. Harvest index. Dry matter. Productivity. Root productivity. Germination. Photoperiod. Water stress. Nutritional requirements. Cultivars.

The climatic and soil requirements of cassava are presented, and the main physiological parameters (leaf photosynthetic rate, CGR, LAI, total DM production, and HI) are discussed. The effects of temp., day length, solar radiation, water, nutritional stress, and var. characters on the aforementioned variables and yield are analyzed. (Summary by M. de W.) C01

0167

20741 INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE. 1981. Effects of soil bulk density on root and shoot growth of cassava. In ______. Annual Report for 1980. Ibadan, Nigeria. p.14. Engl.

Cassava. Cultivars. Cultivation. Soil requirements. Soil physical properties. Root development. Plant height. Shoots. Leaf area. Nigeria.

A root-box study was conducted to investigate the effects of 3 soil bulk density treatments, 1.4, 1.6, and 1.8 g/cm^3, on cassava root and shoot growth. Cassava was grown in collapsable boxes 48 x 46 x 100 cm, with sides that could be removed for monitoring root growth at different stages. Measurements on root growth were made for cv. TMS30572 at 48, 78, 108, 132, and 185 days after planting. Root density, measured as length and dry wt., was not significantly affected by the soil bulk treatments used. Neither were there significant differences in plant height, leaf area, nor shoot dry wt. However, the shoot:root ratio was generally higher at soil bulk density of 1.6 g/cm^3 than at other densities. (Summary by M. de W.) C01

0168

22710 KASELE, I.N.; HAHN, S.K.; OPUTA, C.O.; VINE, P.N. 1984. Effects of shade, nitrogen, and potassium on cassava. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.55-58. Engl., Sum. Engl., 19 Refs. [Programme National Manioc, B.P. 11635, Kinshasa, Zaire]

Cassava. Shading. Fertilizers. N. K. Root development. Root productivity. Nigeria.

The effects of shade, N, and K on the formation of tuberous roots in cassava were studied. In pot expt., shade delayed initiation of bulking by about 40 days and reduced tuberous cell size and no. as well as DM diversion to tuberous roots. Tuberous roots were detected in plants treated with K earlier than in unfertilized plants. N did not affect tuberization but significantly increased no. of tuberous roots. Root diameter and wt., storage cell size and no., and DM allocation to roots were significantly greater in plants supplied with K, alone or in combination with N, but were significantly reduced by N applied without K. (Author's summary) C01

0169

23441 MABANZA, J.; JONARD, R. 1984. Sur l'isolement et le développement in vitro des protoplastes de Manihot glaziovii Muell. (On the isolation and in vitro development of protoplasts of Manihot glaziovii Muell). Comptes Rendus des Séances de l'Académie des Sciences (Serie 3: Sciences de la Vie) 298(19):563-566. Fr., Sum. Fr., Engl., 8 Refs., Illus.

[Laboratoire d'Histophysiologie et Radiobiologie Végétales, Université des Sciences et Techniques du Languedoc, 34060 Montpellier Cedex, France]

Cassava. Manihot glaziovii. Tissue culture. Cytology. Cytogenetics.

The mesophyll protoplasts of Manihot glaziovii, a woody species, were isolated and planted in order to induce somatic fusion with cassava mesophyll protoplasts. Sustained growth and protoplasts-derived calli were easily obtained on agar medium. (Author's summary) C01

0170

23442 MABANZA, J.; JONARD, R. 1983. L'isolement et le développement in vitro des protoplastes de manioc (Manihot esculenta Crantz). (Isolation and in vitro development of cassava protoplasts). Comptes Rendus des Séances de la Société de Biologie et de ses Filiales 177(5-6):638-645. Fr., Sum. Engl., Fr., 19 Refs., Illus. [Laboratoire d'Histophysiologie et Radiobiologie Végétales, Université des Sciences et Techniques du Languedoc, 34060 Montpellier Cedex, France]

Cassava. Tissue culture. Plant breeding. Isolation. Cytology. Cytogenetics.

Protoplasts were isolated and their development in vitro followed in different culture media in order to induce a resistance to CBB in different sensitive edible cassava cv. Two categories of cell proliferation are produced: (1) by budding division with normal caryokinesis but without reconstitution of the cell wall, forming pseudocallus or single cells; (2) by cleavage division regenerating the classic cells and the valid callus. The extent of these 2 types of proliferation varies according to the medium. (Author's summary) C01

0171

23231 MENDES, R.A. 1982. Folhas e gemas na micropropagacao da mandioca. (Leaves and buds in cassava micropropagation). Revista Brasileira de Mandioca 1(1):83-84. Port., Sum. Port., Engl., 8 Refs. [Centro Nacional de Recursos Genéticos, Caixa Postal 102.373, 70.000 Brasilia-DF, Brasil]

Cassava. Cultivars. Tissue culture. Apical meristems. Leaves. Propagation. Brazil.

A method of cassava micropropagation through the cultivation of leaves and buds was developed. The new plant originated from a seedling produced by means of meristem culture. (Author's summary) C01

See also 0175 0177 0179 0186 0229

C02 Cyanogenesis

0172

22776 BRIMER, L.; BROGGER C., S.; MOLGAARD, P.; NARTEY, F. 1983. Determination of cyanogenic compounds by thin-layer chromatography. 1. A densitometric method for quantification of cyanogenic glycosides, employing enzyme preparations (B-glucuronidase) from Helix pomatia and picrate-impregnated ion-exchange sheets. Journal of Agricultural and Food Chemistry 31(4):789-793. Engl., Sum. Engl., 31 Refs., Illus. [Dept.

of Chemistry BC, Royal Danish School of Pharmacy, 2 Universitetsparken, DK-2100 Copenhagen O, Denmark]

Cassava. Cassava meal. Analysis. Cyanogenic glycosides. HCN.

A densitometric method for quantitative determination of cyanogenic glycosides is described. It is based on the release of HCN catalyzed by the enzyme preparation beta-glucuronidase from Helix pomatia and subsequent direct detection of HCN on hydrophobic, picrate-impregnated, transparent, ion-exchange sheets. The sheets are placed directly on the enzyme-wetted chromatogram, and the intensities of the obtained spots are determined. No significant changes in intensities of spots occur over a period of 28 days, if the sheets are protected from corrosive vapors. If a densitometer is not available, or when a rapid field test is required, a semiquantitative determination is possible by visual inspection. The method was found suitable for the separate estimation of cyanogenic principles in CM, lima beans, and linseed meal. (Author's summary) C02

0173

22096 RAO, P.V.; HAHN, S.K. 1984. An automated enzymic assay for determining the cyanide content of cassava (Manihot esculenta Crantz) and cassava products. Journal of the Science of Food and Agriculture 35(4):426-436. Engl., Sum. Engl., 9 Refs., illus. [Charles F. Kettering Laboratory, 150 East South College Street, Yellow Springs, OH 45387, USA]

Cassava. Roots. Cassava products. Gari. Foofoo. Eba. Chickwangue. Cassava bread. Linamarin. Linamarase. Cyanides. Hydrolysis. Analysis. Nigeria.

An automated enzymic method for the analysis of cyanide in cassava and cassava products is described. A total of 300 analyses/day can be handled easily. A wide range of free (nonglycosidic) or bound (cyano-substituted glycosides) cyanides (0.4-4.0 micrograms HCN/ml) can be assayed in the extracted solutions. The upper limit of detection for the bound cyanide can easily be increased by another threefold by assaying it under partial hydrolysis conditions. Two enzymic methods, one manual and one automated on Technicon's Auto Analyzer, agreed well for the free and the bound cyanide in the leaf and the peeled storage root samples. (Author's summary) C02

See also 0253

C03 Chemical Composition, Methodology and Analyses

0174

22725 SAFO-KANTANKA, O.; ABOAGYE, P.; AMARTEY, S.A.; OLDHAM, J.H. 1984. Studies on the nutrient content of yellow-pigmented cassava. In Terry, E.R ; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.103-104. Engl., Sum. Engl., 5 Refs. [Crop Science Dept., Univ. of Science & Technology, Kumasi, Ghana]

Cassava. Cultivars. Composition. Analysis. Isolation. Identification. Vitamin A. Ghana.

A local Ghanian cv. of yellow cassava, Bankye Borode, was found to have begun to acquire pigmentation after 3 mo. of growth. The pigment was extracted using petroleum ether in acetone (1:1) or hexane as solvent. The extract was purified by column chromatography. The absorption spectrum of the pigment corresponded with that of beta-carotene, with peak absorption at 450 nm. The extract and beta-carotene gave identical Rf values of 0.82 and 0.805, resp., when chromatographed on silica-gel adsorbent. It was concluded that the yellow pigment is beta-carotene, the precursor of vitamin A. A proximate analysis revealed that, apart from its carotenoid content, Bankye Borode was not much different from Ankra, a local unpigmented cv., in nutrient composition. (Author's summary) C03

See also 0172 0177 0200

C04 Plant Nutrition

0175

23404 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Mycorrhiza project. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.59-70. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Mycorrhizae. Isolation. Fertilizers. P. Mulching. Herbicides. Weeding. Cultivars. Inoculation. Colombia.

In 1982, the objectives of the mycorrhiza project of CIAT's Cassava Program were to: (1) collect and maintain pure mycorrhizal strains; (2) evaluate the effectiveness of mycorrhizal strains and determine cultural practices favoring highly effective mycorrhizal associations during the entire cassava growth period and to preserve a high spore population in the soil; and (3) evaluate the conditions under which field inoculation can be considered economically feasible. The preliminary collection of strains increased to approx. 250 and procedures for isolating VA mycorrhizal fungi were standardized. The most effective species evaluated to date are Glomus manihotis (C-1-1, C-2-2, C-17-1) and Entrophospora colombiana (C-1-4 and C-10). Expt. on the effects of P on root infection by mycorrhizae were conducted at 4 sites, where a good yield response was obtained with 50 kg P/ha, but a marked increase in vesicle formation was observed at higher P levels in Quilichao and Carimagua-La Reserva soils. Root infection was found to decrease when plants were under water stress. The effect of mulching with 15 t Brachiaria decumbens straw/ha and inoculation with G. manihotis strain C-1-1 were studied in 2 cassava var.; inoculation increased yield consistently but not significantly. Expt. with herbicides to determine their effect on cassava yields and mycorrhizal infection suggest that the reduced spore production at 27 and 41 wk. after planting with herbicide applications could be due to the absence of weeds acting as hosts for mycorrhizal production and to a direct negative chemical effect. Radical weed control by herbicides may be detrimental for mycorrhizal spore production in crops with a shorter growth cycle than cassava. Expt. on cv. differences and on mulches indicated that the native mycorrhizal population is highly effective for cassava production and that the introduction of effective strains is only worthwhile in areas where the quantity and quality of the native population are low. In other expt. it was concluded that it is favorable to place the inoculum under the cuttings at planting and to reinoculate in lateral strips after the dry season. The following procedures are mentioned that predict the effectiveness of native mycorrhizae: mycorrhizal spore counts in the soil to determine the population; observation of root infection in native plants; morphological comparisons with isolated strains from the collection to establish the quality of the native strains; use of the response of cassava to P to determine the quality of native strains; survey of obligate mycotrophic plants such as native legumes or nonmycorrhizal plants that indicate the presence or absence of effective strains. (Summary by EDITEC) C04

0176

23417 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Mycorrhiza project. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.301-323. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Mycorrhizae. Field experiments. Laboratory experiments. Strains. Temperature. P. Inoculation. Cultivation systems. Rotational crops. Fertilizers. Colombia.

During 1983 the mycorrhiza project of CIAT's Cassava Program emphasized evaluating vesicular-arbuscular (VA) mycorrhizae under greenhouse and field conditions. Research was also conducted to determine long-term effects of agricultural practices on the native mycorrhizal population in the field. Seventy strains of the collection were evaluated for their effectiveness in the greenhouse Test I; of these, 33 strains had high potential to increase cassava production, 11 high potential to increase fine root growth, 18 high potential to infect cassava roots, and 18 were uneffective strains. Test II evaluated the competitive ability of mycorrhizal strains with native mycorrhizal fungi; Glomus manihotis (strains C-1-1 and C-20-2) was the only species that competed for root infection with the native population. Inoculations with G. manihotis may be worthwhile in fields containing low no. of Entrophospora colombiana. When the established species was G. occultum, the latter 2 species were able to compete with very high no. of that species. There was an antagonistic effect between G. manihotis and a high spore population of G. occultum. High no. of Acaulospora appendicula can stimulate plant growth. A synergistic effect of E. colombiana was found with increasing no. of Gigaspora pellucida. E. colombiana from Popayán (Colombia) was effective at 20°C, but the same species from Carimagua was not. To introduce strains into cooler regions, evaluations for lower temp. adaptation are required. G. manihotis absorbed more P at the higher application levels. E. colombiana favored plant growth most at 50 kg P/ha and G. occultum showed the lowest effectivity at all levels of applied P. Field inoculation trials indicated that: inoculation increased yields considerably; soluble P fertilizers could be substituted by insoluble rock phosphate; G. manihotis strain C-1-1 was suitable for both P sources (C-33-1 is more suitable for rock phosphates). The most effective placement method was to apply half of the inoculum at planting under the cutting and the other half in a side-band to the cuttings at 4-5 mo. growth. Direct negative correlation is likely to exist between the no. of native mycorrhizae and the yield increase due to inoculation. From the trials on the effect of agricultural practices on the native mycorrhizal population, it was concluded that each cropping system and fertilizer application can change the mycorrhizal species composition. In crop rotations in Caicedonia, the mycorrhizal spore population was higher than in the cassava continuous cropping system; fertilization decreased the no. of spores in both systems. (Summary by EDITEC) C04

0177

23403 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Soils and plant nutrition. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.25-57. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Cultivars. Soil requirements. Soil physical properties. P. Ca. Mg. Mineral content. Leaves. K. Fertilizers. N. Zn. Soil fertility. Cultivation. Land preparation. Soil conservation practices. Mycorrhizae. Cuttings. Herbicides. Insecticides. Inoculation. Productivity. Root productivity. Colombia.

Of 688 cassava germplasm accessions evaluated in CIAT-Quilichao for tolerance to low P and high soil acidity, it was found that the adaptation index for the best 20 cv. ranged between 4.49 for M Col 1612 and 20.27 for M Col 628. From the evaluation of the 77 best adapted and selected cv. in 1979, and reevaluated in 1982 in small plots, it was concluded that cv. can not be selected based on high internal P concn. While DM production was highly variable at high Ca and Mg concn., the critical levels corresponding to 95% of max. yield were estimated in 0.24% for Mg and approx. 0.46% for Ca. The critical levels in the petioles were 0.32% of Mg and 0.48% of Ca. No significant differences were observed for the different K application days but the sole application of K 30 days after planting gave higher yields than split application. The critical K level in the youngest fully expanded leaf at 4 mo. after planting was 1.7%. In NPK fertilization trials in 10 different sites, it was found that while cassava shows a K requirement similar to that of other crops, the P requirement is smaller possibly due to effective mycorrhizal associations. Critical P and K levels in the youngest fully expanded leaf, required to obtain a max. yield, were 0.4 and 1.5%, resp. The response to N was low, but in most infertile soils cassava leaves contained above 4% and in some sites up to 6.5%. The critical Zn level in the youngest fully expanded leaf was 33 ppm. Cassava cuttings treated with a 4% $ZnSO_4.7H_2O$ solution increased av. yields from 11.5 to 25 t/ha. M Per 247 and 2 hybrids were tolerant to Zn deficiency and produced high yields of 20 t/ha with no Zn application. In 1982 the long-term fertility trial completed its 4th cycle. Although NPK were only applied the 1st year, yields up to 30 t/ha were obtained. N responses during the 4 yr were small and relatively stable over time; P responses were considerable during the 1st year but this element lost importance over time, while K response was small at the beginning and increased over time. The effect of annual application was considerable, with yields of 71 t/ha for M Col 1684 and 55 t/ha for CMC 40. Cassava planting trials in 15% slopes in Mondomo (Cauca, Colombia) indicated that the traditional practice of preparing the soil with oxen or preparing the individual planting holes was both necessary and adequate. Research on factors determining effectiveness of mycorrhizae indicated that: (1) None of the cutting treatments recommended have long-term detrimental effects, but the herbicide alachlor applied to the foliage reduces root infection and DM production. (2) NPK and Zn or B sources or methods of application had no significant effects on root infection. (3) Some of the variations observed in determining cassava P concn. are due to differences in the effectiveness of the association with mycorrhizae. (4) In Quilichao the native mycorrhizal population is very efficient so that inoculation has no beneficial effects. (5) In Carimagua, although responses to inoculation were more significant in sterilized soil than in unsterilized soil, inoculation was highly significant in the latter, especially when P was applied. (6) Mycorrhizal responses were higher when the more soluble P sources were applied. (7) On the av. for all the species that were used as inoculation sources in Carimagua soil, yields increased 37% with strains from Quilichao and 21% with strains from Carimagua, which indicates that strain efficiency is also important. (Summary by EDITEC) C04

0178

23416 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Soils and plant nutrition. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.275-300. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Germplasm. Cultivars. Soil physical properties. Nutrient uptake. Agricultural lime. Fertilizers. N. P. K. Ca. Mg. Mycorrhizae. Inoculation. Soil conservation practices. Intercropping. Colombia.

During 1983, the soils and plant nutrition section of CIAT's Cassava Program continued to select germplasm for tolerance to acid and low P soils. Cv. with higher P adaptation indexes were M Col 628, M Col 1514, M Bra 36, M Bra 41, M Ven 321, and CM 430-37 (Quilichao, Colombia), and CM 841-9, CM 978-28, and CM 621-251 (Carimagua, Colombia). Of 150 kg N/ha absorbed by plants of cv. M Col 22 in Quilichao, 50 kg returned to the soil as fallen leaves, 40 kg remained in the tops, and 60 kg in the roots. Of the 75 kg K/ha absorbed by the plants, only 10 kg returned to the soil as fallen leaves, 15 kg remained in the tops, and 50 kg in the roots. Nutrient extraction by the cassava plant is clearly indicated by the reduction in soil N, K, Ca, and Mg levels during the growth cycle; the marked reduction in available P, especially in fertilized plots, evidences the fixation by the soil of applied soluble P. If these nutrients are not returned to the soil in the form of plant residues or organic/inorganic manures, the cassava crop can seriously affect soil fertility. Cassava is more competitive than its intercropped counterparts under very low and very high fertility levels, while at intermediate levels of lime or fertilizers, cowpea and peanut have a relative advantage over cassava. Trials on the residual effect of NPK fertilizers indicated that it is advisable to reduce applied P and increase applied K from one year to another, by using a compound fertilizer such as 10-20-20 or 15-15-15. CM 523-7 responded to the application of Ca in Carimagua, applied as gypsum and broadcasted at 200 kg/ha. CM 430-37 responded to the application of 40-60 kg Mg/ha. In Quilichao and Carimagua, cassava responded to P applications, but only to the traditional method of soil application. The most efficient strains were C-1-1 and C-20-2 (Glomus manihotis) collected in Quilichao and Carimagua, resp., and C-10 (Entrophospora colombiana) and C-15-2 (Acaulospora mellea), both from Carimagua. Under field conditions in Carimagua, strains C-1-1, C-4-2, C-10, and C-19-1 were selected for yield responses. In Mondomo, strain C-10 was more effective than C-1-1, and strain C-4-2 (G. caledonicum from Mondomito) was also effective but only in the absence of applied P. In trials on soil erosion control practices on slopes, it was found that fertilized cassava produced vigorous plants that protected the soil from the impact of rainfall and prevented increased weed growth, thus reducing the need for weedings. Soil losses were further reduced by applying maize mulch on the soil surface, intercropping cassava with Brachiaria humidicola, and zero tillage. The highest yields and the least amount of erosion were obtained with zero tillage. (Summary by EDITEC) C04

0179

22792 KRUTKUN, T. 1983. [Toxicity of arsenic as sodium arsenate on cassava grown on Map Bon sandy loam soil]. Kasetsart Journal 17(2):34-37. Thai., Sum. Engl., 12 Refs.

Cassava. Cultivation. Soil physical properties. Growth. Thailand.

Sodium arsenate was applied at 100 ppm and above to cassava plants grown in pots in sandy loam soil. Growth ceased immediately following application and the plants died within 1 wk. (Author's summary) C04

See also 0166 0168 0209

D00 CULTIVATION

See 0295 0297

D01 Soil, Water, Climate and Fertilization

0180

23214 ACOSTA-ESPINOZA, J. 1978. Estudios preliminares sobre el cultivo de la yuca (*Manihot esculenta* Crantz) en el Estado de Yucatán. (Preliminary study on the cassava crop in the Yucatán state). Tesis Ing.Agr. Saltillo, Coahuila, México, Universidad Autónoma Agraria Antonio Narro. 147p. Span., Sum. Span., 26 Refs.

Cassava. Cultivars. Cultivation. Rainfall data. Land preparation. Planting. Fertilizers. N. P. Weeding. Pests. Diseases and pathogens. Mycoses. *Oidium*. *Cercosporidium henningsii*. *Cercospora caribaea*. *Phytophthora drechsleri*. *Sphaceloma manihoticola*. *Rosellinia*. Agronomic characters. Germination. Roots. Productivity. Root productivity. Statistical analysis. Plant height. Harvest index. Mexico.

In the state of Yucatán, Mexico, cassava is cultivated at a family level. To promote its cultivation at a commercial level, the yield and performance of 6 var. (Criolla, I-TU, Cubana, Sra está en la mesa, Guaxupe, and Smalling Santa Cruz) were studied in a red clayey soil at the exptl. field in Uxmal. The lot was fertilized with 60-80-00, watered 14 times, and harvested at 12.5 mo. The most outstanding var. regarding yield were Criolla and Cubana with 36.8 and 33.3 t/ha, resp. It was likewise determined that cassava var. and lines from CIAT had the most favorable agronomic characteristics for their utilization in future breeding programs in Mexico. (Summary by M. de W. Trans. by L.M.F.) D01

0181

23447 BOURKE, R.M.; EVENSON, J.P.; KEATING, B.A. 1984. Relationship between the altitudinal limit of cassava and soil temperature in Papua New Guinea. Tropical Agriculture (Trinidad) 61(4):315-316. Engl., Sum. Engl., 7 Refs. [Dept. of Human Geography, Australian National Univ., Canberra, Australia]

Cassava. Climatic requirements. Temperature. Soil requirements. Germination. Papua New Guinea.

Observations on the upper altitudinal limit of cassava at various locations in Papua New Guinea gave a mean of 1800 m. The mean of a set of soil temp. measurements at one location at this alt. was 17.9°C. Exptl. work in Queensland, Australia, has indicated that a mean soil temp. of 18°C is the lowest temp. for satisfactory cassava establishment. It is suggested that the upper altitudinal limit of cassava in Papua New Guinea is related to soil temp. (Author's summary) D01

0182

21476 CATAÑO A., H.O.; PEREZ E., C.A.; DIAZ D., A. 1983. Evaluación de tres sistemas de preparación del suelo para cuatro materiales de yuca (*Manihot esculenta* Crantz). (Evaluation of three land preparation systems for four cassava materials). Acta Agronómica (Colombia) 33(4):23-32. Span., Sum. Span., Engl., 16 Refs., Illus.

Cassava. Cultivars. Cultivation. Land preparation. Soil physical properties. Energy productivity. Productivity. Root productivity. Labour. Costs. Colombia.

The effect of 3 land preparation systems on productivity of the cassava crop was compared as well as their effect on physical properties of the soil. The energy balance in cassava production is determined. The systems studied were: (1) high tillage level (disk plowing at 30 cm, 2 heavy harrowings at 15-30 cm, 1 light disk harrowing, ridges at 1.0 m distance and 0.30 m high); (2) medium tillage level (chisel plowing at 40 cm, 1 heavy disk harrowing, ridges); (3) low tillage level (ridges). A split plot exptl. design was used with 8 replications. The highest yield was 34.74 t/ha with the medium tillage level system, followed by 31.77 t/ha with the high tillage level system and 31.08 t/ha with the low tillage level system. The medium tillage level gave the best performance in both the energy balance and economic analyses. (Author's summary) D01

0183

23414 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Agroecological studies. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.233-238. Engl. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Ecosystems. Production. Soil physical properties. Climatic requirements. Colombia.

As a 1st step to a more rigorous quantitative approach to the classification and to the establishment of the homogeneity of the 6 edaphoclimatic zones established by CIAT's Cassava Program, the following main areas were defined in 1983 in terms of cassava production: the NW or Caribbean coast of Colombia; the eastern-central part of Colombia (Santander); the southern Andean valleys of Colombia; the northern coast/highlands in Venezuela; the Belem and Sao Luis areas, NE Brazil; the upland belt in NE Brazil, west of the coastal plains stretching from Recife to Salvador; the Sao Mateus area, Espirito Santo, and its westward extension, Brazil; the coastal area between Florianapolis and Laguna, Santa Catarina, Brazil; the Porto Alegre area and westard extension, Rio Grande do Sul, Brazil; the rio Uruguay valley, SE Brazil, and Misiones, Argentina; the southern half of Paraguay; Haiti and the Dominican Republic; and Cuba. In terms of broad-scale physical environments, the following soil types were preliminarily determined as of major importance for cassava production: Acrisols (25% of cassava in Latin America), Ferralsols (20%), and Luvisols (20%). In terms of climates, the most important are: humid equatorial (25%), marine savanna tropical (15%); humid subtropical, humid temperate, dry temperate, continental savanna tropical, and continental semitropical (between 7-12% each). (Summary by EDITEC) D01

0184

22774 INDONESIA. MINISTRY OF AGRICULTURE. AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT. 1981. Tuber crops: cassava. In ________. 5 years of agricultural research and development for Indonesia 1976-1980. Jakarta. pp.23-24,27-28. Engl., Illus.

Cassava. Cultivars. Composition. Cultivation. Fertilizers. N. P. K. Soil requirements. Soil physical properties. Cassava chips. Storage. Cultivation systems. Rotational crops. Indonesia.

Between 1976-80, 711 cassava var. were collected in Indonesia. Two of these, Adira I and Adira II, were selected for their high yield, pest resistance, and agronomic characters. Several fertilization trials in different types of soil and their effect on yield are indicated; the treatment of cassava chips with a sulphite solution to store them up to 6 mo. is mentioned. Finally the use of cassava in relay cropping is reported. (Summary by M. de W.) D01

0185

22779 INTERNATIONAL SUPERPHOSPHATE MANUFACTURERS ASSOCIATED. PARIS. 1981. Manioc, patate douce et igname. (Cassava, sweet potato, and yam). In ________. Guide sur la fertilisation phosphatée. France. pp.1-5. Fr., 5 Refs.

Cassava. Sweet potato. Yams. Production. Productivity. Fertilizers. N. P. K. Africa. Asia. North America. South America. Central America. Oceania. Europe.

Data on cultivated land and production of cassava, sweet potato, and yam worldwide are given. Total area planted to cassava is 13,132,000 ha with a production of 119,374,000 t. Av. cassava yields are 8.8 and 2-30 t/ha on a worldwide and national basis, resp. Based on fertilizer exports, K is considered the principal nutrient. The recommended dose of P for the 3 crops is between 40-80 kg/ha. In general, the recommended N-P-K application for cassava is 60-60-120, although this varies according to soil type. The importance of P for the crops is indicated, and the potential of the aforementioned crops, particularly cassava, is discussed. (Summary by M. de W.) D01

0186

23448 KANG, B.T. 1984. Potassium and magnesium responses of cassava grown in Ultisol in southern Nigeria. Fertilizer Research 5(4):403-410. Engl., Sum. Engl., 9 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivars. Cultivation. Soil physical properties. Fertilizers. K. Mg. N. P. Planting. Spacing. Harvesting. Soil analysis. Leaves. Mineral content. Productivity. Root productivity. Nigeria.

Results of 3 consecutive croppings to study the K and Mg responses of 2 improved cassava cv., TMS 30395 and 30211, grown on an acid, sandy loam, Ultisol (Typic paleudult) in southern Nigeria are reported. On land newly cleared from Eupatorium fallow a significant K response in the 1st cropping year was observed only with the more vigorous cv. TMS 30395. Both cv. responded to K applications at rates of 30 and 60 kg/ha in 2nd and 3rd croppings, resp. A significant response to application of 20 kg Mg/ha was observed in the 3rd crop with cv. TMS 30211. Cv. TMS 30395 seems to be more effective in utilizing Mg from the soil. (Author's summary) D01

0187

22714 NDAYI, K. 1984. Factors limiting cassava production among peasants in Lukangu, Zaire. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.71-72. Engl., Sum. Engl. [Programme National Manioc, Gandajika, B.P. 22, Mbuji-Mayi, Zaire]

Cassava. Production. Cultivation. Cultivation systems. Soil physical properties. Timing. Planting. Intercropping. Cotton. Maize. Beans. Xanthomonas campestris pv. manihotis. Mononychellus tanajoa. Zaire.

A survey of cassava production was conducted in Lukangu, Zaire, in 1982, covering the type of land selected for cultivation; planting times; diseases, insects, and pests attacking cassava; the possibility of solving food shortages in the region by intercropping; and, lastly, the possibility of enabling the peasants to plant cassava in fertile valleys as a result of introducing improved resistant var. from the Programme National Manioc. (Author's summary) D01

0188

22713 VINE, P.N.; AJAYI, O.B.; MITCHOZOUNOU, D.M.; HOUNKPATIN, E.J.; HOUNKPEVI, T. 1984. Soil-conserving techniques in cassava and yam production. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.67-70. Engl., Sum. Engl., 10 Refs. [Dept. of Agronomy, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Cultivars. Cultivation. Water requirements (plant). Land preparation. Ploughing. Mulching. Timing. Planting. Pest control. Insecticides. Acaricides. Zonocerus variegatus. Mononychellus tanajoa. Nigeria.

The potential of some soil-conserving practices in the production of cassava and yam in Nigeria was investigated. Dry season planting of cassava to hasten canopy development to protect the soil during the subsequent rainy season and the effects of mulching and tillage on both cassava and yams were examined. Dry season cassava, when protected by insecticide or acaricide, yielded more than 30 t/ha at 14 mo. after planting. A certain amount of residual soil moisture at planting time was found necessary for crop establishment. Soil splash was reduced more by mulching than by omission of tillage both in the cassava and in the yam studies. Other findings were that planting cassava stakes on a slant is suitable for both tilled and untilled plots and that the hardness of the soil does not appreciably affect the ease with which cassava roots can be pulled from the ground. (Extracted from author's summary) D01

See also 0156 0157 0159 0161 0163 0166 0167 0168 0175
0176 0177 0178 0191 0192 0245 0288 0292 0293
0302 0303 0304

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

0189

21119 ABREU E., J.; NIVAR P., M.U. 1984. Eficacia y fitocompatibilidad de varios herbicidas en el cultivo de la yuca. (Efficiency and phytocompatibility of several herbicides in the cassava crop). San Cristóbal, República Dominicana, Instituto Politécnico Loyola. Finca Experimental Agrícola. Informe no.12. 16p. Span., Sum. Span., 13 Refs., Illus. [Inst. Politécnico Loyola, San Cristóbal, República Dominicana]

Cassava. Cultivars. Field experiments. Cultivation. Climatic requirements. Soil physical properties. Weeds. Weeding. Herbicides. Root productivity. Dominican Republic.

In order to obtain new techniques to efficiently control the weed in the cassava crop, the efficiency and phytocompatibility of 10 preemergent herbicides were studied. Best results were obtained with: diuron at a rate of 2.16 kg a.i./ha, metribuzine at 0.77 kg a.i./ha, metolachlor at 2.59 l a.i./ha, and oxyfluorfen at 0.40 l a.i./ha. (Author's summary. Trad. by M. de W.) D02

0190

23409 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Cultural practices. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.145-164. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Cultivars. Cultivation systems. Intercropping. Maize. Cowpea. Planting. Spacing. Productivity. Root productivity. Weeds. Weeding. Herbicides. Hoeing. Costs. Agricultural equipment. Labour. Soil conservation practices. Colombia.

In 1982, the cultural practices section of CIAT's Cassava Program focussed on evaluating multiple cropping, weed control, and soil erosion control in cassava planted on slopes. Cassava var. M Col 113 and hybrid CM 849-1 were intercropped with 2 maize var. (Population 31 and La Posta). M Col 113, in association with Population 31, yielded 10 t roots/ha more than in monoculture, and with La Posta its yield was the same as in monoculture. CM 849-1 outyielded M Col 113 by 18.5 t/ha in monoculture, but suffered a moderate reduction when intercropped with Population 31 and a significant reduction with La Posta. Intercropping tended to decrease starch content in M Col 113 but not in CM 849-1. Both cassava materials showed similar land use efficiency indexes. Av. fresh root yields for cassava var. M Ven 77 intercropped with cowpea were greater than 50 t/ha. In the 1 x 1 m spatial arrangement, intercropped cassava gave the lowest yield, while at 1.8 x 0.55 m it yielded the highest. Leaving weeds uncontrolled between rows or between plants within rows can reduce cassava root yields significantly, but weeds growing between plants within rows appear to be more detrimental for root production than weeds between rows. It is therefore necessary to identify postemergent control systems that will also cover the area between plants. In Palmira, Carimagua, and Caribia (Colombia), 5 postemergent weed control systems were evaluated. In Palmira, the best yield (58.3 t/ha) was obtained with oxyfluorfen + paraquat applied with ultralow vol. equipment. In Carimagua, the best results were obtained with 2 hand weedings (20.6 t/ha), and in Caribia, the highest yield was obtained with hand weeding (28.0 t/ha). The use of the chemical hoe, however, is promising for its low price, ease of handling, and economical use of the herbicide. In addition, under low weed pressure the chemical hoe can reduce labor costs 30% compared with hand weeding. The trial on soil erosion control methods on 30% slopes, initiated in 1979, was completed this year, and the efficiency of strip cropping and the use of live barriers to reduce soil erosion was proved. Total soil loss in strip cropping was reduced 22% compared with that observed in traditional cropping systems. Cassava yield after 18 mo. in the strip cropping system with fertilization was 12.2 t/ha compared with 5.3 t/ha for the traditional system. It is feasible to produce cassava under hillside conditions; however, the technology required will be labor-intensive. (Summary by EDITEC) D02

0191

23422 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Cultural practices. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.445-475. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Propagation materials. Cultivars. Hybrids. Dry matter. Cuttings. Production. Climatic requirements. Soil requirements. Timing. Germination. Planting. Spacing. Intercropping. Cowpea. Fertilizers. N. P. K. Nutritional requirements. Weeding. Productivity. Root productivity. Pest control. Colombia.

Great differences were found between cv. in their ability to produce planting material; this ability is relatively independent from total top growth but is greatly influenced by total top DM distribution among parts not useful for cutting production. Cv. with high root yield characteristics are, at the same time, most efficient in producing cuttings. Climatic and soil conditions affected the production of planting material in the same cv. Cutting production increases with plant age, reaching an optimum in some cases but continuing to increase in others. There appears to be no limiting max. age for cutting production. In CIAT-Palmira, the min. plant age was found to be 8 mo., but hybrid CM 849-1 demonstrated that cutting production can begin at 6 mo. of age. Old cuttings from the middle and lower portions of the primary stems had rapid sprouting and vigorous early growth compared with younger cuttings (upper portion of primary and secondary stems); however, younger cuttings yielded significantly more commercial roots/plant than older cuttings. Small cuttings (10 cm long) can reduce crop establishment and vegetative development considerably, thus affecting cutting production significantly. Cuttings slightly longer than those recommended for commercial root production (20 cm) may be best to ensure good vegetative growth and high cutting production, with no detrimental effect on root production. To obtain increased no. of cuttings/plant and per hectare, vertical planting of 20-cm cuttings was superior to inclined or horizontal planting. To obtain a high no. of cuttings/unit area, planting densities of up to 40×10^3 plants/ha should be used but if the crop is ratooned, it is necessary to thin the regrowth to 1-2 shoots/plant. If a good cutting and root production is desired, it is advisable to plant a density of 20×10^3 plants/ha. Single row cassava in monoculture suffered no substantial changes in its cutting production potential when the spatial arrangement was changed from square to rectangular while maintaining plant density. However, in association with cowpea, the rectangular planting pattern minimized the competition between crops and was decisive in maintaining an adequate vegetative growth and cutting production in cassava. N and P fertilization is essential for the production of high quality planting material in sufficient quantity; K had no significant effect. P nutrition of mother plants plays a key role in high quality stake production, especially if this planting material is to be sown on acid low P soils. A deficient weed control affects in similar proportions both production of cuttings and roots; therefore, it is necessary to maintain good weed control when both root and planting material production are to be optimized. (Summary by EDITEC) D02

0192

22786 CORREA, H.; BUENO, L.C. DE S.; PEREIRA, P.; VIEIRA NETO, J.C. 1981. Avaliacao do comportamento de quatro cultivares de mandioca (*Manihot esculenta* Crantz) em diferentes sistemas de conducao das plantas. (Evaluation of the performance of four cassava cultivars in systems with plants differing in their number of stems). Ciencia e Pratica 5(2):119-128. Port., Sum. Port., Engl., 5 Refs., Illus.

Cassava. Cultivars. Cultivation. Climatic requirements. Rainfall data. Soil physical properties. Stems. Statistical analysis. Agronomic characters. Plant height. Productivity. Root productivity. Starch content. Dry matter. Brazil.

Var. x no. of stems (1, 2, 3 or more) interaction was studied in cassava var. Sonora, Riqueza, Branca de Santa Catarina, and IAC-14-18, planted on a dark red Latosol in Lavras (MG, Brazil), from Nov. 1977 to June 1979. The following agronomic parameters were evaluated: stand at harvest time, plant height, av. no. of stems, stem diameter, no. of tuberous roots, branch yield, fresh wt. of root yield, root DM and starch content. Sonora and Branca de Santa Catarina showed the highest root yields, fresh wt. of roots, and starch contents. These var., besides Riqueza, showed the greatest plant heights, branch yields, and root DM. For Riqueza, av. no. of stems increased with initial no. of stems while for Sonora, Branca de Santa Catarina, and IAC-14-18, it was not necessary to leave more than 2 stems/plant. The smallest stem diameter was observed on the free growth system (more than 3 stems/plant). The no. of tuberous roots was not influenced by var. or no. of stems. (Author's summary) D02

0193

20793 LEIHNER, D.E.; HOLGUIN V., J.; LOPEZ M., J. 1980. El coquito (Cyperus rotundus L.) en el cultivo de yuca: interacciones y control. [Purple nutsedge (Cyperus rotundus) in cassava: interactions and control]. Revista COMALFI 7(3-4):.-20. Span., Sum. Span., Engl., 2 Refs., illus.

Cassava. Cultivation. Weeds. Weeding. Hoeing. Herbicides. Intercropping. Colombia.

Recent information on the biological balance between purple nutsedge (Cyperus rotundus) and cassava is analyzed; the possibilities of influencing this balance to favor cassava are also studied. The slow initial growth of cassava highly favors the development and propagation of C. rotundus, resulting in competition between the 2 species during the 1st part of the cassava growth cycle. While competition for light may be of little importance, the allelopathic effect and the large consumption of water and nutrients by the weed may be responsible for cassava production losses. In cassava, mechanical control of C. rotundus continues to be the most common pr ctice; however, this can aggravate the problem instead of reducing it. Only mechanical control during the dry season shows some promise. Preemergence herbicides or preplanting incorporated products currently used in cassava are of limited and erratic effectiveness against C. rotundus, but chemicals with improved effectiveness have been identified. In the area of postemergence herbicides, glyphosate continues to be the most effective. Since there is still no ideal control system, simple practice, or single herbicide to control and finally erradicate C. rotundus, investigation has focussed on integrated control measures that combine mechanical, chemical, and cultural practices. Future investigations will try to establish practical and economical integrated control systems and at the same time determine the factors responsible for yield and quality losses in cassava due to C. rotundus, such as allelopathy and competition for water and nutrients. (Author's summary) D02

0194

23439 MOSANGO, M. 1983. Influences des plantes adventices sur les plantes de culture: quelques résultats. (Effect of weeds on crop plants: some results). Journal d'Agriculture Traditionnelle et de Botanique Appliquée 30(1):35-48. Fr., Sum. Fr., Engl., 16 Refs., Illus. [Université de Kisangani, Faculté des Sciences, B.P. 888, Kisangani, Zaire]

Cassava. Cultivation. Weeds. Productivity. Root productivity. Zaire.

The interrelationships between weed species and cultivated plants are reviewed and aspects of competition are discussed with particular reference to the weed communities in the Kisangani region, Zaire, dominated by Bidens pilosa, Mariscus alternifolius, and Imperata cylindrica in cassava. (Summary by Weed Abstracts) D02

0195

23177 PANE, H.; SUNDARU, M. 1981. Increasing corn and cassava production in Alang-alang area. In Rao, B.V.V., ed. Asian-Pacific Weed Science Society Conference, 8th., Bangalore, India, 1981. Proceedings. Bogor, Indonesia, Central Research Institute for Food Crops. v.2,pp.159-163. Engl., Sum. Engl., 5 Refs. [Central Research Inst. for Food Crops, Jalan Merdeka 99, Bogor, Indonesia]

Cassava. Cultivars. Cultivation. Weeds. Weeding. Herbicides. Hoeing. Root productivity. Maize. Indonesia.

Two expt. were conducted in Sukadana Substation, Lampung, Indonesia, during the wet season of 1980-81. In the 1st, several methods of tillage and weed control were studied on maize. In the 2nd, expt. several weed control methods were tested on cassava cv. Adira 1 and Adira 2. Direct application of glyphosate at the rate of 3 l/ha in between rows of cassava at 1 and 3 mo. after planting gave the highest fresh wt. of roots among weed control methods tested. High yield was also obtained from the plots which were hand weeded once at 1 mo. after planting followed by 3 l glyphosate/ha at 3 mo. after planting. These treatments increased cassava yield over hand-weeded plots. It was also found that cassava cv. Adira 2 (with branches) and cv. Adira 1 (with no branches) had yield losses of about 71 and 82%, resp., caused by weed competition. (Author's summary) D02

0196

21498 PIANG, L.N. 1982. Suitability of five preemergence herbicides for cassava (Manihot esculenta Crantz). MARDI Research Bulletin 10(1):26-32. Engl., Sum. Mal., Engl., 4 Refs. [Malaysian Agricultural Research & Development Inst., Food Technology Division, Bag Berkunci 202, Pejabat Pos U.P.M., Serdang, Selangor, Malaysia]

Cassava. Cultivars. Cultivation. Fertilizers. Weeds. Weeding. Herbicides. Plant injuries. Malaysia.

Two expt. were conducted to determine the suitability of 5 preemergence herbicides for cassava. The 1st showed that alachlor, fluometuron, and oryzalin were safe to cassava at 1.5 kg/ha and produced a satisfactory weed control. Applied at 1.5 kg/ha, diuron induced some phytotoxicity; tebuthiuron gave a long and excellent weed control but induced severe phytotoxicity. The 2nd expt. confirmed that alachlor, fluometuron, and oryzalin were selective and had a wide margin of safety to cassava. Diuron had been found to be partially selective and may not be safe if applied at more than 1.5 kg/ha. However, it may be used in combination with alachlor at a reduced rate. It is concluded that suitable herbicides for cassava were alachlor, fluometuron, and oryzalin. (Author's summary) D02

0197

22785 VASEY, D.E. 1983. Plant growth on experimental island beds and nitrogen uptake from surrounding water. Agriculture, Ecosystems and Environment 10(1):15-22. Engl., Sum. Engl., 24 Refs. [710 North 21st Street, Apt.5, Coeur d'Alene, ID 83814, USA]

Cassava. Cultivation. Water requirements (plant). Experiment design. N. Nutrient uptake. Growth. Papua New Guinea.

The cultivation of crops on raised planting surfaces surrounded by standing water was investigated with Brachiaria mutica planted in pots from which the roots could extend through the substrate to the standing water. The total N levels of artificial ponds were higher in those exposed to sunlight than in those which were completely shaded. In further studies with wet and upland rice, Colocasia esculenta, Xanthosoma saggitifolium, cassava, sweet potato, maize, and Dioscorea alata, only C. esculenta grew normally. (Extracted from summary by Field Crop Abstracts) D02

0198

23443 YANGALI A., J. 1981. Evaluación en rendimiento de cinco variedades de yuca (Manihot esculenta) en seis épocas de siembra. (Yield evaluation of five cassava varieties, planted at six different times). Tegucigalpa, Honduras, Secretaría de Recursos Naturales. 18p. Span., Sum. Span., 3 Refs., Illus.

Cassava. Cultivation. Timing. Planting. Harvesting. Productivity. Root productivity. Statistical analysis. Honduras.

At the Centro Universitario Regional del Litoral Atlántico (Honduras), 6 planting times (March, May, July, Sept., Nov., and Jan.) were evaluated during 1980-81 with 5 cassava var. (Itú, Valenca, San Andrés, Mexico 59, and Guaymas 323) in a Latin square exptl. design. Two harvest dates, at 8 and 10 mo., were evaluated as additional information. Yields showed highly significant diferences for planting and harvesting times. The best planting seasons were May and March with low rainfall and the worst, Nov. (high rainfall). Yields at 10 mo. exceeded those at 8 mo. by 37.27%. There were highly significant differences for var. Guaymas 323 was the highest yielding var. with 20.07 and 28.03 t/ha at 8 and 10 mo., resp., whereas Valenca gave the lowest yields (12.7 and 17.03 t/ha, resp.). This latter var. was susceptible to thrips (Frankliniella williamsii). (Author's summary. Trans. by L.M.F.) D02

See also 0175 0178 0180 0184 0187 0188 0245 0289 0290 0292 0293 0302 0303 0304

D03 Energy Productivity and Yields

0199

23410 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Regional trials. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.165-170. Engl. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Cultivars. Selection. Root productivity. Technological package. Technology. Ecosystems. Colombia.

The 8th cycle of regional trials for promising selections of CIAT's Cassava Program was completed in 1982 under improved low input technology at 9 Colombian sites. The global av. yield of all trials, including all var. planted at all sites, was 8.2 t of dry roots/ha at 12 mo. (almost 3 times the Colombian av.). The av. yield of the best local cv. was 5.9 t/ha (almost double the national av.), confirming the fact that by adopting simple but improved agronomic practices, yield can be increased 100% for all existing cv. Yield can be improved up to 200% compared with the national av. by adopting simple improved technology and CIAT selections (M Col 1684, CM 516-7, CM 507-37, CM 489-1, CM 922-2). The av. yield of the best performing CIAT selection at each site was 10.9 t/ha (400% of the national av. regardless of irrigation, fertilizers, and chemical control of diseases and insect pests under a broad range of environmental conditions). Data of 8 yr indicate that CIAT genotypes are a useful source of variability for selection in at least 3 edaphoclimatic zones. CIAT genotypes were of little value in Popayan, Pereira, CIAT-Quilichao, and Florencia, indicating that more breeding efforts are required for these areas. M Col 1684 has demonstrated wide adaptation as well as good stability. (Summary by EDITEC) D03

0200

22091 GOMEZ, G.; VALDIVIESO, M. 1984. Cassava for animal feeding: effect of variety and plant age on production of leaves and roots. Animal Feed Science and Technology 11(1):49-55. Engl., Sum. Engl., 18 Refs. [Centro Agronómico Tropical de Investigación y Enseñanza, Apartado 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Bitter cassava. Sweet cassava. Timing. Harvesting. Composition. Protein content. Dry matter. Cassava chips. Cassava leaves (vegetable). Colombia.

Two cassava var., CMC-40 (low-cyanide) and CMC-84 (high-cyanide), were grown under similar edaphoclimatic conditions and evaluated monthly at 4 plant ages (mo. 9-12) for their production of leaves and roots as animal feeds. Sample areas of 560 m^2/var. were harvested at each plant age. Max. leaf production occurred at 11 mo. and reached 1.17 and 1.85 DM/ha, with av. CP contents of 27.4 and 25.1% on DM basis, for var. CMC-40 and CMC-84, resp. Whole roots were processed and chips were sun-dried. DM content of whole roots and estimated total dried chip production were lower for var. CMC-40 (33.2% DM; 8.9 t/ha) than for var. CMC-84 (38.9% DM; 10.1 t/ha). Plant age had little effect on dried chip production of CMC-40, but production of var. CMC-84 increased with age, reaching a max. of 12 t/ha with 1-yr-old plants. The av. chemical composition of dried chips is presented. (Author's summary) D03

0201

22783 O'HAIR, S.K.; LOCASCIO, S.J.; FORBES, R.R.; WHITE, J.M.; HENSEL, D.R.; SHUMAKER, J.R.; DANGLER, J.M. 1983. Root crops and their biomass potential in Florida. Soil and Crop Science Society of Florida Proceedings 42:13-17. Engl., Sum. Engl., 27 Refs., Illus. [Agricultural Research & Education Center, Florida State Univ., Homestead, FL 33031, USA]

Cassava. Cultivars. Harvest index. Energy productivity. Productivity. Root productivity. Sweet-potatoes. USA.

During trials in Florida, USA, the HI, total plant yield, and kcal produced daily/ha of cassava cv. CMC 40 were 0.79, 11.4 t/ha, and 14 x 10^4, resp. These data are discussed and compared with the ones obtained for sweet potato, chicory, and other crops. Likewise, future research needs are discussed. (Summary by M. de W.) D03

See also 0156 0157 0159 0161 0163 0166 0168 0175 0180
0182 0190 0195 0198 0223 0244 0245 0292 0301
0302 0303 0304

D04 Postharvest Studies

0202

23411 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Cassava utilization. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.171-180. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Development. Economics. Marketing. Drying. Solar drying. Cassava chips. Animal nutrition. Poultry. Swine. Cassava meal. Roots. Deterioration. Storage. Colombia.

The semicommercial phase of the pilot project for the production, processing, and marketing of cassava on the Atlantic Coast of Colombia was completed. Natural drying of cassava is a technically, economically, and socially feasible agroindustrial activity offering the advantages of: promoting technology that is rapidly adopted by farmers; stimulating the formation and integration of groups or associations of farmers that carry out production, processing, and marketing activities; and encouraging the continuous, active, and integrated participation of institutions involved in rural development projects. Efforts on the evaluation and introduction of modifications for the processing of cassava chips in the natural drying pilot plant in Betulia (Sucre, Colombia) continued to improve drying efficiency and plant operation. as well as the development and evaluation of a through circulation drier for cassava chips in a joint project with the U. del Valle. Under CIAT conditions, the system allows cassava chips to be dried for 48 continuous hours at a loading density of 125 kg/m^2 of drying floor, with an airflow rate of 18 m^3/min/m^2 of drying floor. Feeding trials with broilers indicate that whole roots of high HCN var. can be used safely if they are adequately processed (sun-drying of whole root chips). The satisfactory results obtained with broilers fed with diets containing 20-30% CM with 300 ppm HCN indicate that the limit of HCN of 100 ppm set by the EEC for dried cassava products should be reevaluated. The inclusion of CM at a level of 20% for broilers has produced the best biological and most economic results, similar or slightly better than those obtained with a commercial balanced feed. The combination of 3 protein sources (SBM, fish meal, and cottonseed meal) in balanced diets with 20% CM has produced better performance of broilers than the use of only 1 or 2 protein sources. Feeding trials with growing pigs and lactating sows and their litters have also shown that the CM from whole roots of high HCN var. can be used at levels of 30-40% with good results. A spectrophotometric assay to detect scopoletin was developed and a positive correlation was found between scopoletin content in root parenchyma 2 days after harvesting and the degree of physiological deterioration. There is a close relationship between scopoletin content and mechanical damage of roots. In general, root DM content is directly related to deterioration. Although resistance to physiological deterioration can be obtained through preharvest pruning or postharvest curing, medium-term storage can only be achieved through the control of the secondary microbial deterioration that generally starts 5-7 days after harvest. Roots treated with potassium sorbate showed no microbial growth even after 2 wk. of storage. These treated roots were stored in plastic bags to obtain curing conditions. Storing roots in plastic bags with holes allowed storage for up to 4 wk. with no need for the sorbate treatment. (Summary by EDITEC) D04

0203

23423 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Cassava utilization. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.477-486. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Roots. Deterioration. Storage. Technological package. Costs. Economics. Solar drying. Drying. Cassava chips. Colombia.

During 1983, the utilization section of CIAT's Cassava Program worked on fresh cassava deterioration and storage, and on cassava drying. Roots stored in sealed bags with no perforations and treated with thiabendazole only showed less than 5% losses due to microbial deterioration after 2 wk. Roots stored 2 h after harvesting had curing process 100% effective while roots stored with a 4 h delay suffered 30-40% losses due to physiological deterioration. Therefore, storage should be carried out on or near the farm to avoid delays; packing should be done in shaded areas. Changes in quality of roots stored during 2 wk. were min. On-farm trials were initiated to test this storage method in the area of Rozo, Valle (Colombia); the results obtained are comparable with those obtained at CIAT. Farmers are interested in this method, which if integrated into the system would greatly benefit the fresh root market in Colombia. The capacity of the cassava processing pilot plant on the Atlantic coast of Colombia was increased. During 1983 the construction of 6 additional drying plants was initiated. In the process of developing a through circulation dryer, several materials were evaluated to substitute the concrete blocks of the solar collector. The efficiency of the collector using river boulders or corrugated iron sheets was similar at 3 airflow rates, with similar increases in the drying temp. over the ambient temp. In terms of costs, the 2 alternatives appear to be similar, but the transportation cost of boulders could limit their use to specific locations. A Brazilian-type chipper that produces rectangular bars is being evaluated. Initial results indicate that the geometry of the chips is a significant improvement over that of chips produced by the Thai-type machines. (Summary by EDITEC) D04

0204

22788 HIROSE, S.; DATA, E.S.; QUEVEDO, M.A.; URITANI, I. 1984. Relation between respiration and post-harvest deterioration in cassava roots. Japanese Journal of Crop Science 53(2):187-196. Engl., Sum. Engl., Jap., 21 Refs., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte, Philippines]

Cassava. Cultivars. Roots. Cortex. Sweet-potatoes. Storage. Pruning. Deterioration. Plant physiological processes. Plant respiration. Philippines.

Expt. were carried out to study changes in respiration in cassava root pieces or tissue blocks in relation to physiological deterioration (PD), and to elucidate the effects of pruning on PD. Cassava cv. used were Golden Yellow, Hawaiian-5, Kadabao, Cambodia, CCS-1984, and CCS-167; sweet potato was used as control. When root pieces were artificially wounded, the respiratory rates reached a peak 1 day after harvest, followed by a max. peak 5-6 days later; the respiratory rate of intact roots was lower than that of the injured roots. The respiratory response of sweet potato was different from cassava; high rates were observed soon after harvest, and then decreased gradually without any noticeable peaks during the 4 days after harvest. Var. differences in respiratory rates of cassava roots were observed; cv. Golden Yellow and Kadabao showed a much higher respiratory rate than cv. Hawaiian-5. No significant difference in the deterioration degree between intact and injured roots was seen; root pieces with high degree of PD showed higher respiration rates than the roots with low degree of PD. After 4 days of storage under low or high humidity conditions, the wt. losses were 2.92 and 0.88%, resp. Roots of pruned plants deteriorated more slowly than the unpruned control; no difference in the respiratory rate between the former and the latter was seen. (Summary by M. de W.) D04

0205

22798 RICKARD, J.E.; GAHAN, P.B. 1983. The development of occlusions in cassava (Manihot esculenta Crantz) root xylem vessels. Annals of Botany 52(6):811-821. Engl., Sum. Engl., 53 Refs., Illus. [Tropical Development & Research Inst., 56-62 Gray's Inn Road, London WC1X 8LU, England]

Cassava. Roots. Deterioration. Plant physiology. Biochemistry. Laboratory experiments. Plant tissues. United Kingdom.

Cassava roots exposed to physiological stress arising from wounding, respond by forming colored occlusions in the xylem vessels and producing chemically similar deposits in the storage parenchyma. Colorless occlusions consisting of lipids, carbohydrates, and phenols, including leucoanthocyanidins and catechins, were present in a limited no. of xylem vessels in freshly harvested cassava roots. These occlusions were found to increase in frequency in injured roots especially when stored at low humidity. Concurrent with the appearance of colored products in the xylem vessels, there was a loss of response to tests for phenols, but an increase in lignin-like material. However, the presence of lignin in these occlusions was not substantiated; the lignin-like responses were probably produced by condensed tannins with lignin-like properties formed by the polymerization/condensation of catechins and leucoanthocyanidins. Observed increases in polyphenol oxidase and peroxidase activities could be related to such reactions. (Author's summary) D04

See also 0209

E00 PLANT PATHOLOGY

0206

22995 RODRIGUEZ M., S. 1982. Actual reglamentación cuarentenaria en relación con semillas sexual y asexual de yuca (Manihot esculenta). (Present quarantine measures in relation to cassava sexual and asexual seeds). Ciencia y Técnica en la Agricultura: Viandas Tropicales 5(1):37-47. Span., Sum. Span., Engl., 6 Refs.

Cassava. Seed. Cuttings. Diseases and pathogens. Pests. Quarantine measures. Cuba.

Current quarantine regulations in Cuba, regarding cassava sexual and asexual seed, are analyzed. In addition, the policy regarding multiplication and handling of these materials after their introduction for release to farmers is discussed and available resources and infrastructure for the phytosanitary phase of this control are given. Aspects that require further study to assure the successful introduction and generalization in the large-scale production of the genetic materials are identified. (Author's summary) E00

0207

23181 SINGH, K.G. 1982. Harmonisation and effectiveness of plant quarantine legislations and regional cooperation in the ASEAN Region. In Heong, K.L.; Lee, B.S.; Lim, T.M.; Teoh, C.H.; Ibrahim, Y., eds. International Conference on Plant Protection in the Tropics, Kuala Lumpur, Malaysia, 1982. Proceedings. Kuala Lumpur, Malaysian Plant Protection Society. pp.647-658. Engl., Sum. Engl., 6 Refs. [ASEAN Regional Plant Quarantine Centre & Training Inst., Serdang, Selangor, Malaysia]

Cassava. Pests. Diseases and pathogens. Quarantine measures. Legal aspects. Cassava brown streak virus. Cassava African mosaic virus. Cassava mosaic virus. *Sphaceloma manihoticola*. *Mononychellus tanajoa*. Frog skin disease. Mycoplasmoses. *Tetranychus urticae*. *Oligonychus peruvianus*. Asia.

The ASEAN (Association of Southeast Asian Nations) region has a diverse set of rules and regulations governing plant quarantine. Through the establishment of the ASEAN - Plant Quarantine Centre and Training Institute (PLANTI) efforts have been made to standardize treatment procedures and action plans formulated in the chance introduction of exotic pests and diseases. PLANTI has been given the responsibility of carrying out training and research, and to act as a reference center for ASEAN. Training of the regional officers would be through short- and medium-term courses. It has been emphasized that in the area of plant protection, regional action is absolutely essential. Pests are known to cross barriers or geographical boundaries with ease. Malaysia has been a forerunner in the establishment of a no. of plant protection measures including the ANRPC SALB (South American Leaf Blight) Agreement. A list of pests A_1, of quarantine importance not yet introduced in the ASEAN region, and A_2, present in 1 or more ASEAN countries, is given. (Author's summary) E00

See also 0288

E02 Bacterioses

0208

22800 ATHAYDE, J.T.; ROMEIRO, R. DA S. 1983. Atividade biologica do exopolissacarídeos de *Xanthomonas campestris* pv. *manihotis*. (Biological activity of the exopolysaccharides of *Xanthomonas campestris* pv. *manihotis*). Fitopatologia Brasileira 8(3):485-490. Port., Sum. Port., Engl., 29 Refs. [Empresa Capixaba de Pesquisa Agropecuária, Caixa Postal 391, 29.000 Vitoria-ES, Brasil]

Cassava. Cultivars. *Xanthomonas campestris* pv. *manihotis*. Laboratory experiments. Research. Shoots. Symptomatology.

A crude preparation of the exopolysaccharide of *Xanthomonas campestris* pv. *manihotis* was obtained by growing the pathogen on solid culture medium for 30 h at 28°C. Bacterial growth was then placed in phosphate buffer solution and the suspension was centrifuged at 10,000 g/20 min. Ethanol was added to the supernatant to 70% concn. obtaining a white precipitate that was dialyzed against distilled water. The dialysate was considered the crude preparation of the exopolysaccharide. Shoots of cassava cv. Chagas and Braquinha were used to test the biological activity of the crude exopolysaccharide. The basal part of shoots was immersed in different dilutions of the crude exopolysaccharide. The time for wilting to occur was inversely proportional to exopolysaccharide concn. Turgescence recovery was observed when 0.5 cm of the basal part of the shoots was removed and the shoots were transferred to distilled water. (Author's summary) E02

0209

22077 HERNANDEZ M., J. 1984. Efecto y características de algunos aislamientos de rizobacterias fluorescentes en genotipos de yuca (*Manihot esculenta* Crantz). (Effect and characteristics of some fluorescent rhizobacterial isolates on cassava genotypes). Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 80p. Span., Sum. Span., Engl., 51 Refs., Illus.

Cassava. Clones. Pseudomonas. Isolation. Identification. Biochemistry. Inoculation. Cuttings. Root productivity. N. P. K. Erwinia carotovora. Roots. Deterioration. Statistical analysis. Research. Colombia.

Selected fluorescent strains of Pseudomonas spp., isolated from the rhizosphere of cassava plants growing in different regions of Colombia, produced statistically significant increases in the fresh wt. of roots and improved health (decreased incidence of root rots) when seedlings or cuttings of clone CM 523-7 were inoculated before planting, at different concn. and intervals of application. Inoculation of roots of susceptible cassava clone CMC-40 by immersion in bacterial suspensions before storage, considerably reduced the microbial deterioration and external growth of fungi which normally occur on storing cassava roots. No significant effect of the inoculation on the NPK content of the leaf was observed. In vitro antibiosis, caused by selected strains of the fluorescent rhizobacteria, was observed against various bacterial pathogens which cause root rots, such as Erwinia carotovora pv. carotovora. Selected fluorescent isolates were tested and characterized taxonomically using Bergey's manual: Pseudomonas putida (isolates F-44, F-64, F-61, F-71, F-56) and P. fluorescens (isolate F-87). The presence of large populations of antagonistic, fluorescent rhizobacteria around the roots seems to be related to the growth and health promotion effects found in cassava plants. These biological effects could be of great importance in increasing the world production and yield of cassava. (Author's summary) E02

0210

23444 MUSERE, E.; IKOTUN, T. 1983. In vitro inhibition of growth of Xanthomonas campestris pathovar manihotis by antagonists. Fitopatologia Brasileira 8(3):467-472. Engl., Sum. Engl., Port., 9 Refs. [Dept. of Agricultural Biology, Univ. of Ibadan, 62550 Ibadan, Nigeria]

Cassava. Xanthomonas campestris pv. manihotis. Laboratory experiments. Research. Culture media. Disease control.

Three isolates of Bacillus cereus and 2 of B. subtilis were used against Xanthomonas campestris pv. manihotis on agar plates to detect possible antagonism. All isolates of both bacteria were antagonistic to this important pathogen of cassava. Both antagonistic bacteria grew so fast that they gave no chance for X. campestris pv. manihotis to develop on agar plates. This is a desirable quality for future field work. On dry surfaced agar plates, colonies of X. campestris pv. manihotis were rough in the presence of B. cereus, whereas a clear zone of inhibition was caused by B. subtilis. B. cereus and B. subtillis have been found to be normally present on cassava leaves in the field and may be useful in keeping down the population of the pathogen living epiphytically on cassava leaves. Also, Penicillium sp., P. purpurescens, Aspergillus niger, and A. tamarii were used to antagonize the pathogen on agar plates. Both species of Penicillium gave the best and most stable zones of inhibition. The effects of the antagonists used in this study were neither due to a lowering of pH of the medium nor to nutrient deprivation, but probably to the production of antimicrobial substances. (Author's summary) E02

0211

23062 PADRON, J.; CORREA, S. 1983. Comportamiento de un grupo de variedades de yuca (Manihot sculenta) frente a Xanthomonas manihotis. (Performance of some cassava varieties in relation to Xanthomonas manihotis). Centro Agrícola 10(3):105-114. Span., Sum. Span., Engl., 8 Refs.

Cassava. Cultivars. Xanthomonas campestris pv. manihotis. Plant injuries. Statistical analysis. Cuba.

The behavior of the collection of cassava var. of the U. Central de las Villas, Cuba, in the presence of Xanthomonas campestris pv. manihotis, was studied. Each var. was planted in a plot of 40 plants, under strong and uniform natural infection conditions during the period analyzed. Also, cuts of the leaf tips were artificially inoculated with a bacterial culture. The damage observed in each var. was recorded at monthly intervals and double classification and variance analyses were made. Values of simple correlation between the damage caused in each var., the response to inoculation, shoot death, dieback, and foliage lesions were estimated. (Extracted from author's summary) E02

0212

22993 PINO A., J.A. 1982. Enfermedades y plagas transmisibles por semillas sexual y asexual de yuca en Cuba. Medidas cuarentenarias para evitarlas. (Diseases and pests transmissible through sexual and asexual cassava seeds in Cuba. Preventive quarantine measures). Ciencia y Técnica en la Agricultura: Viandas tropicales 5(1):7-20. Span., Sum. Span., Engl., 17 Refs.

Cassava. Seed. Cuttings. Diseases and pathogens. Pests. Quarantine measures. Cuba.

Disease and pest problems in Cuba are outlined as well as the infrasctructure existing for phytosanitary control. The procedure to be followed regarding transfer, and later reproduction, of sexual and asexual cassava seeds is indicated and several measures that restrict the entry of harmful agents into the country are given. (Extracted from author's summary) E02

0213

23449 TRUJILLO, G.E.; SUBERO, L.J.; LUCIANI, J. 1982. Añublo bacteriano de la yuca en la zona central del país. (Cassava bacterial blight in the central zone of Venezuela). Revista de la Facultad de Agronomía (Venezuela) 12(3-4):235-248. Span., Sum. Span., Engl., 15 Refs., Illus. [Univ. Central de Venezuela, Facultad de Agronomía, Maracay, Venezuela]

Cassava. Xanthomonas campestris pv. manihotis. Isolation. Identification. Venezuela.

Cassava plants showing angular spots near leaf veins, wilting of young shoots, dieback, or canker formation of lignified stem parts, were found in fields at the Saman Mocho exptl. station in the state of Carabobo, Venezuela, and at U. Central de Venezuela in the state of Aragua. The pathogen was isolated and identified as the bacteria Xanthomonas campestris pv. manihotis, causal agent of CBB. This disease was thought to be restricted to the eastern Venezuela. This is the 1st report of its incidence in the central zone, constituting a serious threat to cassava crops. (Author's summary) E02

0214

22696 UMEMURA, Y.; KAWANO, K. 1983. Field assessment and inheritance of resistance to cassava bacterial blight. Crop Science 23(6):1127-1132. Engl., Sum. Engl., 12 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Cultivation. Soil physical properties. Planting. Seed. Cuttings. Fertilizers. N. P. K. Zn. Xanthomonas campestris pv. manihotis. Inoculation. Plant breeding. Selection. Root productivity. Resistance. Colombia.

CBB, caused by Xanthomonas campestris pv. manihotis, caused 18-92% yield reduction on susceptible cassava clones relative to resistant clones depending on location, planting time, and level of simultaneous infection by superelongation disease (Elsinoe brasiliensis) in expt. carried out in the Llanos Orientales, Colombia. Root DM content of susceptible clones was much lower than that of resistant clones. Susceptible clones did not produce cuttings for the next planting. No cassava clone under study was immune to CBB. Cv. order of resistance was stable over years. The CBB on leaves of resistant clones spread slowly while on susceptible clones it spread rapidly causing defoliation and death of stem. Resistance appeared to be a quantitatively inherited trait (h^2 = 0.63) largely controlled by additive genetic factors and it was not negatively correlated with yielding ability per se. Cassava resistance to CBB is highly effective in minimizing damage caused by the disease, and the use of resistant parents in hybridizations, combined with simple phenotypic field selection under high natural disease pressure, should effectively improve resistance of cassava cv. (Author's summary) E02

See also 0165 0170 0187 0206 0218 0242 0297

E03 Mycoses

0215

22794 ADISA, V.A. 1983. Surface mycoflora of Manihot esculenta and M. utilissima tubers in Nigeria. Indian Phytopathology 36(3):533-538. Engl., Sum. Engl., 7 Refs. [Dept. of Botany, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Roots. Deterioration. Moulds. Isolation. Analysis. Identification. Aspergillus. Penicillium. Botryodiplodia theobromae. Monolinia fructicola. Sclerotium rolfsii. Rhizopus. Rhizopus stolonifer. Fusarium. Phytophthora. Mucor. Cercosporidium henningsii. Nigeria.

Fifteen fungi were isolated from the surface of roots of Manihot esculenta and M. utilissima collected from 10 states of Nigeria. Some of these fungi caused deterioration of cassava roots on inoculation. There was an increase in the no. and % occurrence of fungi as the time after harvest for taking the root sample increased. (Author's summary) E03

0216

22334 BOHER, B.; DANIEL, J-F.; FABRES, G.; BANI, G. 1983. Action de Pseudotheraptus devastans (Distant) (Het. Coreidae) et de Colletotrichum gloeosporioides Penz. dans le développement de chancres et la chute des feuilles chez le manioc (Manihot esculenta Crantz). [The effect of Pseudotheraptus devastans (Het. Coreidae) and Colletotrichum gloeosporioides on the development of cankers and leaf shedding in cassava]. Agronomie 3(10):989-993. Fr., Sum. Fr., Engl., 8 Refs., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo]

Cassava. Glomerella cingulata. Pseudotheraptus devastans. Insect biology. Symptomatology. Congo.

In expt. conducted in Congo, the role of the coreid Pseudotheraptus devastans and the fungus Glomerella cingulata (Colletotrichum gloeosporioides) in the cassava candlestick disease (anthracnose), was demonstrated. Histopathological studies showed that the fungus was present on the stems in the latent form, and that penetration was induced by the lesion that followed insect puncture; initial lesions then extended as a result of the colonization of cortical parenchyma and vascular tissues by *G. cingulata*. The spread of the disease was correlated with increase in the population of *P. devastans*. The insect has also been reported as a pest of coconut trees; general information on its biology, as well as a key to differentiate it from other coreids present in cassava, *Mirperus torridus* and *Homoeocerus* sp., are given. Illustrations of the adult and 1st instar larvae are provided, and the symptoms and development of the disease are described. (Author's summary) E03

0217

23406 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Pathology. *In* ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.97-118. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Mycoses. *Sphaceloma manihoticola*. *Elsinoe brasiliensis*. *Choanephora curcubitarum*. Culture media. *Diplodia*. Frog skin disease. *Aleurotrachelus socialis*. Cassava Caribbean mosaic virus. Mycoplasmoses. Disease control. Seed. Ecosystems. Colombia.

The causal agent of the superelongation disease was identified in its sexual stage as *Elsinoe brasiliensis* and in its asexual stage as *Sphaceloma manihotis* (= *E. jatrophae*). Research on host/pathogen interaction indicated that the destruction of the stem cuticle significantly increases symptom severity. Pathogenic specialization could exist; GA appears to have little potential as a selection tool to identify field resistant cv., but the hormone appears to provide the pathogen with an advantage since it induces its growth and increases the amount of susceptible young tissue. A highly significant and negative correlation was seen between the yield of cuttings produced by all clones and superelongation severity in each clone under monoclonal and multiclonal systems; the results demonstrate the importance of superelongation disease in determining root and cutting yields. The culture media which produce max. production of the characteristic structures of *Choanephora curcubitarum* are indicated. The artificial inoculation of this pathogen showed that penetration only occurs through foliar wounds. In Media Luna, plant germination and establishment increased when cuttings visually selected among plants produced through meristem culture techniques and treated cuttings (captan/carbendazim, 3000 ppm each) were used against *Diplodia* root rot. Frog skin disease symptoms occurring on roots are described. The transmission of the causal agent to healthy cassava plants has only been possible through grafting under greenhouse conditions. *Aleurotrachelus socialis* (500/plant) caused 100% transmission of frog skin disease, suggesting that among the whitefly population the no. of vectors is relatively low. Particles observed under electron microscopy are described. The Caribbean mosaic virus caused yield reductions of approx. 38.5% in var. Secundina. Virus-like particles have been isolated but it has not been possible to infect healthy cassava with the isolated virus. A specific antiserum has been produced and is presently used for serological detection in infected plants. Antholysis has been observed in certain cassava plants for over 3 yr. Recent expt. have demonstrated that cuttings obtained from plants affected by antholysis perpetuate the disease to the following generation suggesting the presence of a transmissible pathogen. Fresh tissue sections stained with Dienes' stain showed the presence of a darkly stained mycoplasm-like material in the phloem of the diseased peduncle; ultrafine sections of the same tissues showed pleomorphic mycoplasm-like organisms (spherical, but they also have ovoid and elongated forms). In screening for genotype evaluation, planting material of similar quality should be used as well as clean planting material to obtain high yields. Devoting a plot within the farm exclusively to the production of planting material will help the farmer to obtain high quality cuttings. To control fungal/bacterial contamination on/in cassava seeds and their further dissemination, and to improve seed germination, heat must be applied (120 s of microwave exposure or 14 days at 60°C in electric ovens) as well as fungicides (i.e. thiram or captan + carboxin) applied after collection. Results of ecosystem studies related to persistence, presence of diseases and pests, and av. yields, are discussed. (Summary by EDITEC) E03

0218

23419 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Pathology. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.371-399. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Seed. Mycoses. Cuttings. Viroses. Ecosystems. Roots. Deterioration. Biological control. Colombia.

During 1983, research conducted by the pathology section of CIAT's Cassava Program focused on 4 types of pathological problems: botanical seed pathogens, pathogens affecting vegetative propagation material, pathogens affecting the crop during the growth cycle, and pathogens of preharvest root rots. Besides Xanthomonas campestris pv. manihotis and Colletotrichum spp., other pathogens were detected in botanical seed including Penicillium sp., Neurospora sp., Fusarium sp., Cladosporium sp., Aspergillus sp., Rhizopus sp., and Diplodia manihotis. The selection of cuttings with good agronomic characteristics was found to be more important than fungicidal treatments for yield production. A new viral problem found this year is described. The economic importance of latent viruses detected in symptomless clones is being investigated. Frog skin disease appears to be induced by a complex of viral agents. The Caribbean mosaic appears to be a reaction to a complex viral infection and/or the existence of several endemic viral problems in the area. Research on disease complexes in Carimagua emphasize the need to conduct field evaluations to identify genotypes with multiple resistance in order to obtain yield stability. Planting at the beginning of the rainy season facilitates the identification of clones with this type of resistance. Different disease and pest complexes were also identified in each edaphoclimatic zones: in edaphoclimatic zone I, Diplodia stem rots, Choanephora leaf blight, root rots, brown leaf spot, and mites; in edaphoclimatic zone II, superelongation disease and mealybugs; in edaphoclimatic zone III, mites; and in edaphoclimatic zone V, mites and scale insects. There is a group of fluorescent Pseudomonas strains that induce root development, which appears to be related to the inhibitory effect on the population of detrimental microorganisms in the rhizosphere; there appears to be no nutritional effect or it is too low. Results to date are encouraging and indicate a promising biological control for root rots commonly found in any cassava plantation. (Summary by EDITEC) E03

0219

22715 MAKAMBILA, C. 1984. Epidemiology of anthracnose in cassava. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.73-78. Engl., Sum. Engl., 6 Refs., Illus. [Univ. Marien Ngouabi, B.P. 69, Brazzaville, Congo]

Cassava. Cultivars. Glomerella manihotis. Glomerella cingulata. Stems. Inoculation. Rainfall data. Symptomatology. Congo.

The symptoms of anthracnose induced by Colletotrichum manihotis (C. gloeosporioides) were studied using either stem fragments or whole cassava plants artificially inoculated. The symptoms develop on tissue that has become necrotic because of insect (Pseudotherapus devastans) bites and becomes the germination site for conidia from the pathogenic agent. Factors, such as RH, the type of insect-caused injury, insect populations, and stem lignification were investigated to determine their effect on disease development. (Author's summary) E03

0220

22717 MUIMBA-KANKOLONGO, A.; ADENIJI, M.O.; TERRY E.R. 1984. Susceptibility of cassava to Colletotrichum manihotis. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.82-85. Engl., Sum. Engl., 5 Refs., Illus. [Programme National Manioc, B.P. 11635, Kinshasa, Zaire]

Cassava. Cultivars. Colletotrichum manihotis. Inoculation. Statistical analysis. Ecology.

Studies were conducted to determine how inoculum concn., pathogen virulence, cassava hosts, insect mediation, planting time, and location influence the susceptibility of cassava to anthracnose (Colletotrichum manihotis). Results indicated that the severity of infection is directly related to inoculum concn. and virulence of the isolate, although no specific races were identified among the isolates. A latent phase of C. manihotis exists, during which its acervuli can be recovered from tender, symptomless stems. Pseudotherapus devastans feeding on cassava mediate the initiation of infection, and the degree of infection varies according to planting season and location. (Author's summary) E03

0221

22718 OTIM-NAPE, G.W. 1984. Botryodiplodia stem rot of cassava and methods of selecting varieties for resistance. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.86-88. Engl., Sum. Engl., 2 Refs., Illus. [Serere Agricultural Research Station, P.O. Soroti, Uganda]

Cassava. Cultivars. Botryodiplodia theobromae. Field experiments. Resistance. Selection. Uganda.

After Botryodiplodia stem rot of cassava was observed for the 1st time in Africa (in Uganda) in 1981, a series of expt. were initiated to: determine the effects of stem maturation on infection, identify suitable methods of screening for field resistance, and screen var. for sources of resistance to the disease. Four cassava var. were planted in a split plot expt., with var. as the main plots and stem maturation as the subplots. At maturity, the stems were harvested, and the no. of B. theobromae pustules counted. The no. of pustules was directly related to maturity of the stem. Two methods of screening for resistance were compared: scoring for rot severity on a 0-5 scale and counting rot pustules/unit area. Scoring for severity was deemed most suitable for resistance screening, and counting of pustules had advantages for epidemiological and pathogenicity studies. In screening tests of 8 families, 4 of them, IYT (OP) 1979, PYT (OP) 1980, 30555 (OP) 1979, and 30572 (OP) 1980, exhibited some resistance to the disease. (Author's summary) E03

0222

20755 RONDON G., A.; APONTE, A. 1981. Estudio del superalargamiento de la yuca y búsqueda de cultivares tolerantes a la enfermedad. (Study of cassava superelongation and screening for disease resistant cultivars). Maracay, Venezuela, Fondo Nacional de Investigaciones Agropecuarias. 11p. Span., Sum. Span., 7 Refs., Illus. [Fondo Nacio ^1 de Investigaciones Agropecuarias, Maracay, Venezuela]

Paper presented at Coloquio Internacional de la Protección de los Cultivos Tropicales, Lyon, Francia, 1981.

Cassava. Sphaceloma manihoticola. Cultivars. Selection. Laboratory experiments. Field experiments. Inoculation. Symptomatology. Disease control. Venezuela.

The occurrence of superelongation, caused by Sphaceloma manihoticola, in different cassava growing areas of Venezuela in 1975, is reported. Preliminary data are given on pathogenicity tests carried out with different var. to select disease-resistant genetic material. Among the cv. tested, M. Col-1684, M. Col-677, M. Ven-7, and Branca were outstanding. Chemicals and rates recommended for treatment of propagation material to control the disease are indicated. (Summary by M. de W. Trans. by L.M.F.) E03

0223

22716 TERRY, J.M.; MTAKWA, P.W.; MSHANA, D. 1984. Cassava yield losses from brown leaf spot induced by Cercosporidium henningsii. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.79-81. Engl., Sum. Engl., 7 Refs., Illus. [Univ. of Dar es Salaam, Chuo Kikuu, Morogoro, Tanzania]

Cassava. Cultivars. Cercosporidium henningsii. Plant damage. Productivity. Root productivity. Statistical analysis. Tanzania.

The progress of cassava brown leaf spot (Cercosporidium henningsii) and its effect on yield of 5 cassava cv., Apin Valenca, F279, Mzungu, Tanga, and T27, were studied. Field plots of each cv. were established in an area (Morogoro, Tanzania) where brown leaf spot is endemic, and half the plots were sprayed with the fungicide benomyl. Disease progress in the plots was recorded by counting the no. of lesions/plant and by recording % defoliation. Disease intensity was highest between 3-6 mo. after planting. In 1981-82, the epiphytotic reached a peak 3 mo. after planting; in 1982-83, there was a low peak 3 mo. after planting and a higher peak at 5 mo. All variables were subjected to analysis of variance with Duncan's new multiple-range test. The independent t-test showed very highly significant differences between sprayed and unsprayed plots. Root yield from fungicide-sprayed plots was compared with that from corresponding diseased plots, the differences in 1981-82 ranging from 1.7 to 32.3% for the 4 cv. and averaging 26.8% for the susceptible cv. In 1982-83, the range was from 15.2 to 38.1% for 3 cv. and 30% for the 2 susceptible cv. (Author's summary) E03

See also 0206 0212 0214 0297

E04 Viroses

0224

22719 MASSALA, R. 1984. Distribution and severity of cassava mosaic in the Congo. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds.

Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. p.89. Engl., Sum. Engl. [Dept. de Biologie Cellulaire et Moléculaire, Faculté des Sciences, Univ. Marien Ngouabi, B.P. 69, Brazzaville, Congo]

Cassava. Cassava programs. Cassava African mosaic virus. Congo.

Phytosanitary surveys in the People's Republic of Congo have shown that CAMD occurs throughout the country although the prevalence and effects of the disease differ with the ecological zone. Under the auspices of Programme National Manioc, prevalence and rate of natural infection of local and introduced var. as well as other epidemiological factors are being studied. Identification and characterization of the causal agent of CAMD are also planned. (Author's summary) E04

See also 0160 0164 0165 0212 0217 0218 0295 0297

E05 Mycoplasmoses

See 0212 0217

F00 PEST CONTROL AND ENTOMOLOGY

See 0207 0288

F01 Injurious Insects and their Control

0225

22793 BARNARD, P.C.; BROOKS, S.J. 1984. The African lacewing genus *Ceratochrysa* (Neuroptera:Chrysopidae): a predator on the cassava mealybug, *Phenacoccus manihoti* (Hemiptera:Pseudococcidae). Systematic Entomology 9(4):359-371. Engl., Sum. Engl., 21 Refs., Illus. [Dept. of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD, England]

Cassava. *Phenacoccus manihoti*. Biological control. Predators and parasites. Insect biology. Entomology. Africa.

The Afrotropical lacewing subgenus *Ceratochrysa* is raised to full generic status on the basis of several unique characters which make it one of the most distinctive genera in the tribe Chrysopini. Its distribution has extended to include Madagascar and Mauritius, and the genus seems most closely related to the Oriental and Pacific *Chrysopa oceanica* group. Only 4 of the 13 nominal species are recognized as valid, and 8 new synonyms are established. The larva of one species is a predator on the cassava mealybug in SE Nigeria; this is the 1st description of the larva of an endemic African chrysopid genus. (Author's summary) F01

0226

23405 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Entomology. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.71-95. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Entomology. Germplasm. Cultivars. Resistance. Phenacoccus. Biological control. Predators and parasites. Aleurotrachelus socialis. Insect biology. Lagocheirus araeniformis. Insecticides. Vatiga illudens. Vatiga manihotae. Phoenicoprocta sanguinea. Cyrtomenus bergi. Anastrepha pickeli. Erinnyis ello. Araecerus fasciculatus. Lasioderma servicorne. Colombia.

During 1982, the entomology section of CIAT's Cassava Program evaluated the cassava germplasm bank for resistance to Phenacoccus herreni; natural enemies were identified (the fungus parasite Cladosporium, the hymenopteran Acerophaga coccois, and the predators Ocyptamus and Kalodiplosis occidarum) and are being evaluated. The biological cycle of Aleurotrachelus socialis is described. Based on var. resistance studies, it was determined that the mechanism responsible for resistance to A. socialis includes oviposition preference and antibiosis. Dipping cuttings in Aldrex 2 for 5-10 min avoided infestation by Lagocheirus araeniformis. Cutting treatments with insecticides to control stemborers should be done at least 2 wk. after cutting. Oviposition preference studies of L. araeniform's indicated that there were no significant differences in the no. of cuttings infested between var. with high and low HCN under field and lab. conditions; however, the no. of biological stages in high HCN var. in the field was higher than in low HCN var. (298 vs. 206, resp.). A new stemborer species was identified as Lepturges sp. Vatiga manihotae and V. illudens populations were consistently higher in cassava and maize in association than in cassava in monoculture. P fertilization did not affect Vatiga populations. A significantly greater population of Vatiga was found in irrigated cassava during the dry season than in the nonirrigated controls. Vatiga populations were lower in cassava associated with weeds than in clean plots. No significant differences in predator populations were observed between cassava in monoculture and in association with maize. Significant negative regressions were observed between plant density and Vatiga population/leaf. Adults are uniformly dispersed on the plant while nymphs tend to concentrate on the lowest leaves. The biological cycle of Phoenicoprocta sanguinea is described, indicating that its larvae are parasitized by Apanteles sp. and its eggs by Trichogramma sp. Cyrtomenus bergi showed strong feeding preference for low HCN var. and it was found parasitized by the fungus Metarrhyzium sp. The use of an alternate nonpreferred crop by C. bergi in rotation with cassava is a feasible means to control the pest. Studies with Anastrepha manihoti and A. pickeli indicate that plants that are not protected during the 1st 3 mo. of growth show problems in producing damage-free planting material in the presence of a severe attack. The use of light traps for Erinnyis ello adults to predict increases in oviposition is indicated as useful. Araecerus fasciculatus and Lasioderma servicorne can cause considerable losses in dry chips. (Summary by EDITEC) F01

0227

22721 FABRES, G.; KIYINDOU, A. 1984. Comparative bioecology of two coccinellids, predators of the cassava mealybug, in the Congo. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.93-96. Engl., Sum. Engl., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, B.P. 181, Brazzaville, Congo]

Cassava. Phenacoccus manihoti. Biological control. Ecology. Predators and parasites. Laboratory experiments. Congo.

Within the biocenosis of the cassava mealybug (Phenacoccus manihoti), 2 coccinellid species, Exochomus flaviventris and Hyperaspis senegalensis hottentotta, stand out because of their large no. and their constant presence in the ecosystem. The biological parameters of these 2 predators were studied in the lab. The biological cycle, development time of different stages, sex ratio, as well as fertility and longevity of the females were determined. Using the data, the intrinsic rate of multiplication of each species was calculated and the control potential of these 2 local aids to pest control was compared. In the field, population dynamics were studied along with those of the mealybug. The range of variation in population no. in each species and the time of emergence in the field were recorded. This information facilitates the definition of the role played by the species in regulating mealybug populations. It also should serve to direct the choice of exotic species to be introduced to supplement these insects' predatory activity. (Author's summary) F01

0228

22720 LEMA, K.M.; HENNSESSEY, R.D.; HERREN, H.R. 1984. The cassava mealybug front hypothesis: role of indigenous natural enemies. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.90-92. Engl., Sum. Engl., 21 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Phenacoccus manihoti. Biological control. Insect control. Zaire.

Ten years after the discovery of the cassava mealybug, Phenacoccus manihoti, in Zaire, reports claim that damage from the pest in Bas-Zaire and Bandundu states has been decreasing since 1978 and reached a min. in 1983. At the same time, severe outbreaks have been reported in Kivu and Shaba states where the pest has recently been introduced. It is believed that cassava mealybug infestations form a "front" that progresses to colonize and destroy new areas, whereas in previously invaded areas the damage is gradually reduced. This phenomenon and the role that might have been played by indigenous natural enemies as well as that of other factors are discussed. The list of the former, including parasitoids, predators, and pathogens, is given. (Author's summary) F01

0229

22722 LEMA, K.M.; MAHUNGU, N.M. 1984. Effects of fertilizer application on postembryonic development and reproduction of the cassava mealybug. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical roots crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.97-98. Engl., Sum. Engl., 5 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivars. Laboratory experiments. Phenacoccus manihoti. Fertilizers. N. P. K. Water requirements (plant). Nigeria.

Expt. were conducted with 2 cassava var., TMS 30001 and TMS 30572, in the greenhouse to ascertain the effect of NPK, N, and K fertilizer application on the postembryonic development and reproduction of the cassava mealybug, Phenacoccus manihoti. N and NPK were applied at the rates of 60, 120, and 190 kg/ha and K at the rates of 15, 30, and 45 kg/ha. Results showed that none of the applications significantly ($P < 0.05$) affected either the development or the fertility of the mealybug on the 2 cassava var. (Author's summary) F01

0230

22790 NOYES, J.S. 1984. A new genus species on encyrtid (Hymenoptera: Chalcicoidea) parasitic on the cassava mealybug, Phenacoccus manihoti Matile-Ferrero (Hemiptera:Pseudococcidae). Bulletin of Entomological Research 74(3):529-533. Engl., Sum. Engl., 4 Refs., Illus. [British Museum (Natural History), Cromwell Road, London SW7 5BD, England]

Cassava. Phenacoccus manihoti. Predators and parasites. Entomology. South America.

Parapyrus manihoti gen. et sp. n., an encyrtid parasite of Phenacoccus manihoti in South America, is described from the adults of both sexes. The parasite has potential use as a control agent of the mealybug in West and Central Africa where it is established as a cassava pest. (Author's summary) F01

0231

22996 PINO A., J.A.; FILIPIA, R. 1982. La escama blanca (Lepidosaphes alba) y su efecto sobre el material de propagación de yuca (Manihot esculenta). [The white scale (Lepidosaphes alba) and its effect on cassava propagation material]. Ciencia y Técnica en la Agricultura: Viandas tropicales 5(1):69-89. Span., Sum. Span., Engl., 14 Refs., Illus.

Cassava. Cultivars. Aonidomytilus albus. Cuttings. Planting. Germination. Cuba.

The effect of white scale (Lepidosaphes alba) on the germination of cuttings of cassava var. Señorita was evaluated during 1981 at the Centro de Mejoramiento de Semillas Agámicas, Santo Domingo, Cuba. Variance analysis (simple classification) was used as statistical method. The % of germination decreased with the increasing of the infestation score. With 0 and 1 degrees of infestation the germination value was 100%, whereas for the degrees 2, 3, 4, 4.5, and 5, the values were 80, 40, 20, 20, and 0%, resp. The cutting wt. decreased when the degrees of infestation increased; cuttings with a degree of 5 reached only 16.71% of the wt. of healthy cuttings. (Author's summary) F01

0232

22994 PINO A., J.A.; FILIPIA, R. 1982. El piojo harinoso (Phenacoccus gossypii) sobre yuca (Manihot esculenta) en Cuba. [The cassava mealybug (Phenanoccus gossypii) in Cuban cassava crops]. Ciencia y Técnica en la Agricultura: Viandas tropicales 5(1):21-35. Span., Sum. Span., Engl., 14 Refs., Illus.

Cassava. Cultivars. Phenacoccus. Insect biology. Entomology. Identification. Cuba.

In 1981 a mealybug was found on plants and cuttings of cassava clone CEMSA 74-725 at the Centro de Mejoramiento de Semillas Agámicas in Villa Clara, Cuba. It was determined that the insect corresponds to Phenacoccus gossypii Tows. and Cockerell. Females showed 3 nymphal stages whereas males only showed 2: prepupal and pupal. This is the 1st time the insect has been reported in cassava in Cuba; however, it has been detected on other crops, namely, Althaea officinalis, Acalypha sp., and Helianthus annuus. (Author's summary) F01

0233

22010 POWERS, N.R.; HERREN, H.R. 1980. Biological control strategies for the cassava mealybug and green spider mite. In Ezumah, H.C., ed. Workshop on Cassava Production and Extension in Central Africa, Mbanza-Ngungu, Zaire, 1980. Proceedings. Ibadan, Nigeria, International Institute of Tropical Agriculture. Proceedings Series no.4. pp.107-115. Engl., 1 Ref., Illus.

Cassava. Phenacoccus. Mononychellus tanajoa. Biological control. Predators and parasites. Economics. Africa.

Biological control strategies for the cassava mealybug and the green spider mite are described. Aspects of project planning are discussed, especially to establish whether the target species is introduced or native. Suitable areas for investigation for natural enemies should be chosen. The inventory of natural enemies should include parasitoids, predators, and pathogens associated with the insect pest. Investigation into the structure of the enemy complex implies that any search for natural enemies must cover the entire life cycle of the host. In some cases, there are key species that control the pest, but generally a complex of many different parasitoids and predators is required for effective control. The population dynamics role of biotic mortality factors should be studied. Bioecological studies should be carried out and priorities should be established in the importation of promising species and mass propagation. Applicable criteria that should satisfy a biological control include high searching ability, high degree of host specificity, good synchronization with their host, high reproductive rate, and a high degree of adaptability to a wide range of ecoclimate conditions. Suitable release areas should be chosen where population build-up and dispersal of natural enemies can be assessed. The final evaluation of the project, which includes studies on population build-up in release areas, should be done over a period of at least 2 yr. A proper economic analysis of the project may provide figures on the economic benefits obtained from biological control. (Summary by EDITEC. Trans. by L.M.F.) F01

See also 0206 0212 0218 0219 0235 0242

F03 Injurious Mites and their Control

0234

22030 BOCZEK, J.; DAVIS, R. 1984. New species of eriophyid mites (Acari: Eriophyoidea). Florida Entomologist 67(2):198-213. Engl., Sum. Engl., Span., 3 Refs., Illus. [Dept. of Applied Entomology, Agricultural Univ. of Warsaw, Nowoursynowska 166, Poland]

Cassava. Injurious mites. Calacarus guerreroi. Colombia.

Nine species of eriophyid mites are described: 3 were collected from Poland, Aceria malvacearum n. sp., Aculus malvae n. sp., and Epitrimerus tanaceti n. sp.; 5 from Brazil, Aculus pitangae n. sp., A. cauliflorus n. sp., A. catappae n. sp., A. solani n. sp., and Phyllocoptes caseariae n. sp.; and 1 from Colombia, Calacarus guerreroi n. sp., on cassava. (Author's summary) F03

0235

23418 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Entomology. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.325-369. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Injurious mites. Mononychellus tanajoa. Cultivars. Hybrids. Resistance. Root productivity. Biological control. Predators and parasites. Aleurotrachelus socialis. Erinnyis ello. Simulation models. Insect biology. Phenacoccus. Germplasm. Cyrtomenus bergi. Sweet cassava. Insect control. Insecticides. Acaricides. Roots. Colombia.

During 1983 the entomology section of CIAT's Cassava Program conducted resistance studies with several hybrids from var. crosses resistant to Mononychellus sp. and Tetranychus sp. The yield of 9 untreated hybrids (5.9 kg/plant) was 21% higher than that of treated plants (4.9 kg/plant). In Valle del Cauca, Colombia, 4 groups of mite predators, Phytoseidae, have been identified, the most important being the groups Neoseiulus and Typhlodromalus. In an other Colombian area (Valledupar, Cesar), the most important species found was N. idaeus. A methodology for lab rearing these predators is described. Resistance to Aleurotrachelus socialis can be combined with high yielding ability. The combined av. yield of 27 hybrids selected with this characteristic was 62% higher than that of regional var. The population of these whiteflies was also lower in the resistant hybrids. Of 53 var. evaluated in Quilcacé, 13 were selected for showing no damage symptoms. M Col 749 yielded 89 t/ha and the av. yield of selected var. was 40.5 t/ha. In a simulated Erinnyis ello damage expt., the largest reduction in yield was seen when damage occurred between 3-4 mo. after planting. Larval mortality of E. ello fed on cassava plants contaminated with baculovirus was 45-82% at 48 h and 88-100% at 72 h, depending on the viral solution concn. A method to produce baculovirus is described. In plots where the central plants were infested with Phenacoccus herreni, only 23% of the plants showed mealybugs 7 wk. after infestation. Only 8 of 400 var. evaluated for resistance to P. herreni were promising. More than 2000 var. of the germplasm bank were evaluated under field conditions during natural infestation of mealybugs; approx. 24% showed no symptoms and 40.8% a 2.5 or less damage rating (scale from 0 to 5). At CIAT-Palmira, mealybug parasites (Acerophagus coccois, 40% of the species collected) predominated over predators (Kalodiplosis coccidarum was the most common). In Carimagua, predators (especially Ocyptamus sp., 42% of the total collected) predominated. Studies carried out with Cyrtomenus bergi indicate that this pest can be severe and cause considerable losses in commercial roots, particularly in var. with low HCN. Studies on the control of this pest indicate that insecticide (Sistemin) applications can reduce the damage. Horizontal planting of cuttings is the least favorable for population growth of Aonidomytilus albus. (Summary by EDITEC) F03

0236

22723 EZULIKE, T.O.; EMEHUTE, J.K.U. 1984. Functional response of Amblyseius fustis to increasing density of its prey Mononychellus tanajoa. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.99-100. Engl., Sum. Engl., 10 Refs., Illus. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Mononychellus tanajoa. Predators and parasites. Laboratory experiments. Nigeria.

The functional response of Amblyseius fustis to increasing density of its prey Mononychellus tanajoa was studied in the lab. at a temp. of 24-29°C and RH of 50-73%. In tests at 8 densities of prey (10, 20, 30, 40, 50, 60, 70, and 80 nymphs and adults), the predator increased its consumption of prey up to a max. at a density of 40. The no. of eggs laid by the predator was not influenced by prey density. The functional-response curve is typical of invertebrate predators. (Author's summary) F03

0237

22765 FLECHTMANN, C.H.W. 1982. The cassava mite complex. 3. New distribution records, mainly from Colombia and Africa. References to other plants. Anais da Escola Superior de Agricultura Luiz de Queiroz 39:809-813. Port., Sum. Port., 6 Refs. [Depto. de Zoologia, Escola Superior de Agricultura Luiz de Queiroz, Caixa Postal 96, 13.400 Piracicaba-SP, Brasil]

Cassava. Injurious mites. Tetranychus neocaledonicus. Mononychellus tanajoa. Brazil. Paraguay. Colombia. New Caledonia. Nigeria. Gabon. Mozambique. Zaire. Uganda. Senegal.

A list of new records of injurious mites is given. The presence of Tetranychus desertorum on Manihot esculenta in Brazil, is reported. In Paraguay, T. escolasticae was observed on Manihot utilissima plants. In Colombia, Oligonychus gossypii, Eutetranychus banksi, Aponychus schultzi, Atrichoproctus uncinatus, and Allonychus brasiliensis were reported; only the latter is reported to cause damage. Oligonychus thelytokous was observed on M. utilissima plants in New Caledonia. In Africa, Mononychellus tanajoa was recorded in Nigeria, Mozambique, Zaire, and Uganda; M. progressivus was reported in Nigeria and Gabon. In Nigeria, O. gossypii was reported on M. esculenta, M. glaziovii, and other plants; in Nigeria E. aacora, E. monodi, and T. neocaledonicus, were also reported. In Senegal and Nigeria E. monodi was reported as well. (Summary by M. de W.) F03

0238

22724 ODONGO, B.; OTIM-NAPE, G.W. 1984. Control of the cassava green mite in Uganda. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.101-102. Engl., Sum. Engl., 9 Refs., Illus. [Serere Agricultural Research Station, P.O. Soroti, Uganda]

Cassava. Mononychellus tanajoa. Plant breeding. Seed. Resistance. Selection. Mite control. Leaves. Plant anatomy. Uganda.

Investigations were conducted at Serere Agricultural Research Station (eastern Uganda) to identify and promote resistance of cassava to Mononychellus tanajoa, the most destructive arthropod pest of cassava in the country. Six cassava families that were imported as seeds from the International Institute of Tropical Agriculture, Nigeria, and were included in the breeding program, exhibited different degrees of hairiness of leaf surface. When they were subjected to severe mite attack during the dry season, their resistance correlated with the no. of hairs on the leaves. This information helped in selecting cassava var. with high mite resistance. (Author's summary) F03

0239

21161 VEIGA, A.F. DE S.L. 1977. Mandioca (Manihot utilissima Pohl). (Cassava). In Instituto de Pesquisa Agronomicas. Brasil. Projeto fitossanidade; Relatorio Técnico, período 1975/76. Recife-PE, Brasil. pp.81-88. Port.

Cassava. Mononychellus tanajoa. Mite control. Insect biology. Identification. Pest damage. Temperature. Rainfall data. Acaricides. Brazil.

Two projects for the control of Mononychellus tanajoa in Pernambuco, Brazil, are presented. The 1st one includes the identification and description of the mite, its host specificity, damage caused to the crop, the effect of climatic factors on mite population, and its geographic distribution. The 2nd project studies the effect of different miticides. (Summary by M. de W.) F03

See also 0187 0206 0212 0218 0226 0233 0242 0295 0297

G00 GENETICS AND PLANT BREEDING

See 0288

G01 Breeding, Germplasm, Varieties and Clones, Selection

0240

22799 BUENO, A. 1983. Selection in cassava seedlings. Pesquisa Agropecuária Brasileira 18(9):997-1000. Engl., Sum. Engl., Port., 7 Refs. [Centro Nacional de Pesquisa de Mandioca e Fruticultura, Caixa Postal 007, 44.380 Cruz das Almas-BA, Brasil]

Cassava. Seed. Clones. Field experiments. Agronomic characters. Harvest index. Productivity. Root productivity. Statistical analysis. Brazil.

The interrelationships among important cassava traits were evaluated at the seedling and clonal stages to determine a selection criterion which could effectively identify superior F_1 segregates that could maintain superior clonal performance. Fresh root wt. of seedlings and clones was positively correlated with stem + leaf wt. and HI. Strong competitors were high root yielders at both stages of propagation. Selection for fresh root yield at the seedling phase was not an effective mechanism for the identification of genotypes which could maintain high fresh root yield at the clonal stage. Under these study conditions, none of the measured traits was considered to be efficient for the selection of superior seedlings which could reproduce superior clones. Further detailed studies are needed in which priority is given to problems of interplant competition in genotypic mixtures and to the differential effects of the environment on seedlings and clones since they must be grown in different years. (Author's summary) G01

0241

23407 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Germplasm development. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.119-132. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Germplasm. Identification. Cultivars. Ecosystems. Soil physical properties. Hybridizing. Colombia.

In 1982, the germplasm development section of CIAT's Cassava Program continued emphasizing the collection and introduction of germplasm, especially from Mexico, Peru, and Brazil; the collection totals over 3000 clones. The objectives of germplasm evaluation in edaphoclimatic zones I, II, IV, and V are (1) identify clones that can be used directly as recommended var.; (2) identify gene sources for traits requiring improvement at CIAT or for breeding populations of national programs; and (3) provide national programs with information on clonal performance under specific conditions, especially to identify susceptibility to pests and diseases. In edaphoclimatic zone I the promising materials M Ven 25, M Ven 23, M Ven 45A, M Col 2215, M Bra 12, and M CR 2 have been identified, and in edaphoclimatic zone II, M Per 242, M Per 245, M Bra 5, M Col 1894, and M Col 1964. In edaphoclimatic zone V preliminary observations indicate that there are at least 15-20 potentially adapted clones based on plant vigor and resistance to Phoma. Asian clones from Thailand and Malaysia were found susceptible to CBB and the superelongation disease; Rayong 1 and Black Twig showed intermediate resistance to mites and thrips. Hybrid CM 681-2 gave the highest yield in Valledupar (Colombia) and is resistant to mites. Hybridization activities in Carimagua and Popayan (Colombia) are briefly described. (Summary by EDITEC) G01

0242

23420 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Germplasm and breeding. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.401-432. Engl., Sum. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Germplasm. Plant breeding. Ecosystems. Clones. Selection. Root productivity. Dry matter. Injurious mites. Diseases and pathogens. Injurious insects. Cassava bacterial blight. Resistance. Planting. Timing. Seed. Tissue cultures. Colombia.

During 1983 the germplasm development and varietal improvement sections of CIAT's Cassava Program were consolidated into 1 unit. Germplasm evaluation efforts were concentrated in edaphoclimatic zone I (northern coast of Colombia) because of its relative importance regarding cassava production. Breeding emphasis continued on adaptation to moderate and high stress conditions. A total of 524 clones were introduced through in vitro transfer. By the end of the year, the total no. of accessions stored in vitro was 2017. The overall breeding strategy for cassava is based on var. improvement for each edaphoclimatic zone. The main components of this strategy in Colombia are: parental selection based on adaptation to the zone; formation of separate breeding populations for each zone; centralized production and planting of hybrid seed at CIAT-Palmira; and decentralization of all selection stages past the F_1 by evaluation in sites representative of each zone. The breeding process to develop gene pools is described as well as the strategy for selecting new hybrids. In edaphoclimatic zone I new clones have been identified that will contribute to the gene pool for this zone, but only few clones have been identified combining high yield potential, high DM content, and moderate resistance to mites. In the edaphoclimatic zone II, the challenge in the future will be to recombine resistance to diseases in the rainy season with resistance to mites and insects in the dry season; there are a few clones that combine good resistance, but it will greatly depend on the planting date. In edaphoclimatic zone V the germplasm base is still narrow, but there is great potential to improve productivity and cassava quality in this zone. In edaphoclimatic zone VI, the objective is to breed for resistance to CBB. Regarding international germplasm exchange there are 2 ways in which materials are made available to national programs and other institutions: true seed or clones in the form of aseptic in vitro cultures. A list of 42 elite clones with descriptions of their adaptation to each of the climatic zones, yield, quality, and resistance characteristics, was compiled and published. The materials are available in vitro. (Summary by EDITEC) G01

0243

23408 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Varietal improvement. In _______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.133-143. Engl. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Hybridizing. Selection. Ecosystems. Adaptation. Cultivars. Clones. Colombia.

During 1982, the var. and improvement section of CIAT's Cassava Program continued to evaluate and select breeding materials at the Instituto Colombiano Agropecuario (ICA)-Caribia and ICA-CIAT-Carimagua, and hybridization and initial selection activities were concentrated in CIAT-Palmira. Increased importance was given to the selection process in Caribia and Carimagua as representative environments, as well as to the selection for general adaptation in terms of yield and yield stability, and parental selection for crosses to produce hybrid populations to be used as selection sources by national programs. In Caribia, selections M Col 22 and M Col 1684 showed the best adaptation; the highest yielding materials always included these accessions in their crosses. In Carimagua, there are widely adapted clones such as M Col 1468, M Col 1684, and CM 507-37; germplasm accessions have been identified with adaptation to this area (M Per 245, M Bra 5, M Ven 77, M Col 1916, and M Pan 101). The importance of expt. conducted in CIAT-Palmira has shifted towards maintenance of breeding materials and hybridization. Between 10,000-30,000 F_1 seeds are annually produced by the selection program and up to 40,000 seeds have been distributed to national programs in Brazil, Mexico, Thailand, and recently China, Malaysia, and the Philippines. While a specific hybridization scheme could be required for each edaphoclimatic zone, wide adaptability (spatial stability) across edaphoclimatic zones is highly desirable since the hybrid population resulting from crosses of widely adapted parents should offer opportunities for selection at various locations. The importance of edaphoclimatic zone II in terms of its present surface area is small, but its future potential can be large since its stress conditions allow materials to be evaluated for numerous factors, particularly yield. Genotypes selected under numerous adverse factors tend to perform better under low stress conditions. (Summary by EDITEC) G01

0244

21187 KAWANO, K.; JENNINGS, P.R. 1983. Tropical crop breeding. Achievements and challenges. In Smith, W.H.; Banta, S.J., eds. Symposium on Potential Productivity of Field Crops under Different Environments, Los Baños, Philippines, 1980. [Proceedings]. Manila, International Rice Research Institute. pp.81-99. Engl., Sum. Engl., 29 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Harvest index. Rice. Plant geography. Diseases and pathogens. Productivity. Root productivity. Cultivation. Cultivation systems. Field experiments. Plant breeding. Selection. Colombia.

The different factors that a tropical crop breeding program should consider in order to succeed are discussed. All the parameters analyzed are compared with the results obtained for cassava and rice. When the HI is the yield-limiting factor, such as the case of cassava, a quantum yield increase by selection is possible. Competition and evolution of cv., diseases, pests, cultural practices, and socioeconomic aspects are considered. The center of origin and productivity, and the transfer of expt. stations results to farm production are analyzed. It is emphasized that the identification of cultural practices within the reach of the farmers in each target area is very important, and that the research plots for var. selection should be

managed at a level within the reach of the av. farmer. The major selection criterion should be the overall performance of a population and, secondarily, selection for individual single traits. The final selection should be based on moderate and stable yield over years in a given environment. (Summary by M. de W.) G01

0245

20753 SUPERINTENDENCIA DO DESENVOLVIMENTO DO NORDESTE. BRASIL. 1967. Cultura da mandioca. (Cassava). In ______. Contribuicao ao estudo das plantas alimentares. Recife-PE, Brasil. Culturas alimentares, no.1. pp.149-154. Port.

Cassava. Cassava meal. Cultivars. Roots. Branching. Selection. Root productivity. Fertilizers. N. P. K. Ca. Mg. Zn. B. Mo. Brazil.

The importance of cassava in the state of Pernambuco, Brazil, is mentioned; data on production, yield, and chemical composition of farinha, the main cassava product consumed, are given. A total of 115 cv. was evaluated in the municipalities of També and Araripina; cv. were separated into 7 groups according to root shape and branching habit. In Araripina, the 1st harvesting (4 plants/cv.) 8 mo. after planting showed that 60% of the cv. produced less than 100 g/plant. The competition among cv. was studied in També; no significant differences were found in relation to root productivity. Further analysis on starch content and flour differences is suggested for a better selection. The effect of plant density on cv. performance and different fertilization treatments were also studied. (Summary by M. de W.) G01

See also 0178 0180 0184 0199 0291

G02 Cytogenetics

0246

23452 PERRY, A.B. 1943. Chromosome number and phylogenetic relationships in the Euphorbiaceae. American Journal of Botany 30:527-543. Engl., Sum. Engl., 80 Refs., Illus.

Cassava. Manihot. Chromosomes. Cytogenetics. Polyploidy.

A preliminary survey of the chromosome no. and phylogenetic relationships in Euphorbiaceae is reported. A technique has been developed for obtaining somatic chromosome no. in many species of the family by smearing young leaf and stem tip material. A list of chromosome no. with the genera arranged within tribes according to the system of Pax and Hoffmann is presented based on literature and present work. New chromosome no. for 90 species and var. involving 19 genera are reported for the 1st time. Chromosome no. determinations were made on 109 species and var. of Euphorbiaceae distributed among a total of 22 genera. The basic no. 6, 7, 8, 9, 10, and 11 are indicated for the family. The primary basic no. is probably 8; 9 is suggested to be the basic no. for Manihot. The taxonomic relationships within the family, on the basis of the chromosome morphology and basic chromosome no., are discussed. Polyploidy, evolution, and distribution are also analyzed. (Extracted from author's summary) G02

See also 0169 0170

H00 NUTRITION

H01 Cassava Foods and Nutritive Value

0247

22768 LONGE, O.G. 1984. Water-holding capacity of some African vegetables, fruits and tubers measured in vitro. Journal of Food Science 49(3):762-764. Engl., Sum. Engl., 11 Refs. [Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Roots. Composition. Dry matter. Fibre content. Starch content. Digestibility. Cooking. Nigeria.

The acid detergent fiber contents of some vegetables, starchy fruits, and tubers (including cassava), and their acetone-dried powder, have been estimated to determine the water-holding capacity of these foods when raw or cooked. Water-holding capacity was variable among the different classes of foods, being 2.1-4.5 g/g acetone-dried powder from starchy fruits and tubers (cassava, 4.4), and varying between 7.8-18.2 g/g acetone-dried powder from leafy and nonleafy vegetables. Cooking solubilized the starch in starchy fruits and tubers, resulting in an increase in relative proportion of acid detergent fiber in the acetone-dried powder (cassava, from 14.6 to 30.9), with a significant ($P < 0.05$) increase in water-holding capacity. Vegetables were not markedly affected by cooking except for okra and waterleaf, the water-holding capacity of which was significantly ($P < 0.05$) increased on cooking. (Author's summary) H01

0248

22728 NUNFOR, F.A. 1984. An improved technique of processing cassava fufu. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the Interna'.onal Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.111-113. Engl., Sum. Engl., 4 Refs., Illus. [Inst. of Agronomic Research, B.P. 13, Njombe, Cameroon]

Cassava. Foofoo. Processing. Steeping. Fermentation. Solar drying. Grinding. Nutritive value. Protein enrichment. Soybean flour. Cameroon.

The preparation of fufu involves steeping peeled cassava roots for 3-5 days, mashing, sun-drying the pulp for 2-4 days, and milling into flour (2% protein). A study was carried out to reduce the time consumed and to improve the nutritional value of the product. Peeled roots were grated before being soaked, the result being that fermentation proceeded faster than with the whole roots. When the grated pulp was inoculated with 3-day-old cassava liquor, the fermentation time was further reduced, and a simply designed solar/fire dryer reduced drying time substantially. The nutritional value was improved to 6% protein by the addition of full-fat soybean flour (10% of total wt). The proximate analysis showed 5.5% protein, 3.3% lipids, 79.6% starch, and 1.26% soluble sugars for the improved fufu, and 1.54, 0.77, 82.0, and 0%, resp., for the traditionally processed fufu. The HCN content for improved and traditionally processed fufu was 30.7 and 19.6 mg/kg, resp. The product was not significantly different ($P < 0.05$) organoleptically from the unenriched flour. (Author's summary) H01

0249

22797 OKAFOR, N.; IJIOMA, B.; OYOLU, C. 1984. Studies on the microbiology of cassava retting for foo-foo production. Journal of Applied Bacteriology 56(1):1-13. Engl., Sum. Engl., 25 Refs., Illus. [Anambra State Univ. of Technology, Awka Campus, P.M.B. 5025, Awka, Nigeria]

Cassava. Cultivars. Foofoo. Processing. Steeping. Fermentation. Laboratory experiments. Research. Isolation. Identification. Biochemistry. Starch content. Hydrolysis. pH. Lactic acid. Nigeria.

Five bacteria (Bacillus, Lactobacillus, Klebsiella, Leuconostoc, and Corynebacterium) and a yeast (Candida spp.) were isolated from cassava being fermented for foofoo production. Retting of cassava was assessed by determining the wt. required to crush cylindrical cassava pieces. A wt. in excess of 2.5 kg was required to crush an unfermented peeled cassava cylinder 4 mm in diameter and 4 cm long, whereas a wt. as small as 20 g could crush the same piece after retting. The organisms were studied for their ability to cause retting of sterile cassava pieces, alone or in various combinations. Retting did not occur unless either Bacillus sp. or Corynebacterium sp. was present. Only these 2 organisms hydrolyzed starch. The lactic acid bacteria lowered the pH of the fermenting medium although they did not bring about retting. The typical aroma of foofoo was produced, however, only when the lactic acid bacteria were present in the mixture. Only Corynebacterium sp. was, however, shown to produce pectinolytic enzymes and it is possible that Bacillus sp. caused retting by disintegrating other cell components. The typical aroma of foofoo is disliked by some individuals and it seems possible that foofoo with a bland aroma, which will presumably be more acceptable to this group, can be produced by using organisms causing retting while excluding those forming lactic acid. (Author's summary) H01

0250

23440 PHAN, T.H.; MERCIER, C. 1984. Amélioration de la composition et de la texture du plat traditionnel africain Le Foufou par addition de monoglycérides au manioc. (Improvement of the composition and the texture of the traditional African meal foofoo by adding monoglycerides to cassava). Sciences des Aliments 4(1):109-120. Fr., Sum. Fr., Engl., 17 Refs., Illus. [Inst. National de la Recherche Agronomique, Centre de Recherches Agro-alimentaires, Laboratoire de Biochimie et Technologie des Glucides, rue de la Geraudiere, 44072 Nantes Cedex, France]

Cassava. Foofoo. Cultivars. Sweet cassava. Bitter cassava. Starch content. Processing. Steeping. Fermentation. Cooking. Boiling. Cassava meal. Food additive. Congo. France.

A comparative study between bitter cassava cv. Moudouma and sweet cassava cv. Ombete was carried out to replace bitter cassava with sweet cassava, and hence eliminate the fermentation process (retting), and to improve the texture of the foofoo made with sweet cassava, not appreciated by local African consumers. No significant difference was observed in the chemical composition of the 2 cv. On the other hand, fermentation modified both the chemical composition and the starch behavior when cooked. Loss of oligosaccharides, ashes, and proteins, and a production of organic acids (acetic, propionic, and butyric) were detected during the fermentation. The comparison of fermented and unfermented bitter and sweet cassava Brabender viscoamylograms and of their corresponding foofoo aqueous suspension I spectra demonstrated the effect of the released organic acids on amylose complexing. By decreasing the extent of soluble amylose and increasing the gelatinization temp. of starch, this complexing reduces stickiness and therefore is responsible for foofoo texture. Added monoglycerides to natural and unfermented sweet cassava led to a similar and even better texture than the homemade foofoo texture, in particular for hardness and stickiness measured by a GTX-IN texturometer. Refined oil was unsuccessful, but any unrefined oil, contaminated with monoglycerides and/or fatty acids, could be used as a texture improver agent for natural sweet cassava foofoo. (Author's summary) H01

0251

22326 ROOSEVELT, A.C. 1980. Parmana: prehistoric maize and manioc subsistence along the Amazon and Orinoco. New York, Academic Press. 320p. Engl., 720 Refs., Illus.

Cassava. Maize. Human nutrition. Ecology. Ecosystems. Venezuela.

Various hypotheses that have been proposed to explain the differential cultural development in the Amazon region are discussed. Archaelogical and etnohistorical evidence to reject them is presented. The ecological difference between the flood plains and the tropical forest is indicated to highlight the influence of the habitat on the development of different societies. The roles played by maize and cassava, and by their agronomic characters, on the cultural evolution of the zone are analyzed. Illustrations are included. (Summary by M. de W.) H01

0252

22697 TOMA, R.B.; TABEKHIA, M.M. 1979. Nutritional composition of some Nigerian meals. Nutrition Reports International 19(2):189-194. Engl., Sum. Engl., 15 Refs.

Cassava. Gari. Composition. Protein content. Fat content. Carbohydrate content. Fibre content. Water content. Ash content. Mineral content. Food energy. Analysis. Nigeria.

Six Nigerian meals were prepared, freeze-dried, and analyzed for proximate composition and 5 macrominerals. Data were compared with FAO Nutritional Standards for protein, Ca, and Fe. Meals were limited in their supply of protein, except for those supplemented with animal protein. Gross energy values, as well as Fe and Ca (except for one meal), were adequate. (Author's summary) H01

See also 0173 0174 0276 0278 0279 0287

H02 Nutritive Disorders in Humans

0253

20757 MABERLY, G.F.; CORCORAN, J.M.; EASTMAN, C.J. 1982. The effect of iodized oil on goitre size, thyroid function and the development of the Jod Basedow phenomenon. Clinical Endocrinology 17(3):253-260. Engl., Sum. Engl., 26 Refs. [Dept. of Medicine, Westmead Centre, Westmead, New South Wales, Australia]

Cassava. Endemic goitre. Clinical manifestations. Human physiology. Biochemistry. Analysis. Statistical analysis. Iodine. Cyanides. Thiocyanates. Deficiency diseases. Malaysia.

In the Lubok Antu district of Sarawak, Malaysia, 240 subjects with 75% prevalence of goiter were studied before and 1 and 2 yr following iodized (poppy seed) oil injection. After 1 yr the prevalence of goiter was reduced to 33%, but 2 yr after injection goiters had regrown in 14 subjects (6%). The mean urinary I concn. was low initially, 0.17 ± 0.08 (SD) micromole/l, consistent with I deficiency, and rose to a level of 2.6 ± 2.5 micromoles/l at 1 yr, before falling to 0.46 ± 0.38 micromole/l, again consistent with deficiency. Such a rapid depletion of I may be related to the high consumption of cassava. Before injection, serum TSH concn. showed a wide scatter from normal up to 62 mU/l and at 1 yr, serum TSH concn. were undetectable. At 2 yr serum TSH was again detectable in 50% of subjects with levels up to 8.6 mU/1. During the 2nd yr, there was a progressive rise in the mean serum T_4 (thyroxine) concn. from 92 ± 22 to 110 ± 22 nmol/1 ($P < 0.05$). Serum T_3 (triiodothyronine) concn. rose serially in all subjects from a preinjection mean of 1.9 ± 0.3 to 2.5 ± 0.9 nmol/1 ($P < 0.001$) and then fell significantly below the baseline level to a mean of 1.7 ± 0.6 nmol/1 at 2 yr after injection ($P < 0.01$). The mean serum r(reverse) T_3 levels followed the same trend. At 1 or 2 yr following injection, 8 subjects were clinically hyperthyroid. Four of these consented to venesection and hyperthyroidism was confirmed biochemically. These data revealed the following: goiters decreased rapidly in size in response to iodized oil injection; significant though incomplete depletion of the I stores occurred within 2 yr of injection; the consistent increase in serum T_3 was associated with a fall in serum TSH to undetectable levels; the prevalence of the Jod Basedow phenomenon was 1.7%. The need for closer biochemical monitoring of subjects receiving massive doses of I and a reappraisal of the use of iodized oil in the treatment of endemic goiter is suggested. (Author's summary) H02

0254

22329 AYELOLA, O.O.; AYANGADE, S.O.; OKE, O.L. 1983. The possible role of cassava in the thiocyanate level of pregnant women. Nutrition Reports International 28(3):585-592. Engl., Sum. Engl., 13 Refs. [Dept. of Chemistry, Univ. of Ife, Ile-Ife, Nigeria]

Cassava. Human nutrition. Gari. Cassava flour. Foofoo. Thiocyanates. Analysis. Metabolism. Nigeria.

Samples of maternal blood, fetal (cord) blood, amniotic fluid, breast milk, and urine were taken from 150 pregnant women with different socioeconomic status and analyzed for SCN. The mean SCN level was higher in the plasma (20.52 Mmole/1) with a range of 0-83.00 Mmole, followed by the urine (18.9 Mmole) with a range of 3.10-37.60 Mmole. Although the range was similar in the amniotic fluid and fetal plasma (0-43.30 and 0-44.80 Mmole, resp.), the mean was higher in the amniotic fluid (10.42 Mmole) than the fetal plasma (6.78 Mmole). Only the maternal plasma SCN level gave a significant positive correlation with the fetal plasma ($P < 0.05$). All the other correlations were insignificant. The content in the breast milk (16.81 Mmole) may be sufficiently high enough to affect the thyroid function of a breast-fed infant in the presence of insufficient I and this may possibly be the etiology of endemic goiter. (Author's summary) H02

H03 Animal Feeding

0255

19522 AGUDELO T., J.C.; BENEDETTI M., R.J. 1980. Utilización de la harina de hoja de yuca como fuente parcial de proteína. (Cassava leaf meal utilization as a partial source of proteins). Tesis Med.Vet.Zoot. Montería, Colombia, Universidad de Córdoba. Span., Sum. Span., 13 Refs., Illus.

Cassava. Animal nutrition. Poultry. Cassava leaves (vegetable). Solar drying. Colombia.

The effect of using CLM at levels of 0 (check), 7.5, 11, and 15% in starter and finishing diets for chickens (1-42 and 45-56 days, resp.) was studied. There was no significant difference in the av. wt. of the animals during both phases; however, the highest av. wt. were obtained with the diet containing 7.5% CLM. A significant difference in wt. gain/animal/day was observed during the starter phase. Av. consumption/animal did not show significant differences. Data suggest that age improves the use of CLM since the excess fiber may affect younger chickens. It was also observed that CLM favored chicken pigmentation. (Summary by M. de W. Trans. by L.M.F.) H03

0256

22795 BALOGUN, O.O.; FETUGA, B.L. 1984. Influence of methionine and palm oil supplementation of cassava flour-soybean meal diets on performance, nitrogen retention and rate of tissue deposition in weanling pigs. Livestock Production Science 11(3):315-327. Engl., Sum. Engl., Fr., Germ., 30 Refs. [Dept. of Animal Production, Faculty of Agriculture, Univ. of Ilorin, P.M.B. 1515, Ilorin, Nigeria]

Cassava. Animal nutrition. Swine. Feed constituents. Digestibility. Metabolism. Nigeria.

Thirty-six 8-wk.-old weanling Large White x Landrace pigs, initially averaging 7.8 kg body wt., were used to evaluate the effect of palm oil and met. supplementation on growth performance, N retention, plasma urea concn., and rate and proportion of tissue deposition of pigs fed CF-SBM diets. Palm oil levels of 3.00, 6.35, and 9.70%, and met. levels of 0.47, 0.55, and 0.63% were used. All diets had a common protein level of 20%. Increasing the palm oil level from 3.00 to 6.35% of the diet significantly improved growth rate of pigs on all dietary met. levels. Daily N retention was not significantly influenced by increased dietary palm oil, although levels higher than 3.00% depressed the efficiency of retention of ingested N at all dietary met. levels. Increased caloric density due to increased palm oil levels resulted in a greater proportion of fat relative to lean in the carcass. Calculated daily rate of lean deposition reached a max. in the group of pigs fed the 0.63% met. diet containing 6.35% palm oil, while max. efficiency of feed conversion to lean was reached on the same met. level but with 9.70% palm oil. Min. plasma urea concn. was obtained on a diet containing 0.63% met. and 3.00% palm oil. (Author's summary) H03

0257

22729 FOMUNYAM, R.T.; ADEGBOLA, A.A.; OKE, O.L. 1984. Cassava-based diets for rabbits. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.114-116. Engl., Sum. Engl., 2 Refs. [Inst. of Animal Research, Mankon, Cameroon]

Cassava. Animal nutrition. Rabbits. Cassava flour. Maize. Feed constituents. Metabolism. Costs. Nigeria.

Rabbits, New Zealand White and Californian breeds, fed maize- or cassava-based diets had comparable reproductive, growth, and carcass traits, although feed intake and av. daily gain were significantly ($P < 0.05$) greater for rabbits fed the cassava-based diets. It was more profitable to raise rabbits on cassava-based diets than on maize based diets. (Author's summary) H03

0258

22985 GOMEZ, G.; SANTOS, J.; VALDIVIESO, M. 1984. Evaluation of methionine supplementation to diets containing cassava meal for swine. Journal of

Animal Science 58(4):812-820. Engl., Sum. Engl., 17 Refs. [Centro Agronómico Tropical de Investigación y Enseñanza, Apartado 7170, Turrialba, Costa Rica]

Cassava. Animal nutrition. Swine. Cassava meal. Methionine. Feed constituents. Costs. Sorghum. Soybean flour. Cottonseed meal. Fish meal. Colombia.

The effect of met. supplementation to diets containing high levels of CM (approx. 65%) was studied with gestating and lactating gilts as well as with growing-finishing pigs. In both expt., met. supplementation did not improve ($P > 0.05$) the results obtained with the unsupplemented diets. Handling of the feed during the gestation period could explain the differences found in relation to data previously reported; group feeding appeared to be responsible for the poorer reproductive performance previously obtained with CM-based diets. Diets for growing-finishing pigs based on CM and SBM produced results similar to those of the control diet (yellow maize + SBM), irrespective of met. supplementation. Further studies using least-cost diets formulated to include 30% CM for gestating and lactating gilts, 40% CM for baby pigs, and 20 and 30% CM for growing-finishing pigs produced normal performance and required balancing, when necessary, with less than 0.06% met. The CM price used was equivalent to 80% of the current sorghum price. Combinations of CM with SBM or with SBM-cottonseed meal-fish meal resulted in well-balanced least-cost diets. (Author's summary) H03

0259

22085 MAKHAMBORA, P.E. 1978. The economics of using a cassava-based ration in pork production. Lilongwe, University of Malawi. Bunda College of Agriculture. Research Bulletin no.9. pp.46-50. Engl., Sum. Engl., 3 Refs.

Cassava. Swine. Animal nutrition. Feed constituents. Maize. Costs. Malawi.

Eighteen litters of Large White x Landrace crossbred pigs were used in a feeding trial to determine the performance of pigs fed a maize-based ration (F_1), a peeled cassava-based ration (F_2), and an unpeeled cassava-based ration (F_3). A completely randomized design was employed. The av. daily live wt. gains of the pigs were 0.47, 0.49, and 0.44 kg for F_1, F_2, and F_3, resp., and the differences were significant ($P < 0.01$). Pigs fed the F_2 ration had the highest feed conversion efficiency (3.3 kg feed/kg of live wt. gain) seconded by those on the F_3 ration (3.9 kg feed/kg of live wt. gain); those on the F_1 ration had the lowest (4.2 kg feed/kg of live wt. gain). It was estimated that the pigs fed on the F_2 ration would give the highest gross margin followed by those on the F_3 and F_1 rations. (Author's summary) H03

0260

22730 NGOKA, D.A.; CHIKE, E.C.; AWONIYI, A.B.; ENYINNIA, T.; ODURIKWE, S.O. 1984. Effects of cassava meal on the hatchability of chicken eggs. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.117-119. Engl., Sum. Engl., 13 Refs. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Cassava meal. Maize. Animal nutrition. Poultry. Feed constituents. Nigeria.

Yaffa hens and Rhode Island Red cocks were fed CM in maize-based rations at 4 dietary levels, substituting maize at 0, 50, 75, and 100%; 800 eggs were collected from the hens and incubated in 5 replicate batches for all the treatments. The no. of infertile eggs, mortality in the shell, salability, and incubation period were recorded. The eggs from the birds fed the highest level of cassava showed a significantly (P < 0.05) higher infertility and lower hatchability than the others. Other differences were not significant. The results suggest that CM can be substituted for maize up to 75% in breeders' rations without deleterious effects on the hatchability of chicken eggs. (Author's summary) H03

0261

22043 NITIS, I.M. 1983. Use of by-products to feed Bali cattle. In Kiflewahid, B.; Potts, G.R.; Drysdale, R.M., eds. By-product utilization for animal production: proceedings of a workshop on applied research, Nairobi, Kenya, 1982. Ottawa, Canada, International Development Research Centre. pp.26-36. Engl., Sum. Engl., Fr., Span., 10 Refs. [Dept. of Animal Nutrition & Tropical Pasture Production, Udayana Univ., Denpasar, Bali, Indonesia]

Cassava. Animal Nutrition. Cattle. Cassava chips. Feed constituents. Costs. Indonesia.

Two feeding expt. were carried out in a mixed-farming village in Indonesia to study the effect of replacing 30% of the green roughage with readily available agroindustrial by-products (copra meal, rice bran, hen manure, and cassava chips) on the performance of Bali steers with an av. initial live wt. of 101-114 kg. The completely randomized block design arrangement consisted of 5 treatments (1 diet with 100% green roughage and 4 diets of 70% green roughage + 30% various concentrate mixtures) and 4 replications, with 2 steers/replication. Sixteen steers were raised using traditonal methods for comparison. In expt. 1, the concentrate-supplemented diet was formulated to meet the requirements for the 100-200, 200-300, and 300-400 kg live wt. ranges. In expt. 2, the best diet in expt. 1 was compared with the cheapest concentrate-supplemented diet. Expt. 1 and 2 lasted 200 and 68 wk., resp. Cattle supplemented with various concentrate mixtures gained 2.7-3.9 times more wt. (P < 0.05) and were 50.5-67.7% more efficient in utilizing the feed than those fed on green roughage alone. Among the concentrate-supplemented groups, the response varied according to the growth stages. Cattle supplemented with concentrate mixtures required 2.25 yr to reach 375 kg (market wt.), whereas those fed green roughage were expected to take 2-3 times longer to reach the same wt. Simple benefit-cost analysis showed that the gross profit from cattle receiving concentrate mixtures was 55.5% more than those receiving only green roughage. The greatest live wt. gain (av. 349 g/day) occurred in cattle supplemented with 10% copra meal + 10% rice bran + 10% cassava chips, whereas the highest gross profit resulted from cattle supplemented with 20% rice bran + 10% hen manure. The constraint was not on the concentrate but on the availability and cost of the green roughage. (Author's summary) H03

0262

22328 OBIOHA, F.C.; OKEKE, G.C.; ONUA, E.C.; OBOEGBUNAM, S.I. 1983. The effect of varying protein and energy levels on the utilization of processed cassava peels by mice. Nutrition Reports International 28(3):531-545. Engl., Sum. Engl., 18 Refs. [Dept. of Animal Science, Univ. of Nigeria, Nsukka, Nigeria]

Cassava. Animal nutrition. Laboratory animals. Cortex. Processing. Drying. Solar drying. Silage. Freezing. Composition. Costs. Nigeria.

Four levels of cassava peel meal (CPM), 0, 10, 20, and 40%, in either ensiled, sun-dried, or frozen form were incorporated into 10 diets containing 19, 20, 21, or 22% protein and 3.1, 2.9, 2.7, or 2.3 Mcal/kg ME resp., and fed to growing mice, such that CPM levels increased with protein but decreased with energy levels. Feed intake was not depressed by CPM inclusion even at high levels; feed intake/g metabolic wt. was significantly enhanced at high CPM levels. However, gains and PER were maximized while liver fat was minimized by the maize control diet ($P < 0.05$). Performance was influenced more by CPM levels than by mode of CPM processing. Increasing protein and amino acids and decreasing energy proved effective in moderating the effects of high CPM and HCN levels. Up to 40% CPM can be fed to mice preferably in ensiled or frozen form, with substantial savings in feed costs. (Author's summary) H03

0263

23450 OKE, O.L. 1984. The use of cassava as pig feed. Nutrition Abstracts and Reviews (Series B) 54(7):301-314. Engl., Sum. Engl., 54 Refs.

Cassava. Animal nutrition. Swine. Amino acids. Lysine. Cysteine. Cystine. Methionine. Protein enrichment. Maize. Feeds and feeding. Feed constituents. Cassava chips. Cassava leaves (vegetable). Pellets. Cassava meal.

Amino acid imbalance, especially with respect to lysine and S-containing amino acids (SAA), is one of the numerous problems involved in substituting cassava for maize in pig rations. Imbalance with respect to SAA leads to lower efficiency of feed conversion, and this increases as the amount of cassava in the diet increases, as more SAA will be needed for detoxification. As a 1st step towards solving some of these problems it is suggested that workers in this field should record the cyanide content of the cassava used, the theoretical content of lysine and SAA in the ration formulation, whether palm oil (or any other oil) is used, and in what form the cassava is fed. Some of the results reported in this review suggest that certain min. amounts of lysine and SAA are needed for high efficiency. If properly supplemented with a good source of protein and with vitamins and minerals, cassava can be used as the only source of energy for pigs. (Extracted from author's summary) H03

0264

21471 OMOLE, T.A.; ONWUDIKE, O.O. 1983. Efecto del aceite de palma sobre el uso de harina de cáscara de yuca para conejos. (The effect of palm oil on the use of cassava peel meal by rabbits). Producción Animal Tropical 8(1):30-37. Span., Sum. Span., 9 Refs. [Dept. of Animal Science, Univ. of Ife, Ile-Ife, Nigeria]

Cassava. Animal nutrition. Rabbits. Feed constituents. Cassava meal. Cortex. Metabolism. Cyanides. Cyanogen. Detoxification. Nigeria.

Two studies were carried out to determine the effect of palm oil on the use of cassava peel meal by rabbits. Without palm oil there was a significant reduction in the rate of gain of rabbits when cassava peel exceeded 30% of the diet. With palm oil supplements the drops in rate of gain and feed efficiency with increasing levels of cassava peel were less than with the unsupplemented diets. Without palm oil, feed intake dropped significantly with more than 40% of cassava peel; with the supplemented diets, feed intake was not significantly affected even with up to 50% of cassava peel. With palm oil supplements, serum thiocyanate remained about the same for rabbits given 0-50% of cassava peel, while there was a significant increase in urine thiocyanate. With the unsupplemented diet the reverse was the case. Since urine is a pathway of excretion, it would appear that palm oil supplements allowed a higher rate of removal of cyanide from the body than when no palm oil was given. (Author's summary) H03

0265
22335 PREMAKUMARI, K.; KURUP, P.A. 1983. Effect of feeding cooked tapioca as compared to rice on the metabolism of glycosaminoglycans in rats. Indian Journal of Biochemistry and Biophysics 20(3):163-166. Engl., Sum. Engl., 26 Refs. [Dept. of Biochemistry, Univ. of Kerala, Trivandrum 695034, India]

Cassava. Animal nutrition. Laboratory animals. Cassava chips. Rice. Cooking. Metabolism. India.

Feeding young male albino rats cassava, when compared with rice, resulted in a decrease in the concn. of many glycosaminoglycans (Glg) in the aorta, heart, liver, and kidney. The activity of glucosamine phosphate isomerase (glutamine forming) and UDPG dehydrogenase decreased while the pattern of change in the activity of enzymes concerned with degradation of Glg was not uniform. Concn. of PAPS (3'-phosphoadenosine-5'-phosphosulfate) and the activity of sulfate activating system (sulfate adenyltransferase and adenylsulfate kinase) in the liver were increased. (Author's summary) H03

0266
22039 RAVINDRAN, V.; KORNEGAY, E.T.; CHERRY, J.A. 1983. Feeding values of cassava tuber and leaf meals. Nutrition Reports International 28(1):189-196. Engl., Sum. Engl., 22 Refs. [Virginia Polytechnic Inst. & State Univ., Blacksburg, VA 24061, USA]

Cassava. Animal nutrition. Swine. Poultry. Cassava meal. Cassava leaves vegetable). Alfalfa. Soybean flour. Oats. Maize. Feed constituents. Metabolism.

Two trials were conducted to evaluate the feeding values of cassava root and leaf meals. In trial 1, 40 starter pigs weighing 7.3 kg were randomly assigned to one of the following 5 dietary treatments in 4 replicates: (1) maize-soybean basal (B); (2) B + 10% CM; (3) B + 20% CM; (4) B + 10% oats; and (5) B + 20% oats. Inclusion of CM or ground oats had no significant effect on daily gain, daily feed intake, or feed/gain of the starter pigs. In trial 2, the feeding value of CLM was compared with that of dehydrated alfalfa meal (ALM) using 288 two-week-old Japanese quails. A maize-soybean diet served as the control and the leaf meals were incorporated at the levels of 2.5, 5.0, 7.5, and 10.0%. All diets were isonitrogenous and isocaloric. Body wt. gains were not significantly different between birds fed the control and diets containing leaf meals. However, there was a trend for birds fed diets containing 2.5% CLM or ALM to gain faster and more efficiently than the controls. Feed intake and feed/gain were linearly ($P < 0.05$) increased as the leaf meals were incorporated above 5% level. The performance of birds fed CLM and ALM diets was similar. (Author's summary) H03

0267
22098 STEVENSON, M.H. 1984. The nutritional value of cassava root meal in laying hen diets. Journal of the Science of Food and Agriculture 35(1):36-40. Engl., Sum. Engl., 13 Refs. [Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland]

Cassava. Animal nutrition. Poultry. Cassava meal. Pellets. Feed constituents. Nutritive value.

A total of 288 layer hens (144 Hixes white, 144 Hisex brown) were randomly allocated to 1 of 12 dietary treatments and fed ad libitum for ten 28-day-periods. The diets, fed either as mash or pelleted, were a control diet and 5 other diets with increasing levels of added CM (100, 200, 300, 400, 500 g/kg diet). At the end of the expt., 4 Hixes white birds from each treatment were taken for the measurement of water intake. The apparent ME content of the diets was measured by the total collection method. The inclusion of high levels of CM had no detrimental effect on egg production or food intake. However, as the level of cassava increased, there was a tendency towards a decrease in food consumption in the meal-fed birds. Water consumption was significantly greater in the birds given pelleted feed than in those given mash. Also, at the higher levels of cassava inclusion in the meal-fed birds, water consumption was greater. The apparent ME content of the CM was 14.1 MJ/kg DM. (Author's summary) H03

0268

22097 STEVENSON, M.H.; JACKSON, N. 1983. The nutritional value of dried cassava root meal in broiler diets. Journal of the Science of Food and Agriculture 34(12):1361-1367. Engl., Sum. Engl., 21 Refs. [Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland]

Cassava. Animal nutrition. Poultry. Feed constituents. Cassava meal. Nutritive value. Metabolism.

In each of 2 expt., 600 male broiler chicks (Ross 1) were randomized into 24 groups, each containing 25 birds. From the age of 7 days they were given 1 of 6 exptl. diets: a control diet having ground wheat as the main cereal source and 5 other diets in which mainly the wheat was replaced by increasing amounts (100, 200, 300, 400, 500 g/kg diet) of dried CM. Neither body wt. nor food intake were significantly affected in either expt. by the inclusion of dried CM at levels up to 500 g/kg. Food conversion efficiency was not affected by dietary treatment except in expt. 1 after 4 wk., when the diet with 100 g CM/kg resulted in a better food conversion efficiency than in the case of the other dietary treatments. The carcass and abdominal fat wt. and the chemical composition of the carcasses were not affected by dietary treatment. In the cecal contents the proportion of acetic acid was increased and that of propionic and valeric acids reduced by the inclusion of dried CM. The MC of the litter was not significantly affected by the presence of CM although the litter became wet and sticky in the groups given the 2 highest levels of CM in expt. 1. For this reason, the max. recommended level of inclusion of dried CM in broiler diets is 30%. (Author's summary) H03

0269

22092 TEWE, O.O. 1984. Effect of cassava-based diets varying in cyanide content on the performance and physiopathology of the African giant rat (Cricetomys gambianus Waterhouse). Animal Feed Science and Technology 11(1):1-9. Engl., Sum. Engl., 19 Refs. [Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Animal nutrition. Laboratory animals. Maize. Cortex. Roots. Pulp. Feed constituents. HCN content. Metabolism. Nigeria.

Twenty-four male weanling African giant rats were allocated to 4 treatment groups in a 16-wk. trial. Their diets were based on (1) maize, (2) cassava peel, (3) whole cassava roots, and (4) cassava pulp. HCN content of diets was 0, 597, 150, and 110 mg/kg, resp. Diets were isocaloric and isonitrogenous. Feed consumption was similar on all diets. Growth rate, feed efficiency, and PER were better ($P < 0.05$) on diets 1 and 4. Serum, organ, and urinary thiocyanate were higher ($P < 0.05$) on the cassava-based diets. Serum urea concn. increased proportionally with dietary HCN level. No pathological lesions were observed in spleen, kidney, liver, and thyroid glands of animals on all treatments. (Author's summary) H03

0270

22037 TEWE, O.O.; OKE, O.L. 1983. Performance, carcass characteristics and economy of production of growing pigs on varying dietary cassava peel levels. Nutrition Reports International 28(2):235-243. Engl., Sum. Engl., 10 Refs. [Dept. of Animal Science, Univ. of Ibadan, Nigeria]

Cassava. Animal nutrition. Swine. Feed constituents. Feeds and feeding. Cortex. HCN content. Costs. Nigeria.

Twenty-four pigs were divided into 4 groups of 6 animals each, and fed 4 diets formulated to contain 20% protein and different levels of cassava peels, 0, 10, 20, and 30% in diets 1-4, resp. The cassava peel contained 280.6 ppm HCN. Feed intake increased with higher dietary cassava peel level while body wt. gain was highest ($P < 0.05$) on diet 1 and least on diet 2. Feed efficiency and protein efficiency ratios were poorer on diets containing cassava peel. Significant differences ($P < 0.05$) were obtained in dressing %, carcass length, trimmed fat, dissected fat, and belly wt. Pigs on 20 and 30% cassava peel-based rations produced leaner carcasses than others. The profit margin was highest on the 20% cassava peel ration. (Author's summary) H03

0271

22100 WILLIAMS, P.E.V. 1984. Digestibility studies on ammonia-treated straw. Animal Feed Science and Technology 10(2-3):213-222. Engl., Sum. Engl., 21 Refs. [Rowett Research Inst., Bucksburn, Aberdeen AB2 9SB, Great Britain]

Cassava. Animal nutrition. Sheep. Feed constituents. Digestibility.

Barley straw (cv. Sonja, a winter var.), either treated with anhydrous ammonia (30 g NH_3/kg straw DM) in an oven at 90°C for 16 h or left untreated, was offered to 8 sheep in digestibility trials. The digestibility of DM of ammonia-treated and untreated straw was 0.50 and 0.42, of OM 0.52 and 0.45, and of acid detergent fiber 0.59 and 0.47, resp. A series of digestibility trials is summarized in which ammonia-treated straw was offered with supplements of either rolled barley, turnips, fish meal, cassava, or molasses to either sheep or cattle. When the straw constituted less than 50% of a diet which included either rolled barley or turnips, the digestibility of acid detergent fiber in the diet was lower than recorded when straw was offered alone. The apparent digestibility of the straw DM, in the diets with rolled barley or turnips, was also lower than when the straw was offered alone. However, when the supplement constituted approx. 5% of the DM of the diet, supplementation of ammonia-treated straw with either fish meal, cassava, or molasses tended to increase the digestibility of acid detergent fiber and the apparent DM digestibility of the straw. Results suggest that changes in bacterial lysis occurred depending on the levels of supplementation used; high levels of rapidly fermentable carbohydrates in diets with straw tended to depress digestion of cellulose by bacteria, but small additions of either protein or rapidly fermentable carbohydrates stimulated it. (Author's summary) H03

0272

22769 YEONG, S.W.; SYED ALI, A.B. 1976. The use of tapioca in broiler diets. MARDI Research Bulletin 5(1):95-103. Engl., Sum. Engl., Mal., 6 Refs.

Cassava. Animal nutrition. Poultry. Maize. Cassava chips. Pellets. Feed constituents. Nutritive value. Metabolism. Malaysia.

Five expt. were conducted to study the possibility of replacing maize with cassava chips in broiler-finisher diets. In the 1st 2 trials, 5 isonitrogenous and isocaloric diets with graded levels of ground cassava chips (0, 15, 30, 40, and 50%) substituting maize, were fed to commercial broiler chickens from wk. 5 to 10. It was observed that as cassava levels increased, body wt. and feed efficiency decreased linearly ($P < 0.01$), although the essential amino acids content in all diets was as high as the requirement levels. Pelleting the cassava diets slightly improved feed efficiency but could not overcome the adverse effect completely. In the subsequent trials, diets with graded levels of cassava were supplemented with different levels of met. Results showed that 40 or 50% cassava supplemented with 0.2% met. were comparable with maize control diets in terms of body wt. gains and feed efficiency. No significant difference was found in the carcass of broilers fed maize and cassava diets in terms of % of ready-to-cook (total giblets, carcass, and neck) and meat to bone ratio. Absence of yellow pigment in the skin, shanks, and depot fat was observed in broilers fed high cassava diets. (Author's summary) H03

See also 0200 0202 0288

H04 HCN Toxicity and Detoxification

0273

22726 EJIOFOR, M.A.N.; OKAFOR, N. 1984. Microbial breakdown of linamarin in fermenting cassava pulp. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.105-107. Engl., Sum. Engl., 11 Refs. [Cassava Programme, National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Gari. Fermentation. Industrial microbiology. Linamarin. Linamarase. HCN. Detoxification. Nigeria.

Linamarin-hydrolyzing microorganisms were inoculated into fresh cassava pulp. The generation times were 59, 58, 78, and 74 min for *Alcaligenes faecalis*, *Leuconostoc mesenteroides*, *Saccharomyces cerevisiae*, and *Rhodotorula minuta*, resp. The bacteria *L. mesenteroides* and *A. faecalis* hydrolyzed cassava linamarin, releasing a max. of 0.100 and 0.090 mg HCN/g of pulp, resp., at 72 h. At 96 h, *S. cerevisiae* released a max. of 0.105 mg HCN/g of pulp, and *R. minuta* 0.108 mg HCN/g of pulp. Alone, the linamarase endogenous to the cassava released 0.045 mg HCN/g of pulp at 72 h, and 0.051 mg HCN/g of pulp at 96 h. It is suggested that the 4 microorganisms can be used in the commercial detoxification of cassava pulp during the production of gari or other fermented cassava-based meals. (Author's summary) H04

0274

22090 GOMEZ, G.; VALDIVIESO, M.; DE LA CUESTA, D.; SALCEDO, T.S. 1984. Effect of variety and plant age on the cyanide content of whole-root cassava chips and its reduction by sun-drying. Animal Feed Science and Technology 11(1):57-65. Engl., Sum. Engl., 21 Refs. [Centro Agronómico Tropical de Investigación y Enseñanza, Apartado 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Sweet cassava. Bitter cassava. Timing. Cassava chips. Drying. Solar drying. Cyanides. HCN content. Colombia.

The cyanide content of fresh whole root chips of 2 cassava var. (CMC-40, low-cyanide, and CMC-84, high-cyanide) as affected by plant age (9-12 mo.) was determined monthly, as was the effect of sun drying, either on concrete floors (plain or black-painted) or on inclined trays, on cyanide elimination. Total cyanide contents in fresh chips of var. CMC-84 were always higher (772 $\pm$ 167 vs. 436 $\pm$ 111 mg/kg DM) than those of var. CMC-40, and in both var. cyanide contents in chips decreased as plant age increased. Most of the cyanide in fresh chips was found as bound cyanide (66 and 79% for CMC-40 and CMC-84, resp.), but the proportion of free cyanide was higher than values previously determined in the separate root tissues. Sun drying on inclined trays normally required less time than on a concrete floor; at the fresh chip loading rate used (8.5-9.0 kg/m^2) for floor drying, no appreciable differences in drying times and cyanide elimination were found between plain and black-painted concrete surfaces. Sun drying on a concrete floor eliminated more cyanide for both var. than on inclined trays. Most of the remaining cyanide in chips dried on a concrete floor was found as free cyanide, but in chips dried on trays these values were considerably lower. Results are discussed in relation to the max. HCN concn. (100 mg/kg) that has been set as a quality standard for cassava chips or pellets. (Author's summary) H04

See also 0173 0248 0262 0264 0269

100 PROCESSING, PRODUCTS AND USES

102 Uses, Industrialization, Processing and Storage

0275

22982 BEST, R.; ALONSO, L. 1983. The development of a through circulation solar heated air drier for cassava chips. Cali, Centro Internacional de Agricultura Tropical. 14p. Engl., Sum. Engl., 13 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Paper presented at Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983.

Cassava. Cultivars. Cassava chips. Solar drying. Drying. Processing. Mechanization. Industrialization. Small-scale equipment. Development. Colombia.

A pilot-scale through circulation drier, using solar heated air, has been developed for drying cassava chips. The design of the drier system, which includes a bottom ventilated drying bin, centrifugal fan, and solar collector, is described. In the evaluation trials the variables studied were drier loading (37.5-150.0 kg/m^2), airflow (11-18 m^3/min m^2), and varying air conditions in the range 24-28°C and 62-72% RH. Design parameters for drier scale-up are presented. (Author's summary) 102

0276

23087 COLOMBO, A.J.; SCHOENLEIN, N.C. 1982. Hidrolise enzimatica da farinha de mandioca. (Enzymatic hydrolysis of cassava flour). Revista de Farmacia e Bioquimica da Universidade de Sao Paulo 18(1):47-67. Port., Sum. Port., Engl., 12 Refs., Illus. [Facultade de Ciencias Farmaceuticas da Univ. de Sao Paulo, Caixa Postal 30786, Sao Paulo-SP, Brasil]

Cassava. Cassava flour. Starch content. Hydrolysis. Enzymes. Brazil.

The use of barley enzymes for the saccharification of cassava starch was studied. Thermic pretreatment, agitation, relation between barley flour and CF and time of hydrolysis, were considered. Barley flour was used instead of barley malt as an economical industrial choice. Best yields were obtained with pretreatment, agitation, barley flour/CF relation of 3/7, and a hydrolysis time of 8 h. (Author's summary) I02

0277

22322 FIGUEROA S., F.J.; OSPINA P., M.T. 1984. Funcionamiento y costos de operación de un sistema de secado artificial de yuca utilizando aire forzado calentado por un quemador de carbón. (Performance and operation costs of an artificial forced-air cassava drying system heated with a coal burner). Tesis Ing.Agr. Palmira, Universidad Nacional de Colombia. 119p. Span., Sum. Span., Engl., 18 Refs., Illus.

Cassava. Cultivars. Processing. Drying. Development. Industrialization. Small-scale equipment. Colombia.

A forced-air through circulation drier has been developed for drying cassava chips; the system uses an indirect coal-fired burner to heat the air which is drawn through the burner/heat-exchanger unit by a centrifugal fan with backward curved blades. Combustion gases did not mix with the heated air. The system operated at a fixed airflow rate of 36 m^3/min with a drying area of 2 m^2. An av. air drying temp. of 58°C was achieved by using 15 kg of coal for lighting the burner and then after 2 h, periodic feeding with 5 kg/h. These operating conditions were determined in 11 tests in the 1st trial undertaken. In the 2nd trial, operating the burner under the conditions obtained initially, tests were carried out using loads of cassava chips of 50, 100, 150, 175, 200, and 250 kg of fresh cassava/m^2 of drying area. It was found that loads higher than 100 kg/m^2 gave the highest efficiencies in terms of kg of water extracted/kg of coal burnt and kg of coal/kg of dry cassava produced. The lowest cost, in terms of energy consumption, were those using 150 and 200 kg/m^2. It is recommended to use loading rates of 150-200 kg/m^2 given the lower costs obtained, compared with the other loading rates studied. (Author's summary) I02

0278

21497 KHALID, N.M. 1982. Relative sweetness of high fructose cassava syrup, high fructose corn syrup and sucrose. MARDI Research Bulletin 10(1):105-109. Engl., Sum. Mal., Engl., 7 Refs., Illus. [Malaysian Agricultural Research & Development Inst., Food Technology Division, Bag Berkunci 202, Pejabat Pos U.P.M., Serdang, Selangor, Malaysia]

Cassava. Fructose. Sucrose. Maize. Confectioneries. Organoleptic examination. Statistical analysis. Malaysia.

The relative sweetness of high fructose cassava syrup (CS) to high fructose corn syrup (HFCS) and sucrose was determined by a forced choice paired comparison method. It was found that CS in water solutions containing 13% solids was equal in sweetness to 11.4% sucrose solution and 12.8% solution of HFCS. CS and HFCS having equal sweetness were used in a lemonade drink. A triangle test was used to differentiate the 2 high fructose syrups at equivalent sweetness. CS could be differentiated from HFCS due to the presence of a slight caramel flavor and light brown color in CS. The hedonic scale method was used to determine whether there was any significant difference among the CS, HFCS, and sucrose samples. There was no significant difference in preference for the 3 samples. (Author's summary) I02

0279

22327 MUCHNIK, J.; VINCK, D. 1984. La transformation du manioc; technologies autochtones. (Cassava transformation: autochthonous technologies). Paris, France, Agence de Cooperation Culturelle et Technique. Conseil International de Langue Francaise. 172p. Fr., 114 Refs., Illus.

Cassava. Production. Statistical data. Cassava products. Uses. Cassava meal. Atieke. Gari. Roots. Cassava leaves (vegetable). Composition. Processing. Washing. Peeling. Rasping. Fermentation. Pressing. Screening. Gelatinization. Drying. Development. Small-scale equipment. Socio-economic aspects. Costs. Economics. Brazil. Ivory Coast. Nigeria.

Different autochthonous techniques to process cassava are reviewed. The worldwide importance of small-scale cassava transformation industries is highlighted within historic, social, economic, and technical contexts. The composition of the cassava roots and leaves is presented and the different uses of cassava by-products are given. Tables on production, yield, and consumption are included. The general process (peeling, rasping, fermentation, screening, gelation, drying, detoxification), as well as the processes to obtain farinha, atieke, and gari, are described in detail. The techniques are reevaluated under a multidisciplinary approach. (Summary by M. de W.) I02

0280

22727 NWOKEDI, P.M. 1984. Performance of a cassava peeling machine. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.108-110. Engl., Sum. Engl., 1 Ref., Illus. [Engineering Research Dept., National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Roots. Peeling. Small-scale equipment. Small-scale processing. Development. Nigeria.

The development, design, and manufacture of a peeling machine suitable for village use in Nigeria are discussed. The machine is an oval chamber that has holes cut along the walls and is lined with sharp wire gauze. Cassava roots are loaded in the chamber, which is mounted on 2 mild-steel rods, 35 cm in diameter, attached at either end. The rods allow the chamber to rotate clockwise. The left rod is connected to a 5-hp electric motor by means of a v-belt pulley. Thirty balls coated with wire gauze are added to the chamber. The machine is mounted on a 33° angle. The angle permits the sharp edges of the chamber and balls to carry out effective abrasive peeling. The roots are cleaned as they are being peeled, the chamber passing through a water-filled pan underneath it. The performance of the machine was tested with 3 batches of roots, peeled in 3 days; in other series of tests the roots were sorted by size before being peeled by the machine. In the 1st tests the efficiency was 43%, whereas in the 2nd ones it improved to 68%. Illustrations are included. (Author's summary) I02

0281

21437 ROMERO M., Z. 1983. Producción de alcohol a partir de mandioca. (Alcohol production from cassava). Revista Técnica (Brasil) 16(2):21-24. Span., Sum. Span., 2 Refs.

Cassava. Sweet cassava. Bitter cassava. Composition. Ethanol. Production. Processing. Washing. Peeling. Rasping. Hydrolysis. Enzymes. Fermentation. Paraguay.

All the steps involved in the production of ethanol from cassava are presented and described. (Summary by M. de W.) I02

0282

11905 SAWADA, I.M.N.; MORAES, I. DE O.; HOKKA, C.O. 1979. Obtencao do etanol for fermentacao continua. (Ethanol production through continuous fermentation). In Congresso Brasileiro de Mandioca, 1o., Cruz das Almas-BA, 1979. Anais. Bahia, Brasil, Empresa Brasileira de Pesquisa Agropecuária. Departamento de Informacao e Documentacao. pp.373-397. Port., 4 Refs., Illus.

Cassava. Cassava meal. Starch content. Enzymes. Hydrolysis. Industrial microbiology. Fermentation. Ethanol. Production. Brazil.

The process of ethanol production by continuous fermentation, using CM, was studied. The saccharification of CM starch using commercial amylase and amyloglucosidase, in a continuous system, and working with different holding times (30, 50, 90 and 110 min), was considered 1st; then the continuous saccharification with the extracellular amylolytic enzymes produced by Aspergillus usamii var. Shirousamii, in 2 culture media, saccharified and cooked (pH 4.5) CF, was analyzed. Saccharomyces cerevisiae var. Hakken-1 was used for the alcoholic fermentation and the inhibitory effect of ethanol was investigated. Economic aspects of the process are given. The use of cassava as raw material for the production of ethanol by continuous fermentation is technically feasible. Cassava starch can be transformed into fermentable sugars by the action of enzymes produced by the fungi, when these are cultivated in the same substrate in a continuous system; however, the use of commercial enzymes is more advantageous from the operational and economic points of view. (Summary by I.B. Trans. by M. de W.) I02

0283

23095 SILVA, J. DE S.E.; LACERDA FILHO, A.F. 1984. Construcao de secador para produtos agricolas. (Construction of a drier for agricultural products). Vicosa-MG, Brasil, Universidade Federal de Vicosa. Informe Técnico no.41. 17p. Port., Illus. [Univ. Federal de Vicosa, 36.570 Vicosa-MG, Brasil]

Cassava. Drying. Processing. Development. Small-scale equipment. Brazil.

The advantages of using artificial drying are mentioned and the instructions, materials, and blueprints are given of a fixed-bed drier that can be used for cassava, coffee, maize, rice, and beans, among others. The drier consists of a base, a motor, a heat source (oven), a drying chamber, a ventilator to feed the drying chamber, and a ventilator to avoid the adhesion of particles to the walls and permit their constant flow. The process is described and the parameters that should be considered for each product are indicated. (Summary by M. de W. Trans. by L.M.F.) I02

See also 0202 0203 0273 0288 0293

0284

0922 ARDILA V., J.; ROMANO O., L. 1977. Progreso técnico y perspectivas de producción de alimentos en Colombia. (Technical advance and food production perspectives in Colombia). Bogotá, Instituto Colombiano Agropecuario. 43p. Span.

Cassava. Economics. Development. Production. Technology. Statistical data. Colombia.

The general theory on the contribution of the agricultural sector to economic development and on the contribution of technological change to the development of the sector is discussed as well as the calculation of the growth rates in production of 8 basic foodstuffs (wheat, sugarcane for brown sugar loaf, maize, rice, sugar, potato, plantain, and cassava) and observations on meeting the demand for the years 1980 and 1985. Production series, area, and yield over 26 yr are used with which 5-yr mobile av. (1950-54, 1971-75) are computed to eliminate variations between years. It is concluded that continuity is necessary in the generation and dissemination of knowledge and new technology and that resources be assigned to these activities. Research should become an autonomous process covered by state organisms. Statistical tables on the discussed topics are included. (Summary by M.T. Trans. by L.M.F.) J00

0285

22315 ARMIJO C., A.C.; CABEZAS S., O.; SANCHEZ F., J.L. 1983. Análisis económico de la producción y comercialización de la yuca en la Región Atlántica en 1982. (Economic analysis of cassava production and commercialization in the Atlantic region, in 1982). San José, Costa Rica, Ministerio de Agricultura y Ganadería. Departamento de Estudios Económicos. Serie: Economía para Mercadotecnia no.2.D.E.E. 20p. Span., Sum. Span.

Cassava. Production. Marketing. Economics. Costs. Costa Rica.

The income-yield capacity of cassava cultivation in the Atlantic region of Costa Rica was determined for 1982 through case studies. This region was characterized by having an av. farm size of 7.88 ha, with an av. 1.64 ha planted to cassava (20.77% of the total area under cultivation) and a mean production of 8.65 kg/ha. When the av. net income was determined, it was found that 5 case studies had acceptable income-yield capacity, 2 low income-yield capacity, and 10 negative income-yield capacity. The mean total cost/ha planted to cassava was estimated, divided into operative costs (labor, materials, and others), variable costs, and fixed costs. Data are given on the net gross income and on the net return covering operative costs, variable costs, and total costs. (Summary by L.M.F.) J00

0286

21193 ARMIJO C., A.C.; CABEZAS S., O.; SANCHEZ F., J.L. 1983. Análisis económico de la producción y comercialización de la yuca en la Región Zona Norte. (Economic analysis of cassava production and commercialization in the Northern Region). San José, Costa Rica, Ministerio de Agricultura y Ganadería. Departamento de Estudios Económicos. Doc.E.E.1 Serie: Economía para Mercadotecnia. 22p. Span., Sum. Span.

Cassava. Production. Marketing. Economics. Costs. Costa Rica.

The income-yield capacity of cassava cultivation in the northern zone of Costa Rica in 1982 was found to be excellent in a case study carried out there. This region was characterized by having farms with an av. size of 23.7 ha with 5.77 ha planted to cassava; the total area planted represented 24% of the region. When the av. net income/ha was determined, it was found that 6 farms had very high income, 8 good income, and 1 low income. The mean total cost/ha planted to cassava was estimated, divided into operative costs, variable costs, and fixed costs. Data are given on the net gross income and on the net return covering operative costs, variable costs, and total costs. (Summary by L.M.F.) J00

0287

6276 BELTRAN B., J.A. 1975. Factores económicos y sociales relacionados con la sustitución de trigo en pan y pastas. (Socioeconomic factors related to the substitution of wheat in bread and pasta). IIT Tecnología no.97:8-21. Span., Illus.

Cassava. Socio-economic aspects. Composite flours. Cassava flour. Cassava bread. Pasta. Marketing. Economics. Colombia.

Since the high consumption of wheat and its low production (according to data from 1950 to 1974) have made it necessary to import the cereal in Colombia, it is considered that wheat flour should be substituted with other farinaceous products. The nutritional status should also be considered. According to nutritional surveys in 1963-67, the country's population only consumes 85% of the required calories and 78% of the necessary proteins. Therefore the situation becomes more critical in the lower income groups. The following alternatives to reduce wheat imports are discussed: substitute bread for other products, such as the arepa (cornmeal griddlecake), cassava bread, and bread made from other starches and flours; substitute the wheat in breads and pasta for locally produced starches and flours, such as white rice, corn flour, CF and cassava starch, and maize starch, including soybean flour as protein supplement. A trial was carried out for 3 wk. at a girls' school and it was concluded that breads made with composite flours had an above av. quality. Their possibilities of commercialization are optimistic. It should be noted that there was preference for cassava starch-based bread. Likewise, the substitution of wheat in pasta has been studied and results show that it is feasible to substitute wheat with composite flours. In order to produce and consume enriched breads and pasta made from composite flours, the production of raw material must be guaranteed through the maintenance of policies that foment and promote increased crop production. (Summary by ODEI. Trans. by L.M.F.) J00

0288

23401 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Annual Reports for 1982 and 1983. Cali, Colombia. 521p. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Development. Developmental research. Research. Colombia.

The 1982 and 1983 CIAT Cassava Program Annual Reports are presented separately. Both concentrate on research activities and results in physiology, soils and plant nutrition, mycorrhiza project, entomology, pathology, germplasm development, var. improvement (in 1983, germplasm and breeding), cultural practices, regional trials, cassava utilization, economics, scientific training, tissue culture, international cooperation in 1982 and a new section of agroecological studies in 1983. Individual papers for 1982 are recorded in this publication under the following consecutive no.:

0157, 0159, 0180, 0182, 0190, 0199, 0202, 0216, 0226, 0241, 0243, and 0289. For 1983 the no. are: 0158, 0160, 0179, 0181, 0183, 0191, 0203, 0217, 0235, 0242, and 0296. (Summary by EDITEC) JOO

0289

23412 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Economics. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.181-195. Engl., Sum. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava programs. Marketing. Cultivation. Cultivars. Fertilizers. Fallowing. Mycorrhizae. Colombia.

In 1982 the economics section of CIAT's Cassava Program conducted regional studies on cassava production and utilization in Latin America and Asia; collaborated in the production, processing, and market expansion project of a cassava pilot plant on the North Coast of Colombia; and continued on-farm trials to incorporate farmer stratification in the trial design. On-farm trials evaluated interactions between the var., fertilization, and the fallow system at 4 main sites (Mondomo, Media Luna, the Llanos, and Socorro). Traditional cassava growers in Latin America do not use fertilizers but employ a fallow system. It was not possible to establish if the fertilizer can substitute the fallow system and if there is a profitable response to fertilizers at the farm level since the responses appear to depend on the fallow system and soil conditions. Fertilization did not appear to perfectly substitute a long-term fallow system. The hypothesis that fallow is associated with changes in the mycorrhizal population and that soil chemical analyses do not provide a precise index of the available nutrients for the plant at low nutrient levels, is presented. An other hypothesis is that there is a micronutrient or another biotic factor that has been overlooked in the trials. In evaluating the profitability of alternative weed control methods, hand weeding appears to be the most profitable method for all sites. (Summary by EDITEC) JOO

0290

23424 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. CASSAVA PROGRAM. 1984. Economics. In ______. Annual Reports for 1982 and 1983. Cali, Colombia. pp.487-509. Engl., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Development. Cassava programs. Marketing. Socio-economic aspects. Economics. Cultivation. Cultivation systems. Fallowing. Fertilizers. P. Mycorrhizae. Income. Colombia.

During 1983, the economics section of CIAT's Cassava Program developed a methodology for planning and evaluating integrated cassava development projects and concentrated on on-farm research of rotation systems in Mondomo (Cauca, Colombia). The objectives and constraints of cassava development in Latin America are discussed as well as integrated development projects, the development of the macro planning frame, the assessment of institutional capacity, project financing, phasing of activities in project execution, and support activities (opening of credit lines, farmer organization and training, opening of market channels, policy intervention in marketing). The Colombian cassava development project, the integrated rural development program (DRI), socioeconomic characteristics of the target region, the screening process, progress of the project to date, and potential economic benefits are also briefly analyzed. The role of CIAT as a catalyst of integrated cassava projects is discussed. Results of 2 yr of on-farm research trials and rotation systems in Mondomo are given. A linear programming model of the farming system in Mondomo was constructed with special emphasis on the fallow system. It indicates that when fertilizer is not used, the optimum strategy for the farmer, regardless of farm size, is to use a long-term fallow system. As production in the region has expanded in relation to market possibilities, farmers have increasingly had to shorten their fallow period and their future incomes will decrease as a result of reduced fertility. The introduction of fertilizers in the fallow system increases potential incomes; a continuous cropping system would require improved erosion control methods as well as fertilization and perhaps a rotation system with a green manure or grain crop. The following phase of on-farm research in the region will focus on adapting such a system to local conditions. (Summary by EDITEC) J00

0291

20746 CIAT ACHIEVES high-output from low-input farming. International Agricultural Development 2(2):12-13. 1982. Engl., Illus.

Cassava. Cassava programs. Development. Technology. Colombia.

The results of a decade of research at CIAT are summarized. Regarding the cassava program, its goal is to develop an improved production technology suitable to the limited conditions of the producers. The improvement of germplasm has resulted in new pest- and disease-resistant lines that outyield traditional clones. In regional trials, the lines tested have shown a broad adaptability and field stability over ti . When combining low-input, improved management practices with new lines, yields of 30 t/ha have been obtained. With improved practices, traditional clones have given an av. of 20 t/ha, which is double the world av. Since the quality of new lines is not always superior to that of traditional clones, further research will be carried out to maintain or increase yields and improve quality. (Summary by M. de W.) J00

0292

22698 CONCEPCION, R.N. 1983. A quantitative land evaluation technique for rainfed agriculture in a developing country (The Philippines). Ph.D. Thesis. Ithaca, N.Y., Cornell University. 452p. Engl., Sum. Engl., 167 Refs., Illus.

Cassava. Maize. Rice. Cultivation. Soil physical properties. Rainfall data. Fertilizers. N. P. K. Water requirements (plant). Labour. Productivity. Statistical analysis. Philippines.

Research was conducted to develop an operational knowledge about the quantitative relationship between yield of rainfed crops (maize, rice, and cassava) and measurable soils, land management, and climate variables in the Philippines. The objectives were to identify and formulate sets of criteria for land classification and productivity evaluation of rainfed agricultural areas. Soil, farm management, and climatic data from 10 representative rainfall-dependent provinces in the Philippines were generated, compiled, and analyzed with the use of the computer facilities at the U. of the Philippines at Los Baños. The sequential and pairwise correlation tests and the multiple regression analyses were performed to determine the sets of variables that provide the best estimate of the crop yield and its variation. A total of 68 regression models were calculated. The general linear model technique was employed to test the interaction of location and the set of variables in the selected regression equations. A total of 34 final productivity models were calculated from the best general linear models by including the dummy variables in the equations. The discriminant analyses were performed to estimate the probably land classes of the different observations made for the selected crops. The study indicated that crop yield and farming systems in the rainfed agricultural areas were directly influenced by the physical and management variables such as slope, effective rooting depth, rainfall distribution, and labor availability. Significant no. of location-related productivity models have correlation coefficients greater than 50% with level of significance of 0.01%. In the estimation of land classes for rainfed crops, management variables have to be included in the discriminant analyses to obtain reliable classification results. The results of discriminant analyses showed that the variables selected to classify observation sites of the rainfed crops can provide the following correct classification: 98.3% fertilized rainfed rice, 100% for unfertilized rainfed rice, unfertilized maize, and unfertilized cassava, and 67.7% for fertilized maize. (Author's summary) J00

0293

23240 DOWNER, A.V. 1974. Cassava (Manihot esculenta Crantz). Georgetown, University of Guyana. Agronomy Review Series no.9. 17p. Engl., Sum. Engl., 53 Refs.

Cassava. Cultivation. Propagation materials. Fertilizers. Uses.

Papers and/or abstracts of papers published recently are reviewed to provide rough guidelines for cassava production. Aspects covered include: parameters which can be used to differentiate var., proportions of major fertilizer elements utilized and the optimum application time, storage of cuttings, and planting methods. The process of root development is also mentioned. Different uses of the cassava root products and the factors limiting their use are examined. (Author's summary) J00

0294

21459 LEGORRETA P., F. DE J. 1983. Efecto de la fertilización N-P-K y densidad de población (DP-ha) sobre el rendimiento de forraje fresco de yuca (Manihot esculenta) en la sabana de Huimanguillo, Tabasco. (Effect of N-P-K fertilization and population density on the yield of fresh cassava forage in the Huimanguillo savanna, Tabasco). Tesis Ing.Agric. Cuautitlán, Universidad Nacional Autónoma de México. 68p. Span., Sum. Span., 41 Refs., Illus.

Cassava. Cultivation. Fertilizers. N. P. K. Planting. Spacing. Productivity. Forage. Composition. Protein content. Dry matter. Ash content. Fibre content. Statistical analysis. Mexico.

Trials were carried in the Huimanguillo savanna, Tabasco, Mexico, where edaphic conditions hinder the production of basic crops, to determine the optimum N-P-K fertilization rate and population density for increased fresh cassava forage yield. A Plan Puebla I matrix design in randomized blocks was used with 5 replications. Evaluation parameters were based on the fresh forage yields/treatment and their quality according to results of dietetic analysis during 2 harvesting periods. A marked response to N fertilization was observed since forage yields and quality gradually increased with increasing N rates. The level of 120 N gave the best results as to production and quality. Population density/ha did not have a significant effect on yield. (Extracted from author's summary. Trans. by L.M.F.) J00

0295

23184 MAKAME, M.H.; BEGG, C. 1984. Root-crops program, Zanzibar. In Kirkby, R.A., ed. Crop Improvement in Eastern and Southern Africa:

Research Objectives and On-Farm Testing; a regional workshop, Nairobi, Kenya, 1983. Ottawa, Canada, International Development Research Centre. pp.60-63. Engl., Sum. Engl., 2 Refs. [Ministry of Agriculture, P.O. Box 159, Kizimbani, Zanzibar, Tanzania]

Cassava. Cassava programs. Cultivation. Diseases and pathogens. Injurious mites. Development. Tanzania.

The situation of cassava in Zanzibar (Tanzania) and the creation of the root crops program are presented. The objectives of the program include the selection of high yielding, pest- and disease-resistant var., the distribution of the selected material, and training. Emphasis is placed on the direct distribution of propagation material to the farmers. (Summary by M. de W.) JOO

0296

11789 MANDIOCA. (Cassava). Acompanhamento da Situacao Agropecuária do Paraná 3(8):36-40. 1977. Port.

Cassava. Production. Productivity. Costs. Brazil

In 1976, Paraná was in the 8th place among the cassava-producing states of Brazil, with a production of 1,292,000 t/yr, a cultivated area of 71,000 ha, and a yield of 17.8 t/ha. The production, cultivation, and postharvesting aspects of cassava in different regional centers are briefly mentioned. (Summary by M. de W.) JOO

0297

23185 OTIM-NAPE, G.W. 1984. Strategies for root-crop improvement in Uganda. In Kirkby, R.A., ed. Crop Improvement in Eastern and Southern Africa: Research Objectives and On-Farm Testing; a regional workshop, Nairobi, Kenya, 1983. Ottawa, Canada, International Development Research Centre. pp.78-87. Engl., Sum. Engl., 5 Refs. [National Root Crops Improvement Programme, Serere Research Station, P.O. Soroti, Uganda]

Cassava. Cassava programs. Cultivation. Diseases and pathogens. Injurious mites. Development. Uganda.

A brief history of cassava and sweet potato cultivation in Uganda is given. The creation of the National Root Crops Improvement Programme and its objectives are presented. In order to develop improved high yielding var. and husbandry practices that will increase farmer benefits, existing root crop var. will be evaluated for their pest and disease resistance and promising var. will be tested on-farm or at the village level. Root or tuber quality will be also analyzed. It is highlighted that in the strategy to improve root crops, the development of easily adoptable crop technologies can only be achieved based on: (1) a real understanding of the limitations of existing crop var. and husbandry practices followed by farmers, and (2) an understanding of farmers' circumstances. (Summary by M. de W.) JOO

0298

22331 SANDOVAL, J. 1977. Modelo teórico-práctico para la organización de productores de yuca. (Theoretical-practical model for the organization of cassava producers). In Reunión Nacional sobre Instrumentos de Comercialización: Organizaciones de Mercadeo Agropecuario para Productores, 4a., Maracaibo, 1977. Trabajo presentado. Maracaibo, Venezuela, Corporación de Desarrollo de la Región Zuliana. pp.110-125. Span.

Cassava. Production. Development. Socio-economic aspects. Venezuela.

A model is given that proposes the organization of the intermediate- and large-scale cassava producers in the Zuliana region, Venezuela, to obtain better benefits and to establish commercialization channels according to the region's needs. The cassava produced would be used in the animal feed industry. The different phases of the model are presented and its advantages and disadvantages are discussed. (Summary by M. de W.) JOO

0299

22701 TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS-AFRICA BRANCH, 2nd., DOUALA, CAMEROON, 1983. Tropical root crops: production and uses in Africa; proceedings. Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Ottawa, Canada, International Development Research Centre. 231p. Engl., Sum. Engl., Fr., Span., 611 Refs., Illus.

The papers presented at this symposium are recorded individually in Vol. XI, no.1 and no.2 of the 1985 journal Abstracts on Cassava, under the following consecutive no.: no.1: 0012, 0018, 0027, 0063, 0069, 0070, 0080, and 0116; no.2: 0165, 0174, 0187, 0188, 0218, 0219, 0220, 0223, 0224, 0227, 0228, 0229, 0236, 0238, 0248, 0257, 0260, 0273, 0280, 0301, and 0302.

0300

20792 VENEZUELA. MINISTERIO DE AGRICULTURA Y CRIA. 1978. Diagnóstico de la producción e industrialización de la yuca en el país. (Diagnosis of the production and industrialization of cassava in the country). Caracas, Instituto Interamericano de Ciencias Agrícolas. Fondo Simón Bolivar. 139p. Span., Sum. Span., 25 Refs., Illus.

Cassava. Economics. Costs. Cultivation. Productivity. Root productivity. Cassava flour. Cassava starch. Casave. Development. Venezuela.

Cassava production and industrialization in the major cassava producing areas of Venezuela are analyzed. These areas were divided into regions taking into account the states, importance as to production, area under cultivation, location of existing industrial plants and those under construction. The eastern region consists of the states of Anzoátegui, Monagas, Sucre, and Bolívar; the western region of the states of Zulia, Trujillo, and Táchira; and the central region of the states of Cojedes and Yaracuy. Data were obtained from interviews with farmers, technicians, and officials working at different public and private institutions (primary information), and from bibliographic reviews (secondary information). The fact of having different data on a same aspect could have been restricting in this study; however, it was believed that they could constitute true approximations to reality and therefore make it possible to detect factors causing current problems in cassava production and industrialization, as well as indicate corrective measures to overcome them. Major conclusions of the diagnosis indicate that the production capacity of the processing plants was of 47,000 t with raw material requirements of 160,000 t. For 1979, due to the installation of new processing plants, 241,000 t were needed and the annual production of by-products such as pellets, flour, and starch was estimated at 74,000 t. A total of 25,300 ha planted to cassava would be needed. The production structure was characterized by being obtained from plots of less than 5 ha, widely dispersed. Therefore it was estimated that the industrial requirements for 1979 would be difficult to satisfy. The climatic conditions prevailing in the cassava producing areas did not limit the crop. In Venezuela there were great extensions of land with suitable soils for cassava cultivation. It was therefore suggested to promote cassava cultivation in areas where there were processing plants. The difference in yields, pest and disease resistance, and starch content over a same area, was due to the use of propagation materials of different var. Greater technical assistance should be given to cassava growers regarding cultural practices and disease and pest control. Income, production and transportation costs, and credits, and their impact on industrialization, are discussed. Finally basic recommendations are given and an integrated proposal is presented with which the problems occurring in cassava production and industrialization in Venezuela could be solved. (Summary by M. de W. Trans. by L.M.F.) J00

See also 0182 0185 0199 0202 0203 0233 0257 0259 0261 0277

K00 OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0301

22712 IKEORGU, J.E.G.; WAHUA, T.A.T.; EZUMAH, H.C. 1984. Crop performance in complex mixtures: melon and okra in cassava-maize mixture. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.63-66. Engl., Sum. Engl., 15 Refs., Illus. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Cultivars. Cultivation. Soil physical properties. Intercropping. Fertilizers. N. P. K. Harvesting. Productivity. Root productivity. Energy productivity. Nigeria.

A 2-yr investigation was conducted at Ibadan, Nigeria, to determine the economic benefits of including melon and okra in a cassava-maize intercropping system. Fresh root yields of cassava were reduced by 28% by maize in the mixture but only by 3, 6, and 9% by okra, melon, or both, resp. Intercropping had no adverse effect on the grain yield of maize; yield was 19% higher in the maize-cassava intercrop than in monoculture. Fresh fruit yields of okra were reduced by 72, 89, and 56% in mixtures with cassava, cassava-maize, and cassava-maize-melon, resp. Melon seed yields were decreased by 56 and 76% in mixtures with cassava and cassava-maize, resp. The cassava-maize cropping system yielded the highest amount of calories/ha; however, total productivity/unit area of land was highest in the cassava-maize mixture with both okra and melon. (Author's summary) K01

0302

22711 UNAMMA, R.P.A.; ENE, L.S.O. 1984. Weed interference in cassava-maize intercrop in the rain forest of Nigeria. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.59-62. Engl., Sum. Engl., 8 Refs., Illus. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Maize. Intercropping. Cultivation. Soil physical properties. Fertilizers. N. P. K. Weeding. Productivity. Root productivity. Energy productivity. Costs. Nigeria.

In 1981-82, studies of cassava and maize intercropped on sandy loam in the rain forest zone of Nigeria were conducted to determine when and how long the plants had to be kept weed-free. The major weeds present in the control (8 wk. after planting) were mainly annual broadleaves, grasses, and sedges. The broadleaves included Boerhaavia diffusa, Calopogonium mucunoides, Cleome ciliata, Commelina benghalensis, Eupatorium odoratum, Euphorbia hirta, Talinum triangulare, and Trianthema protulacastrum; the grasses comprised mainly Andropogon gayanus, Brachiaria deflexa, Cynodon dactylon, Digitaria horizontalis, Panicum maximum, Paspalum orbiculare, and Setaria barbata. Uncontrolled weed growth caused a 2-yr av. loss of US$5607/ha in yield value compared with the mixture kept weed-free from planting to maturity. Av. value of yield for 2 yr (US$9206/ha) from the cassava-maize intercrop was much higher than that for the sole crops, although yield in grain and roots was lower. The yield of the crop mixture was depressed by weed interference during the 1st 4-8 wk.; however, weeds emerging after this period did not significantly impair the yield. (Author's summary) K01

0303

21146 VALAREZO M., C.A.; SAMANIEGO R., V.H. 1984. Investigación sobre cultivos múltiples de maíz, yuca y frejol. Proyecto Zamora-Nangaritza. (Research on multiple cropping of maize, cassava, and beans. Zamora-Nangaritza Project). Quito, Ecuador, Programa Regional para el Desarrollo del Sur de Ecuador. Gerencia de Desarrollo Agropecuario. Publicación no.38. 11p. Span., Sum. Span., Engl., 7 Refs., Illus.

Cassava. Cultivars. Maize. Cowpea. Intercropping. Cultivation. Climatic requirements. Rainfall data. Agricultural lime. Fertilizers. N. P. K. Urea. Productivity. Root productivity. Ecuador.

Information was gathered to determine the possibilities of diversifying crop production, improving the ecological equilibrium, balancing the farmers' diets, and reducing production risks, as part of the Research and Extension Subproject of the Integrated Rural Development Project of the Zamora-Nangaritza area, Dominican Republic. An expt. was laid out on a well-drained, alluvial soil in Soapaca, Yanzatza Canton, Zamora Province (850 m.a.s.l.) from June 1981 to June 1982. Treatments were: T_1, cassava at 10,000 plants/ha; T_2, cassava + maize at 10,000 and 5000 plants/ha, resp.; and T_3, cassava + maize + cowpea at 10,000, 5000, and 3000 plants/ha, resp. These were arranged in a randomized complete block design with 4 replications in 70 m^2 plots; 20-cm long cuttings of cassava var. Embayecana were used. At planting 10-30-10 was applied at the rate of 200 kg/ha in addition to 70 kg N (urea 46%)/ha, applied 30 and 60 days after planting. Cassava in monoculture yielded more marketable roots (29.5 t/ha) than cassava + maize (12.8 t/ha) and cassava + maize + cowpea (23.3 t/ha). (Author's summary) K01

See also 0184 0187 0191

K02 Descriptive and Comparative Studies

0304

21185 GREENLAND, D.J.; OKIGBO, B.N. 1983. Crop production under shifting cultivation and maintenance of soil fertility. In Smith, W.H.; Banta, S.J., eds. Symposium on Potential Productivity of Field Crops under Different Environments, Los Baños, Philippines, 1980. [Proceedings]. Manila, International Rice Research Institute. pp.505-524. Engl., Sum. Engl., 70 Refs., Illus. [International Rice Research Inst., P.O. Box 933, Manila, Philippines]

Cassava. Cultivation. Cultivation systems. Shifting cultivation. Soil physical properties. Soil fertility. Soil requirements. Fallowing. Energy productivity.

A general overview of shifting cultivation in the world is given. The different cultivation practices included are described. Several phases and categories of land cultivati systems in relation to different land types are discussed. Crop productic under shifting cultivation is presented and the soil improvement under natural fallows in forest, savanna, and grassland regions is analyzed. Finally, the basis of the energy efficiency of shifting cultivation systems is reviewed. (Summary by M. de W.) K02

See also 0292

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)
<u>l</u>	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
<u>M</u>	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)
R*f*	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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PN-AAS-515

Abstracts on Cassava
(Manihot esculenta Crantz)

CONTENTS

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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

Sequential number in the journal (for use of indexes)

Authors

Year of publication

Accesion number (for photocopy requests)

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

Original title

Author address

Additional notes

Source

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Language of paper

Language of summary

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

Keywords

The detoxification of cassava associated with fermentation depends on endogenous linamarase hydrolysis of the constituent cyanogenic glucosides. Addition of exogenous linamarase preparations to fermenting grated cassava not only increased the rate and extent of detoxification but also consistently yielded gari with innocuous levels of cyanide. A preliminary screening of several fungal isolates for their ability to synthesize linamarase, resulted in the identification of 2 fungi, Penicillium steckii and Aspergillus sydowi, capable of producing this enzyme in commercial quantities. The use of linamarase or linamarase-producing fungi in cassava fermentation for gari production may be an interesting possibility. (Author's summary) I02

Abstract

Abstractor and/or translator

Subject categories

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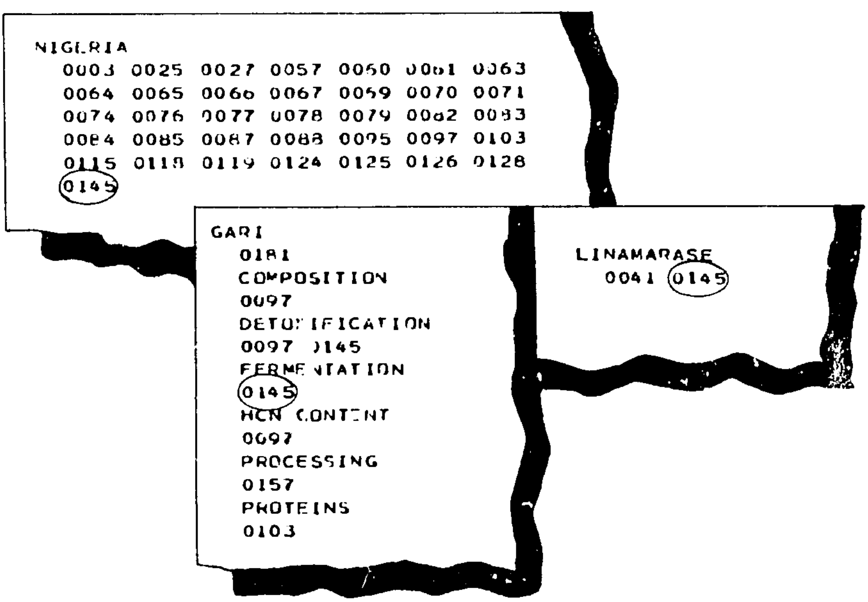

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B00 PLANT ANATOMY AND MORPHOLOGY

See 0306 0337 0403

C00 PLANT PHYSIOLOGY

0305

23750 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Physiology. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.33-57. Engl., Illus.

Cassava. Cassava programs. Cultivars. Plant physiology. Water stress. Hybrids. Leaves. Leaf area. Root productivity. Stomata. Water requirements (plant). Soil water. Transpiration. Climatic requirements. Field experiments. Laboratory experiments. Photosynthesis. Cassava latent virus. Cassava Caribbean mosaic virus. Frog skin disease. Symptomatology. Colombia.

Results from trials at the Quilichao station (Cauca, Colombia) confirmed the hypothesis that for a stable high yield under stress and nonstress conditions, a var. with a LAI above optimal in nonstress conditions is required. At the Carimagua station (Llanos Orientales), other expt. showed that leaf conductance and abaxial transpiration decreased with increased VPD ($r = -0.815$ and $r = -0.637$, resp.), and leaves facing the wind showed extremely lower conductances than the leaves on the opposite side of the same plant (0.65 ± 0.28 and 3.34 ± 1.00 mm/s, resp.). A series of trials was conducted to observe the effects of changing humidity on leaf conductance of a wide range of species, including cassava, under lab. conditions. All species showed a decrease in apparent photosynthetic rates (P_A) and leaf conductance as VPD increased. The % reduction in P_A and leaf conductance varied among species, with beans showing the lowest reduction (25%) and cassava the highest (85%). The species also varied in weighted stomatal density (relative distribution on both leaf surfaces) by 7-fold, and the reduction in both P_A and conductance was highly correlated with it ($r = 0.753$ and $r = 0.717$, resp.). The photosynthetic rate of C-3 species surveyed showed a marked positive correlation with max. conductance ($r = 0.681$). Results suggest that for assessing the potential of an area for increased cassava production it is recommended to consider the air humidity of the zone. The effects of 3 viral diseases (latent, Caribbean mosaic, and frog skin) on photosynthesis were studied. In separate trials, in which cassava plants were infected with each virus, photosynthesis was reduced from 29.8 to 24.4, 26.8 to 13.0, and 26.0 to 21.2 mg $C_2/dm^2/h$ for latent virus, frog skin, and Caribbean mosaic virus, resp. This reduction in photosynthesis, and therefore in yield, was seen in plants infected with latent virus, both with and without symptoms. With Caribbean mosaic virus a decrease in photosynthesis was only observed when the symptoms were visible. In the case of frog skin it is suggested that the reduced size of the root sink in infected plants has a feedback effect reducing photosynthesis, which is removed when the relative size of the source (the leaves) to the sink is reduced. (Summary by M. de W.) C00

0306

22981 COCK, J.H. 1984. Cassava. In Goldsworthy, P.R.; Fisher, N.M., eds. The physiology and tropical field crops. New York, Wiley & Sons. pp.529-549. Engl., 40 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Propagation. Propagation materials. Seed. Cuttings. Fertilizers. N. P. K. Germination. Productivity. Root productivity. Plant anatomy. Leaves. Stomata. Photosynthesis. Growth. Timing. Light. Temperature. Stems. Branching. Roots. Leaf area. Photoperiod. Water requirements (plant). Transpiration. Soil requirements. Salinity. pH. Ca. Al. Biomass production. Pests. Resistance. Colombia.

A complete review is given of physiological aspects of cassava related to its propagation, growth, and development. The relationship between photosynthesis and leaf, stem, and root growth is discussed. Several factors affecting yield improvement and its stability are analyzed: physiological limits, temp., photoperiod, water stress, and soils. (Summary by EDITEC. Trans. by M. de W.) C00

0307

23264 INDIRA, P.; RAMANUJAM, T. 1984. Screening of varieties for salt and drought tolerance in cassava. In Cassava Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.34. Engl.

Cassava. Cultivars. Stomata. Water requirements (plant). Water stress. Transpiration. Temperature. India.

Thirteen promising cassava var. were screened for their tolerance to water stress, rate of transpiration, and leaf temp. in a pot expt. under greenhouse conditions. Plants were subjected to water stress at different stages of plant growth by withholding watering and therefore depleting soil moisture by 50%. Var. H-97, H-1315, Ce 22, H-648, CI-167, and H-2304 were relatively tolerant, with stomatal diffusive resistance and transpiration rate values ranging from 30 to 52 s/cm and from 0.2 to 0.8 micrograms $H_2O/cm^2/s$, resp., while corresponding values in susceptible var. were 11-25 s/cm and 1-4 micrograms $H_2O/cm^2/s$. (Summary by M. de W.) C00

0308

23260 RAMANUJAM, T. 1984. Source sink relationship in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.31-32. Engl.

Cassava. Plant physiology. Plant physiological processes. Plant assimilation. Leaf area. Roots. Dry matter. India.

Short-term expt. were conducted using cassava cv. H-2304 in which the LAI was maintained from 3.0 to 6.3 and the source and sink activity was monitored. At high LAI the sink activity was reduced by 75% when compared with lower limits. In another expt. cv. M-4 and H-165 were used and the sink size was altered by retaining a fixed no. of roots and monitoring DM production. CGR was reduced significantly when the sink size was reduced. (Summary by M. de W.) C00

0309

22371 SAN JOSE, J.J.; BERRADE, F. 1983. Transfer of mass and energy in a cassava (*Manihot esculenta* Crantz cv. Cubana) community 1. Microclimate and water vapour exchange in a savanna climate. Annals of Botany

52(4):507-520. Engl., Sum. Engl., 33 Refs., Illus. [Centro de Ecología, Inst. Venezolano de Investigaciones Científicas, Apartado 1827, Caracas 1010-A, Venezuela]

Cassava. Cultivars. Field experiments. Climatic requirements. Temperature. Light. Rainfall data. Water requirements (plant). Soil physical properties. Fertilizers. N. P. K. Plant physiological processes. Leaves. Leaf area. Canopy. Venezuela.

The energy balance approach was used to evaluate the transfer processes which occur between a cassava community, growing during a savanna wet season, and its environment. Crop performance under these conditions was also analyzed. During this season the soil profile remained near saturation, hence net radiation absorbed by the cassava crop during typical low radiation days was mainly dissipated as latent heat (78-86%), a process which depends on the growth stage and on the foliage cover of the canopy. However, the seasonal root environment, with a sufficient water supply, contrasted with the extremely variable shoot environment, because the daily flux density of short wave radiation input reached values similar to those reported for typical dry season days. On these days, cassava responded to environmental stress mainly by a reduction in transpiration. At the end of the wet season soil water content markedly decreased, an additional stress factor on the roots, which produced a notable reduction of cassava LAI. The moderate changes in energy partitioning determined by morphological and physiological adaptive responses of cassava thus produced a hindrance in the equilibrium between water vapor transfer and the surrounding savanna environment. (Author's summary) COO

See also 0462 0465 0493

C01 Plant Development

0310

23744 ARESTA, R.B.; FUKAI, S. 1984. Effects of solar radiation on growth of cassava (Manihot esculenta Crantz). 2. Fibrous root length. Field Crops Research 9(5):361-371. Engl., Sum. Engl., 22 Refs., Illus. [Cagayan State Univ., Piat, Cagayan, Philippines]

Cassava. Cultivars. Root system. Roots. Soil physical properties. Cultivation. Planting. Timing. Climatic requirements. Light. Solar radiation. Growth. Shoots. Australia.

Effects of solar radiation on the growth of fibrous roots of cassava cv. M Aus 7 were examined by growing plants without shade (control) and under shade cloths which reduced input to 78 and 32%, resp., of full solar radiacion. Plants were at 2 different stages of growth when shading treatments were imposed. Results indicate that cassava can develop fibrous root systems rapidly and extensively. Estimated total fibrous root length/m^2 ground area to a depth of 120 cm was 32 and 23 km/m^2 at the end of the expt. for the 2 crops, 133 and 84 days old, resp. Shading the plants for 35 days reduced the rate of increase in root length density and hence decreased total root length in the 2 crops. Reduction in solar input to 32% resulted in a 50% reduction in elongation rate of fibrous roots. Reduction to 78% resulted in a similar reduction in elongation rate when plants were at root bulking stage, but much less reduction when plants were at the thick root initiation stage. Results indicate that under limited carbohydrate supply, the shoot was a stronger sink than both fibrous and thick roots. The latter, at the initiation stage, were weaker sinks than fibrous roots, but at the bulking stage they were about equal to fibrous roots. (Author's summary) C01

0311

23743 FUKAI, S.; ALCOY, A.B.; LLAMELO, A.B.; PATTERSON, R.P. 1984. Effects of solar radiation on growth of cassava (Manihot esculenta Crantz). 1. Canopy development and dry matter growth. Field Crops Research 9(5):347-360. Engl., Sum. Engl., 10 Refs., Illus.

Cassava. Cultivars. Canopy. Leaf area. Dry matter. Soil physical properties. Cultivation. Planting. Timing. Climatic requirements. Light. Solar radiation. Growth. Leaves. Roots. Root productivity. Australia.

Cassava cv. M Aus 7 plants were grown under shade cloths (78 and 32% of full solar radiation) and without shade cloth (control) to examine effects of solar radiation input on crop growth. Plants were at 3 different stages of growth when shading treatments were imposed. Leaf area development and light interception by the canopies were examined during the expt., and DM samplings were made at the beginning and the end of the treatment periods. Specific leaf area under full sun decreased with ageing of the plants. Low radiation produced leaves with high specific leaf area, particularly in young plants. However, because of reduced leaf DM increase, LAI was slightly reduced under low solar input. Light measurement in the canopies showed an exponential attenuation of horizontal light flux density with accumulated LAI down the canopy. In the canopies with full ground cover, more than 90% of the incident radiation was intercepted by the top half. In such canopies, light extinction coefficients were 0.59-0.76, while the canopy with partial ground cover had a lower value. Coefficients were higher in the canopies under heavy shade, indicating an adaptation in canopy structure to reduced light environment. Reduction in solar input to 78% had significant effects on both root and leaf growth (reduction of 86 and 47%, resp.) of the younger plants, while it had very little effect on plants in the late bulking stage. Reduction in solar input to 32% reduced CGR to about half that of the control, regardless of plant age. It affected DM growth of roots more than tops, and hence reduced HI of plants of all ages. Shading significantly reduced root no. during the root initiation stage, but not during the other stages. (Author's summary) C01

0312

24037 LOZANO, J.C.; PINEDA, B.; JAYASINGHE, U. 1984. Effect of cutting quality on cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.433-439. Engl., Sum. Engl., 7 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Cuttings. Apical meristems. Tissue culture. Hybrids. Climatic requirements. Germination. Plant height. Root productivity. Productivity. Starch content. Symptomatology. Cassava Caribbean mosaic virus. Temperature. Colombia.

In 2 trials the general performance of a native cassava cv. of long-standing use (Secundina) and a recently selected and promising hybrid was investigated in relation to planting material source. The parameters evaluated were: root, starch, and cutting yields; root rot resistance; and root and cutting quality. When cuttings from plants obtained through meristem culture were used, root and starch yields were larger and plant height and the production of good quality planting material were significantly higher than in plants coming from traditional planting material. When comparing the native cv. with the selected hybrid, there were no differences in yield of fresh roots if clean cuttings were used. However, significant differences were found in cutting production and root rot resistance. Results indicate a continuous decrease in the performance of cassava cv. with time due to the effect of biotic stresses during each cycle. A careful evaluation of the genotypes during selection by using planting material of equal quality and the use of clean planting material for a high performance are recommended. (Summary by M. de W.) C01

0313

24009 MELIS, R.J.M.; VAN STADEN, J. 1984. The effect of gibberellic acid and gibberellin inhibitors on cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.267-275. Engl., Sum. Engl., 14 Refs., Illus. [Dept. of Crop Science, Univ. of Natal, Pietermaritzburg 3200, South Africa]

Cassava. Cultivars. Plant growth substances. Growth. Shoots. Roots. Leaf area. Dry matter. Plant pigments. South Africa.

The effect of GA and gibberellin inhibitors (Alar and RSW-0411) on the physiology of greenhouse-grown cassava was investigated. Foliar application of GA and gibberellin inhibitors markedly affected shoot and root growth. GA applied to a dwarf cv. (MSAF2) stimulated shoot growth, resulting in decreased root DM. Following GA treatment, ABA and cytokinin activity in the root decreased. Application of gibberellin inhibitors to a tall cv. (MSAF1) decreased elongation and shoot DM. This decreased shoot growth resulted in a significant increase of root DM. (Author's summary) C01

0314

23259 RAMANUJAM, T. 1984. Effect of plant density on growth and development of morphologically contrasting genotypes of cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.30-31. Engl., Illus.

Cassava. Cultivars. Planting. Spacing. Leaf area. Root productivity. Dry matter. India.

The optimum LAI for max. root yield was studied in 5 cassava cv. (H-2304, H-165, H-1423, H-398, and CI-590) grown at 4 different plant densities (6940, 12,340, 17,770, and 27,770 plants/ha). The mean LAI at full canopy ranged from 2 to 8 depending on the cv. and plant density. All cv. showed lower LAI during mo. 8 and 9. Total biomass production ranged from 13.0 to 27.1 t DM/ha. Significant differences in CGR were noticed among treatments (4.3-9.0 g/m^2/day). Regarding root yield, CI-590 adapted well to high plant densities, yielding 39 and 44 t/ha for plant densities of 27,770 and 17,770 plants/ha, resp., compared with 30 t/ha for the normal plant density (12,340 plants/ha). (Summary by M. de W.) C01

0315

24038 ROCA, W.M.; REYES, R.; BELTRAN, J. 1984. Effect of various factors on minimal growth in tissue culture storage of cassava germplasm. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.441-446. Engl., Sum. Engl., 6 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Laboratory experiments. Research. Cultivars. Storage. Tissue culture. Culture media. Growth-chamber experiments. Temperature.

Photoperiod. Illumination. Plant growth substances. N. Shoots. Leaves. Growth. Colombia.

The influence of various factors in tissue culture storage on growth rate and viability of cassava germplasm stored in vitro was evaluated. Cv. responded differently to low temp.; thus the use of this factor alone is not completely suited for adequate storage. Osmotic pressure, due to the presence of mannitol, was only effective if sucrose was also present in the medium and only at 22°C storage. Although the inclusion of activated charcoal reduced shoot growth rate, it increased culture viability. In addition, intermediate levels of N supported viability at 22°C, and larger storage vessels promoted propagation potential of the cultures. It was determined that sufficient growth limitation and high viability could be achieved through storage at 22-24°C and by using media with low osmotic pressure, activated charcoal, and large vessels. Furthermore, minimal growth storage could be linked to cryogenic techniques as a system for long-term conservation and international exchange of germplasm. (Author's summary) C01

0316

22337 ROCA, W.M. 1984. Root and tuber crops: cassava. In Sharp, W.R.; Evans, D.A.; Ammirato, P.V.; Yamada, Y., eds. Handbook of plant cell culture. New York, MacMillan Publishing Co. v.2,pp.269-301. Engl., 63 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Plant tissues. Apical meristems. Shoots. Cuttings. Tissue culture. Culture media. Plant development. Rooting. Propagation. Disease control. Germplasm. Storage. Temperature.

After a brief review of the origin of cassava, its current production and uses, and a botanical description, the tissue culture technique applied to the crop is described in detail. The procedures for the meristem and shoot tip culture techniques are given step by step as well as its applications (production of healthy clones, recovery of var. yield and vigor, germplasm conservation, international exchange of germplasm). Two methods to store cassava clones, cryogenesis and min. growth storage, are presented. Reference is made to other culture methods that are being developed: embryo culture, cell and callus culture, protoplast culture, and anther culture. Future prospects of all the aforementioned cassava tissue culture techniques are indicated. (Summary by M. de W.) C01

See also 0306 0309 0323 0340 0356 0362 0396 0399 0463 0465

C02 Cyanogenesis

0317

23262 RAMANUJAM, T.; INDIRA, P. 1984. Effect of girdling on the distribution of hydrocyanic acid in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.32. Engl.

Cassava. Cultivars. Leaves. Cyanogenesis. HCN. Roots. Translocation. India.

When var. H-97 (high HCN content) attained full canopy at mo. 5, the stem bark was girdled in an intent to understand the role of leaves in cyanogenesis in cassava. HCN potential of cassava roots showed a significant positive correlation with leaf HCN. Girdling the stem bark at the base of the stem resulted in a 13-fold increase in HCN content of the stem bark just above the incision zone in a week's time when compared with the region below the incision. Root HCN content of var. H-97 decreased 50%. (Summary by M. de W.) C02

See also 0325 0421 0438 0510

C03 Chemical Composition, Methodology and Analyses

0318

23724 BARDALAYE, P.C.; WHEELER, W.B. 1984. Gas chromatographic determination of ametryn and its metabolites in tropical root crops. Journal of the Association of Official Analytical Chemists 67(2):280-284. Engl., Sum. Engl., 3 Refs., Illus. [Univ. of Florida, Dept. of Food Science & Human Nutrition, Pesticide Research Laboratory, Gainesville, FL 32611, USA]

Cassava. Herbicides. Roots. Analysis. USA.

Residue analysis of the herbicide ametryn is widely known but an analytical method for determining its metabolites has not yet been reported in the literature. A method was developed for the extraction and determination of ametryn and 3 metabolites, 2-methylthio-4-amino-6-isopropylamino-s-triazine (GS-11354), 2-methylthio-4,6-diamino-s-triazine (GS-26831), and 2-methylthio-4-amino-6-ethylamino-s-triazine (GS-11355) in tanier, yam, and cassava. Residues were extracted from crops with ethyl acetate-toluene (3 + 1 vol./vol.), using a Polytron homogenizer and anhydrous sodium sulfate added for drying. The extracts were cleaned up by automated gel permeation chromatography on Bio-Beads SX-3 gel in the same solvent system. Quantitative determination was performed by gas chromatographic (GC) analysis on a column packed with 5% DEGS-PS on 100-120 mesh Supelcoport using either an N-P detector or a flame photometric detector (FPD) in the sulfur mode. Min. detection by the FPD was 10 ng each for ametryn, GS-11354, and GS-11355, and 21 ng for GS-26831; by the N-P detector, 0.3 ng of each component gives easily quantifiable peaks. On a ppm basis, starting with 25 g sample, the FPD detected a min. level of 0.04 micrograms/g each for ametryn, GS-11354, and GS-11355, and 0.08 micrograms/g for GS-26831. The N-P detector could detect 0.0024 micrograms/g for all 4 compounds. In addition to superior sensitivity, instrumental conditions allowed the complete separation of components in 10 min for the N-P detector: more than 30 min was required for the FPD. Recoveries from fortified tanier, yam, and cassava ranged from 67 to 111% at levels of 0.1-1.0 micrograms/g. (Author's summary) C03

0319

23707 GLORIA, L.A.; URITANI, I. 1984. Decrease in beta-carotene content of yellowish cassava roots suffered from physiological deterioration. Journal of Japanese Society of Food Science and Technology 31(9): 609-612. Engl., Sum. Engl., Jap., 12 Refs. [Dept. of Agricultural Chemistry & Food Science, Visayas State College of Agriculture, Baybay, Leyte 7127-A, Philippines]

Cassava. Cultivars. Roots. Vitamin A. Vitamin content. Analysis. Deterioration. Philippines.

Almost all the orange pigment in the yellowish roots of cassava cv. Golden Yellow was indicated to be beta-carotene. The content of beta-carotene in the tissue was in the range of 70 micrograms/g dry wt., and was largest in the innermost part (C-part) followed by the intervening part (B-part, where physiological deterioration occurred) and the outermost part (A-part). The content in the B- and C-parts decreased after the appearance and development of physiological deterioration. (Author's summary) C03

0320

24022 GOMEZ, G.; VALDIVIESO, M. 1984. Changes in cyanide content of cassava tissues as affected by plant age and variety. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.323-328. Engl., Sum. Engl., 8 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Cultivation. Planting. Soil physical properties. pH. Rainfall data. Temperature. Harvesting. Timing. Leaves. Roots. Cortex. Cyanides. Cyanogenic glucosides. Plant tissues. Dry matter. Statistical analysis. Colombia.

Plants of 2 cassava var. CMC-40 (low cyanide) and CMC-84 (high cyanide), were studied from mo. 9 to 12 of age. Cyanide concn. was highest in the root peel and lowest in the parenchyma; leaves showed intermediate concn. as compared with the root tissues. The cyanide in the root peels of both var. diminished with plant age. Cyanide concn. in the parenchyma was the most stable parameter and was practically not affected by plant age; the cyanide content of the root parenchyma of var. CMC-84 was approx. 3 times higher than that of roots of var. CMC-40 (623 $\pm$ 25 and 234 $\pm$ 10 ppm, DM basis, resp.). Changes in cyanide content of leaves of CMC-40 were more pronounced than in var. CMC-84. Ninety percent or more of total cyanide in cassava tissues was present as cyanogenic glucoside or bound cyanide. (Author's summary) C03

0321

22771 KAJIWARA, S.; MAEDA, H. 1983. The monosaccharide composition of cell wall material in cassava tuber (Manihot utilissima). Agricultural and Biological Chemistry (Japan) 47(10):2335-2340. Engl., Sum. Engl., 20 Refs., Illus. [Fermentation Research Inst., Agency of Industrial Science & Technology, Ministry of International Trade & Industry, Yatabemachi, Higashi 1-1-3, Ibaraki 305, Japan]

Cassava. Roots. Composition. Analysis. Starch content. Carbohydrate content. Ash content. Enzymes. Hydrolysis. Sugar content. Glucose.

The monosaccharide composition of cell wall material (CWM) in the cassava root and the contents of the other constituents were determined for more advanced industrial utilization. Starch, 80% ethanol-soluble sugar, uronic acid, lignin, ash, and CWM contents in the cassava root were 86.1, 2.4, 3.4, 0.5, 0.9, and 4.5%, resp. Rhamnose, fucose, arabinose, xylose, mannose, galactose, and glucose contents in CWM were 1.9, 1.2, 2.6, 4.2, 2.0, 12.8, and 52.7%, resp. The degradation pattern of CWM by enzymatic and sequential acid hydrolysis was studied. Aspergillus niger cellulase preparation was the most effective and 57.1% of CWM was degraded by the enzyme preparation. About 50% of the hemicellulose part was extracted from CWM by hot water only. (Author's summary) C03

0322

23469 LALONDE, L.; FOUNTAIN, D.W.; KERMODE, A.; OUELLETTE, F.B.; SCOTT, K.; BEWLEY, J.D.; GIFFORD, D.J. 1984. A comparative study of the insoluble storage proteins and the lectins of seeds of the

Euphorbiaceae. Canadian Journal of Botany 62(8):1671-1677. Engl., Sum. Engl., Fr., 13 Refs., Illus. [Dept. of Biology, Univ. of Calgary, Calgary, Alta., Canada T2N 1N4]

Cassava. Manihot. Seed. Protein content. Analysis.

The major storage protein within seeds of the Euphorbiaceae is the 11S crystalloid, which is only completely soluble in buffer or salt solutions if SDS or urea is present. Prior to this study, only the storage proteins of the castor bean had been characterized. The nonreduced crystalloid protein complex in all species tested has a mol. wt. of 50,000-55,000, and in reduced form the proteins migrate on polyacrylamide gels as 2 distinct groups of polypeptides, 1 in the mol. wt. range 20,000-25,000 and the other in the 29,000-35,000 range. In this respect the proteins have the general characteristics of those of castor bean, but only the proteins of Jatropha gossypifolia show striking similarities. Within any 1 genus, the storage proteins appear to be more or less identical (e.g., Manihot spp.) or show distinct differences (e.g., Euphorbia spp.). The soluble lectin proteins of J. gossypifolia have very similar hemagglutination properties to those of castor bean lectins, and the glycoproteins of both species separate similarly on polyacrylamide gels. Few other species contain glycoproteins or lectins that can cause agglutination. (Author's summary) C03

0323

24006 LAWANSON, A.O.; IMEVBORE, A.M.A.; FANIMOKUN, V.O. 1984. The effects of waste-gas flares on the surrounding cassava plantations in the Niger Delta regions of Nigeria. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.239-245. Engl., Sum. Engl., 9 Refs., Illus. [Dept. of Botany, Univ. of Ife, Ile-Ife, Nigeria]

Cassava. Wastes. Roots. Starch content. Vitamin content. Carbohydrate content. Amino acids. Analysis. Soil moisture. Temperature. Root productivity. Nigeria.

The retardation of root yield of Manihot esculenta due to waste-gas flares, which has been frequently observed by local farmers in Nigeria, is described. Cassava roots decreased in length and in wt. as the distance from the flares decreased. Such decreases were also correlated with decreases in root starch and ascorbic acid contents. In addition, root amino acid and total sugar contents increased with decreasing distance from the flares. The high levels of amino acids and sugar in roots closer to the flares suggest reduced synthesis, or increased degradation of root proteins and insoluble carbohydrates, resp. Of all the environmental factors examined, only soil temp. increased as the distance from the flares decreased. Waste-gas flares, most probably through their effect on the surrounding soil temp., reduce the quantity and quality of root yield on cassava plantations. (Author's summary) C03

0324

23714 LUND, E.D. 1984. Cholesterol binding capacity of fiber from tropical fruits and vegetables. Lipids 19(2):85-90. Engl., Sum. Engl., 11 Refs. [United States, Citrus & Subtropical Products Laboratory, P.O. Box 1909, Winter Haven, FL 33883, USA]

Cassava. Fibre content. Enzymes. Analysis. USA.

The cholesterol binding capacity of 28 fiber samples from a var. of the more common tropical fruits and vegetables was determined. The binding capacities of cholestyramine, cellulose, lignin, guar gum, and citrus pectin were also determined. Capacities were evaluated by an in vitro method that simulates the effect of the human digestive system on fiber using a series of enzymatic treatments before the binding was determined. Binding values varied from 3% for a soluble fraction of cassava to 84% for cholestyramine. Since in most cases the soluble fraction is composed of soluble pectin and hemicellulose, the low values are probably the result of enzymatic hydrolysis. Values for most fruit and vegetable fiber samples were less than or almost equal to cellulose or lignin (20 and 16%, resp.). (Extracted from author's summary) C03

0325

23741 LUTALADIO, N.B.; WAHUA, T.A.T.; HAHN, S.K. 1984. Variability in leaf HCN, protein, and macro-nutrient concentration in different canopy portions of cassava. Beitrage zur Tropischen Landwirtschft und Veterinarmedizin 22(2):155-160. Engl., Sum. Engl., Germ., Russ., Fr., Span., 7 Refs. [Dept. of Agronomy, Univ. of Ibadan, Ibadan, Nigeria]

Cassava. Cultivars. Canopy. Leaves. HCN content. Protein content. Mineral content. P. K. Ca. Mg. Analysis. Statistical analysis. Nigeria.

HCN, protein, P, K, Ca, and Mg contents of 3 cassava cv. (Isunikakiyan, LCN 6051, and TMS 30555), planted in pots, were determined after 4 mo. of growth. HCN, protein, P, and K concn. increased from the base to the upper part of the canopy; those of Ca and Mg increased from the upper canopy to the base. Composite samples provide adequate values, with plant-to-plant variability decreasing only for HCN, protein, P, and K. Variability was higher in branched cv. (LCN 6051 and TMS 30555) than in nonbranched ones. To determine cassava leaf HCN and macronutrient contents, samples taken from all canopy sections or from the mid-canopy are adequate. If fresh leaves are to be used as forage, leaf samples from the upper third of the canopy should be analyzed for HCN as a precaution. (Author's summary) C03

0326

23265 NAMBISAN, B.; SUNDARESAN, S. 1984. Cyanoglucoside metabolism in cassava and its possible control. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.35-36. Engl.

Cassava. Cultivars. Cyanogenic glucosides. Analysis. Roots. Processing. Boiling. Drying. Cooking. Detoxification processes. India.

The cyanogenic glucoside content was determined in the proximal, middle, and distal root portions of different cassava var. with high, medium, and low cyanide content, and on cassava roots that had undergone different processing methods or had been cut into different sized pieces. Var. H-165 and H-226 contained 150-250 micrograms cyanogenic glucosides, whereas var. M-4 and H-1687 only contained 20-50 micrograms. Variation in cyanogenic glucoside content was detected within different root portions, as well as between roots of the same plant or between different plants of the same var. When cassava is processed by boiling in water, the most effective method to remove cyanogenic glucosides is to reduce the size of root pieces. (Summary by M. de W.) C03

0327

23486 O'HAIR, S.K. 1984. Cassava root qualities and yield in a subtropical environment. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean:

proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.161-166. Engl., 18 Refs. [Agricultural Research & Education Centre, Univ. of Florida, 18905 S.W. 280 St., Homestead, FL 33031, USA]

Cassava. Cultivars. Starch content. Roots. Cortex. Plant tissues. Timing. Harvesting. Dry matter. Fibre content. Ecosystems. USA.

Initial starch distribution studies were done in the peel, parenchyma, and central pith of the proximal, central, and distal sections of roots harvested from 10-mo.-old plants of cassava clone CMC-40. In expt. 2, genetic and environmental effects on tissue starch concn. of cv. CMC-40, CMC-92, MCol-1684, and HMC-2, planted in 4 Florida locations (Homestead, Gainesville, Live Oak, and Quincy), USA, were evaluated. To determine the effects of aging on root starch content in expt. 3, root samples from cv. CMC-40 and CMC-92 after 3 seasons of growth were used. In the 1st expt. starch concn. in CMC-40 ranged from 7 to 53% for the central pith and parenchyma, resp. Peel starch content ranged between 14-22%. The proximal section presented larger starch concn. than the central or distal sections with av. of 35, 29, and 29%, resp. The location x cv. interaction was significant for the parenchymatous and peel tissues, but not for the central pith. In all cv. the peel starch concn. was significantly lower at Quincy than at Homestead. With the exception of CMC-40, the differences between Homestead and Live Oak were not significant. Since the greatest range in peel starch concn. was observed in HMC-2, with a min. of 16% in Quincy and a max. of 28% in Live Oak, lat. and growing season length were ruled out as factors, since they were similar for both locations. Parenchyma starch concn. varied significantly among locations but not related to the lat. Within locations, cv. differed significantly in parenchyma starch content. CMC-92 had the lowest starch content at 3 locations and HMC-2, the highest. The difference in % DM, starch concn. in dried tissue, and fresh wt. starch concn. between the 3 seasons of deposit were very significant. The oldest tissue had a very low DM content and of that, only 45% was starch. Differences, although not significative, were observed among these parameters between the distal and proximal sections, being larger in the latter. CMC-92 presented the lowest values of starch in % dry and fresh wt. High correlations between root specific gravity and the % dry wt. and the % of starch in the dried material were observed. It is indicated that in breeding programs the selection for high starch and lower fiber content in the older tissues might be a means of improving cassava root quality. The selection for high starch content can be made at one location. Once the roots have passed through one growing season, the selection parameters change due to changes in root tissue between seasons. Older tissue has a higher water content and a lower starch concn. in relation to total DM. (Summary by EDITEC. Trans. by M. de W.) C03

0328

22095 O'HAIR, S.K.; FORBES, R.B.; LOCASCIO, S.J.; RICH, J.R.; STANLEY, R.L. 1983. Starch and glucose distribution within cassava roots as affected by cultivar and location. HortScience 18(5):735-737. Engl., Sum. Engl., 6 Refs., Illus. [Agricultural Research & Education Center, Univ. of Florida, Homestead, FL 33031, USA]

Cassava. Cultivars. Cultivation. Ecosystems. Roots. Starch content. Glucose. Plant tissues. Cortex. Statistical analysis. USA.

The root starch distribution of 4 cassava cv. (CMC-40, CMC-92, MCOL-1684, and HMC-2), grown at 4 locations in Florida, USA, was analyzed. Starch and glucose variation among cv. and locations indicate that both genetic and environmental factors are involved. Glucose content of all tissues sampled was less than 1%. The correlation between glucose and starch was negative in the parenchymatous and pith tissues for all cv. except HMC-2. Location had little effect on starch concn., which was twice as much in the parenchymatous tissue than in the peel, and 1/3 more than in the central pith. The portion of the root closest (proximal) to the plant had a higher starch concn. than did the distal portion. (Author's summary) C03

See also 0317 0355 0360 0362 0398 0399 0418 0419
0436 0463

C04 Plant Nutrition

0329
23752 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Mycorrhiza project. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.79-97. Engl., Illus.

Cassava. Cassava programs. Mycorrhizae. Inoculation. Growth. Cultivars. Water stress. Dry matter. Fertilizers. P. N. K. Root productivity. Colombia.

CIAT's mycorrhizal isolate collection has more than 420 pure cultures from more than 90 origins in Colombia. Six newly described species are: Glomus manihotis, Howeler, Sieverding et Schenck; Acaulospora appendicula, Spain, Sieverding et Schenck; A. longula, Spain et Schenck; A. mellea, Spain et Schenck; A. morrowae, Spain et Schenck; Entrophospora colombiana, Spain et Schenck. Of the 103 isolates tested to date, 41 have been found to be very effective in increasing the growth of cassava. Glomus spp. isolates are generally effective, whereas with the other species, the effectivity of an isolate depends on its origin. Regarding the interaction between cassava cv. and mycorrhizal isolates, cv. M Col 1226 showed affinity for G. manihotis (Quilichao), but the performance of M Col 700 with different isolates and species varied little. Var. CM 342-170 was inoculated with several mycorrhizal fungi under wet and dry soil conditions; the most effective mycorrhizal fungi under both soil water conditions were G. manihotis and E. colombiana. Cv. M Ven 77 was grown in sterilized soils with 5 levels of P ranging from 0 to 200 kg/ha and inoculated with 1 of 5 mycorrhizal isolates. Growth of noninoculated plants was extremely poor and plants showed clear symptoms of P deficiency; only with 200 kg P/ha growth improved slightly and deficiency symptoms disappeared. Inoculation with G. manihotis resulted in the largest growth, and inoculation with Acaulospora spp. gave poor plant growth at low levels of P. Two strategies to supply mycorrhizal inoculum to the farmer are proposed: (1) industrial production with the constraint of costs and (2) on-farm production which requires appropriate technology development. The latter has led to research on suitable soil sterilants and host plants. In a farmer's field in Mondomo, Colombia, 7 mycorrhizal species were tested on cv. CMC 92. Results show that isolates of G. manihotis, a mycorrhizal species of generally high effectivity for cassava, may differ in their efficiency under certain conditions. The effectivity of placing half of the mycorrhizal inoculum under the cassava cutting at planting, and the other half banded on either side of the plant 5 mo. after planting, was again confirmed. Results of the study carried out to determine the effect of NPK fertilization on inoculation response show that for optimum use of an introduced fungus to the field, a balanced nutrition of the plant is required. Likewise, besides saving P fertilizer by inoculation with an effective mycorrhizal fungus, N and K fertilizer levels can be decreased considerably for obtaining max. yields. In trials on the persistence of mycorrhizal inoculation effects, inoculation of the field with _G. occultum_ initially, together with diammonium phosphate application in the 2nd yr., considerably decreased yields in the 2nd yr. The same especies was, however, the most effective at increasing yields with Huila rock phosphate as P source. (Summary by M. de W.) C04

0330

23751 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Soils and plant nutrition. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.59-77. Engl., Illus.

Cassava. Cassava programs. Germplasm. Minerals. P. pH. Selection. Soil fertility. Water requirements (plant). Nutrient uptake. Fertilizers. N. K. Irrigation. Agricultural lime. Cultivation systems. Inter-cropping. Cowpea. Groundnut. Rice. Root productivity. Productivity. Soil conservation practices. Soil impoverishment. Green manures. Cover crops. Dung. Colombia.

From CIAT's cassava germplasm collection, 13 var. were selected as highly adapted to low-P soils, and 36 were considered well adapted. In another trial 77 var., selected from single row trials in previous years, were grown in plots with 0 or 75 kg P/ha, band-applied, yielding on the av. 25 and 31 t/ha, resp. Nutrient absorption by cassava was studied in Carimagua where cv. M Ven 77 was grown in 4 large plots with or without applied fertilizers (1 t of 10-20-20 and 5 kg Zn/ha) and with or without gravity irrigation during the 4 mo. of dry season. Plant growth was not markedly affected by lack of soil moisture, and supplemental irrigation had only a minor effect. Application of fertilizer increased plant growth more markedly, and at time of harvest increased total DM 64% and root yield 44%. Fresh root yields were 43, 28, 24, and 32 t/ha with irrigation and fertilization, with irrigation but no fertilization, without irrigation and fertilization, and without irrigation but with fertilization, resp. In both irrigated and nonirrigated plots, the concn. of all 3 major elements decreased markedly during the dry mo. and increased at the onset of the regular rains, remaining constant during the rest of the growth cycle. In fertilized and unfertilized plants the accumulation of N, P, and K was 222, 35, and 220, and 135, 18, and 101 kg/ha, resp. The study of the responses of cassava, peanut, cowpea, and rice to the application of fertilizers and lime, both in monoculture and in association, indicated that all crops showed a similar response to NPK whether grown in association or alone; however, the response to lime tended to be reduced in associations due to the lower yield levels obtained in each crop. In monoculture, cassava was relatively tolerant to both soil infertility and acidity, but required high levels of lime and fertilizers to reach max. yields. When cassava was grown in association, each crop at the same population as in monoculture, its yields were little affected by the presence of rice and peanuts, but greatly affected by the severe competition from cowpea. In a long-term fertility trial, only with annual application of high levels of K (250 kg/ha) was it possible to maintain high yield levels and adequate amounts of K in the plant and in the soil; the reapplication of high levels of NPK with the sixth crop more than tripled yields from 13 to 45 t/ha. Trials studying the possible recuperation of exhausted soil with NPK application showed that the application of 100 kg N, P, and K/ha increased yields from 13 to 29 t/ha. However, this level of fertilization could not recuperate cassava yields to those levels obtained in nonexhausted soil. In the same exhausted soil, the potential value of green manures in the recuperation of soil, in the presence or absence of chemical fertilizers, was considered. The application of 10-30-10 alone increased yields from 17 to 32 t/ha, but the incorporation of kudzu, zornia, or peanuts increased cassava yields another 7-11 t/ha. When the efficiency of organic manures was compared with chemical fertilizers and rock phosphates, the yields obtained with cow manure and chicken manure were 25 and 31 t/ha, resp. Chemical fertilizers alone increased yields to 23 t/ha, but not consistently. (Summary by M. de W.) C04

0331

23475 GIRESSE, P.; JAMET, R. 1982. Essais de fertilisation de la culture du manioc par les sédiments marins glauconieux du Congo. (Fertilizer trials made in cassava using Congolese glauconitic sediments). Cahiers Office de la Recherche Scientifique et Technique Outre-Mer (Serie Pedologie) 19(3):283-292. Fr., Sum. Fr., Engl., 6 Refs., Illus. [Centre de Recherches de Sédimentologie Marine, Univ. de Perpignan, Av. de Villeneuve, 66025 Perpignan Cedex, France]

Cassava. Cultivation. Field experiments. Soil amendments. Soil physical properties. Fertilizers. N. P. K. Mg. S. Sodium. Productivity. Soil fertility. Congo.

Since the big deposits of muddy glauconite (G) and glauconite carbonate (CG) in the continental shelf of the Republic of Congo have potential use as soil amenders, trials were carried out to determine to what extent they are likely to increase soil fertility and crop yields. Cassava cuttings were planted in 40-cm^3 boxes, perforated to allow normal water flow (3 cuttings/box). The 2 types of glauconite sediments, G and CG, were used at 2 different dosages: 2.5 and 5% for CG and 5 and 10% for G, with 2 replications and a control; boxes were kept under field conditions. After a 18-mo. plant cycle, CG and G produced total DM wt. of 570.1 and 793.5, and 840.5 and 1643.7 g for the different dosages, resp., whereas the total DM wt. of the control was 318.4 g. Despite considerable leaching, these sediments preserved an adequate soil fertility. (Summary by M. de W.) C04

0332

22782 HAHN, S.K.; KANG, B.T.; AYANABA, A. 1981. Cassava varietal response to mycorrhizal fungi in phosphate deficient soils. In Emejuaiwe, S.O.; Ogunbi, O.; Sanni, S.O., eds. Global impacts of applied microbiology. London, Academic Press. pp.127-132. Engl., Sum. Engl., 8 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivars. Cultivation. Soil physical properties. Mycorrhizae. Inoculation. Nigeria.

When 26 cassava cv. were screened for compatibility with indigenous vesicular-arbuscular (VA) mycorrhizal fungi in P-deficient soil, large differences in cv. response were observed. Some widely adapted, high yielding improved cv. were heavily infected, indicating a high degree of compatibility. Some local cv. were also heavily infected. Subsequently, Isunikakiyan, a local cv. which is heavily infected by indigenous VA mycorrhizae, and TMS 30572, an improved, widely adapted, high yielding cv. with poor compatibility, were inoculated with an efficient endophyte (Glomus mosseae). Only TMS 30572 responded positively to the inoculation. (Author's summary) C04

0333

23255 MOHANKUMAR, B.; NAIR, P.G.; LAKSHMI, K.P. 1984. Inter-relationships of potassium, sodium, calcium and magnesium on their uptake, yield and quality of cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.25-27. Engl., Illus.

Cassava. Cultivars. K. Ca. Mg. Sodium. Statistical analysis. HCN content. Absorption. India.

The effects of different levels of K, Ca, and Mg were studied in cassava cv. H-1687. Differences in root productivity were not statistically significant among treatments; HCN content was not affected by the treatments either. The higher the level of K or Mg applied, the higher their uptake; the interaction of K and Mg was found to be antagonistic. Higher levels of K also decreased Na uptake. (Summary by M. de W.) C04

0334

23258 NAIR, P.G.; PRABHAKAR, M. 1984. Investigation on phosphorus nutrition of cassava in relation to residual effect and uptake. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.28-30. Engl.

Cassava. Cultivars. Nutritional requirements. P. pH. Soil physical properties. Fertilizers. N. K. Manures. Root productivity. Soil analysis. India.

The residual effect of added P on yield and P uptake was studied in a randomized block design using cassava cv. H-1687 and M-4 grown on an acid laterite soil and applying 5 levels of P (0, 25, 50, 75, and 100 kg/ha). The highest yields were obtained with 25 kg P/ha: 22.67 and 16.13 t/ha for cv. H-1687 and M-4, resp. P uptake was also highest at this dose (28.50 kg/ha), but the differences between the various levels were not significant. Available P increased from 100 to 213 kg/ha in 3 yr of continuous application of P at 100 kg/ha. (Summary by M. de W.) C04

0335

23257 PILLAI, N.G.; MOHANKUMAR, B.; NAIR, P.G.; KABEERATHUMMA, S.; POTTY, V.P. 1984. Permanent manurial trial on cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.28. Engl.

Cassava. Cultivation. Fertilizers. N. P. K. Manures. Root productivity. India.

In 1977 an expt. using a randomized block design and 3 replications was started to study the collective and cumulative effects of FYM and NPK fertilizers on the yield and quality of cassava; the expt. is in its 6th yr of completion. Max. root yield (31.20 t/ha) was recorded for FYM + NK. Among individual nutrients, K responded better than N and P. Ash was also found to be superior to FYM in increasing root yield. (Summary by M. de W.) C04

0336

23474 SIEVERDING, E.; LEIHNER, D.E. 1984. Influence of crop rotation and intercropping of cassava with legumes on VA mycorrhizal symbiosis of cassava. Plant and Soil 80(1):143-146. Engl., Sum. Engl., 11 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Mycorrhizae. Cultivation. Cultivation systems. Inter-cropping. Rotational crops. Fertilizers. N. P. K. Zn. B. Climatic requirements. Soil physical properties. Field experiments. Laboratory experiments. Colombia.

In comparison with cassava grown in monoculture, the root infection of cassava with vesicular-arbuscular mycorrhiza was increased by crop rotation with grain legumes in the field (Quilichao, Colombia). This was also found when cassava was intercropped with legumes and fertilized. A possible specificity of mycorrhizal fungi to increase the yield of one species more than the other when grown in association is discussed. (Author's summary) C04

See also 0306 0463 0465

D00 CULTIVATION

See 0410 0461 0462 0472 0477 0493

D01 Soil, Water, Climate and Fertilization

0337

23493 FUKAI, S. 1985. Tabular descriptions of crops grown in the tropics. 5. Cassava (Manihot esculenta Crantz). Canberra, Australia, Commonwealth Scientific and Industrial Research Organization. Division of Water and Land Resources. Technical Memorandum 85/3. 54p. Engl., Sum. Engl., 37 Refs. [Dept. of Agriculture, Univ. of Queensland, St. Lucia, Qld. 4067, Australia]

Cassava. Taxonomy. Agronomic characters. Uses. Climatic requirements. Plant geography. Light. Temperature. Soil requirements. Soil physical properties. Salinity. pH. Nutritional requirements. Water requirements (plant). Developmental stages. Bacterioses. Mycoses. Injurious insects. Viroses. Australia.

To aid in the assessment of the suitability of land for cassava, a tabular description is given of the principal characteristics of the species, with emphasis on environmental relationships. (Author's summary) D01

0338

23483 GUMBS, F.A. 1984. Soil constraints to root crop production in the Caribbean. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.45-50. Engl., 18 Refs. [Dept. of Soil Science, Univ. of the West Indies, St. Augustine, Trinidad]

Cassava. Land preparation. Soil physical properties. Nutritional requirements. Fertilizers. Water requirements (plant). Soil requirements. Drainage. Erosion. Soil conservation practices. Caribbean.

The most important chemical and physical soil constraints to root crop production (including cassava) in the English-speaking Caribbean are examined. Although cassava is the most tolerant, among root crops, to low soil fertility, the use of fertilizers can increase yields. However, due to small farm size and small markets, farmers are reluctant to make larger investments in fertilizers. Therefore there is a need for the following strategies: development of systems which allow for the sole use of organic manures with and without fallowing; use of the above with a limited amount of inorganic fertilizers; and reevaluation of the cost/benefit from the use of low levels of inorganic fertilizers. Soil compaction, water requirements, waterlogging and drainage, and soil erosion and conservation are discussed. (Summary by EDITEC. Trans. by M. de W.) D01

0339

24005 KANG, B.T.; OKEKE, J.E. 1984. Nitrogen and potassium responses of two cassava varieties grown on an Alfisol in southern Nigeria. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.231-237. Engl., Sum. Engl., 12 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivars. Soil physical properties. Fertilizers. N. P. K. Productivity. Root productivity. Leaves. Composition. Cultivation systems. Nigeria.

A fertilizer trial was established on an Alagba soil series (Oxic Paleustalf) at Ikenne in the forest zone of SW Nigeria, for 3 consecutive croppings, to determine responses of cassava var. TMS 30555 and TMS 30572 to N and K. N application increased plant top yield and foliar N % with no significant effect on root yield. K application significantly increased plant top and root yields, and foliar K %. K response was observed in the 2nd yr of continuous cassava cropping with var. TMS 30555 and in the 3rd yr with var. TMS 30572. Var. TMS 30572 appears to be more effective in utilizing soil K. K response can be expected on this Alagba soil series when IN ammonium acetate extractable soil K test level is less than or equal to 0.15 meq/100 g soil. (Author's summary) D01

0340

23478 SUSHAMA, P.K.; PILLAI, G.R.; GEORGE, T.P.; MATHEW, J. 1982. Effect of leaf area on tuber yield of irrigated tapioca. Agricultural Research Journal of Kerala 20(1):95-97. Engl., Sum. Mal., 4 Refs. [Agronomic Research Station, Chalakudy, Trichur, Kerala, India]

Cassava. Irrigation. Leaves. Leaf area. Root productivity. India.

In a randomized block design 5 plots were irrigated at IW/CPE ratios of 1.00, 0.75, 0.50, 0.25, and a nonirrigated control. Total no. of irrigations were 12, 9, 6, and 2 at intervals of 12, 17, 26, and 50 days, resp. Each treatment had 5 replications. Root productivity increased progressively with an increase in the ratio of irrigation and the max. (44.60 t/ha) was obtained at IW/CPE ratio of 1.00. In relation to the control, increases of 62, 51, 46, and 26% in root yield were observed in irrigated plants at 1.00, 0.75, 0.50, and 0.25 IW/CPE ratios, resp. Leaf area/plant followed a similar trend. There was a significant positive correlation between leaf area and root yield (r = 0.973). (Summary by M. de W.) D01

0341

23179 WARGIONO, H.J.; SOENARJO, R. 1977. [Cultural management for increasing production of cassava in Indonesia]. Bogor, Indonesia, Central Research Institute for Agriculture. 11p. Indon., Sum. Engl., Indon., 13 Refs.

Paper presented at the Symposium I Peranan Hasil Penelitian Padi dan Palawija dalam Pembangunan Pertanian, Maros, 1977.

Cassava. Cultivation. Planting. Spacing. Fertilizers. N. K. Cultivars. Branching. Indonesia.

Cassava is an important source of carbohydrates and calories in Indonesia due to its ability to grow in soils of marginal fertility and to its competitive superiority over other staple food crops. Improved production methods and cv. can increase production. Current agronomy research activities study production techniques related to planting distance, rate and methods of fertilizer application, and cropping systems. Exptl. results indicate that in poor soils a 100 x 60 cm spacing appears to be best for nonbranching clones, while in better soils cassava clones, both branching and nonbranching types, should be planted at 100 x 100 cm or wider spacing. Greater response to fertilizer application was observed in poor soils. The max. N fertilizer rate ranged from 90 to 120 kg/ha in poor soils and from 60 to 90 kg/ha in better soils, potash requirements being between 50-100 kg/ha in both soils. Applying 1/3 of the NK dosage in holes at planting and the rest 2-3 mo. after planting gave higher yields. It is suggested that cassava should be grown with other food crops in order to increase farmers' income and decrease soil erosion. (Author's summary) D01

See also 0305 0309 0329 0330 0331 0334 0335 0336
0343 0344 0345 0346 0348 0349 0356 0360
0396 0398 0459 0460 0471 0475 0476 0486
0496 0498 0499 0501 0502 0503 0504 0505
0506 0509

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

0342

19235 CARVALHO, J.E.B. DE 1979. Aspectos importantes ao controle das ervas daninhas na cultura da mandioca. (Important aspects of weeding in cassava crops). Cruz das Almas-BA, Brasil, Empresa Brasileira de Pesquisa Agropecuaria. Centro Nacional de Pesquisa de Mandioca e Fruticultura. 32p. Port., 7 Refs.

Paper presented at Curso Intensivo Nacional de Mandioca, 3o., Cruz das Almas-BA, Brasil, 1979.

Cassava. Cultivation. Weeds. Weeding. Hoeing. Mulching. Agricultural equipment. Climatic requirements. Timing.

Different aspects related to weed control are discussed: definition, economic importance, losses caused by crop competition, and classification (annual, biennial, and perennial, or broad- and narrowleaved). Different control measures are described: manual, mechanical, cultural, biological, chemical, and mulching. Principles of chemical control, advantages of using herbicides, and different types of treatment (applied to soil and plant) are mentioned. Among the different spray equipments, those of land application are mentioned, in particular knapsack sprayers and tractor-drawn sprayers. Elements of the sprayers, such as filters, pipes, and nozzles, are described. Recommendations are given on the care and maintenance of sprayers and on their calibration. Different factors affecting herbicide selectivity are indicated: (1) physical and mechanical: application method and time, herbicide formulation, soil properties, physicochemical properties of the herbicide, and precipitation; (2) environmental factors such as temp., available soil water, and RH; (3) morphological and anatomical factors; and (4) physiological selectivity. Other aspects studied included herbicide persistence in the soil, its volatibility, decomposition by light, chemical processes, and microorganisms. The different ways of acting and classes of herbicides are indicated as well as the different factors that should be taken into account during their application. Recommendations on chemical weed control in cassava, using different herbicides, rates, and application times, are given. (Summary by EDITEC. Trans. by L.M.F.) D02

0343

23782 COCK, J.H. 1985. Some factors in successful cropping. 9. Cassava. Span (England) 28(1):23-25. Engl., illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivation. Climatic requirements. Cultivars. Ecosystems. Plant breeding. Cuttings. Planting. Timing. Spacing. Weeding. Pest control. Biological control. Fertilizers. Soil conservation practices. Root productivity. Colombia.

Based on research results, the advantages of cassava over other crops, the use of improved cv. for different ecosystems, good management practices, crop protection, and soil fertility requirements are discussed in detail. (Summary by M. de W.) D02

0344

23482 COOPER, B.R. 1984. Prospects for increased cassava production in Trinidad - A review of some agronomic constraints and opportunities. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.39-43. Engl., 16 Refs. [Caribbean Agricultural Research & Development Inst., St. Augustine, Trinidad]

Cassava. Production. Productivity. Labour. Prices. Cultivars. Nutritional requirements. *Xanthomonas campestris* pv. *manihotis*. Mechanization. Trinidad.

After presenting the levels of production and the current systems used in Trinidad, the agronomic aspects that affect the increase in the efficiency of cassava production are discussed. The main factors limiting cassava production include low yields due to low technological inputs, high labor requirements in a country where it is expensive and scarce, and limited demand for cassava since it is only consumed fresh. The potential of new cassava var., the use of N, and weed control are discussed. The disease representing the major threat is that caused by *Xanthomonas campestris* pv. *manihotis*, for which strict control measures are recommended. Finally, the need of crop mechanization to increase production and reduce animal feed imports is highlighted. (Summary by EDITEC. Trans. by M. de W.) D02

0345

22987 CORREA, H.; FERREIRA, L.D. 1982. Levantamento e analise tecnica de práticas culturais usadas pelos produtores de mandioca nos municípios de Conceicao dos Ouros e Cachoeira de Minas. (Survey and analysis of cultural practices used by cassava producers in the municipalities of Conceicao dos Ouros and Cachoeira de Minas). In Empresa de Pesquisa Agropecuária de Minas Gerais. Projeto mandioca: relatorio 76/79. Belo Horizonte-MG, Brasil. pp.13-19. Port. [Escola Superior de Agricultura de Lavras, Caixa Postal 37, 37.200 Lavras-MG, Brasil]

Cassava. Production. Cultivation. Cultivation systems. Rotational crops. Root productivity. Land preparation. Agricultural lime. Fertilizers.

Cuttings. Selection. Cultivars. Planting. Spacing. Timing. Weeding. Injurious insects. Erinnyis ello. Cassava bacterial blight. Harvesting. Brazil.

The technical factors involved in cassava production in the municipalities of Conceicao dos Ouros and Cachoeira, MG, Brazil, were identified. The target population included 210 rural producers and 36 starch factories. The sample of producers was divided into groups I (1-4 ha), II (4-8 ha), III (8-15 ha), and IV (more than 15 ha). Crop rotation (only including grasses) and planting on the flat were the conservation practices most used by producers. The total estimated av. yield was 16.3 t/ha, which was superior to the mean national yield reached during the 1975-77 period. Yields were relatively low for the groups with smaller cultivated areas. Of the properties, 79% used mechanical land preparation; 69% of the producers applied lime and 68% fertilizers, these inputs being more commonly used among the large-scale cassava producers. Cuttings were selected prior to planting by 84% of the producers. Groups using 20-cm cuttings had the highest yields, except group III. Groups I and IV used the largest amounts of cuttings (5.5 and 6.0 m^3/ha, resp.). Cv. Branca de Santa Catarina was used on 86% of the properties. Plant population ranged between 10,000-20,000 plants/ha. Only 38% of the surveyed farms (a) followed the recommendation of planting 16,667-20,000 plants/ha; (b) reseeded. Planting is done by hand with a furrow opener between Sept.-Oct. Weed control is manual and pruning is a widespread practice. Fertilizers are applied at 30, 60, and 90 days after planting by 55% of the farms. Ants and the cassava hornworm were the most common pests, and CBB the most frequent disease. Harvesting was done manually between 18-20 mo. (Summary by EDITEC. Trans. by L.M.F.) D02

0346

24004 GURITNO, B.; SITOMPUL; SOETONO; BRUIJN, G.H. DE 1984. The agronomy of Mukibat cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.225-229. Engl., Sum. Engl., 3 Refs. [Faculty of Agriculture, Brawijaya Univ., Malang, Indonesia]

Cassava. Cultivation. Mukibat system. Cultivars. Propagation materials. Manihot glaziovii. Propagation. Grafting. Planting. Spacing. Fertilizers. N. P. K. Harvesting. Timing. HCN content. Indonesia.

The Mukibat system of cassava production in Indonesia can lead to significant yield increases as compared with the traditional cassava production system. Preparation of graft combinations is time-consuming, but once prepared, they can be reused for repeated planting. Mukibat cassava can be planted like ordinary cassava; the traditional digging of planting holes can be omitted. For pure stand conditions a plant density of about 8000 plants/ha was found to be optimal. N fertilization increased yield significantly up to a level of 100 kg/ha. No significant response to P and K was found. High root yields can be obtained after a growth period of 12-15 mo. However, Mukibat cassava has a higher HCN content than ordinary cassava. (Author's summary) D02

0347

22041 KAYODE, G.O. 1983. Effects of various planting and harvesting times on the yield, HCN, dry-matter accumulation and starch content of four cassava varieties in a tropical rainforest region. Journal of Agricultural Science 101(3):633-636. Engl., Sum. Engl., 8 Refs. [National Cereals Research Inst., P.M.B. 5042, Ibadan, Nigeria]

Cassava. Cultivars. Cultivation. Timing. Planting. Harvesting. Weeding. Productivity. HCN content. Starch content. Dry matter. Root productivity. Nigeria.

Results of a 2-yr study in a rainforest zone of SW Nigeria to determine the effects of various planting and harvesting times on the yield, HCN, DM accumulation, and starch content of cassava showed that times of planting and harvesting significantly affected all the variables studied. May planting (highest total rainfall, 1714-1778 mm, and mean sunshine, 57.9-60.0 h) gave highest yield and starch content, which suggests that large-scale cassava production for industrial starch and human consumption should be planted in this month. The harvesting time expt. shows that cassava roots will continue to grow until mo. 24, although, because of increasing demand for land, it will not be economic to leave cassava on the field for more than 15 mo. For optimum starch and DM accumulation, cassava should be harvested between 12-15 mo. (Author's summary) D02

0348

24007 LEIHNER, D.E. 1984. The production of planting material in cassava: some agronomic implications. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.247-255. Engl., Sum. Engl., 5 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Propagation materials. Climatic requirements. Soil physical properties. pH. Rainfall data. Temperature. Cuttings. Timing. Planting. Spacing. Fertilizers. N. Weeding. Cultivars. Colombia.

Several agronomic trials aimed at the obtainment of suitable practices for cutting production were established in 5 different locations in Colombia, including CIAT stations. Cuttings of different ages could be obtained within the same plant, more mature stakes showing more vigorous sprouting but young stakes frequently giving higher yields. High planting densities increased total no. of primary and secondary stems/ha thus increasing total no. of cuttings/ha although av. cutting wt. could decrease. High natural soil fertility or fertilization on poor soils increased cutting production significantly. In early growth stages, cassava was highly sensitive to weed competition which could reduce top growth drastically. Good timely weed control is therefore essential to produce large no. of good quality cuttings/plant. (Author's summary) D02

0349

24008 LEIHNER, D.E. 1984. Storage effects on planting material and subsequent growth and root yield of cassava (*Manihot esculenta* Crantz). In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.257-265. Engl., Sum. Engl., 7 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cuttings. Storage. Water content. Mineral content. Carbohydrate content. Water requirements (plant). Germination. Productivity. Colombia.

Storage of cassava planting material is necessary when harvest and subsequent plantings are separated in time due to drought, flood periods, or low temp. Therefore, several trials were carried out to design practices to improve cutting quality before and after storage. Cuttings lost viability when dehydration reduced MC to less than 60%. Storing cassava planting material as 100 cm or longer stems was highly effective to avoid dehydration and maintain viability for several months. Besides moisture, cuttings lost carbohydrate reserves during storage, mainly in the form of total and reducing sugars. Mineral element concn. varied during storage according to the site and condition of production. However, a relative increase of N, P, and K concn. in cutting tissue was noticed, possibly as a result of total DM loss. Cuttings with good nutritional status showed better sprouting and crop establishment than those from a poorly nourished crop. Sprouting and establishment could also be aided by rehydration and bioactivator treatments, resulting in equal or even superior yields with stored than with fresh planting material. (Author's summary) D02

0350

23253 NAIR, G.M.; RAMANUJAM, T.; PRABHAKAR, M. 1984. Quality parameters of planting material and its regeneration studies in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.17-21. Engl., Illus.

Cassava. Cuttings. Storage. Planting. Germination. Dry matter. Leaf area. Stems. Maturation. Root productivity. India.

Cassava cv. H-1687 was subjected to 10 different treatments before and immediately after harvesting: topping at harvest and removal of mother stem (T1); topping at harvest and retaining of mother stem (T2); topping, allowing axillary buds to develop, and removal of mother stem (T3); topping, allowing axillary buds to develop, and retaining of mother stem (T4); retaining of leaves and mother stem (T5); retaining of leaves and removal of mother stem (T6); topping and heaping dry soil over mother stem (T7); smearing of cowdung slurry on tops and retaining of mother stem (T8); smearing of red earth on tops and retaining of mother stem (T9); and dipping of tops in wax and retaining of mother stem (T10). Germination and subsequent establishment of the treated stems were studied under field conditions. Germination was more than 95% in the case of T1, T5, T6, and T10 and poor (76%) in the case of T3. Storing the stems for a period of 15 days resulted in the highest germination (96%), highest LAI (1.56), and max. DM accumulation (209.3 g/plant). Storage beyond 60 days resulted in low germination (75%), min. LAI (0.71), and min. DM production (106.7 g/plant). Germination and LAI were also higher in the stems stored either in vertical or in inverted position than in the ones stored horizontally. Root productivity was not affected by stem girth, physiological age of the stem, or replacement or nonreplacement of cuttings that had failed to sprout; however, the use of longer cuttings (40 cm) and replanting 15 days after planting resulted in higher yields than those obtained with 20-cm cuttings and replanting 30 days after planting. Root productivity was also affected by the time of transplanting germinated cuttings of the same age of those already in the plot. (Summary by M. de W.) D02

0351

23272 NANDA, S.K.; NAIR, G.M. 1984. Development of cassava harvesting aids. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.52. Engl.

Cassava. Weeding. Hoeing. Developmental research. India.

A rake- and blade-type weeder for cassava crops was designed. Preliminary performance trials indicated the need for longer blades and deeper penetration into the soil. (Summary by M. de W.) D02

0352

22333 OLUNUGA, B.A.; OBAJIMI, A.O. 1980. Effects of some herbicides on the growth and yield of cassava and maize grown in mixture. In Annual Conference of the Weed Science Society of Nigeria, 9th., Ibadan, Nigeria, 1979. Proceedings. Ibadan, National Cereals Research Institute. pp.93-96. Engl., Sum. Engl., 7 Refs. [National Cereals Research Inst., Moor Plantation, P.M. Box 5042, Ibadan, Nigeria]

Cassava. Maize. Cultivation systems. Inter-cropping. Planting. Timing. Fertilizers. N. P. K. Weeding. Herbicides. Root productivity. Nigeria.

Fluometuron and Primextra (atrazine + metolachlor), each at 2 or 4 kg a.i./ha, were compared for their effects on the growth and yield of cassava and maize grown in mixture. The herbicides were applied preemergence to maize and cassava was planted 1 day and 3 wk. after treatment. Fluometuron at 4 kg a.i./ha was toxic to maize but well tolerated by cassava. Atrazine was selective in maize but toxic to cassava, especially when the cassava was planted 1 day after treatment with the herbicide. Primextra was selective in maize. Although cassava showed some symptoms of damage at the outset, these symptoms disappeared with time and the yield was not adversely affected. (Extracted from author's summary) D02

0353

20752 SILVA, A.J.V. DA; WEISS, A.E.; ALMEIDA, A.G. DE; MESQUITA, C. DE M.; CARNEIRA, J.M. DA S.; SILVA, J.C. DA; ABRAMOVITZ, J.; GUIMARAES, L.B. DE M.; FREITAS, R. DE; CARVALHO, R.M. 1981. Sistema mecanizado para colheita de raíces de mandioca. (Mechanized harvesting system for cassava roots). Informativo do Instituto Nacional de Tecnología 14(26): 35-39. Port., Sum. Port., Engl., Illus. [Fundacao de Tecnologia Industrial, Divisao de Desenho Industrial e Engenharia do Produto, Rio de Janeiro, Brasil]

Cassava. Agricultural equipment. Harvesting. Development. Brazil.

An agricultural implement has been designed and constructed to facilitate cassava root harvesting. The elaboration and the development of this equipment was based on certain parameters (depth control to 350 mm, operation on various types of soil, easy upkeep in the fields), and on the analysis of the existent data on cassava cultivation. The definitive form of an inclined plane was adopted as a result of field tests, during which some different characteristics of wt., width, length, and angulation of the initial prototypes were altered. Performance tests compared the traditional manual harvest and this type of mechanical harvest. Results indicated that with the new tool the productivity was 5-fold that of manual cassava uprooting. Moreover, physical human effort has been notably reduced and that the operation performed by the implement substitutes the subsoiling, thus reducing operational costs. (Author's summary) D02

0354

23467 VILLAMAYOR JUNIOR, F.G.; PEREZ, R.D. 1983. Effect of location, position and duration of stem storage on cassava yield. Radix 5(1):5-7. Engl., 4 Refs., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Leyte, Philippines]

Cassava. Cultivars. Cuttings. Storage. Cultivation. Planting. Timing. Water requirements (plant). Germination. Productivity. Root productivity. Philippines.

Stems 1 m long of 8-mo.-old plants of cassava cv. Golden Yellow were stored in bundles of 10 in a vertical, horizontal, or inverted position under shade or in the open. The cuttings were planted after storage for 1-3 mo. MC decreased during storage; moisture losses from the stem were 2.7, 7.0, and 8.2% following storage for 1, 2, and 3 mo., resp. Root yields decreased with increased storage, and were greater for cuttings stored in the shade. (Summary by Field Crop Abstracts) D02

See also 0312 0314 0336 0341 0356 0358 0361 0365
0371 0396 0460 0463 0475 0476 0486 0488
0496 0498 0499 0500 0501 0502 0503 0505
0506 0507 0508 0509

D03 Energy Productivity and Yields

0355

23736 ABENOJA, E.A.; CERNA, A.F. 1983. The effect of age and frequency of topping cassava on quality of shoots, dry matter and tuber yield. Radix 5(1):12-13. Engl., 5 Refs. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte, Philippines]

Cassava. Cultivars. Cultivation. Shoots. Harvesting. Timing. Dry matter. Protein content. Water content. Root productivity. Statistical analysis. Philippines.

Cassava cv. Golden Yellow grown during 1983 was detopped every 4, 6, or 8 wk. from 4, 5, or 6 mo. after planting until harvest. Root no. and wt. of detopped plants, as well as MC, wt., and DM yield of the topped shoots, were unaffected by the age or frequency of detopping; protein content of the shoots increased with plant age. (Summary by Field Crop Abstracts) D03

0356

23745 AVILAN R., I.; MENESES, L.; ARIAS, C.; PEREZ, O. 1981. Distribución del sistema radical de la yuca (Manihot esculenta, Crantz) cultivada a diferentes distancias entre plantas. (Root system distribution of cassava grown at different plant densities). Agronomía Tropical 31(1-6):189-210. Span., Sum. Span., Engl., 29 Refs., Illus. [Centro Nacional de Investigaciones Agropecuarias, Apartado 4653, Maracay 2101, Venezuela]

Cassava. Cultivars. Cultivation. Climatic requirements. Planting. Spacing. Root system. Soil physical properties. pH. Roots. Root productivity. Productivity. Venezuela.

The distribution of the root system of cassava Clon 60 (Me-75-VEN 60), grown at different distances between plants (70, 100, and 120 cm) and maintaining the same interrow distance (100 cm), was studied. Samples were taken at 7 and 9 mo. after planting, using the trench and the monolithic methods in a combined way. Spacing was observed to affect total root no. and wt. The largest total no. of roots and their lowest wt. was found in plants spaced at 70 cm. The largest wt. and the smallest no. of roots was found in plants spaced at 120 cm. The distance between plants affected the proportion of fine and thick roots: the greater the distance, the smaller the no. of fine roots. At closer distances, the values of the ratio canopy wt.:root wt. were higher. Root system distribution was influenced by physical characteristics of the soil. (Author's summary) D03

0357

24018 DAHNIYA, M.T. 1984. Evaluation of cassava for leaf and root production in Sierra Leone. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.299-302. Engl., Sum. Engl., 10 Refs. [Faculty of Agriculture, Njala Univ. College, Univ. of Sierra Leone, PMB, Freetown, Sierra Leone, West Africa]

Cassava. Cultivars. Soil physical properties. Harvesting. Productivity. Root productivity. Leaves. Roots. Sierra Leone.

Studies over a 2-yr period in Sierra Leone show that cassava var. Nucass 3 significantly outyielded (25.5 t/ha) the other var. (Nucass 1, Nucass 2, Rocass 1, and Rocass 3) while the local cv., Cocoa, had the lowest production (5.9 t/ha). Cassava var. reacted differently to leaf harvest in terms of root yields. Compared with plants whose leaves were not harvested, there was a total fresh root yield reduction ranging from 22 to 42% when leaves were harvested monthly. (Author's summary) D03

0358

24003 GODO, G.H. 1984. Yield components as influenced by methods of planting cassava cuttings. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.219-224. Engl., Sum. Engl., 7 Refs., Illus. [Office de la Recherche Scientifique et Technique Outre-Mer, D'Adiopodoume, B.P. V51 Abidjan, Ivory Coast]

Cassava. Cuttings. Planting. Spacing. Cultivation. Productivity. Root productivity. Roots. Leaves. Stems. Dry matter. Plant height. Ivory Coast.

Through monthly samplings, the influence of vertical and horizontal planting methods on the expression of total biological yield components of cassava was investigated in a field expt. in Ivory Coast. Horizontal planting resulted in a greater production of roots/plant but yielded as many thick roots as did vertical planting. In turn, vertical planting outyielded horizontal planting with respect to DM of roots, thick roots, leaves, and stems. In small farming systems where no mechanization is involved, vertical planting could be used to obtain greater yields. (Author's summary) D03

0359

23281 LAKSHMI, K.R.; RAMANATHAN, S. 1984. Preharvest forecasting of cassava yield. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.62. Engl.

Cassava. Cultivation. Harvesting. Root productivity. Productivity. Cultivars. Agronomic characters. Statistical analysis. India.

Suitable statistical methodology for forecasting cassava yield, based on biometrical characters as variables, was developed. Variables considered were the length of the main stem, stem girth, leaves retained, and total leaves produced. R^2 values increased with plant age. Variations in yield due to these variables were 61, 55, and 73% for var. M-4 (1 mo. before harvest), H-1687, and H-2304 (both 2 mo. before harvest), resp. (Summary by M. de W.) D03

0360

23256 MOHANKUMAR, B.; PILLAI, N.G. 1984. Evaluation of prod potential of cassava. In Central Tuber Crops Research Institute. Progress Report 1983. Trivandrum, India. p.27. Engl.

Cassava. Cultivars. Production. Root productivity. Cultivation. Cl requirements. Water requirements (plant). Irrigation. Fertilizers. N. India.

The production potential of cassava cv. M-4, H-2304, and H-168 evaluated under rainfed and irrigated conditions and at different f izer combinations in the field using a split plot design with 3 re tions. Supplementary irrigation during drought mo. (ca. 20 mm wate increased root yield by 40.9% over the rainfed crop. Cv. H-2304 and gave better yields than M-4. Root productivity increased with incr levels of combined fertilizers. Root HCN content was reduced by 34. to supplementary irrigation. However, fertilization increased roo content in both rainfed and irrigated conditions. (Summary by M. de W

0361

23283 PRASAD, M. 1984. Effect of planting season on yield of ca cultivars. In Central Tuber Crops Research Institute. Annual Pr Report 1983. Trivandrum, India. p.107. Engl.

Cassava. Cultivation. Planting. Timing. Cultivars. Hybrids. India.

The optimum planting time of cassava under the agroclimatic cond prevailing in Orissa, India, was studied. Planting was done at fortn intervals starting June 1st to mid-Aug. Hybrid cv. H-165, H-226, H- and H-2304 and the local var. Gopalpuram were used. Planting in th wk. of June resulted in the highest yield (15.3 t/ha) and in mid-Aug. lowest (1.2 t/ha). (Summary by M. de W.) D03

0362

23261 RAMANUJAM, T. 1984. Effect of pruning on the production pote of cassava. In Central Tuber Crops Research Institute. Annual Pro Report 1983. Trivandrum, India. p.32. Engl.

Cassava. Cultivars. Leaf area. Pruning. Climatic requirements. Ti Harvesting. Root productivity. Starch content. India.

Cassava cv. H-2304, H-165, and M-4 were pruned during the dry peri maintain the same LAI. By mo. 16 root yield increased significantly (3-fold) in all 3 cv. in comparison with the yield obtained at mo. Starch content in cv. M-4 and H-2304, harvested at mo. 16, did not significantly from that obtained when harvested at mo. 10. (Summary de W.) D03

See also 0306 0311 0314 0327 0329 0335 0339 03
0345 0347 0349 0350 0354 0365 0396 03
0408 0426 0456 0499 0500 0501 0504 05
0506 0507 0508 0509

D04 Postharvest Studies

0363

23740 CABALLERO I., C.; VALVERDE G., E. 1983. Evaluación de métodos para el almacenamiento y conservación posterior a la cosecha de raíces de yuca, cv. Valencia. (Evaluation of different methods for storage and postharvest conservation of roots of cassava cv. Valencia). Agronomía Costarricense 7(1-2):55-61. Span., Sum. Engl., Span., 14 Refs., Illus.

Cassava. Cultivars. Roots. Deterioration. Storage. Post-harvest losses. Post-harvest technology. Moulds. Costa Rica.

Roots of cassava cv. Valencia were assessed during 2 mo. of storage after the following treatments: ambient storage (control), pruning the plants 16 days prior to harvest, cuticular antitranspirant dip, sealed polyethylene bags, storage in moist sawdust or in moss, cold storage, and field clamps. All treatments, except the control, significantly reduced wt. loss at the end of the storage period. Additionally, all treatments except antitranspirant dip significantly reduced the rate of deterioration as compared with the control. Box storage in moist sawdust, followed by storage in moss, cold storage, and polyethylene bags, resp., were considered the best individual storage methods to preserve roots of cv. Valencia, the most important cassava cv. in the Costa Rican market. None of these treatments significantly affected internal root quality of cooked roots during the exptl. period. The primary deterioration of the roots was of physiological nature. Secondary deterioration was caused by microbial rots. *Trichoderma* sp., *Fusarium* sp., *Botryodiplodia* sp., *Rhizopus* sp., *Alternaria* sp., *Penicillium* sp., and some unidentified bacteria were among the microorganisms associated with postharvest deterioration. (Author's summary) D04

0364

23266 PADMAJA, G.; BALAGOPAL, C.; NANDA, S.K. 1984. Post harvest aspects of cassava in relation to spoilage and preservation. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.36-39. Engl., Illus.

Cassava. Deterioration. Moulds. Enzymes. Rhodanese. Linamarase. Cyanides. Thiocyanates. India.

The adaptability of *Rhizopus oryzae* (a fungus associated with postharvest cassava spoilage) to cyanide was studied by growing the organism in media containing 1.0 or 5.0 mM of KCN; the low and high KCN adapted spores were used to study their ability to elaborate rhodanese in media containing 2.0, 3.0, and 4.0 mM of KCN. Low KCN adapted spores released more rhodanese than high KCN adapted spores. Linamarin repressed rhodanese release by *R. oryzae* during its growth phase. (Summary by M. de W.) D04

0365

23263 RAMANUJAM, T.; MOORTHY, S.N. 1984. Time of harvest and maturity index for cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.33. Engl., Illus.

Cassava. Cultivars. Timing. Harvesting. Root productivity. Starch content. Cassava starch. Dry matter. Analysis. India.

Yield, starch determination and physical properties, and bulking rates were studied at different times of harvesting in 8 promising cassava cv. Root no. did not change significantly once the tuberization phase was completed; however, when roots were not harvested for long periods (up to 2 yr) they started to decay. Cassava starch content decreased by 4-8% when harvesting was prolonged beyond 10 mo. A significant positive correlation was observed between DM and the % of determined starch. At mo. 6 the bulking rate was very high (20-36 g/day) in cv. H-165, H-1687, H-226, and CI-59J; a 2nd peak in root bulking was seen between mo. 14-16 for all cv. The mol. wt. of starch did not change with crop age. (Summary by M. de W.) D04

0366

24034 WHEATLEY, C.C.; LOZANO, J.C.; MARRIOTT, J.; SCHWABE, W.W. 1984. Pre-harvest environmental effects on cassava root susceptibility to post-harvest physiological deterioration. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.419-429. Engl., Sum. Engl., 14 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Ecosystems. Climatic requirements. Harvesting. Roots. Deterioration. Storage. Temperature. Dry matter. Cyanogenic glucosides. Enzymes. Analysis Water stress. Pruning. Colombia.

A hypothesis involving preharvest environmental factors is proposed to explain intracultivar variation in susceptibility to physiological deterioration; results of expt. testing this hypothesis are presented. It was demonstrated that the main factors controlling cv. susceptibility to physiological deterioration are environmental: plants defoliated due to severe stresses were more resistant than nondefoliated plants of the same cv. Site and prevailing preharvest environmental conditions also affected the degree of susceptibility. Pruning expt. gave results which closely agreed with the defoliation effects and confirmed reports that preharvest pruning induced resistance to physiological deterioration. Such induced resistance was obtained for at least 9 wk. after pruning and was unaffected by subsequent regenerative growth. A reduction in root DM content occurred following pruning but is not causally related to resistance to physiological deterioration. (Author's summary) D04

See also 0319 0328 0349 0416 0437 0463 0466 0469

E00 PLANT PATHOLOGY

0367

23091 LOZANO, J.C.; JAYASINGHE, U. 1983. Pathological problems of cassava (*Manihot esculenta* Crantz) disseminated by sexual or asexual propagated material. In Sing, K.G., ed. Exotic plant quarantine pests & procedures for introduction of plant materials. Serdang, Selangor, Malaysia, Asean Plant Quarantine Centre and Training Institute. pp.19-23. Engl., 10 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Propagation materials. Cuttings. Seed. *Colletotrichum*. *Diplodia*. *Xanthomonas campestris* pv. *manihotis*. *Xanthomonas campestris* pv. *cassavae*. *Phoma*. *Sphaceloma manihoticola*. *Verticillum*. *Agrobacterium tumefasciens*. *Erwinia carotovora*. Viroses. Colombia.

Cassava pathogens that can be disseminated by the interchange of sexual seeds can be divided into those that infest the seed and those that infect it. *Colletotrichum* spp., *Diplodia* spp., *Phoma* spp., and *Xanthomonas campestris* pv. *manihotis* are included in the former group whereas only *X. campestris* pv. *manihotis* and *Colletotrichum* spp. have been reported as infecting cassava seeds. The symptoms on cassava seeds of infection with

X. campestris pv. manihotis are described. Pathogens disseminated through vegetative planting material can be classified as localized or systemic. The 1st classification includes Agrobacterium tumefasciens, Sphaceloma manihoticola, Colletotrichum spp., Phoma spp., Diplodia manihotis, X. campestris pv. manihotis, Verticillum spp., Erwinia carotovora pv. carotovora, and X. campestris pv. cassavae. Symptoms caused by each one are given. Since systemic pathogens generally do not produce visible symptoms, their identification is impossible; these can be fungal, bacterial, or viral. Different sanitary measures to minimize the risk of dissemination of cassava pathogens through propagation materials are recommended. (Summary by M. de W.) E00

See also 0337 0396 0461 0462 0486 0493

E02 Bacterioses

0368

23093 KIMURA, O. 1979. Caracterizacao isoenzimática de patovares de Xanthomonas campestris (Pammel) Dowson, isolados de mandioca (Manihot esculenta Crantz), por eletroforese de disco em gel de poliacrilamida. (Isoenzymatic characterization of Xanthomonas campestris pathovars, isolated from cassava by polyacrylamide disc gel electrophoresis). Tese Mestrado. Brasil, Universidade de Brasilia. 93p. Port., Sum. Port., Engl., 82 Refs., Illus.

Cassava. Cultivars. Xanthomonas campestris pv. manihotis. Xanthomonas campestris pv. cassavae. Isolation. Identification. Analysis. Brazil.

Disc electrophoretic profiles of total protein, esterase, acid phosphatase, alkaline phosphatase, and glucose-6-phosphate dehydrogenase were determined for 11 isolates of Xanthomonas campestris pv. manihotis and 3 isolates of X. campestris pv. cassavae, in polyacrylamide gel. These profiles permitted the differentiation of a South American isolate from 2 African strains of X. campestris pv. cassavae. The isolates of X. campestris pv. manihotis could be separated into 2 groups with different levels of pathogenicity by analyzing the profiles of acid phosphatase. The similarity in isozymic activity between the South American isolate of X. campestris pv. cassavae and some of the isolates of X. campestris pv. manihotis suggests that the former could be a yellow strain of X. campestris pv. manihotis. Esterase and acid phosphatase were more useful in characterizing the pathovars of X. campestris from cassava than total protein, alkaline phosphatase, or glucose-6-phosphate dehydrogenase. (Author's summary) E02

0369

23746 MARCANO, M.; TRUJILLO, G.; LUCIANI, J.; RONDON, A. 1981. Respuesta de algunos cultivares de yuca (Manihot esculenta Crantz) al añublo bacteriano. (Response of some cassava cultivars to bacterial blight). Agronomía Tropical 31(1-6):237-246. Span., Sum. Span., Engl., 18 Refs., Illus.

Cassava. Cultivars. Inoculation. Xanthomonas campestris pv. manihotis. Resistance. Symptomatology. Venezuela.

At the U. Central de Venezuela, in Maracay, 27 cassava clones from the germplasm banks at the University and at the Centro Nacional de Investigaciones Agropecuarias were evaluated for resistance to bacterial blight (Xanthomonas campestris pv. manihotis). Inoculation was carried out by spraying a bacterial suspension containing 1 x 10^8 cells/ml to 5 or 6 leaves of cassava plants grown from healthy stem cuttings with 4 buds. After inoculation, the plants were placed in a moist chamber for 48 h. Data was taken 8, 15, 30, and 60 days after inoculation. Disease symptoms were rated on a 0-4 scale, in which symptom-free plants were rated 0 and plants showing severe infection with death of more than half of the plants tested, 4. Bacterial blight affected all the studied clones to some extent. The most susceptible clones, rated 3, were: UCV 2062, UCV 2563, UCV 2060, UCV 2161, UCV 2322, UCV 2430, UCV 2221, UCV 2147, UCV 2581, UCV 2112, UCV 2289, UCV 2119, and UCV 2320. Cv. UCV 2368, UCV 2364, UCV 2143, UCV 2291, Branca, M. Ven-32, M. Ven-41, M. Ven-68, M. Col-677, Barinas-1, CMC-308/197, M. Ven-64, and M. Ven-57 were moderately susceptible (rated 2); cv. M. Ven-7 was tolerant (rated 1). (Author's summary) E02

0370

23499 MARTINEZ, A.A.; PRATES, H.S. 1983. A bacteriose da mandioca. (Cassava bacterial blight). Campinas-SP, Brasil, Secretaria de Agricultura e Abastecimento. Coordenadoria de Assistencia Tecnica Integral. Boletim Técnico no.173. 15p. Port., 24 Refs., Illus.

Cassava. Xanthomonas campestris pv. manihotis. Symptomatology. Disease control. Disease transmission. Cuttings. Rotational crops. Brazil.

A brief description is given of the geographic distribution, economic importance, symptomatology, damage, etiology, pathology, favorable conditions, and control measures of CBB caused by Xanthomonas campestris pv. manihotis. Among the control measures discussed are use of resistant var., elimination or reduction of inoculum sources, periodic inspection of the crop, avoidance of planting infected cuttings, and crop rotation for a min. period of 1 yr. (Summary by EDITEC. Trans. by M. de W.) E02

See also 0345 0367 0371 0475

E03 Mycoses

0371

23753 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Pathology. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.99-119. Engl.

Cassava. Cassava programs. Diseases and pathogens. Colletotrichum. Fusarium. Roots. Deterioration. Disease control. Biological control. Xanthomonas campestris pv. manihotis. Sphaceloma manihoticola. Cuttings. Root productivity. Soil fertility. Ecosystems. Climatic requirements. Soil requirements. Colombia.

Seventy-six Colletotrichum isolates were collected from different susceptible clones from 8 localities, and separated into 11 groups based on: conidia morphology, production and acervuli characteristics, mycelial type and color, in vitro production of the sexual stage, and characteristics of the sexual fruiting body. Of these groups, C. gloeosporioides f.s. manihotis, C. gloeosporioides, and C. graminicola were specific to cassava. Six inoculation methods were tested, but the only satisfactory method was the one in which the plant tissue was wounded before conidial spraying. Based on the reaction of 6 differential cassava clones, 2 pathovars were distinguished in C. gloeosporioides f.s. manihotis and 3 in C. gloeosporioides groups. Fusarium solani and F. oxysporum have been isolated from different affected regions and characterized according to phialide and conidial morphology, and cultural characteristics on several differential media. Results of the study on the effect of antholysis disease (mycoplasmal) on yield suggest that in areas where av. temp. are above 27°C the disease might not be of economic importance, but in areas with an av. temp. below 25°C it can be of significant importance. The use of _Pseudomonas putida_ and _P. fluorescens_ and solarization in the control of root rot has been recently investigated with satisfactory results. _P. putida_ has also been used to control CBB caused by _Xanthomonas campestris_ pv. _manihotis_. The selection criteria for cuttings of high quality were evaluated considering sanitary, agronomic, and var. factors. High yields were obtained with cuttings visually selected for absence of disease injury and then treated with fungicides and insecticides. The selection of cuttings according to yield/plant in a given plantation demonstrated that by selecting cuttings from plants with a higher yield than the clonal av. there is a considerable increase in the no. of plants with higher yields than the general clonal av. Cuttings should also be selected from plants grown on the most fertile plots. Clone Secundina showed a continuous yield decrease after 4 consecutive planting cycles with planting material taken from plants which originated from meristem culture. In contrast, the hybrid CM 342-170 showed better yield stability over the same no. of cycles and location. Results of the ecosystem study led to the following conclusions: (1) The presence and severity of diseases and pests were highly dependent on specific climatic and/or edaphic characteristics that restrict them to the ecological zones where they were found. (2) Yield, disease and pest reaction, and no. and quality of cuttings were significantly different between sites for the introduced clones. (3) Nc clones were resistant to the biotic constraints present in more than 2 edaphoclimatic sites. (4) Great variations during the different growing cycles in each location were observed among several clones, although some exhibited yield stability over time. (Summary by M. de W.) E03

0372

23766 NAGAR, R.; SINGH, M.; SANWAL, G.G. 1984. Cell wall degrading enzymes in _Cuscuta reflexa_ and its hosts. Journal of Experimental Botany 35(157):1104-1112. Engl., Sum. Engl., 31 Refs. [Dept. of Biochemistry, Univ. of Lucknow, Lucknow-226 007, India]

Cassava. Mycoses. Enzymes. Analysis. Biochemistry. India.

Pectin degrading, hemicellulose degrading, and cellulose degrading enzymes were studied in _Cuscuta reflexa_, and its susceptible hosts, _Brassica campestris_, _Coccinia indica_, _Datura innoxia_, _Helianthus annuus_, _Holoptelea indica_, _Lantana camara_, _Medicago sativa_, _Manihot esculenta_, _Petunia hybrida_, _Pisum sativum_, _Phaseolus vulgaris_, and _Solanum nigrum_, and the nonsusceptible plants _Ipomoea batata_ and _Solanum tuberosum_. Exo-1,4-beta-D-glucosidase activity was found in _Cuscuta_ but could not be detected in its hosts. Xylanase and cellulase activity of host plants increased while cellobiase activity decreased as a result of infection by the parasite. In cassava, cellulase activity increased from 1.4 ± 0.2 milliunits/mg protein in healthy plants to 3.2 + 0.2 milliunits/mg protein in infected plants. (Author's summary) E03

0373

23275 THANKAPPAN, M. 1984. Control of brown leaf spot disease of cassava through cultural practices. _In_ Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.56-57. Engl.

Cassava. Cultivars. Resistance. Cercosporidium henningsii. Planting. Spacing. Fertilizers. N. P. K. Irrigation. India.

The accessions Ce 451, Ce 673, Ce 216, Ce 667, Ci 160, Ci 373, Ci 140, and Ci 856, identified earlier as resistant to the brown leaf spot disease, and the released cassava var. H-2304, H-1687, H-226, H-165, and H-97 as well as the improved var. M-4 were screened for resistance to Cercosporidium henningsii; the accessions Ci 856, Ci 373, Ci 140, and Ci 160 continued to show a high degree of resistance. Several planting distances (60 x 60, 75 x 75, 90 x 90, 105 x 105, and 120 x 120 cm) and different levels of fertilizers (N and K at 50, 100, 150 and 200, and P at 100 kg/ha) did not have any effect on disease intensity. However, irrigation (10 mm/wk.) had some effect since in irrigated plots the no. of spots/leaf was 23% more than in the nonirrigated plots. (Summary by M. de W.) E03

0374

24026 ZEIGLER, R.S.; LOZANO, J.C.; ALVAREZ, E. 1984. A summary of recent research on the superelongation disease of cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.363-370. Engl., Sum. Engl., 9 Refs. [Inst. des Sciences Agricoles du Burundi, Kisozi, B.P.75, Bujumbura, Burundi]

Cassava. Sphaceloma manihoticola. Taxonomy. Identification. Isolation. Analysis. Plant growth substances. Cultivars. Inoculation. Stems. Resistance. Colombia.

Recent research on pathogen taxonomy, sexual reproduction, host range, and physiology is summarized along with investigations into the nature of superelongation disease resistance. The previously unreported sexual stage of Sphaceloma manihoticola, causal agent of superelongation disease of cassava, is presented as an Elsinoe species (Loculoascomycetes, Myriangiales). Cross-inoculation studies, symptomatology, colony, characteristics, and morphological comparisons among isolates, type specimens, and published descriptions support proposed synonymy of the Elsinoe from cassava with E. jatrophae and E. brasiliensis under the same Elsinoe brasiliensis. S. manihoticola is retained, and S. krugii is combined with S. poinsettiae under the latter name. In vitro production of gibberellin A_4 by the pathogen was demonstrated through combined gas chromatography-mass spectrometry of purified culture extracts. Field-resistant and field-susceptible cv. were treated with different concn. of gibberellin A_4 and inoculated with the pathogen. No difference in response to the hormone was detected between resistant and susceptible cv. when evaluated for change in length and susceptibility. All cv. showed an increase in internode length at 10^3 micrograms/microliter hormone concn., and all showed increased level of disease over control when inoculation followed hormone application. Regardless of field susceptibility, stem tissue of all cv. tested develop resistance to the pathogen after about 8 days. Hormone production appears to confer an advantage to the pathogen by inducing growth and increasing the amount of susceptible juvenile tissue. Disruption of stem cuticle significantly increases the level of disease as measured by no. of lesions, % of susceptible tissue diseased, and no. of diseased internodes. Inoculations of selected cv. of diverse origins and morphology with isolates of diverse origins in all combinations yielded variable, but significant, cv. x isolate interactions suggestive of pathogenic specialization. It is hypothesized that specific host-isolate incompatibility is only part of a complex of resistance mechanisms in field-resistant cv. (Author's summary) E03

See also 0367 0375 0465 0475

E04 Viroses

0375

23430 BARRERA M., N. 1984. Estudios etiológicos y epidemiológicos de la enfermedad de "Et" u hoja acordonada de la yuca, Manihot esculenta Crantz, con énfasis en transmisión por semilla. (Etiological and epidemiological studies of the "Et" disease or cassava shoe stringing, with emphasis on the transmission through botanical seed). Tesis Mag.Sc. Bogotá, Colombia, Pontificia Universidad Javeriana. 91p. Span., Sum. Span., 47 Refs., Illus.

Cassava. Et disease. Diseases and pathogens. Cultivars. Symptomatology. Seed. Cuttings. Temperature. Field experiments. Laboratory experiments. Colombia.

In early 1983 a disturbance not previously recorded in cassava was observed affecting some F_1 progenies of crosses from symptomless parents in the exptl. fields of CIAT's cassava breeding program. The affected plants were scattered over the fields and showed notable narrowing of the folioles (stenophyllous), with leaf elongation giving the appearance of a shoe-string; the foliole showed epinasty, lamina folding, mosaic, and vein thickening. Light microscopy observations allowed the presence of strongly colored (violet, reddish, or purple) cytoplasmic inclusions to be detected in the phloem parenchyma. Ultrathin sections for electron microscopy revealed crystalline cytoplasmic inclusions in the phloem parenchyma, with an ultrastructure of parallel aggregrate lamina. Some dense bodies with filamentous ultrastructure were also observed. In sieve tube cells intranuclear annulis were observed. Disease transmissibility through cuttings (100%) and through sexual seed (0.8%) was verified. When diseased plants were subjected to temp. of 36 and 40°C (night/day, resp.) for 20 days, symptoms did not appear on new leaves until 12 days after the treatment. These, however, reappeared when plants were subjected to temp. below 36°C, indicating the possibility that this disturbance is pathogenic in nature and that viral or virus-like agents may be associated with the disease. (Author's summary. Trans. by L.M.F.) E04

0376

23754 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Virology. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.121-129. Engl., Illus.

Cassava. Cassava programs. Viroses. Cassava Caribbean mosaic virus. Cassava latent virus. Frog skin disease. Cassava common mosaic virus. Inoculation. Identification. Electron microscopy. Analysis. Cultivars. Clones. Root productivity. Colombia.

Selected plants of cassava var. M Col 2063 (Secundina) from yield stability and planting material selection trials were indexed for the Caribbean mosaic disease (CMD). The incidence of CMD was high irrespective of the source of planting material. A virus was mechanically transmitted from cassava plants infected with a symptomless latent disease to Chenopodium quinoa. Large, chlorotic local lesions were produced on C. quinoa 8-10 days after inoculation. Very long, flexuous rod-shaped virus particles were observed with the electron microscope in a partially-purified fraction from infected C. quinoa plants. The virus retained infectivity following several treatments. This disease seems to be widespread in Latin America. Two native and 2 introduced cassava clones, originated from thermotherapy-treated and meristem-cultured plants, were planted in a frog skin disease endemic area and evaluated for 2 or 3 successive growth cycles. The 2nd and 3rd cycle fresh root yield of the native and introduced clones was consistently less than the yield of the 1st cycle plants. The incidence of frog skin disease was generally higher in the later cycles with the exception of the clone CMC 40 which was not affected by the disease. A flexuous, rod-shaped virus isolated from CMD-infected cassava was identified as an isolate of cassava common mosaic virus, based on host range, serological reaction, and the size and shape of the virus particle. With the immunosorbent electron microscope technique the CMD isolate was determined to be serologically related to cassava common mosaic virus, Narcissus mosaic, and potato virus X, all members of the plant potexvirus group. The double antibody sandwich form of ELISA has also been used in the serological detection of cassava common mosaic virus. (Summary by M. de W.) E04

0377

23274 MALATHI, V.G.; NAIR, N.G. 1984. Transmission, identification and serodiagnosis of cassava mosaic disease. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.54-56. Engl., Illus.

Cassava. Cultivars. Cassava African mosaic virus. Inoculation. Aleyrodidae. Isolation. Identification. Electron microscopy. India.

Several indicator hosts were inoculated, using sap transmission, with a preparation of diseased plants of cassava cv. Kalikalan. Only *Nicotiana benthamiana* and *N. glutinosa* showed systemic symptoms. In another expt., 1-mo.-old cuttings of cassava var. H-226 and H-1687 were exposed to viruliferous whiteflies that had been collected from diseased plants in the field; another set of 1-mo.-old cuttings of the same var. were exposed in the field to the proximity of diseased plants for 15-30 days. The plants so treated were planted and grown in a greenhouse; none of the plants showed any symptoms up to 100 days. Two methods were used to purify the CAMV from young expanded cassava leaves of field-diseased plants of var. H-1687 and Kalikalan. With the 1st one, geminate particles were seen under the electron microscope, but could not be detected with the 2nd. (Summary by M. de W.) E04

0378

23278 PALANISWAMI, M.S.; PILLAI, K.S. 1984. Studies on cassava white fly as the vector of CMD. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.59-60. Engl., Illus.

Cassava. *Bemisia*. Vectors. Insect biology. Biological control. Cassava African mosaic virus. Injurious mites. India.

The biology of *Bemisia tabaci* is presented. *Amblysius* sp., *Poecilomyces farinosus*, and *Prospaltella flava* were identified as its natural enemies. The role of the red spider mite, if any, was studied under greenhouse conditions. Mites were fed on infected plants of cassava cv. Kalikalan, then transferred to healthy plants of cv. H-226, and 48 h later killed with dimethoate (0.05%). The plants were observed during 3 mo. but no symptoms were seen. (Summary by M. de W.) E04

0379

23273 SHANTA, P.; THANKAPPAN, M.; NAIR, N.G. 1984. Cassava mosaic disease: epidemiology studies on CMD under different agroclimatic conditions. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.52-54. Engl., Illus.

Cassava. Cultivars. Cassava African mosaic virus. Aleyrodidae. Root productivity. Field experiments. Resistance. Timing. Climatic requirements. Rainfall data. India.

The dissemination of CAMD into cassava crops and within the crop, the relationship of the environment with disease dissemination and whitefly activity, and the difference in yields of healthy and diseased plants under different agroclimatic conditions were studied. Field trials were carried out in the locations of Nagercoil, Trivandrum, Palghat, and Salem in India; var. M-4, H-226, and H-1687 were used for dissemination studies, and var. M-4, H-1687, and Kalikalan for yield studies. Plots in which the within crop dissemination was considered had an inoculum source of 10% of infected plants; plots for the dissemination into the crop had no inoculum. H-226 was more susceptible to field dissemination and harbored more whiteflies than the other 2 var. Kalikalan was also highly susceptible to field dissemination. The % reduction in root yield due to CAMD at mo. 7 was 4.7, 12.6, and 42.6 in M-4, H-1687, and Kalikalan, resp. At mo. 12 there was no reduction in M-4, whereas in H-1687 it was of 20.3%. Yield reduction in infected plants of var. Kalikalan was inversely proportional to the age of the plant when the infection occurred. (Summary by M. de W.) E04

0380

24024 THOUVENEL, J.C.; FARGETTE, D.; FAUQUET, C.; MONSARRAT, A. 1984. Serological diagnostic of African cassava mosaic by immuno-enzymatic method. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.353-356. Engl., Sum. Engl., 7 Refs., Illus. [Laboratoire de Virologie, Office de la Recherche Scientifique et Technique, B.P. V 51, Abidjan, Cote d'Ivoire, West Africa]

Cassava. Cassava African mosaic virus. Analysis. Symptomatology. Identification. Manihot glaziovii. Ivory Coast.

CAMD affects more than 95% of the cassava plants in the Ivory Coast. The suspected causal agent, cassava latent virus, is a geminivirus. It was purified from systematically infected Nicotiana benthamiana An antiserum was prepared by injecting rabbits with the purified virus. Testing of cassava plants by classical serological methods, such as microprecipitin and gel-diffusion precipitin tests, was not possible due to the very low virus level in cassava leaves. It was possible, however, to detect the virus in cassava using ELISA. (Author's summary) E04

0381

19706 VERHOYEN, M. 1983. Les virus des végétaux au Burundi. (Vegetable viruses in Burundi). Tropicultura 1(1):21-22. Fr., Sum. Fr., Engl.

Cassava. Viroses. Burundi.

Viral diseases observed on different plant species (maize, cassava, beans, Japanese plum, potato) on 2 occasions in Burundi are described. Additional inspections are needed and examinations should be conducted in a specialized lab. to perfect virus identifications. Control measures proposed are: true identification of the pathogens, avoidance of diffusion through selection stations, crop rotations, knowledge of vectors and their biology. Priorities will be determined on the basis of the estimations of crop losses. (Author's summary) E04

See also 0305 0367 0399 0463 0465

E05 Mycoplasmoses

See 0371

E06 Nematodes

0382

23725 AFOLAMI, S.O. 1982. Changes in nematode types and population density in the first two years of cocoa establishment. In International Cocoa Research Conference, 8th., Cartagena, Colombia, 1981. Proceedings. Ibadan, Nigeria, Cocoa Research Institute of Nigeria. pp.301-306. Engl., Sum. Engl., Fr., Port., Span., 12 Refs., Illus. [Cocoa Research Inst. of Nigeria, Onigambari, P.M.B. 5244, Ibadan, Nigeria]

Cassava. Cultivation. Cultivation systems. Inter-cropping. Nematodes. Nigeria.

A 1-ha plot freshly cleared for cocoa planting was sampled to determine the nematode types and their population levels. Soil samples were taken from cocoa seedling rhizosphere 3 mo. after transplanting, and subsequently at 2-mo. intervals. Helicotylenchus spp., Meloidogyne spp., Scutellonema spp., Trichodorus sp., Criconemoides limitaneum, Hemicycliophora sp., Hoplolaimus pararobustus, and Xiphinema spp. were recovered in low no. from soil samples taken from the plot prior to cocoa planting. In the 2nd yr of the expt. the nematode population of the soil had changed considerably. Cassava/cocoa plots had the least of all nematode types. (Extracted from author's summary) E06

0383

24029 CAVENESS, F.E. 1984. Cassava storage root yield losses from root-knot nematode (Meloidogyne incognita and M. javanica) parasitism. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.381-385. Engl., Sum. Engl., 21 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivars. Nematodes. Inoculation. Plant height. Root productivity. Productivity. Nigeria.

The root knot nematodes, Meloidogyne incognita race 2 and M. javanica, significantly reduced stem height and wt., and storage root wt. of 2 cassava cv., TMe 30555 and TMe 30572, after a 15.5-mo. growing period in the tropical rain forest zone of southern Nigeria. A slight reduction in mean plant height together with a severe reduction in stem wt. would provide less robust planting cuttings of inferior quality for the next crop. Nematode galls were not observed on storage roots but only on fine feeder roots. At harvest the feeder roots generally remain unseen in the soil and any yield reduction may be attributed to other causes or the problem may pass unnoticed. (Author's summary) E06

0384

23604 HUTTON, D.G.; COATES-BECKFORD, P.L.; EASON-HEATH, S.A.E. 1983. Management of Meloidogyne incognita populations by crop rotation in a small-scale field trial and nematode pathogenic effects on selected cultivars. Nematropica 13(2):153-163. Engl., Sum. Engl., Span., 12 Refs. [Univ. of the West Indies, Dept. of Botany, Mona, Kingston 7, Jamaica]

Cassava. Cultivars. Cultivation systems. Rotational crops. Nematodes. Pest control. Field experiments. Jamaica.

The density of field populations of the root knot nematode, Meloidogyne incognita Race 1, was suppressed and maintained at a low level for 3 yr in a small-scale crop rotation trial. The cropping sequence from mid-Aug. 1978 to early Jan. 1982 was: a 3:1 mixture of red and white sorrel (Hibiscus sabdariffa); a 5-wk. weed fallow; cassava; a 1- and 3-mo. weed and clean fallow, resp.; Chinese cabbage; maize; red kidney beans; a mixed crop of cowpeas and callaloo (Amaranthus viridis); and finally, red sorrel. The density of Pratylenchus sp. increased in cassava and maize rhizosphere soil while those of Helicotylenchus sp. and Rotylenchulus reniformis increased in maize and cowpea rhizosphere soil. Tylenchorhynchus sp. density increased during the cultivation of red kidney beans and callaloo intercropped with cowpeas. Roots of the 1st crop of red sorrel and maize yielded large no. of M. incognita and Pratylenchus sp., resp. In a greenhouse test, M. incognita infested all cv. grown in the field trial but callaloo and white sorrel appeared to be less suitable hosts of the nematode than the other test plants. The root knot nematode adversely affected growth of all greenhouse-grown crops, except cassava. (Author's summary) E06

F00 PEST CONTROL AND ENTOMOLOGY

See 0396 0461 0486 0493

F01 Injurious Insects and their Control

0385

22997 CARPIO, N.; PINO A., J.A. 1981. Estudio preliminar del efecto del daño simulado de la centella (Lonchaea chalybea) sobre los rendimientos de las raíces de yuca (Manihot esculenta). (Preliminary study on the effect of simulated damage of Lonchaea chalybea on cassava root yield). Ciencia y Técnica en la Agricultura: Viandas Tropicales 4(2):91-98. Span., Sum. Span., Engl., 12 Refs.

Cassava. Simulation models. Carpolonchaea chalybea. Cultivars. Plant height. Root productivity. Productivity. Cuttings. Cuba.

The influence of Carpolonchaea chalybea damage on cassava root yield was studied in areas of the Centro de Mejoramiento de Semillas Agámicas, Santo Domingo, Cuba, in 1980. The simulated damage method was used in a randomized block design with 4 replications and 5 treatments. Plant height was reduced for all treatments compared with check plots. Yields decreased in the 30- and 60-day damage treatments, reaching 88.0 and 89.7%, resp., of the check yields. However, the 120- and 180-day damage treatments outyielded check plots (10.67 and 8.96%, resp.). There was a significant yield difference between the 30- and 60-day damage treatments and the 120- and 180-day ones. (Author's summary) F01

0386

23755 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Entomology. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.131-158. Engl., Illus.

Cassava. Cassava programs. Entomology. Cyrtomenus bergi. Sweet cassava. Bitter cassava. Insect control. Cultivation systems. Inter-cropping. Crotalaria. Insecticides. Root productivity. Injurious mites. Cultivars. Resistance. Biological control. Predators and parasites. Insect biology. Phenacoccus. Pest damage. Erinnyis ello. Simulation models. Aleurotrachelus socialis. Pests. Colombia.

Studies suggest that a relationship between soil moisture and Cyrtomenus bergi populations might exist; results also showed that the insect prefers sweet and low HCN var. and that the use of high HCN var. as a border around fields of sweet var. would not be an effective control measure. Intercropping with Crotalaria was considerably more effective in controlling the insect than the use of dimethoate (61.2, 30.0, and 3.7% of root damage for monocropped nontreated and treated, and intercropped cassava, resp.). Intercropping with Crotalaria, however, reduced yields considerably (29.9 t/ha) compared with cassava in monoculture (38.4 t/ha). Several intercropping designs will be tested to see if cassava yields can be increased while controlling C. bergi. Research on mite control emphasized the use of resistant var. and natural enemies. In the Valle del Cauca, Colombia, 12 species of Phytoseiid mites feeding on the cassava mite complex were identified, represented by the genera: Typhlodromalus, Amblyseius, Galendromus, Neoseiulus, and Tryphlodromips. The life cycles of Typhlodromalus limonicus and Neoseiulus anonymus, the most frequently identified species on cassava mites in the Valle, were studied. Studies were also carried out to assess yield losses due to Phenacoccus and the influence of plant age on its infestation and dispersion. Life cycle studies showed that greenhouse screening is not effective since those var. displaying greenhouse resistance were not actually resistant to mealybugs in the field. Mealybug toxin studies indicated that if an insect toxin is involved in plant damage, it is not translocated upward to the apical buds. The possibility that the toxin is localized to the immediate area of insect feeding was not, however, eliminated. Anagyrus insolitus and A. putonophilus, and Apoanagyrus elgeri, hymenopteran parasites of the family Encyrtidae, were identified as natural enemies of the cassava mealybug. The life cycle of another parasite, Epidinocarsis diversicornis (= Apoanagyrus diversicornis), was studied and expt. were conducted to identify an adequate diet for sustaining large no. of parasite adults. The most preferred hosts were determined to be the 3rd instar females and adult females and the least preferred, 2nd instar males and male cocoons. Damage by the cassava hornworm (Erinnyis ello) was simulated by removing 100% of the foliage at different periods. On fertile soils the av. yield loss was 12.7 and 31.6% and on poor soils, 32.2 and 49.5% for 1 or 2 defoliations, resp. Resistance to Aleurotrachelus socialis was evaluated on 21 cassava clones. Although adult populations were high on resistant clones, pupal development was reduced and plants were not severely damaged. Susceptible var. displayed both higher pupal counts and severe damage symptoms, indicating that some mechanism of resistance or tolerance is present in the selected clones. Studies initiated to determine the yield reduction caused by Lagochirus araneiformis indicate that although it may occasionally cause localized damage, it is not a serious pest of cassava. A total of 31 clones were evaluated on the North Coast of Colombia for termite resistance. Clones grown by farmers on the coast had the lowest termite damage to the roots (0.5%), whereas the regional high-alt. var. had the highest (8.8%). The insect and mite complex on cassava at CIAT has been measured for 4 crop cycles, using 4 var.: CMC 40, M Col 113, M Col 22, and M Col 1684. The major pests that attacked these var. throughout the 1984 growing cycle were mites, thrips, and mealybugs; some lace bug damage was also observed. Thrip damage was the major cause of yield reductions in CMC 40, M Col 22, and M Col 1684, but not in M Col 113. (Summary by M. de W.) F01

0387

23182 GOLOB, P.; HODGES, R.J. 1984. An outbreak of Prostephanus truncatus (Horn), the larger grain borer, in Tanzania. In International Congress of Plant Protection, 10th., Brighton, England, 1983. Proceedings of a Conference. Croydon, England, British Crop Protection Council. p.1102. Engl., 2 Refs. [Storage Dept., Tropical Development & Research Inst., Slough, England]

Cassava. Prostephanus truncatus. Injurious insects. Storage. Tanzania.

Prostephanus truncatus was recorded from stored maize and cassava in the Tabora region of Tanzania in 1980. The beetle was widely distributed in the region, but was absent from most sorghum-growing areas. Up to 70% of maize grain was damaged. Apart from maize, only cassava was consistently infested, but wooden storage structures, clothing, and cooking utensils showed signs of boring. (Summary by Review of Applied Entomology) F01

See also 0378 0390 0399 0431 0465 0475 0476 0502

F03 Injurious Mites and their Control

0388

23729 EL-BANHAWY, E.M. 1984. Description of some phytoseiid mites from Brazil (Acarina: Phytoseiidae). Acarologia 25(2):125-144. Engl., Sum. Engl., Fr., 50 Refs., Ilus. [Laboratory of Plant Protection, National Research Centre, Dokki-Cairo, Egypt]

Cassava. Injurious mites. Biological control. Predators and parasites. Entomology. Brazil.

Ten new species of phytoseiid mites (7 in the genus Amblyseius Berlese, 1 in the genus Typhlodromus Scheuten, and 2 in the genus Phytoseius Ribaga), collected from the Sooretama natural reserve in eastern Brazil, are described. A. ipomeai (Narayanan, Kour & Ghai) comb. nov. is recorded for the 1st time and T. regularis (De Leon) is redescribed. (Author's summary) F03

0389

23477 LAL, S.S.; HRISHI, N. 1983. Effect of mite infestations and leaf fall on tuber yield in certain cassava cultivars. Madras Agricultural Journal 70(4):269-271. Engl., 4 Refs. [Indian Agricultural Research Inst., Regional Station, Kalyanpur, Kanpur-24, India]

Cassava. Cultivars. Injurious mites. Tetranychus neocaledonicus. Eutetranychus orientalis. Root productivity. Leaves. Resistance. India.

Fifty-one cassava cv. were observed in the field for response to infestation by Tetranychus neocaledonicus and Eutetranychus orientalis. Although no cv. showed complete resistance to mite infestation, 5 cv. (CE 140, CE 171, CE 191, CI 175, and CI 574) were found to be the least susceptible and preferred by both mites. A positive correlation coefficient was obtained between roots harvested at 10 mo. after planting and leaves/plant. (Summary by M. de W.) F03

0390

22072 LAL, S.S. 1982. Influence of weather factors on the population of spider mites (Acari: Tetranychidae) and thrip (Thysanoptera) on cassava in Kerala. Indian Journal of Acarology 7(1):5-10. Engl., Sum. Engl., 15 Refs., Illus. [Central Tuber Crops Research Inst., Trivandrum 695017, India]

Cassava. Cultivars. Temperature. Water requirements (plant). Rainfall data. Climatic requirements. Tetranychus neocaledonicus. Tetranychus cinnabarinus. Eutetranychus orientalis. Thrips. India.

An ecological study of the influence of max. and min. temp., humidity, and rainfall on the population of Tetranychus neocaledonicus and T. cinnabarinus, Eutetranychus orientalis, and the thrip Retithrips syriacus on cassava was carried out at Trivandrum (Kerala, India) for 2 yr (1976-78). The spider mite and the thrip populations were low or absent between June-Dec. and thereafter increased suddenly. The peak infestation period was from Jan.-April. The increase in population of the spider mites as well as the thrip was significantly correlated with decrease in humidity, but not with increase in max. or min. temp., or rainfall. (Author's summary) F03

0391

23464 PENA, J.E.; WADDILL, V.H.; O'HAIR, S.K. 1984. Mites attacking cassava in southern Florida: damage descriptions and density estimate methods. Florida Entomologist 67(1):141-146. Engl., Sum. Engl., Span., 5 Refs., Illus. [Univ. of Florida, Inst. of Food & Agriculture Sciences, Agricultural Research & Educational Center, 18905 S.W. 280 St., Homestead, FL 33031, USA]

Cassava. Mononychellus caribbeanae. Tetranychus urticae. Panonychus citri. Pest damage. Symptomatology. Statistical analysis. USA.

Mononychellus caribbeanae, Tetranychus urticae, and Panonychus citri were collected from cassava leaves. Distribution of the mite species on 3 areas of leaves was assessed. M. caribbeanae was observed mainly on the upper leaves, with a virus-like damage pattern. T. urticae and P. citri were observed on the lower leaves causing stippling and leaf browning. The no. of mites attacking the plant was correlated with a visual damage rating. Three times more damage was observed for M. caribbeanae than for T. urticae and P. citri. (Author's summary) F03

0392

23277 PILLAI, K.S.; PALANISWAMI, M.S. 1984. Evaluation of cultivars resistant to spider mites. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.56-59. Engl., Illus.

Cassava. Cultivars. Injurious mites. Resistance. Selection. Irrigation. Fertilizers. India.

Observations over 3 yr of 24 cassava entries tested under field conditions showed that cv. CE-2, CE-4, CE-14, CE-38, CE-81, and CE-139 are fairly resistant to spider mites, with mite populations of 26-59 mites/leaf and leaf fall of only 3-11% against 20-54% in susceptible var. Var. M-4 and H-2304 were screened for mite resistance under rainfed and irrigated conditions. Mite populations were between 350-455 mites/leaf in the nonirrigated plots. Fertilizer application did not have a significant effect on mite population. (Summary by M. de W.) F03

0393

23276 PILLAI, K.S.; PALANISWAMY, M.S. 1984. Integrated pest management on cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.57-58. Engl., Illus.

Cassava. Cultivars. Injurious mites. Mite control. Root productivity. Productivity. India.

Cassava cv. H-230 was subjected to different treatments: spraying of water, dimethoate 0.05%, or urea; the combination of the former 3; plant spacing of 60 cm; and N at 150 and 200 kg/ha. All treatments, except for the spacing and the increase in N application, were very effective in reducing the spider mite infestation and therefore in increasing yields. The economic threshold of spider mite damage was also assessed in var. H-2304, H-1687, and M-4. At 10% leaf infestation there was no marked yield loss, while at 25% infestation yield losses were 18, 11.5, and 8.8% in H-2304, M-4, and H-1687, resp. Mite control recommendations are given based on these results. (Summary by M. de W.) F03

0394

23465 VILLAMAYOR JUNIOR, F.G.; DESTRIZA, T.T. 1983. Simulation of mite damage in cassava through defoliation and its effect on yield. Radix 5(1):1-2. Engl., 1 Ref. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Baybay, Leyte, Philippines]

Cassava. Injurious mites. Defoliation. Simulation models. Root productivity. Philippines.

Cassava cv. Golden Yellow was defoliated by 0, 25, 50, or 75% at 3-6 mo. after planting. The reduction in yield and root no. was greatest at 3 mo. after planting, producing a mean yield of 3.54 kg/plant compared with 4.92 kg for undefoliated plants. The results are interpreted in terms of defoliation caused by mite damage, and possible control measures are suggested. (Summary by Field Crop Abstracts) F03

0395

24025 YASEEN, M. 1984. Investigations on the biology and ecology of Oligota minuta Cam. (Coleoptera: Staphylinidae) a predator of Mononychellus tanajoa (Bondar) (Acari: Tetranychidae) in the Neotropics. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.357-361. Engl., Sum. Engl., 10 Refs. [Commonwealth Inst. of Biological Control, Curepe, Trinidad, West Indies]

Cassava. Mononychellus tanajoa. Biological control. Predators and parasites. Insect biology. Trinidad and Tobago.

The biology of Oligota minuta was studied as part of an investigation seeking to find and evaluate predators of Mononychellus tanajoa. The egg, larval, and pupal stages last 2.0-3.0, 9.0-10.5, and 4.0-5.0 days, resp., at a temp. of 26.8 ± 2.2°C. It is adapted to feed on mites infesting cassava. Larvae and adults both feed on eggs and active mite stages. The species survives periods of low host density on cassava by moving on to other hosts; its attributes make it a promising predator for trial introduction against the mite in Africa. (Author's summary) F03

See also 0378 0386 0403 0463 0465 0475 0502

G00 GENETICS AND PLANT BREEDING

See 0493

0396

23192 BYRNE, D. 1984. Breeding cassava. In Janick, J., ed. Plant breeding reviews. Westport, Connecticut, AVI Publishing. v.2,pp.73-134. Engl., Sum. Engl., 196 Refs., Illus.

Cassava. Uses. Cultivation. Productivity. Plant anatomy. Plant breeding. Flowers. Plant fertility. Pollination. Seed. Germination. Storage. Germplasm. History. Plant geography. Maps. Manihot. Agronomic characters. Genetics. Cytogenetics. Propagation. Ecosystems. Dry matter. Starch content. HCN content. Selection. Deterioration. Protein content. Water stress. Nutritional requirements. Temperature. Light. Resistance. Pests. Crossbreeding. Backcrossing. Mutation. Tissue culture.

A detailed literature review of cassava breeding is presented. A description of the plant is given, with particular reference to the anatomical aspects related to breeding, its uses and origin. Germplasm resources are indicated; cytogenetics and genetics, breeding programs and approaches, edaphoclimatic zones, agronomic (yield, quality, and plant architecture) and adaptation traits (moisture and soil nutrient stress, temp. and photoperiod, and host plant resistance) are discussed in detail. It is suggested that a standardized system is essential for the evaluation of the diverse Manihot germplasm in defined edaphoclimatic zones, supported by rapid recording and cataloging procedures. (Summary by M. de W.) G01

0397

23749 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Cassava varietal improvement in Asia. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.15-31. Engl., Illus.

Cassava. Cassava programs. Cultivars. Germplasm. Seed. Selection. Plant breeding. Clones. Thailand. Philippines. Malaysia. Indonesia. India. Taiwan. People's Republic of China.

In April 1983 a branch of CIAT's Cassava Program was established in Bangkok, Thailand, to help Asian national cassava programs utilize CIAT technology more directly; CIAT's main involvement is in germplasm utilization and development, training, and communications. Sexual seeds have been the major means of germplasm transfer, and during the last 10 yr more than 100.000 hybrid seeds from approx. 1800 crosses have been distributed to cassava breeding programs in Thailand, Indonesia, Philippines, China, Malaysia, India, Vietnam, and Republic of China (Taiwan). In Thailand CIAT germplasm has been effectively evaluated and used, and in Malaysia proper evaluation has been made. In the Philippines, cassava production has increased. Due to limited resources Indonesia is struggling to achieve a scheme of germplasm evaluation and utilization that satisfies national needs. India is not interested in CIAT germplasm due to its lack of mosaic resistance. Finally, in China lowland materials are being tested in subtropical climates. Tables and figures of results of yield trials of different clones and countries are included. (Summary by M. de W.) G01

0398

23756 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Germplasm development. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.159-195. Engl., Illus.

Cassava. Cassava programs. Germplasm. Clones. Hybrids. Selection. Plant breeding. Ecosystems. Climatic requirements. Germination. Water stress.

Root productivity. Resistance. Injurious insects. Injurious mites. Diseases and pathogens. Dry matter. Cultivars. Colombia.

During 1984 CIAT signed an agreement with the International Board for Plant Genetic Resources which officially assigns responsibility to CIAT for conservation of cassava germplasm in Latin America. New collections were introduced from Costa Rica, Guatemala, Panama, and the Philippines, bringing the total no. of accessions in the collection to 3680. The entire collection continues to be maintained in the field, while at the same time the in vitro conservation of all accessions nears completion. Research emphasis has been given to hybridization and selection to produce improved cassava clones. Segregating populations are produced for those programs with the capability of managing seeds; clones that have direct potential as new var. or as parental material for use by national programs are selected. Research carried out and breeding strategies in each edaphoclimatic zone (ECZ) are indicated. Highest priority for breeding is given to ECZ I (lowland tropics, low to moderate rainfall, and long dry season) since an estimated 40% of the world's cassava is grown under these conditions; clones have been tested for germination, drought tolerance, and yield. In ECZ II (lowland tropics, moderate to high rainfall, and savanna vegetation on acid soils), the major problems for cassava production are a complex of diseases during the rainy season and a complex of mites and insects during the long dry season. Therefore, trials have been oriented to the evaluation of new clones over several years of changing pest and disease pressures. In ECZ III (lowland tropics, high rainfall, and humid rain forest vegetation), preliminary preharvest observations suggest that ECZ II-selected clones may have the best chance of good performance here. No breeding population is developed specifically for ECZ IV (medium alt. tropics) because it is of relatively low priority for cassava improvement. However, as CIAT's headquarters are located within ECZ IV, all materials from all breeding populations are maintained and evaluated there. In ECZ V (highland tropics) a separate gene pool is being developed; major constraints are low temp. and Phoma leaf spot. CIAT cannot select directly for the conditions of fluctuating photoperiod and low winter temp. of ECZ VI (subtropics) since no part of Colombia extends to this zone. A collaborative program of germplasm evaluation in the subtropics was established with Cuba in which several hundred clones were shipped in vitro and are presently under multiplication. A simple select/reject evaluation procedure for root DM selection was developed based on the relationship between root specific gravity and DM content. A trial to study the contribution of the dry season drought stress and mite attacks to the reduction of yield and root quality was set in Urumitas, Guajira, a semiarid zone of NE Colombia. Conclusions are: (1) Selection of individual clones with superior performance over a range of water deficit and mite damage levels is feasible. (2) The interaction between effects of water stress and mite attack stress was small. (3) Under conditions of extended drought, early root bulking as an escape mechanism appears to be very effective. Materials included and results of regional trials, a collaborative effort between CIAT and the Instituto Colombiano Agropecuario, are summarized for ECZs I, II, IV, and V. (Summary by M. de W.) G01

0399

23757 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Tissue culture. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.197-217. Engl., Illus.

Cassava. Cassava programs. Germplasm. Tissue culture. Apical meristems. Temperature. Disease control. Manihot. Analysis. Biochemistry. Agronomic characters. Plant anatomy. Roots. Leaves. Petioles. Plant height. Root productivity. Harvest index. Culture media. Colombia.

A total of 221 clones were cleaned by meristem culture in 1984. Attempts to clean up several segregating lines of the so-called ET syndrome by thermotherapy (low or high temp.) followed by meristem-tip culture continued to give negative results. Also, in 1984, 638 cassava clones were sent in vitro to 21 countries and 240 were introduced to CIAT. Embryo germination and plant development was achieved in 10 wild Manihot species. The no. of cassava clones placed into in vitro storage has reached 2155, in other words 58% of CIAT's current collection. Phenotypic stability of clones retrieved from liquid N is being evaluated using morphological, agronomic, and biochemical criteria. Cassava clones M Mex 20, M Col 650, M Col 2497, CM 305-38, and CM 323-375 were retrieved from min. growth storage after 42, 12, 18, 30, and 30 mo., resp. Except for a change in the color of root epidermis and cortex in M Mex 20, no other changes resulted from in vitro storage in any of the morphological and agronomic characters evaluated. Only clones M Mex 20 and M Col 650 showed an increase in yield. However, all clones showed a higher HI as a consequence of in vitro storage. Ten cassava clones and 1 wild Manihot species have been used successfully for protoplast isolation and culture expt.; techniques and culture media are indicated. Research on somatic embryogenesis of cassava was initiated based on the results of researchers at the School of Biological Sciences, U. of Bath, U.K. After obtaining embryogenic cultures, continuous proliferation of the secondary embryos was established. Somatic embryogenesis of different cassava var. has been studied and the regenerated plants have been morphologically analyzed to ascertain whether or not they are true to type. (Summary by M. de W.) G01

0400

23250 EASWARI AMMA, C.S.; ABRAHAM, K.; LAKSHMI, K.R. 1984. Exploitation of hybrid vigour in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.14-16. Engl., Illus.

Cassava. Plant breeding. Genetics. Selfing. Pollination. Agronomic characters. Pollen. Fruits. Plant fertility. Selection. India.

The effect of selfing on leaf and root characters of 16 SI lines of cassava was studied and compared with open pollinated progenies. Significant var. variation was observed for inbreeding effects on most of the characters studied. Based on plant type, yield, cooking quality, and fruit and seed set, 112 SI lines were selected for further studies. (Summary by M. de W.) G01

0401

23077 GULICK, P.; HERSHEY, C.; ESQUINAS A., J. 1983. Genetic resources of cassava and wild relatives. Rome, Italy, International Board for Plant Genetic Resources. AGPG:IBPGR/82/111. 60p. Engl., 14 Refs., Illus. [International Board for Plant Genetic Resources, Secretariat, Via delle Terme di Caracalla, 00100 Rome, Italy]

Cassava. Germplasm. Manihot. Cultivars. Plant geography. Maps. History. Nutritive value. Quarantine measures. Plant anatomy. Developmental stages. Composition. Leaves. Inflorescences. Fruits. Roots. Cortex. Harvest index. Fibre content. Dry matter. HCN content. Seed. Climatic requirements. Water stress. pH. Salinity. P. Pests. Resistance. Cytogenetics. Argentina. Brazil. Colombia. Costa Rica. Cuba. India. Indonesia. Mexico. Nigeria. Peru. Philippines. Thailand. Venezuela. Zaire.

The International Board for Plant Genetic Resources (IBPGR) sponsored 2 complementary working groups on cassava: the 1st in 1981 at CIAT, Colombia, and the 2nd in 1982 at IBPGR headquarters in Rome. Their objectives were to: review the major existing collections of cassava; identify priorities for collection; advise on known genetic erosion, collection procedures, storage and maintenance procedures, and potential depositories for international designation by IBPGR; identify quarantine problems affecting the transfer of material; and agree on a list of descriptors. Areas of priority and strategies for the collection of cassava and wild Manihot spp. in their center of diversity were also more clearly defined. Major world programs that have cassava germplasm collections are described, namely, those of the Empresa Brasileira de Pesquisa Agropecuária (Brazil), CIAT, International Institute of Tropical Agriculture (Nigeria), and SE Asia. Major features of cassava collections in various countries are listed. Recommendations of the working groups on the maintenance of cassava germplasm collections and on the transfer of cassava material are given. A comprehensive descriptor list for cassava that covers data on accession, collection, site, and the plant is included. (Summary by EDITEC. Trans. by L.M.F.) G01

0402

24019 HERSHEY, C.H. 1984. Breeding cassava for adaptation to stress conditions: development of a methodology. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.303-314. Engl., Sum. Engl., 7 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Climatic requirements. Temperature. Photoperiod. Soil water. Water requirements (plant). Soil physical properties. Injurious insects. Injurious mites. Diseases and pathogens. Germplasm. Resistance. Selection. Plant breeding. Hybrids. Colombia.

A description is given of CIAT's cassava breeding program, designed to exploit the adaptation of cassava to various physical and biological stress factors by selection over a range of moderate to high stress environments. The selection environments are described and a decentralized breeding methodology is outlined. (Extracted from author's summary) G01

0403

23246 JOS, J.S.; NAIR, R.B.; SREEKUMARI, M.T.; SHANTA, P.; PILLAI, K.S.; LEKSHMI, K.R. 1984. Collection, evaluation and maintenance of germplasm of cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.11-12. Engl.

Cassava. Germplasm. Plant breeding. Selection. Agronomic characters. Injurious mites. Resistance. India.

A total of 188, 238, and 243 cassava clones were screened for petiole and internodal lengths, and for rind thickness, resp. In the 1st 2, variations of 21.0-46.4 and 0.7-0.3 cm, resp., were recorded. The rind contributed between 9-24% to root wt. Screening for spider mite resistance was also carried out in 430 clones; above 50% were highly susceptible and the rest showed several degrees of resistance. (Summary by M. de W.) G01

0404

24020 LOZANO, J.C.; HERSHEY, C.H.; BELLOTTI, A. 1984. A comprehensive breeding approach to pest and disease problems of cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.315-320. Engl., Sum. Engl., 14 Refs., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Plant geography. History. Ecosystems. Injurious insects. Injurious mites. Diseases and pathogens. Resistance. Clones. Productivity. Selection. Colombia.

The relationship of edaphoclimatic characteristics to cassava genotypes and their pests and diseases is discussed. The stability of genotypes on an ecosystem basis and in relation to their resistance to biotic factors as well as to growers' socioeconomic needs and priorities are also discussed. On the basis of these, an improvement program is suggested which integrates several parameters of evaluation. (Author's summary) G01

0405

23282 NASKAR, S.K. 1984. Introduction, phytosanitary screening and evaluation of exotic germplasm of cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.106-107. Engl.

Cassava. Germplasm. Cultivars. Selection. Productivity. Propagation. Hybrids. Seed. India.

Trials to screen cassava accessions from Nigeria, Uganda, Madagascar, and the Philippines for yield potential are being carried out. Other set of var. from Nigeria are under phytosanitary screening and multiplication. Hybrid seeds of 21 accessions from Nigeria were sown in nursery plots and the germination recorded was very good. The seedlings had been transplanted into polyethylene bags and are under observation. (Summary by M. de W.) G01

0406

23247 NAYAR, G.G.; NAIR, R.B.; RAJENDRAN, P.G.; EASWARI AMMA, C.S. 1984. Genetic improvement of cassava for yield and quality. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.12. Engl.

Cassava. Selection. Hybrids. Ecosystems. Root productivity. Starch content. India.

The yield and root quality of hybrid populations of cassava during 1978-79-80 were evaluated. Based on yield performance, 472 hybrid lines were selected from 1235 hybrid seedlings of elite parents for further studies. The cross H-165 x M-4 gave the highest yield. Promising hybrids were also selected on the basis of early maturation. (Summary by M. de W.) G01

0407

23249 RAJENDRAN, P.G. 1984. Estimation of gene systems governing yield and its component attributes in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.13-14. Engl.

Cassava. Plant breeding. Genetics. Crossbreeding. Backcrossing. Selfing. India.

A study based on line x tester analysis was initiated. Lines used were H-2304, CI 700, CI 699, and CE 22, and testers were CE 380, CI 152, CI 572, CI 13, and M-4. A chimera was identified in CI 699 showing variegated character and was designated as CI 699 A. Crosses were made between the isogenic lines and among 2 other normal plants and the variegated mutant. All F1 seedlings were selfed and backcrossed to the chimera plant for further studies. On the other hand, the cross CI 699 x CI 572 showed simultaneous branching and flowering at 3 mo. of age. (Summary by M. de W.) G01

0408

23248 RAJENDRAN, P.G.; UNNIKRISHNAN, M.; LEKSHMI, K.R. 1984. Estimation of stability parameters for yield and yield components in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.13. Engl.

Cassava. Plant breeding. Hybrids. Root productivity. India.

To compare the phenotypic stability and adaptability of 25 cassava hybrids under diverse environmental conditions, their performance was assessed in 6 locations in Kerala, India. Av. root yields ranged from 1.1 to 2.2 kg/plant. Over all locations hybrid 123/74 gave the highest yields, and at Chokkad Center, the av. root yield of all hybrids was the highest. Starch content was higher in hybrids H-1172, H-242, H-123, and H-21/77. Released hybrids H-97, H-226, H-2304, and H-1687 consistently gave good yields at all the locations tested. (Summary by M. de W.) G01

0409

23180 SOENARJO, R.; WARGIONO, J. 1977. Seven years research on varietal improvement of root and tuber crops. Bogor, Indonesia, Central Research Institute for Agriculture. 19p. Indon., Sum. Engl., Indon., 39 Refs.

Paper presented at the Symposium I Peranan Hasil Penelitian Padi dan Palawija dalam Pembangunan Pertanian, Maros, 1977.

Cassava. Plant breeding. Xanthomonas campestris pv. manihotis. Tetranychus urticae. Cercosporidium henningsii. Clones. Resistance. Productivity. Indonesia.

The main objective of the breeding program at the Central Research Institute for Agriculture (CRIA) in Indonesia is the development of new improved clones of cassava and sweet potato, major root crops in the country. Cassava clones should be early maturing, have high yield potential and desirable quality, and be resistant to major diseases and pests such as CBB (Xanthomonas campestris pv. manihotis), brown leaf spot (Cercosporidium henningsii), and the red spider mite (Tetranychus bimaculatus). Promising cassava clones obtained during the past 7 yr of research are W-1166, W-78, W-236, W-1435, W-1548, W-1705, X-42, X-981, X-396, V-629, No. 806, and No. 817. The possibility of improving cassava yield/unit area and per growing season appears to be more feasible than for sweet potato; however, the prospect of improving the quality of the sweet potato is better. Major constaints to research on root crops at CRIA are the lack of qualified personnel and of adequate facilities. (Extracted from author's summary) G01

0410

23251 SREEKUMARI, M.T.; NAYAR, G.G.; NASKAR, S.K. 1984. Breeding for shade tolerance in cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.16. Engl.

Cassava. Cultivation systems. Intercropping. Shading. Resistance. Selection. Cultivars. India.

Thirty-five cassava accessions were selected to evaluate their performance under coconut shade; of 12 profusely branching var., 9 showed compact branching under shade. Leaves were very thin and the no. of stomata/unit area ranged from 31 to 58. To screen for shade-tolerant lines from seedling stage onwards, 400 cassava seeds were sown under coconut shade; seed germination was 95% and the seedlings established well in the field. From 185 seedlings grown under partial shade during 1982, 48 were selected for 1st clonal evaluation. (Summary by M. de W.) G01

See also 0312 0316 0327 0328 0330 0411 0456 0461 0462 0463 0465 0486

G02 Cytogenetics

0411

23252 JOS, J.S.; BAI, K.V. 1984. Cytogenetics of cassava. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.16-17. Engl.

Cassava. Chromosomes. Cytogenetics. Seed. Roots. Root productivity. Cortex. Dry matter. Starch content. Pollen. Clones. India.

In crosses of diploid OP-4 and tetraploids H-1857, H-2304, and S-300 the % of seed set and viability were 23.20 and 33.08, 17.90 and 75.66, and 5.50 and 80.00, resp. Fourteen plants were cytologically identified as triploids. Root characteristics were studied in 13 triploid and 2 diploid seedlings; yield ranged between 1.00-3.90 kg/plant, and rind thickness from 13.00 to 18.50%. When compared with 2 diploids (control), triploids showed higher DM content; however, starch content was the same in both groups of plants. A new technique to simulate clonal yield in seedlings is presented and the detection of white pollen in one cassava plant is reported. (Summary by M. de W.) G02

See also 0396

H00 NUTRITION

See 0461

H01 Cassava Foods and Nutritive Value

0412

23088 CARRIZALES, V. 1984. Evolución histórica de la tecnología del cazabe. (Historic evolution of casave's technology). Interciencia 9(4):206-213. Span., 38 Refs., Illus. [Centro de Investigaciones del Estado para la Producción Experimental Agroindustrial, Apartado 100, San Felipe, Edo. Yaracuy, Venezuela]

Cassava. History. Plant geography. Casave. Processing. Peeling. Washing. Rasping. Pressing. Screening. Cooking. Drying. Packaging. Uses. Venezuela.

Theories on the origin of cassava and its repercussion on the technology developed by the aborigines (Arawakans and Caribans) for the elaboration of casave are reviewed. The current situation and geographical distribution of this technology, and the improvements that have been made, are indicated. The tools used, and the effect of the existing vegetation on their creation, are described. Some uses given to casave in Venezuela are mentioned. Illustrations are included. (Summary by M. de W.) H01

0413

23760 CARVALHO, L.E. 1983. Estudo sobre a viabilidade de uma farinha mista de mandioca e soja: características físicas, químicas, sensoriais e economicas da mistura. (Study on the feasibility of a composite flour of cassava and soybean: physical, chemical, sensorial, and economic characteristics of the mixture). Tese Mag.Sc. Campinas-SP, Brasil, Universidade Estadual de Campinas. 140p. Port., Sum. Port., Engl., 142 Refs., Illus.

Cassava. Cassava flour. Composite flours. Soybean flour. Processing. Analysis. Composition. Food energy. Water content. Protein content. Fat content. Organoleptic examination. Particle size. Prices. Economics. Brazil.

A simplified process was developed for increasing the protein content of CF through the addition of defatted soybean flour, resulting in a final product that matches the availability, price, nutritive value, and acceptability of cereals. The simple mechanical blending of cassava and soybean flours, in a ratio of 80:20, results in a stable and homogeneous mixture, despite harsh moving and transporting conditions. The acceptability of samples, in which the soybean content varied from 0 to 20%, was highly positive according to the results obtained with organoleptical tests in Campinas, Salvador, and a rural community in NE Brazil. When 20% defatted soybean flour was added, protein content increased from about 1.5 to 11.2%. The availability and the production potential of both flours in Brazil and worldwide, in addition to the acceptability of the product, implies that the composite flour really emerges as an alternative for cereal flours. (Extracted from author's summary) H01

0414

23242 DEBOER, W.R. 1975. Pruebas arqueológicas del cultivo de la yuca: una nota de advertencia. (Archaeological evidences of cassava cultivation: a warning). Amazonía Peruana 4(8):39-59. Span., Sum. Engl., Fr., Germ., 73 Refs., Illus.

Cassava. History. Processing. Cassava bread. Cassava flour. Maize. Rasping. Cooking. Fermentation. South America. Caribbean. Central America.

In the humid tropics of the Americas, where preservation of plant material is unlikely, archaeological evidence for cassava cultivation largely consists of artifacts associated with cassava cultivation in the ethnographic record and which, by analogy, were similarly used in the prehistoric past. The validity of this inference by analogy is examined in terms of ceramic platters and stone grater teeth, 2 of the most commonly cited evidences for cassava cultivation. (Author's summary) H01

0415

22773 EL-DASH, A.A. 1983. Brazil's composite flour program in perspective. New York, United Nations Industrial Development Organization. 44p. Engl., 13 Refs., Illus.

Paper presented for the Joint FAO/ECA Regional Composite Flour Workshop, Dakar, Senegal, 1982.

Cassava. Composite flours. Wheat flour. Sorghum. Maize flour. Soybean flour. Cassava flour. Breads. Cassava bread. Calcium stearyl lactylate. Gluten. Brazil.

The use of non-wheat flours, proteinaceous and starchy, in bakery products is discussed. The former include sweet lupine and defatted soy flour, whereas the latter include cassava, water yam, maize, and sorghum. Their preparation and effect on the physical characteristics of bread dough, and on bread quality and composition, are presented. Factors affecting the levels of non-wheat flours used (wheat quality, flour quality and extraction rate, use of additives, method of baking, and type of product) are analyzed. An evaluation of Brazil's composite flour program is presented. Wheat subsidy, variation in flour quality, and restriction in the use of additives have hindered the project's success. Due to this failure, a different approach has been taken. The development of new products composed entirely of indigenous flours, as well as the use of their technological characteristics (e.g. thermoplastic extrusion), are being encouraged. (Summary by M. de W.) H01

0416

23705 GARCIA, V.V.; FLORES, D.M.; LAPITAN, O.B.; URITANI, I. 1984. Correlation of coumarin and phenol contents and peroxidase activity in flours from stored cassava roots with the food quality. Journal of Japanese Society of Food Science and Technology 31(9):604-608. Engl., Sum. Engl., Jap., 11 Refs., Illus. [Inst. of Food Science & Technology, College of Agriculture, Univ. of the Philippines at Los Baños, College, Laguna 3720, Philippines]

Cassava. Roots. Storage. Drying. Grinding. Cassava flour. Composition. Enzymes. Biochemistry. Cassava bread. Organoleptic examination. Statistical analysis. Philippines.

The relationship between coumarin and phenol contents and peroxidase activity and the food quality of flours made from stored cassava roots was investigated. Food quality was determined by sensory evaluation of nonfermented puto (steamed bread) samples made from the flours of 3 kinds of chips prepared from healthy tissues of cassava roots stored for 0, 10, and 20 days, resp. Results confirmed that root storage allowed the tissues to produce increasing amounts of secondary metabolites and higher peroxidase activity. Furthermore, secondary metabolite content and peroxidase activity in the flours from stored cassava roots had an inverse correlation with flour quality (sensory parameters), especially general acceptability of the puto samples made from these flours. (Author's summary) H01

0417

23178 JOSEPH, A. 1982. Traditional cassava and sorghum technology and its effect on mineral food value. In Rechcigl Junior, M., ed. Handbook of nutritive value of processed food. Boca Raton, Florida, CRC Press. v.1,pp.511-520. Engl., 12 Refs., Illus.

Cassava. Cassava products. Focfoo. Cassava flour. Processing. Peeling. Steeping. Grinding. Cooking. Washing. Drying. Solar drying. Mineral content. Ash content. P. Ca. K. Na. Sorghum. Cameroon.

Ca, K, and Na contents of samples of African cassava products, namely meduame-mbong (boiled and washed cassava root fragments), rolls, fufu, and sun-dried farinas, were determined by flame photometry, P content by the vanadate method, and that of phytate P by Holt's colorimetric method. In the case of meduame-mbong, cooking and washing caused a considerable decrease in the amount of minerals, but a substantial increase in Ca and Na, perhaps due to the water used for washing. In spite of the high % of phytate P in the final product, the P:Ca ratio, although small (0.61), gives this foodstuff a better balance if peeled raw cassava is compared with boiled cassava. The high level of Na in cassava rolls can only come from an external source during the grinding of peeled cassava since cooking and storage increase nutritive losses considerably. No phytate P was found in the final product. The P:Ca ratio was 0.65. In fufu Na content remained positive; however, Ca content decreased in the paste as drying time increased from 15 to 30 days. The presence of phytate P was not detected and the P:Ca ratio markedly improved to 0.80 in fufu at 15 days dehydration. In sun-dried farinas there was a considerable loss of all the studied minerals. The variations in the reduction of mineral content of the different products correspond to the different methods of preparation (peeling, steeping, cooking, washing, grinding, and scraping). Na is the only exception, except for sun-dried farinas. Although cassava-based diets are bromatologically inferior regarding human requirements, people in tropical rain forest areas generally consume cassava leaves cooked with palm nuts, improving the biological value of the diet and compensating Ca and P deficiencies. (Summary by EDITEC. Trans. by L.M.F.) H01

0418

23702 LUND, E.D.; SMOOT, J.M.; HALL, N.T. 1983. Dietary fiber content of eleven tropical fruits and vegetables. Journal of Agricultural and Food Chemistry 31(5):1013-1016. Engl., Sum. Engl., 16 Refs. [U.S. Citrus & Subtropical Products Laboratory, Southern Region, U.S. Dept. of Agriculture, Agricultural Research Service, Winter Haven, FL 33880, USA]

Cassava. Composition. Fibre content. Cellulose. Analysis. USA.

Dietary fiber was determined in the following samples: yam, cassava, Colocasia spp., avocado, date, coconut, pumpkin, grapefruit albedo, and kiwi. Values were obtained for cellulose, hemicellulose, lignin, ash, neutral detergent residue, and enzymatic (soluble and insoluble) fractions. The corresponding values for cassava were 0.66, 0.134, 0.065, 0.041, 0.86, 2.18, and 1.71%, resp. (Extracted from author's summary) H01

0419

23704 NDIOKWERE, C.L. 1984. Analysis of various Nigerian foodstuffs for crude protein and mineral contents by neutron activation. Food Chemistry 14(2):93-102. Engl., Sum. Engl., 10 Refs. [Univ. of Benin, Chemistry Dept., Benin City, Nigeria]

Cassava. Cassava products. Gari. Composition. Protein content. Mineral content. Ca. Fe. K. P. Analysis. Nigeria.

Various Nigerian foodstuffs were analyzed for CP and important minerals (Ca, Fe, K, and P) using the neutron activation technique. The protein content of cassava and its products varied from 1.46 to 2.77%; for cocoyam, yam, rice, and plantains it varied from 4.31 to 12.80% while for grains, maize, guinea corn, and millet as well as for African breadfruit seeds and some popular vegetables, it varied from 4.33 to 31.60%. Corrections for the relevant reaction interferences in N determination were carried out. (Author's summary) H01

0420

23726 ONYENEKE, E.C. 1984. Effect of garri diet on rat plasma phospholipids. Nutrition Reports International 29(4):775-781. Engl., Sum. Engl., 16 Refs., Illus. [Univ. of Nigeria, Dept. of Biochemistry, Nsukka, Nigeria]

Cassava. Gari. Laboratory animals. Metabolism. Animal physiology. Biochemistry. Analysis. Nigeria.

Three groups of 30 young male rats were each given ad libitum a diet with or without 16 or 32% gari for 6 mo. Blood was sampled every 2 wk. Mean plasma phospholipid concn. for all weeks was 111.79, 95.12, and 72.04 mg/100 ml for diets with 0, 16, and 32% gari, resp. Analysis of the various phospholipid components showed a substantial decrease in the levels of phosphatidyl choline and sphingomyelin fractions. (Summary by M. de W.) H01

See also 0324 0325 0337 0443 0446 0449 0456 0457 0466 0473 0476 0487 0488 0490 0497

H02 Nutritive Disorders in Humans

0421

23716 VANDERPAS, J.; BOURDOUX, P.; LAGASSE, R.; RIVERA, M.; DRAMAIX, M.; LODY, D.; NELSON, G.; DELANGE, P.; ERMANS, A.M.; THILLY, C.H. 1984. Endemic infantile hypothyroidism in a severe endemic goitre area of central Africa. Clinical Endocrinology 20(3):327-340. Engl., Sum. Engl., 43 Refs., Illus. [Service des Radioisotopes, Hospital Saint Pierre, 322, rue Haute, 1000 Bruxelles, Belgium]

Cassava. Human health. Endemic goitre. Thiocyanates. Iodine. Deficiencies. Analysis. Statistical analysis. Zaire.

Thyroid function and exposure to dietary goitrogenic factors (I deficiency and SCN overload) were studied at birth and from birth to 7 yr in 200 neonates and 347 children living in the severe endemic goitre area of Ubangi, northern Zaire. Serum T4 was at the lower limit of normal at birth (104 $\pm$ 4 nmol/l) and stayed at that level during the 1st yr of life (123 $\pm$ 9) (nonsignificant), but decreased to 75 $\pm$ 8 (P < 0.001) at 2-4 yr and to 62 $\pm$ 6 (P < 0.001) at 5-7 yr of age. Mean serum FT4 decreased from 10.4 $\pm$ 0.9 pmol/l during the 1st yr to 8.2 $\pm$ 1.0 (nonsignificant) at 2-4 yr (nonsignificant) and to 7.7 $\pm$ 0.9 (P < 0.05) at 5-7 yr. Mean serum TSH was 10.4 (8.4-12.9) mU/l (geometric mean $\pm$ 1 SEM) during the 1st yr, 10.1 (7.5-13.7) (nonsignificant) at 2-4 yr and 24.3 (18.5-31.9) (P < 0.05) at 5-7 yr. Mean serum T3 was 3.23 $\pm$ 0.12 nmol/l during the 1st yr and remained stable thereafter. The frequencies of low T4 (less than 77 nmol/l), high TSH (more than 50 mU/l), and low T4 and T3 (T3 less than 1.69 nmol/l) were twice as high at 5-7 yr as in the 1st yr (65, 42, and 16%, resp.). The urinary I concn. of the children was stable and low throughout the study period. By contrast, serum SCN concn. which was high at birth (129 $\pm$ 5 micromoles/l) decreased to normal values between 3-12 mo. of age and increased again during and after weaning (1-3 yr of age) to reach a value of 140 micromoles/l which was comparable with that observed in adults in the same area. SCN concn. was high (133 $\pm$ 7 micromoles/l) in the mothers' serum but low in the mothers' milk (57 $\pm$ 3 micromoles/l) (P < 0.001). Multivariate analysis showed that both I deficiency and SCN overload were explanatory factors of the serum levels of T4, FT4, and TSH in children. Results show that infantile hypothyroidism is much more frequent at 5-7 yr of age than at birth or during the 1st yr of life. The deterioration in thyroid function during and after weaning is linked to persistent I deficiency accompanied by an increase in overload (diet mainly based on cassava). The variability in the age of onset, the severity, and the duration of infantile hypothyroidism might explain the wide range of psychomotor and physical abnormalities observed in a large proportion of subjects in this area. (Author's summary) H02

0422

22312 FELIPA L., V.R. 1981. Preparación de ensilaje para la zona de Selva Alta con pasto elefante, caña de azúcar y yuca. (Preparation of silage for the high jungle area with elephant grass, sugar cane, and cassava). Tesis Ing. Zootecnista. Lima, Perú, Universidad Nacional Agraria La Molina. 95p. Span., Sum. Span., 39 Refs.

Cassava. Forage. Silage. Fermentation. Feeds and feeding. Palatability. Nutritive value. Composition. Peru.

A study was carried out at the U. Nacional Agraria La Molina, Peru, to determine the optimal combination level of elephant grass (Pennisetum purpureum) with sugar cane (15, 30, and 45%) or cassava (5, 10, and 15%) to obtain a silage of good lactic fermentation for the high jungle areas. The silage was prepared using microsilos made with polyethylene bags, with a total wt. (including grass) of 4 kg. Six treatments and a control (elephant grass), replicated twice, were used. These combinations were vacuum-sealed and stored for 38 days, after which they were opened and evaluated (organoleptically and for nutritive quality, before and after the silage). The nutritive examination determined using proximal analysis, in vitro DM digestibility, and estimated TDN, showed that the best silages of elephant grass are obtained with 30 and 45% sugar cane. The use of cassava in silage preparation did not affect nutritive value. (Author's summary. Trans. by M. de W.) H03

0423

23500 FOMUNYAM, R.T.; ADEGBOLA, A.A.; OKE, O.L. 1984. The reproductive, growth and carcass traits of rabbits fed cassava-based diets supplemented with palm oil. Food Chemistry 14(4):263-272. Engl., Sum. Engl., 14 Refs. [Univ. of Ife, Dept. of Animal Science, Ile-Ife, Nigeria]

Cassava. Feeds and feeding. Dried roots. Animal nutrition. Rabbits. Stylosanthes. Nigeria.

Female rabbits of New Zealand White crosses (New Zealand x California) and Chinchilla crosses (Chinchilla x California), when fed a palm oil-supplemented cassava-based diet, with Stylosanthes guianensis as part of the dietary protein, had reproductive, growth, and carcass traits comparable with those of crosses fed a maize-based diet containing 8% fish meal. (Author's summary) H03

0424

24031 GOMEZ, G.; SANTOS, J.; VALDIVIESO, M. 1984. Least-cost rations containing cassava meal for broilers and growing pigs. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.393-400. Engl., Sum. Engl., 13 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava meal. Processing. Drying. Solar drying. HCN content. Animal nutrition. Poultry. Swine. Feed constituents. Costs. Prices. Income. Economics. Colombia.

A least-cost formulation computer program using CM at a price equivalent to 80% of the current price of sorghum indicated that cassava could be incorporated into practical rations at levels of 20-30% for broilers (0-8 wk.) and 30-40% for growing pigs (weaning to market wt.). CM was used as a substitute for cereal grains, sorghum, or maize. Results of feeding trials with broilers and growing pigs showed that even CM prepared from roots of high cyanide-containing var., such as M Col 1684, can be satisfactorily incorporated if properly dried, at the levels mentioned above in compound or balanced feeds for these species, producing results similar to those obtained with standard practical rations. Exptl. data on body wt. gain, feed consumption, feed conversion, and economic evaluation are presented and discussed. (Author's summary) H03

0425

23432 GOMEZ, G.; VALDIVIESO, M.; SANTOS, J.; HOYOS, C. 1983. Evaluation of cassava root meal prepared from low- or high-cyanide containing cultivars in pig and broiler diets. Nutrition Reports International 28(4):693-704. Engl., Sum. Engl., 17 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Sweet cassava. Bitter cassava. Cassava meal. Solar drying. Grinding. Feed constituents. Composition. Water content. Protein content. Fibre content. Fat content. Ash content. Cyanides. Food energy. Animal nutrition. Poultry. Swine. Colombia.

Cassava roots from low- (CMC-40 and Llanera) or high-cyanide (MCol 1684) cv. were chipped and sun dried on a concrete floor, and after grinding the meal was evaluated in diets for growing-finishing pigs, lactating sows, and baby pigs as well as for broilers. Cyanide content of sun-dried chips was below 100 mg/kg, which is the max. permissible level for animal feeding. Results of feeding trials with pigs and broilers indicated that CM of both the low- and high-cyanide containing cv. was satisfactorily used by these species and animal performance was similar to those fed sorghum-based diets. Roots of so-called bitter cassava cv. such as MCol 1684 are, therefore, suitable for animal feeding, if properly processed and sun dried on a concrete floor. (Author's summary) H03

0426

21465 HERRERA F., E. 1983. Efecto de tres distancias de siembra y tres alturas de corte en yuca (Manihot esculenta Crantz) para la producción de materia seca y proteína. (The effect of three planting distances and three cutting heights in cassava on dry matter and protein production). Tesis Ing.Agr. Guatemala, Universidad de San Carlos de Guatemala. 26p. Span., Sum. Span., 14 Refs.

Cassava. Forage. Cultivation. Planting. Spacing. Plant height. Harvesting. Productivity. Dry matter. Protein content. Guatemala.

Annual DM and crude protein yield of cassava was evaluated using 3 distances in square planting (0.3, 0.6, and 0.9 m) and 3 cutting heights (1.0, 1.4, and 1.8 m) on a Tiquisate soil in the tropical dry zone of Guatemala. A randomized split plot design was used with 9 treatments and 4 replications. Weed control was done by hoeing in all treatments. At planting 50 kg 46-0-0 were incorporated per hectare. Optimum planting distance was 0.3 x 0.3 m, regardless of cutting height. (Author's summary. Trans. by L.M.F.) H03

0427

22067 LAMBERT, M. 1979. Storage and processing of root crops in the South Pacific. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.47-52. Engl., Sum. Engl., 1 Ref.

Cassava. Storage. Processing. Animal nutrition. Oceania.

Yam, taro, cassava, sweet potato, arrowroot, and Irish potato are discussed in terms of storage problems associated with each. Less widely distributed than yam and taro but no less significant is cassava, which is rising to prominence as part of a new animal feed industry in both Tonga and New Caledonia. (Extracted from author's summary) H03

0428

23710 MOHAMED, K.H.; MUTHU, M.S.; PILLAI, N.N.; ALI, S.A.; PANDIAN, S.K. 1983. A simplified hatchery technique for mass production of penaeid prawn seed using formula feed. Indian Journal of Fisheries 30(2): 320-332. Engl., Sum. Engl., 13 Refs., Illus. [Central Marine Fisheries Research Inst., P.B. No. 1912, Cochin-682 018, India]

Cassava. Feeds and feeding. Animal nutrition. Fish. Uses. India.

A technique for large-scale production of penaeid prawn seed using a dry microparticulate formula feed, MPCL-17, is described. The details of preparing the feed from inexpensive, locally available raw materials such as groundnut oil cake, fish meal, dried mantis shrimp, prawn waste, and cassava and fortified with vitamins and minerals, are given. The larvae were grown in outdoor tanks filled with 2 m^3 of seawater, filtered through 60-micron mesh nylobolt cloth. The daily ration of formula feed was offered in 4 equal installments at 6-h intervals and the larval tanks were vigorously aerated. Apart from providing nutrition for the larvae, the feed, under the influence of sunlight, helped create a natural ecosystem conducive for their survival. The easy-to-dispense dry feed greatly simplified the larval rearing procedures and gave an av. survival rate of 66.7% from nauplius to postlarva. The rationale of the feeding schedules and the particle size of the feed offered are discussed in the light of the changes taking place in the functional morphology of the feeding appendages during larval development. (Author's summary) H03

0429

24032 MONTILLA, J.J. 1984. Cassava root and foliage meals in laying hen diets. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.401-409. Engl., Sum. Engl., 12 Refs. [Facultad de Ciencias Veterinarias, Univ. Central de Venezuela, Apartado Correo 4563, Maracay 2101A, Venezuela]

Cassava. Cassava meal. Foliage. Cassava leaf meal. Processing. Drying. Solar drying. Feed constituents. Maize. Poultry. Metabolism. Eggs. Venezuela.

The use of cassava foliage meal (CFM), particularly in combination with root meal was studied. In expt. I, corn meal and cassava root meal dried above 100°C (CRM) in combination with 5 levels of CFM (0, 5, 10, 15, and 20%), were evaluated in a 5 x 2 factorial arrangement; Leghorn hens were used with 4 groups of 12 pullets and 10 layers assigned to each treatment. In expt. II, corn meal, CRM, and sun-dried cassava root meal (SCRM), in combination with 3 levels of CFM (0, 10, and 20%), were evaluated. Black Sex Link hens were used with 4 groups of 15 pullets and 12 layers assigned to each treatment. Hens were placed in individual metal cages and daily records were made of feed consumption and egg production. With CRM and SCRM satisfactory body wt. and 50% egg production were obtained, although inferior to those obtained with maize. Rations based on CRM adversely affected egg production. A slight decrease of egg production observed with

SCRM may be due to the deterioration of cassava quality caused by the long drying period. With CFM egg production was normal up to the 20% level combined with maize, and only up to 10% with SCRM. A strong root x foliage interaction was observed that adversely affected the productive performance when the CFM level was increased, this was possibly due to the increase in HCN concn. (Author's summary) H03

0430

18936 MONTILLA, J.J. 1982. Valor actual y potencial de la raíz y el follaje de yuca en la alimentación animal. (Present value and potential of cassava roots and foliage in animal nutrition). In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomía. Alcance no.31:551-611. Span., 147 Refs., Illus.

Cassava. Animal nutrition. Feeds and feeding. Roots. Forage. Composition. Ash content. Carbohydrate content. Dry matter. Fat content. Fibre content. Protein content. Amino acids. Protein enrichment. Cultivars. Drying. Solar drying. Cyanogenic glucosides. HCN content. Toxicity. Iodine. Rhodanese.

The possible utilization of the cassava canopy and roots in animal nutrition is reviewed on the basis of data presented by several authors. Root composition of 11 var. ranges between 28.0-48.0, 1.3-4.3, 2.6-11.2, 0.4-1.3, 1.3-2.5, and 80.7-93.5% DM, CP, crude fiber, ether extract, ash, and N-free extract, resp. N content/100 g varies between 183-500 mg in CF; S-containing amino acids are limiting, but the energy value is similar to that of corn or sorghum meal. The use of cassava roots for producing protein through microorganisms (3 kg CF produce 0.5 kg protein) is expensive. Satisfactory results are obtained when CF containing nonprotein N (urea-cassava root complex) is combined with a basal ration (Digitaria decumbens straw) and another supplement of sesame seed flour. The process of root drying on cement floors and on trays is described; drying takes 1-2 days with loads of 5 and 10 kg/m^2 on cement floors and inclined trays, resp. Proximate composition of cassava leaves is 77, 8.2, 3.3, 1.2, and 7.2% water, CP, soluble carbohydrates, fat, and crude fiber, resp. Leaf protein content on dry basis ranges between 17.8-34.8% for Brazilian var. and between 18.5-32.4% for Jamaican var. Approx. 75% of leaf CP is true protein and its nutritive value is similar to that of alfalfa. Drying cassava foliage on floors eliminates the HCN present in fresh material. A protein concentrate can be obtained through the addition of an acid to the forage juice, and the coagulated protein is separated by centrifugation. Several aspects that determine the HCN content of cassava are described: root anatomy, fertilization, soil moisture, var., plant age, and also physiological mechanisms of animals that prevent intoxication. Recommendations are given on how to balance cassava-based feed rations. Tables that complete the information given are included. (Summary by EDITEC. Trans. by L.M.F.) H03

0431

23727 NAIR, K.S.S.; MATHEW, G. 1984. Dried tapioca tuber for laboratory rearing of the bamboo borer, Dinoderus minutus Fabr. (Coleoptera: Bostrychidae). Material und Organismen 19(1):49-54. Engl., Sum. Engl., Germ., Fr., Span., 12 Refs., Illus. [Division of Entomology, Kerala Forest Research Inst., Peechi-680 653, Kerala, India]

Cassava. Cassava chips. Uses. Animal nutrition. Entomology. India.

Dried cassava root was found suitable for the lab. rearing of the bamboo borer Dinoderus minutus. Up to a 10-fold increase in the beetle population was obtained on this diet within 60 days. Cassava root is more suitable than reed or bamboo in which survival of the insect is known to be dependent on the starch content, and therefore unpredictable. In addition, it is easy to retrieve the insects from the comparatively soft cassava medium for exptl. studies. (Author's summary) H03

0432

22070 PEDRANA, C. 1979. Processing of root crop products, especially taro and cassava, in Western Samoa. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.258-265. Engl., Sum. Engl., 1 Ref.

Cassava. Taro. Cassava chips. Processing. Grinding. Cassava flour. Feeds and feeding. Swine. Samoa.

The processing of taro in Western Samoa, where it is a major crop, is presented and several by-products are discussed. Pig feeding trials with cassava chips (45% in the ration) indicated that chips steeped overnight in potassium metasulphite solution, then drained and dried, were superior to those that were straight chipped, dried, and with met. added. (Summary by M. de W.) H03

0433

22984 RAVINDRAN, V.; KORNEGAY, E.T.; RAJAGURU, A.S.B. 1983. Utilization of the whole cassava plant as a swine feed. World Review of Animal Production 19(1):7-14. Engl., 65 Refs. [Dept. of Animal Science, Virginia Polytechnic Inst. & State Univ., Blacksburg, VA 24061, USA]

Cassava. Animal nutrition. Swine. Cassava meal. Cassava leaf meal. Nutritive value. Composition. Carbohydrate content. Protein content. Amino acids. Fat content. Mineral content. Vitamin content. Cyanogenic glucosides.

The literature available on the nutritional values of both cassava root and leaf meals in swine diets is reviewed. Carbohydrate, protein (amino acid profile), lipid, mineral, vitamin, and cyanogenic glucoside contents of each one of the meals are discussed. The review shows that if cassava root meal is properly processed and supplemented, it can be incorporated into swine diets at levels up to 40-70%. CLM can be included up to 30% without affecting swine performance. (Summary by EDITEC. Trans. by M. de W.) H03

0434

23286 TORRE V., M.J. DE LA 1982. Utilización de forraje de yuca en la alimentación de terneros de lechería. (Utilization of cassava forage for feeding dairy calves). Tesis Mag.Sc. Turrialba, Universidad de Costa Rica. Centro Agronómico Tropical de Investigación y Enseñanza. 64p. Span., Sum. Span., Engl., 85 Refs., Illus.

Cassava. Animal nutrition. Calves. Feeds and feeding. Forage. Concentrates. Nutritive value. Food energy. Protein content. HCN content. Cultivars. Digestibility. Costs. Costa Rica.

At the Centro Agronómico Tropical de Investigación y Enseñanza in Costa Rica, a study was carried out to determine the levels of cassava forage as protein supplement in the feeding of weanling dairy calves. The animals, with an av. age of 3 mo. and wt. 47.5 kg, were allocated in 5 groups of 6 each. Every group received a diet of cassava forage, concentrates, Cynodon nlemfluensis, and molasses. The treatments, given completely randomized, consisted in the replacement of the protein in the ration by protein provided in the cassava forage; the amounts of the latter in the diets were 0.00, 0.36, 0.73, 1.12, and 1.49 kg DM/100 kg live wt./day, giving 0, 13, 27, 41, and 56% CP, resp. There were no differences in the total DM consumption, wt. gain, and food conversion efficiency among the different treatments. Neither were there HCN intoxication symptoms, even though its content in the forage varied from 8.41 to 25.92 mg/100 g fresh wt. To insure an adequate consumption of an energy supplement, the level of cassava forage can not exceed 23% of the total DM given to calves with 75 kg or less. This level provides 26% of the total protein. From the economic point of view, the use of cassava forage as a source of protein to replace protein sources, such as the meat and bone meal, represents a 22% saving in the costs/unit of protein. (Summary by M. de W.) H03

0435

23709 WYLLIE, D.; MTUI, M.; OLOYA, J.D.; KATEGILE, J.A. 1984. The processing of cassava meal for chicks. Nutrition Reports International 30(5):1127-1136. Engl., Sum. Engl., 20 Refs. [School of Agriculture, West Mains Road, Edinburgh, Scotland]

Cassava. Cassava meal. Feed constituents. Processing. Animal nutrition. Chicks. Solar drying. Drying. Boiling. Fermentation. Metabolism. Composition. Dry matter. Fibre content. Protein content. HCN content. Nutritive value. Tanzania.

The effect of different methods of processing CM on its nutritive value was studied in 2 expt. carried out with chicks to develop simple methods of producing CM for poultry feeding in rural situations. In the 1st expt. 132 day-old chicks were fed for 9 wk. on cassava-based diets, prepared either by sun drying, boiling, roasting, or after fermenting in water. Chicks fed the diet containing cassava fermented in water grew fastest and those fed sun-dried cassava, the slowest. There were no statistically significant differences for feed conversion efficiency but chicks fed boiled cassava tended to perform better than those fed roasted or sun-dried cassava. In the 2nd expt. 180 day-old chicks were fed for 8 wk. on the same basal diet but using cassava prepared by one of the following methods: (a) sun drying; (b) sun drying followed by placement and fermentation under leaves and inclusion of the molds so produced; (c) as for (b) but removal of the molds with a scraper; (d) fermentation in water only; (e) fermentation in water with sodium sulphate added; (f) fermentation in water only but with sodium sulphate added to the final diet. Fermentation under leaves and the addition of sulphate in the water during fermentation reduced the level of HCN comparable with sun drying. Wt. gain and feed conversion efficiency were highest for the diets containing cassava fermented in water, the treatment without any added sulphate tending to give the highest gains. Lowest wt. gain and conversion efficiency were found with the sun drying treatment. Performance improved after fermentation under leaves, especially when the molds so produced were removed before the cassava was incorporated in the diet. (Author's summary) H03

See also 0325 0437 0438 0457 0466 0476 0480 0494

H04 HCN Toxicity and Detoxification

0436

22796 GOMEZ, G.; VALDIVIESO, M.; DE LA CUESTA, D.; KAWANO, K. 1984. Cyanide content in whole-root chips of ten cassava cultivars and its reduction by oven drying or sun drying on trays. Journal of Food Technology 19(1):97-102. Engl., Sum. Engl., 16 Refs. [CIAT, Apartado Aéieo 6713, Cali, Colombia]

Cassava. Cultivars. Cassava chips. Harvesting. Timing. Drying. Solar drying. Cyanides. Dry matter. Colombia.

The effect of sun drying of trays for 48 h and of oven drying in an air-forced oven at 60°C for 24 h on the cyanide content of chips of 10 cassava var. was studied. Fresh cassava chips from whole roots of these var. showed significantly different total cyanide contents among themselves, with values in the range of 100-900 mg/kg on a DM basis. Most of the var. studied exhibited cyanide contents in the range of 200-600 mg/kg. The free cyanide proportion in the fresh chips was in the range of 30-40% of their total cyanide. Sun and oven drying reduced the cyanide content in the dried chips to approx. 15-30% of the initial cyanide content of fresh chips. In addition, the free cyanide content in dried chips accounted for approx. 60-80% of their total cyanide value. (Author's summary) H04

0437

23742 GOMEZ, G.; VALDIVIESO, M. 1984. Effects of sun drying on a concrete floor and oven drying on trays on the elimination of cyanide from cassava whole-root chips. Journal of Food Technology 19(6):703-710. Engl., Sum. Engl., 24 Refs., Illus. (Centro Agronómico Tropical de Investigación y Enseñanza, 7170, Turrialba, Costa Rica]

Cassava. Cultivars. Cassava chips. Drying. Solar drying. Cyanides. Cyanogenic glucosides. Dry matter. Harvesting. Timing. Costa Rica.

The effects of sun drying on a concrete floor at a loading rate of 10 kg/m^2 and oven drying of trays at 60°C at a loading of 20 kg/m^2 on the cyanide elimination from cassava whole root chips were evaluated using 4 cv. (M Col 113, M Col 22, M Col 1684, and CMC 342-170) at 4 plant ages (6, 8, 10, and 12 mo.). Fresh whole root chips of the 4 cv. varied considerably in their total cyanide content, ranging from 1031 $\pm$ 137 mg/kg on a DM basis for cv. M Col 1684 to 296 $\pm$ 48 mg/kg for M Col 113 (a Colombian local cv.); the other 2 cv. showed intermediate levels of around 500-550 mg/kg. Between 20-28% of the total cyanide in fresh chips was free cyanide. Sun drying eliminated 86-94% of the initial total cyanide and 93-98% of the bound cyanide, whereas these losses were of the order of 77-80% and 81-85%, resp., for oven drying at 60°C. Most of the total cyanide in sun-dried chips was found as free cyanide (59-76%), whereas in oven-dried chips the largest proportion of the total cyanide was still present as bound cyanide (59-69%). Cyanide elimination was greater than that reported by earlier workers who used chips from peeled roots and different drying procedures. (Author's summary) H04

0438

23239 IZOKUN-ETIOBHIO, B.O.; UGOCHUKWU, E.N. 1984. Effect of incorporating various levels of cassava (Manihot esculenta Crantz) cyanogenic glucosides in diets fed to albino rats on liver and kidney rhodanese activity. Nutrition Reports International 29(6):1475-1481. Engl., Sum. Engl., 25 Refs. [Dept. of Biochemistry, Univ. of Benin, Benin City, Nigeria]

Cassava. Cassava products. Feeds and feeding. Laboratory animals. Cyanogenic glucosides. Cyanides. HCN. Linamarin. Enzymes. Rhodanese. Biochemistry. Detoxification. Metabolism. Nigeria.

Albino rats were fed ad libitum with diets containing 2 levels (33.5 and 67.0%) of processed cassava, akpu, as well as with pure cyanogenic glucoside (linamarin). Rhodanese (thiosulphate: cyanide sulphur-transferase E.C.2.8.1.1) activity levels in both the liver and the kidney of rats on the test diets were comparable with those of rats on the control diet. The Michaelis constant (Km) and the max. velocity (Vmax) of the liver rhodanese remained unchanged in both the test and in the control animals. Results suggest that the reaction catalyzed by rhodanese may not be the main pathway of detoxification of cyanide as earlier suggested. (Author's summary) H04

0439

23708 OBIDOA, O.; NGODO, V.O.S. 1984. Effect of prolonged consumption of gari (Cassava, Manihot utilissima) on rat hepatic energy metabolism. 1. Mitochondrial respiratory control. Qualitas Plantarum Plant Foods for Human Nutrition 34(3):159-168. Engl., Sum. Engl., 24 Refs., Illus. [Dept. of Biochemistry, Univ. of Nigeria, Nsukka, Nigeria]

Cassava. Gari. Feeds and feeding. Laboratory animals. Hepatic disorders. HCN. Mitochondria. Metabolism. Enzymes. Biochemistry. Analysis. Nigeria.

Rats were fed high (35%, wt./wt.) gari-based diets for a prolonged period and sacrificed after 22-23, 30-31, 45-46, and 59-60 days. Hepatic mitochondrial respiratory control for succinate oxidation was evaluated by 4 criteria (a) osmotic swelling/contraction cycle, (b) O_2 uptake, (c) ATPase activity, and (d) Ca^{2+} uptake. A decrease in the degree of oxidative phosphorylation coupling, and in ATPase activity, and increased mitochondrial swelling/contraction with no apparent effect on Ca^{2+} uptake were suggestive of moderate alterations in mitochondrial energy metabolism caused by the ingestion of gari-based diet. The possible in vivo significance of these observations is discussed. (Author's summary) H04

0440

23269 PADMAJA, G. 1984. Cassava feeding and its relationship to central nervious system disorders. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.48-51. Engl., Illus.

Cassava. Animal nutrition. Metabolism. Linamarin. Thiocyanates. Enzymes. Rhodanese. Biochemistry. Toxicity. India.

The biological toxicity of linamarin was studied. One group of rabbits received a dose of 100 mg linamarin/kg body wt., by intraperitoneal administration, one received 3 mg of potassium cyanide administered the same way, and another was used as control. Blood samples were taken 1, 2, and 3 h after drug administration. In both groups tested there was a significant raise in blood glucose, lactic acid, and pyruvate levels 2 h after drug administration. Serum lactic dehydrogenase and rhodanese activities also increased 2 h after drug treatment, although rhodanese activity increased 1 h after potassium cyanide administration, and decreased afterwards. For both drugs, linamarin and potassium cyanide, serum free SCN level increased 1 h after drug administration. (Summary by M. de W.) H04

See also 0421 0425 0435 0439 0440

I00 PROCESSING, PRODUCTS AND USES

See 0461 0465

0441

23267 BALAGOPALAN, C.; POTTY, V.P.; MOORTHY, S.N. 1984. Fermentation of cassava for the production of industrially important products. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.39-44. Engl., Illus.

Cassava. Fermentation. Ethanol. Industrial microbiology. Cassava starch. Wastes. Waste utilization. Protein enrichment. India.

The immobilization of *Saccharomyces cerevisiae* cells on brick powder, kiesulghur, and silica gel for ethanol production from cassava starch, and SCP production from cassava starch with *Rhizopus oryzae* and from cassava starch factory effluents were studied. For the 3 immobilization supports, 3 different initial concn. of the substrate were used (2, 3, and 5 g/100 ml); with all the supports a decrease in reducing sugar values and an increase in yeast cell concn. were observed. The physical, chemical, and microbiological properties of primary and secondary effluents of starch factories were evaluated. The COD and BOD level effluents from small-scale starch factory units varied from 3870 to 6670 and from 3400 to 6018 mg/l, resp.; pH ranged from 4.5 to 4.7. Bacteria, yeasts, and fungi were identified in the effluents. *Candida* sp. was inoculated to both types of effluents and after 28 h the % of protein was 53.19% for primary effluents and 93.00%, for secondary effluents. (Summary by M. de W.) 101

0442

23733 COLONNA, P.; MERCIER, C. 1983. Macromolecular modifications of manioc starch components by extrusion-cooking with and without lipids. Carbohydrate Polymers 3(2):87-108. Engl., Sum. Engl., 42 Refs., Illus. [Inst. National de la Recherche Agronomique, Centre de Recherches Agro-Alimentaires, Laboratoire de Biochimie et Technologie des Glucides, Rue de la Géraudiere, 44072 Nantes Cédex, France]

Cassava. Starch content. Analysis. Cooking. Enzymes.

Macromolecular structure of cassava starch, extruded with and without lipids (oleic acid, dimodan, soybean lecithin, and copra), was studied using chemical, enzymic, viscometric, and chromatographic methods. Twin screw extrusion-cooking led to a macromolecular degradation of both amylose and amylopectin. The formation of lower mol. wt. material was observed by a decrease of intrinsic viscosities of both components and also by their behavior on Sepharose CL-2B, whereas no modification of beta-amylolysis and I-binding capacity could be detected. Macromolecular degradation was increased by higher temp. and screw speed of the extruder, and was decreased by adding lipids during extrusion. Lipids such as fatty acids, mono- and triglycerides have been shown to act as lubricants (each type in its distinctive way). Lipid extraction, by different solvents, appears to have a low efficiency. Although the addition of triglycerides during extrusion reduces the macromolecular degradation and therefore a high solubility, the amylose-lipid complexes reduce the water-soluble fraction, which was shown to be mainly composed of aggregated amylopectin-like material and to be highly stable after successive freeze-thaw cycles. (Author's summary) 101

0443

23268 MOORTHY, S.N. 1984. Structural changes to enhance quality of cassava starch for industrial utilization. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.45-47. Engl., Illus.

Cassava. Cassava starch. Viscosity. Cooking. Ca. India.

The effect of different types of surfactants on the rheological properties of cassava starch (viscosity, I affinity, and swelling power) was studied. Viscosity was increased and I affinity reduced by all surfactants. Swelling power was reduced by 50% by potassium stearate and palmitate, maintained by glycerol monostearate, and considerably increased by sodium lauryl sulfate and cetyltrimethylammonium bromide. In cooking quality studies with cassava, softness was considered the criterion. Soft textured var. are the most acceptable. Ca content was found to play a key role in determining the softness on cooking. (Summary by M. de W.) 101

0444

23271 NANDA, S.K.; POTTY, V.P. 1984. Testing and evaluation of available packaging materials for handling and storage of cassava products. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.52. Engl.

Cassava. Packaging. Cassava starch. India.

Freshly processed cassava starch was packed and stored in plastic jars, low and high density polyethylene bags, paper bags, metal containers, polyethylene impregnated bags, and jute bags. The stored material had a 12.5% MC, 46 Redwood viscosity, no trace of insect infestation, 0.08×10^6 total microbial count/g, 0.38×10^5 bacteria and 2.80×10^3 fungi/g. Periodic evaluations of these characteristics are being carried out. (Summary by M. de W.) 101

0445

23016 SALAZAR DE BUCKLE, T.; ZAPATA M., L.E.; CARDENAS, O.S.; CABRA, E. 1978. Small-scale production of sweet and sour starch in Colombia. In Weber, E.J.; Cock, J.H.; Chouinard, A., eds. Workshop on Cassava Harvesting and Processing, Cali, Colombia, 1978. Proceedings. Ottawa, Canada, International Development Research Centre. pp.26-32. Engl., Sum. Engl., Illus.

Cassava. Cassava starch. Small-scale processing. Viscosity. pH. Analysis. Washing. Rasping. Screening. Silting. Fermentation. Drying. Economics. Income. Prices. Colombia.

Small-scale starch extraction in Colombian rural areas is discussed from the technical and economic points of view. The processes used for producing sweet and sour starches are described and data on possible mechanisms for fermentation in sour starch production are given. Fermentation produces surface modifications on the starch granules and molecular breakdown that seem to be essential for use in bread baking. Sweet starch could be upgraded to meet user specifications on ash and MC by modifying the washing, peeling, and drying steps. The proposed modifications would not affect the profitability of the process and would open new markets for small-scale sweet starch. Recommendations are given. (Author's summary) 101

0446

21190 SERRANO, L.F. 1975. Consideraciones para el montaje y diseño de operación de una rallandería a nivel de pequeño productor. (Considerations about the establishment and operational design of a small-scale rasping industry). Tesis Ing. Mecánico. Bogotá, Colombia, Universidad de los Andes. 191p. Span., Sum. Span., 8 Refs., Illus.

Cassava. Cassava starch. Composition. Processing. Peeling. Washing. Rasping. Screening. Silting. Fermentation. Drying. Factories. Small-scale processing. Water requirements (processing). Analysis. Particle size. Production. Colombia.

The theoretical process of cassava starch extraction is presented, with emphasis on small-scale industry. Starch is classified according to its final quality, based on preestablished tests, and its demand by different industries. Socioeconomic characteristics that the region should have, physical characteristics of the facilities, operational design of the process, and considerations for the establishment of a small-scale rasping industry, are given. (Author's summary. Trans. by M. de W.) 101

See also 0327 0328 0449 0454 0463 0487

I02 Uses, Industrialization, Processing and Storage

0447

24030 GOMEZ, G.; VALDIVIESO, M. 1984. Effect of whole-root chips loading for drying cassava on trays or concrete floor on cyanide losses. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.387-392. Engl., Sum. Engl., 12 Refs. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cultivars. Cassava chips. Processing. Drying. Solar drying. Dry matter. Cyanogenic glucosides. Enzymes. Analysis. Statistical analysis. Colombia.

Roots of 15-mo.-old plants from cassava var. CMC-40 and CMC-84 were used to determine the effect of different loading rates on cyanide elimination. Three loading rates were used for drying on trays (10, 15, and 20 kg/m^2) and 2 for concrete floors (10 and 12 kg/m^2). With the loading rates used floor drying was more efficient in reducing cyanide, than tray drying. Increasing the loading of chips on trays up to 20 kg/m^2 resulted in higher cyanide losses, especially with the high cyanide var. CMC-84. The proportion of free cyanide in dried chips appeared to progressively increase with increasing loading rates on trays. Floor and tray drying chips of the low cyanide var. produced dried chips containing 100 ppm or less of total cyanide, on a DM basis. These levels were not reached with chips of the high cyanide var. (Author's summary) I02

0448

22071 HRISHI, N.; BALAGOPAL, C. 1979. Processing of root crops in India. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.302-308. Engl., Sum. Engl., 8 Refs.

Cassava. Potatoes. Yams. Sweet potatoes. Colocasia. Storage. Deterioration. Moulds. Cassava chips. Processing. Uses. Animal nutrition. Fermentation. India.

Methods available in India for the processing and utilization of cassava, sweet potato, aroids, yams, and arrowroot, which are among the most widely cultivated edible root crops in the country, are discussed. Improved processing techniques will make expanded cultivation of these crops economically viable. (Extracted from author's summary) I02

0449

23174 LIMA, U. DE A. 1982. Industrializacao de mandioca. Parte B. (Cassava industrialization. Part B). In Câmara, G.M. de S. Mandioca-producao, pre-processamento e transformacao agroindustrial. Sao Paulo, Secretaria da Industria, Comercio, Ciencia e Tecnologia. Serie Extensao Agroindustrial no.4. pp.45-80. Port., 55 Refs., Illus.

Cassava. Roots. Cassava meal. Processing. Peeling. Washing. Rasping. Pressing. Drying. Grinding. Water requirements (processing). Industrial machinery. Industrialization. Production. Cassava starch. Industrial starches. Small-scale equipment. Small-scale processing. Screening. Centrifuging. Fermentation. Uses. Cassava chips. Solar drying. Brans. Tapiocas. Composition. Power sources. Factories. Costs. Marketing. Brazil.

A detailed review of the processing, chemical composition, production costs, and commercialization of cassava by-products in Brazil is presented. Root preparation for subsequent production of farinha, starch, sour starch, modified (pregelatinized, modified with acids, oxidized, phosphatized) starches, chips, chip flour, bran, pellets, tapiocas, and tapioca flakes is reviewed. Quality control aspects of these cassava by-products are discussed. (Summary by EDITEC. Trans. by M. de W.) I02

0450

23270 NANDA, S.K. 1984. Field evaluation of hand operated cassava chipping machine. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.51. Engl.

Cassava. Cassava chips. Processing. Industrial machinery. India.

The feeder, discs with knife assembly, and crank-handle units for chipping machines were designed. A brief description of each component is given. (Summary by M. de W.) I02

0451

24033 PHILLIPS, T.P. 1984. Cassava for food or fuel? In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.411-418. Engl., Sum. Engl., 11 Refs. [School of Agricultural Economics, Univ. of Guelph, Ontario, Canada]

Cassava. Development. Economics. Production. Alcohol. Industrialization. Canada.

The use of agricultural products, specifically cassava, to produce liquid energy, primarily ethyl alcohol and ethanol. is discussed. The advantages and disadvantages of this use for cassava-producing countries are examined. Developing countries have the special problem of needing to greatly increase energy inputs to increase food and industrial production, although they face severe shortages of foreign exchange to purchase imports. In several developing countries, energy farming could boost rural development, increase agricultural productivity, and save scarce foreign exchange. There is a danger though that such a development might compete with food crops. (Author's summary) I02

See also 0412 0413 0414 0415 0431 0435 0441 0442
0444 0446 0457 0462 0466 0470 0471 0473
0476 0482 0485 0487 0488 0497

0452

23712 FUJIO, Y.; SUYANADONA, P.; ATTASAMPUNNA, P.; UEDA, S. 1984. Alcoholic fermentation of raw cassava starch by Rhizopus koji without cooking. Biotechnology and Bioengineering 26(4):315-319. Engl., Sum. Engl., 15 Refs., Illus. [Dept. of Food Science & Technology, Faculty of Agriculture, Kyushu Univ., Hakozaki Higashi-ku, Fukuoka 812, Japan]

Cassava. Cassava starch. Pellets. Fermentation. Ethanol. Industrial microbiology.

Using only wheat bran koji from the Rhizopus strain, raw cassava starch and cassava pellets converted reasonably well to alcohol (ethanol) without cooking at 35°C and pH 4.5-5.0. When the initial broth contained 30 g raw cassava starch, 10 g Rhizopus sp. koji, and 100 ml tap water, 12.1 g of alcohol was recovered by final distillation from fermented broth. In this case, 12.1 g alcohol corresponds to an 85.5% conversion rate based on the theoretical value of the starch content. When the initial broth contained 40 g cassava starch, 14.1 g of alcohol was recovered, corresponding to a 74.5% conversion rate. The alcoholic fermentation process described is considered more effective and reasonable than the former process using raw starch without cooking, since the new process makes it unnecessary to add yeast cells and glucoamylase preparation. (Author's summary) 103

0453

23463 LALUCE, C.; MATTOON, J.R. 1984. Development of rapidly fermenting strains of Saccharomyces diastaticus for direct conversion of starch and dextrins to ethanol. Applied and Environmental Microbiology 48(1):17-25. Engl., Sum. Engl., 18 Refs., Illus. [Dept. of Applied Chemistry, Chemistry Inst., State Univ. of Sao Paulo, Araraquara-SP, Brasil]

Cassava. Cassava starch. Dextrins. Fermentation. Enzymes. Ethanol. Genetics. Culture media. pH. Industrial microbiology.

Alcoholic fermentation, growth, and glucoamylase production of 12 strains of Saccharomyces diastaticus were compared by using starch and dextrins as substrates. Haploid progeny produced from a rapidly fermenting strain, SD2, was used for hybridization with other S. diastaticus and S. cerevisiae haploids. Alcoholic fermentation and enzyme production by hybrid diploids and their haploid parents were evaluated. Although the dosage of the STA or DEX (starch or dextrin fermentation) genes may enhance ethanol production, epistatic effects in certain strain combinations caused decreases in starch-fermenting activity. Both the nature of the starch or dextrin used and the fermentation medium pH had substantial effects on alcohol production. Commercial dextrin was not as good a substrate as dextrins prepared by digesting starch with alpha-amylase. Crude cassava starch digested by alpha-amylase was fermented directly by selected hybrids with almost 100% conversion efficiency. The cassava preparation contained adequate minerals and growth factors. This procedure should be suitable for direct commercial application in cassava producing regions in Brazil and elsewhere. A rapidly fermenting haploid strain, SD2-A8, descended from strain SD2, contains 2 unlinked genes controlling formation of extracellular amylase. A convenient method for detecting these genes (STA genes) in replica plates containing large no. of meiotic progeny was developed. (Author's summary) 103

0454

23703 NOPARATNARAPORN, N.; NISHIZAWA, Y.; HAYASHI, M.; NAGAI, S. 1983. Single cell protein production from cassava starch by *Rhodopseudomonas gelatinosa*. Journal of Fermentation Technology 61(5):515-519. Engl., Sum. Engl., 15 Refs., Illus. [Dept. of Microbiology, Faculty of Science, Kasetsart Univ., Bangkok 9, Thailand]

Cassava. Cassava starch. Industrial microbiology. Culture media. Fermentation. Protein enrichment. Biomass production. Soybean flour.

Rhodopseudomonas gelatinosa was cultivated on cassava starch media for potential SCP. The optimal temp. for growth on the cassava-based medium under aerobic/dark and anaerobic/light conditions was found to be 40°C, and the time required for max. biomass was 9 and 55 h, resp. Under aerobic/dark conditions the max. growth rate was approx. 0.23 1/h with a growth yield of 0.40 g cell/g starch, whereas the growth rate under anaerobic/light conditions was 0.13 1/h with a yield of 0.83 g cell/g starch. This characteristic of *R. gelatinosa* indicated the high ability of CO_2 fixation under light conditions in spite of the longer time required for max. biomass. Under aerobic/dark conditions, the liquefying enzyme activity seemed to play an important role in controlling the starch consumption rate, and the substitution of $(NH_4)_2HPO_4$, as a N source, with SBM greatly improved the specific growth rate to 0.35 1/h while under anaerobic/light conditions, SBM had no effect. (Author's summary) I03

0455

23735 WANG, H.L.; SWAIN, E.W.; HESSELTINE, C.W. 1984. Glucoamylase of *Amylomyces rouxii*. Journal of Food Science 49(4):1210-1211. Engl., Sum. Engl., 13 Refs., Illus. [United States Dept. of Agriculture, Northern Regional Research Center, 1815 North Univ., Peoria, IL 61604, USA]

Cassava. Industrial microbiology. Fermentation. Analysis. Biochemistry.

The production of glucoamylase by *Amylomyces rouxii*, a mold used in rice and cassava fermentations in the Orient, was demonstrated under solid substrate culture conditions. The enzyme purified by ammonium sulfate fractionation, gel filtration, and Sephadex ion exchange column chromatography appears homogeneous. *A. rouxii* glucoamylase is a glycoprotein and has an optimum pH around 4.5, optimum temp. 60°C, a mol. wt. of 55,600 daltons, and K_m values of 15.8, 27.6, and 16.8 mg/ml for soluble starch, glycogen, and amylopectin, resp. Unlike the other fungal glucoamylases, which were found (from culture filtrates) to exist in multiple forms, *A. rouxii* glucoamylase, isolated from solid substrate fermentation, displayed only one form. (Author's summary) I03

See also 0321 0441

J00 ECONOMICS AND DEVELOPMENT

0456

24001 A-AS-SAQUI, M. 1984. The potential of cassava in optimizing small-farm productivity in Liberia. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.199-203. Engl., Sum. Engl., 11 Refs. [Root & Tuber Improvement Program, Central Agricultural Research Inst., P.O. Box 32, Gbarnga, Bong Country, Liberia, West Africa]

Cassava. Productivity. Production. Food energy. Research. Development. Germplasm. Cultivars. Liberia.

Because of the importance of cassava optimizing small-farm productivity in Liberia, a cassava program was initiated at the Central Agricultural Research Institute of the Ministry of Agriculture in 1979 to increase the quantity and to improve the quality of the crop. The program is also motivating the farmers to grow more cassava on their farms, to increase their farm productivity to be self-sufficient in food, and to increase their standard of living. The progress of the program and the importance of cassava are discussed. (Author's summary) JOO

0457

23489 BENNETT, D.; PITTER, M.; JONES, L.; BLAKE, R.; ROSALES, F.; BANTON, O. 1984. Position paper on rootcrops in Jamaica. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.223-228. Engl., 13 Refs. [Ministry of Agriculture, Hope, Kingston 6, Jamaica]

Cassava. Root crops. Production. Processing. Cassava bread. Cassava flour. Composite flours. Wheat flour. Trade. Marketing. Economics. Research. Animal nutrition. Cassava products. Jamaica.

Aspects of root crop production, local and export potentials, processing, marketing, agricultural credit and assistance, research carried out since 1970, and the agricultural engineering for root crop production in Jamaica are briefly summarized. In the 1970-81 period, cassava productivity increased 30%; the main production areas in the country include Saint Elizabeth, Manchester, and Clarendon. Ninety-five percent of the root crops produced in Jamaica are consumed locally and the preparation of a pudding from either cassava or sweet potato is very popular, particularly in rural areas; bammy (cassava bread) is also prepared. There is little local processing. Attempts to establish a flour processing plant to partially substitute imported wheat flour failed due to insufficient cassava supplies, technical difficulties, and limited markets. At present, there is a flour mixture containing 3% CF but it has had low acceptance by the consumers. Research projects for the use of cassava chips or the whole plant for animal feed, and the development of cassava products (biscuits, noodles) have been carried out. Small-scale research is being conducted to use cassava peel and pulp as substrates for biogas production. Currently a chipping machine for cutting cassava roots is being developed for small-scale operation. Cassava bammy is exported in small quantities. There are short-term credits for crops as cassava. Institutions involved in root crop research in Jamaica are listed. (Summary by EDITEC. Trans. by M. de W.) JOO

0458

21168 BESSA JUNIOR, A. DE A.; MELLO, N.T.C. DE 1978. Custo de producao e analise da renda da cultura da mandioca industrial no município de Candido Mota, Estado de Sao Paulo, 1973/74. (Production costs and analysis of the income return from industrial cassava cultivation in the municipality of Candido Mota, state of Sao Paulo, 1973/74). Sao Paulo-SP, Brasil, Instituto de Economía Agrícola. Relatorio de Pesquisa no.9. 19p. Port., Sum. Port., 3 Refs.

Cassava. Production. Costs. Economics. Income. Labour. Brazil.

Production costs and income return in the largest cassava-producing region of the state of Sao Paulo (Brazil), Candido Mota, were determined. The sample of 29 properties was divided into 2 groups according to farm size (less or more than 12.10 ha). In both, the net income was negative, and the interests on land was the factor that increased fixed costs most, whereas labor increased variable costs. Av. productivity was above 14 t/ha with a positive operational cost for both groups. (Summary by M. de W.) JOC

0459

23461 BOX, L. 1984. Cultivadores de yuca y sus variedades: resultados preliminares de los estudios de casos en La Sierra, República Dominicana. (Cassava producers and varieties: preliminary results of case studies in La Sierra, Dominican Republic). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agrosociológica sobre Yuca y Arroz. 22p. Span., 6 Refs. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Cultivars. Sweet cassava. Bitter cassava. Agronomic characters. Root productivity. Soil fertility. Harvesting. Timing. Deterioration. Resistance. Starch content. Socio-economic aspects. Dominican Republic.

Based on interviews to cassava producers of La Sierra region, Dominican Republic, and 18 case studies, a list of 103 names of cassava var. grown in the area was obtained. However, this list had repeated names since sometimes the same material had different names. Analysis permited a new list of 63 potential var. since a final list can only be made based on detailed botanical work. The principal characteristics for which the farmers seem to have selected the currently grown var. are the capacity to grow in low fertility soils and an increasing commercial root yield over a shorter period of time. (Summary by EDITEC. Trans. by M. de W.) JOO

0460

23462 BOX, L. 1984. Reverse transfer: adapting agricultural research to small-holder conditions; the case of cassava cultivation in the Dominican Republic. Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. 23p. Engl., Sum. Engl., 17 Refs. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Paper presented at the Caribbean Studies Association Conference on Strategies for Progress in the Post Independence Caribbean, Saint Kitts, 1984.

Cassava. Cultivation. Cultivation systems. Inter-cropping. Research. Development. Cultivars. Selection. Deterioration. Socio-economic aspects. Technology transfer. Dominican Republic.

A methodology for reverse transfer (or the channeling of information from the farm level to agricultural research centers) is explained and applied to a case study of cassava cultivators in northern Dominican Republic. Reverse transfer is considered to be a necessary condition for successful agricultural research and development programs, especially in countries with weak farmer's organizations and few resources for technology generation. International research centers would be provided with much needed information on local cultivation systems. (Extracted from author's summary) JOO

0461

23479 CARIBBEAN REGIONAL WORKSHOP ON TROPICAL ROOT CROPS, 1st., JAMAICA, 1983. Rootcrops in the Caribbean: proceedings. Dolly, D., ed. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. 285p. Engl., 171 Refs., Illus.

Cassava. Cultivation. Plant breeding. Economics. Diseases and pathogens. Pests. Physiology. Nutritional requirements. Caribbean.

The papers presented at the Caribbean Regional Workshop on Tropical Root Crops held in Jamaica in 1983, are given. Topics included on cassava are divided in the areas of agronomy, plant breeding, economic considerations, pathology and entomology, physiology and nutrition, postharvest considerations, and documents of different countries (Dominican Republic, Jamaica, Guyana, and Trinidad and Tobago). The papers presented at this workshop are recorded individually in this publication under the following consecutive no.: 0327, 0338, 0344, 0457, 0474, 0476, 0484, 0486, 0489, 0492, 0497, 0508, and 0509. (Summary by EDITEC. Trans. by M. de W.) J00

0462

23243 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1984. Annual Progress Report 1983. Trivandrum, India. 142p. Engl., Sum. Hindi., Illus.

Cassava. Cassava programs. Research. India.

Advances in research carried out at the Central Tuber Crops Research Institute, India, during 1983 on root and tuber crops, namely cassava, sweet potato, yams, aroids, and coleus, are presented. Plant breeding, cultivation, plant physiology, plant pathology, and postharvest technology are highlighted. Individual papers on these topics are recorded in this publication under the following consecutive no.: 0307, 0308, 0314, 0317, 0326, 0333, 0334, 0335, 0350, 0351, 0359, 0360, 0361, 0362, 0364, 0365, 0373, 0377, 0378, 0379, 0392, 0393, 0400, 0403, 0405, 0406, 0407, 0408, 0410, 0411, 0440, 0441, 0443, 0444, 0450, 0463, 0464, 0477, 0483, and 0504. (Summary by M. de W.) J00

0463

23245 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1984. Cassava: salient features. In ________. Annual Progress Report 1983. Trivandrum, India. pp.8-11. Engl., Illus.

Cassava. Research. Plant breeding. Root productivity. Propagation. Cultivation. Cuttings. Storage. Fertilizers. Plant physiology. Composition. Pruning. HCN content. Protein enrichment. Cassava starch. Processing. Drying. Cassava African mosaic virus. Injurious mites. Resistance. Cultivars. India.

Results of studies on the effect of early maturing cv., storage of cuttings, planting methods, use of fertilizers, source-sink relationship, composition, pruning, and resistance to water stress on cassava yield are given. Advances in cassava postharvest technology, especially SCP production, chipping and drying, and starch properties, are indicated. In relation to plant pathology, the resistance to CAMD and spider mites, and their control, are mentioned. (Summary by M. de W.) J00

0464
23244 CENTRAL TUBER CROPS RESEARCH INSTITUTE. 1984. Director's introduction. In ________. Annual Progress Report 1983. Trivandrum, India. pp.1-7. Engl.

Cassava. Cassava programs. Research. India.

The history, objectives, organization, facilities, and major research achievements of the Central Tuber Crops Research Institute, India, are presented. (Summary by M. de W.) J00

0465
23747 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. 270p. Engl., Illus.

Cassava. Cassava programs. Development. Developmental research. Research. Colombia.

Research activities carried out in 1984 by CIAT's cassava program and the results obtained are presented. Topics include physiology, soils and plant nutrition, mycorrhizae, pathology, virology, entomology, germplasm development, tissue culture, utilization, and economics. International cooperation and improvement of cassava var. in Asia are also discussed. Individual papers are recorded in this publication under the following consecutive no.: 0305, 0329, 0330, 0371, 0376, 0386, 0397, 0398, 0399, 0466, 0467, and 0468. (Summary by M. de W.) J00

0466
23758 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL 1985. Cassava utilization. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.219-248. Engl., Illus.

Cassava. Cassava programs. Storage. Deterioration. Roots. Temperature. Analysis. Cultivars. Cortex. Plant tissues. Cooking. Organoleptic evaluation. Plant respiration. Composition. Dry matter. Starch content. Marketing. Drying. Solar drying. Processing. Production. Economics. Costs. Income. Development. Composite flours. Wheat flour. Cassava flour. Colombia.

Cassava root storage trials were conducted on the North Coast, Llanos Orientales, and Cauca, representing 3 different zones of Colombia: a lowland area (1), a lowland area with higher rainfall (2), and a high alt. area (3), resp. Fresh cassava roots, treated or untreated with thiabendazole, were stored for 1 or 2 wk. in polyethylene bags. In zone 1, bags were stored under a protecting roof with free air circulation below or in an enclosed room. In the 1st case, acceptably low losses were obtained, while in the latter, losses due to both microbial growth and to internal rotting were unacceptably high. In zones 1 and 2 thiabendazole treatment greatly reduced losses but in zone 3, treated roots had higher losses due to microbial deterioration after only 1 wk. This deterioration was of bacterial, rather than fungal, origin. Results of thiabendazole residue analysis showed that while the peel contained substantial amounts of thiabendazole, the parenchyma or edible portion contained, regardless of storage time prior to analysis, 1 mg/kg of residues, which is well below the max. permitted. In trials to determine the quality of stored roots, cooked samples of fresh and stored roots of the same cv. were basically similar for the consumers, although stored roots did taste sweeter and had a less acceptable external appearance. Expt. were conducted on root respiration levels to determine if losses of starch and DM content due to respiration were maintained at a low, constant level during storage; plastic bag storage was found to ensure a low, constant respiration rate during storage (3-4 mg CO_2/g/day). The commercialization of storage technology considering the integration of farmers, middlemen, and retail groups is being envisaged. In root quality studies, 21 clones harvested at 7, 9, and 11 mo. were evaluated for cooking time, taste, and texture; chemical analyses were performed as well. The 9 mo. harvest produced the best results with roots having, on the av., better taste/texture evaluations and higher DM/starch contents than at the 7 and 11 mo. harvests. Technical and economic data on the commercial operation of the 7 drying plants on the Atlantic Coast of Colombia, have been gathered. During 7 mo., with a total of 4000 m^2 of drying floor, 2395 t of fresh cassava were converted into 946 t dry cassava; therefore the conversion factor is 2.53 t of fresh cassava to produce 1 t dry cassava. The process gave a net profit of Col\$740/t dry cassava. For the 1984/85 season the total no. of plants is expected to be 20 with an estimated capacity to produce 4250 t dry cassava/yr. A pilot plant, with a through circulation drier coupled to a flat plate solar air heater, was constructed at Betulia, Sucre. The collector efficiency and the optimum loading density were 63% and 150 kg/m^2, resp. Trials to study the combination of natural and through circulation drying systems were carried out; a combined drying system will require 200 m^2 of concrete floor for 6 m^2 of drying bin. Investment costs of the different drying systems are analyzed. The evaluation of an indirect coal-fired burner showed that to be thermally more efficient, it requires a continuous operation. A joint CIAT/Instituto de Investigaciones Tecnológicas (IIT)/U. del Valle wheat/cassava composite flour project was undertaken to determine the technical and economic conditions required for the development of a rural CF industry in Colombia. The project is divided into 3 basic research areas: economic evaluation, design and development of processing plant, and bakery product development. (Summary by M. de W.) JOO

0467

23759 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. Economics. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.249-268. Engl., Illus.

Cassava. Cassava programs. Development. Economics. Marketing. Production. Feeds and feeding. Consumption. Income. Costs. Prices. Socio-economic aspects. Starch crops. Fresh products. Deterioration. Mathematical model. Mexico. Colombia.

The information needs for planning and evaluation of cassava projects are presented, and the development of a framework for the systematic collection of information required is analyzed and discussed. The 3 main systems involved in integrated cassava development projects are: production, processing and marketing, and utilization. Therefore, information on these 3 integrating systems must be available for the successful establishment and analysis of integrated cassava projects. For each system, the most appropiate information sources and their importance for management and impact evaluation are summarized. The criteria taken into account for the identification of the market segment for cassava as an animal feed in Mexico are presented and discussed: absorption capacity of the different markets, transportation costs, quality requirements of the different segments, utilization convenience of cassava in the market segments proposed, and the opportunity cost of the cassava used in a certain market segment. The market segment which looks like the most attractive target is the inclusion of dried cassava in feed mixing by integrated producers.

Considering these 2 main demand sectors, the potential production areas for cassava in Mexico were evaluated in collaboration with the Instituto Nacional de Investigaciones Agrícolas (INIA). At present, the Secretaría de Agricultura y Recursos Hidráulicos (SARH) and INIA are increasing their research efforts in the areas selected and have started 20 integrated projects to use cassava as animal feed. To understand more precisely which factors are important in determining the differences in cassava consumption between rural and urban areas, and to perceive the implications this has for cassava research, fresh cassava consumption, together with that of several other starchy crops, was analyzed in the Atlantic Coast region of Colombia. Consumption levels, relative prices, incomes, and appreciation of other properties were assessed among 320 households. The analysis of 12 different statements for each of the 5 crops allowed product properties to be summarized as follows: (1) buying inconvenience, (2) intrinsic value, (3) in-shop availability, and (4) short-term price appreciation. Preliminary specifications of the linear regression model showed a negative relation between the intrinsic value and consumption; it appears that the consumption is not longer determined by the appreciation of its intrinsic value, but the appreciation is determined by the high consumption levels. This characteristic was therefore eliminated from the analysis. Data showed that consumption of the crops studied is not highly dependent on income, and that availability is strongly and positively related with consumption, as expected. The negative sign of the short-term price appreciation was also as expected; where consumers had the impression that the price of a crop had risen, consumption had dropped. The buying inconvenience factor had special relevance in the analysis since cassava, the target crop for this research, scored a very high value and consequently, its consumption was significantly reduced. Available evidence suggests that cassava's buying inconvenience is strongly related with its rapid postharvest deterioration. Effective research to control this adverse quality factor would decrease the present marketing costs of fresh cassava and reduce its buying inconvenience. (Summary by M. de W.) JOO

0468

23748 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1985. International cooperation. In ________. Cassava Program. Annual Report 1984. Cali, Colombia. Working Document no.1. pp.7-13. Engl.

Cassava. Cassava programs. Development. Research. Drying. Plant breeding. Cultivars. Germplasm. Phenacoccus manihoti. Injurious mites. Biological control. Predators and parasites. Cultivation. Post-harvest technology. Economics. Mexico. Panama. Brazil. Colombia. West Indies. Africa. Asia.

In March 1984, a workshop on the development of integrated cassava production, processing, and marketing projects was held at CIAT and attended by top-level administrators of national research and extension programs of 5 countries of Central and South America and the Caribbean. As a result, CIAT and the Instituto Nacional de Investigaciones Agrícolas, Mexico, produced a working document defining Mexican areas with greatest potential for cassava production, processing, and marketing; Mexico established 20 drying plants. In Panama, CIAT and the Instituto de Investigación Agrícola Panameña have collaborated closely on the 1st phase of the development of an integrated cassava drying project for animal feed. In Cuba, the selection of local var. and release of introduced var. and new hybrids, coupled with improved cuttings production schemes and the use of the Colombian system of production, have had a dramatic impact on cassava production. In Colombia, under the Integrated Rural Development project for the production of cassava chips for use in animal feed, the no. of commercial drying plants increased to 20. Through representatives of the Caribbean Agricultural Research Development Institute, arrangements for future cooperation and germplasm exchange between CIAT and the English-speaking Caribbean countries were made. CIAT also started making crosses to produce elite pools of materials resistant to the green spider mite and for the highland cassava growing areas of Africa. The International Institute of Tropical Agriculture (IITA), Nigeria, and CIAT agreed on sending CAMD-tolerant clones to CIAT, after passing through a quarantine period in the UK; at CIAT, they can be crossed with mite-resistant materials and the progeny (as sexual seed) returned to IITA for testing and selection. Collection of biological control agents in the Llanos Orientales of Colombia, followed by studies at CIAT, have led to the identification of predators and parasites of Phenacoccus herreni and one of these was effective in the control of P. manihoti in Africa. Similarly, Phytoseiid predatory mites sent from CIAT to IITA have been effective in controlling green spider mites in preliminary field trials. IITA and CIAT also agreed on the exchange of information; CIAT will provide information on the techniques to control postharvest deterioration of cassava at the farm level and IITA will collaborate with CIAT's Cassava Newsletter and establish closer ties with CIAT's Cassava Information Center. The workshop on the future potential of cassava in Asia, organized by CIAT and the Coarse Grains, Pulses, Roots and Tuber Crops Centre and held in Bangkok (Thailand) in June, 1984, recommended research on breeding, agronomy and cropping systems, postharvest technology, and economics. (Summary by M. de W.) J00

0469

22998 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1981. Cassava. In ________. CIAT in the 1980s. A long-range plan for the Centro Internacional de Agricultura Tropical. Cali, Colombia. pp.5-6,13-39, 49-51,65-85,151-157,170-172,174,180-181. Engl., Illus.

Cassava. Cassava programs. Development. Socio-economic aspects. Production. Plant breeding. Germplasm. Cultivation. Income. Costs. Economics. Climatic requirements. Temperature. Rainfall data. Soil physical properties. Roots. Storage. Drying. Solar drying. Cassava meal. Foliage. Cassava leaves (vegetable). Research. Colombia.

The long-range plan for CIAT's cassava program in the 1980s is given. The selection of cassava from among different alternative crops, the development strategies of the program, and the collaborative links it has with national programs are based on a detailed analysis of the socioeconomic environment in tropical America and the goals that both CIAT and national programs must achieve. The relative importance of cassava in tropical Asian and Latin American countries, production and demand situation in Latin America, production systems and constraints are analyzed. Program objectives are to: (1) develop germplasm and associated cultural practices that require low input levels and respond to improved management in order to increase cassava production in areas where it is currently grown; (2) develop germplasm and associated management practices that, under intermediate levels of inputs, will lead to profitable cassava production on acid, infertile soils of the lowland tropics; (3) develop systems that can improve the utilization of cassava for direct or indirect human consumption; (4) strengthen national cassava research and development programs so that they can perform more effectively. Research strategies include investigation on techniques for fresh cassava storage, drying techniques that improve the quality of the end product (CF or animal concentrates) and reduce its cost, and the use of the whole plant. The international cooperation strategy is discussed; countries have been classified into 4 categories according to their cassava program development: advanced, developing countries with strong national programs, developing countries with weak programs, and calorie-deficient countries uninterested in cassava. Program accomplishments (summary of 1969-80), projected program developments, future headquarter-based research staffing requirements, outposted research staff (subtropics), and regional cooperation (Asia, Andean zone, the Caribbean, Central America, Mexico, and Africa) are indicated. Finally, expected costs and benefits of CIAT activities are analyzed. (Summary by EDITEC. Trans. by L.M.F.) J00

0470

22068 CHANDRA, S. 1979. Handling, storage, and processing of root crops in Fiji. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.53-64. Engl., Sum. Engl., 9 Refs., Illus.

Cassava. Root crops. Storage. Processing. Cassava chips. Cassava starch. Animal nutrition. Cultivars. Root productivity. Production. Economics. Fiji.

In Fiji, small-scale processing of the tropical root crops (ginger, taro, and cassava) is carried out on a very limited scale by only 1 or 2 firms; products include cassava chips and cassava starch. Some associated problems are high wage rates which reduce the viability of the industries, irregular supply of raw materials to the factories, a high degree of variability in the raw materials which affects the quality of the final product, high prices of some crops which results in high cost production and marketing, unavailability or ignorance of appropriate processing technologies, and lack of basic research in food technology. To resolve some of these problems, a food processing lab. is to be established with the Dept. of Agriculture to conduct research on ways of utilizing and preserving tropical roots and other crops grown in Fiji. Hopefully, research results will be used by the private sector to establish new processing industries in the country. (Author's summary) J00

0471

21496 CHAVES, I.C.P. DE V.; SILVA, J.A.B. DA; CHAVES, L.C.V.; LEZDKALNS, R.; MARKUS, V.R. 1978. Sistema agroindustrial da mandioca no Estado do Rio Grande do Sul. (Agroindustrial system for cassava in the state of Rio Grande do Sul). Porto Alegre, Brasil, Secretaria de Coordenacao e Planejamento. Fundacao para o Desenvolvimento de Recursos Humanos. Caderno de Agroindústria no.13. 166p. Port., 13 Refs., Illus.

Cassava. Cultivation. Soil requirements. Climatic requirements. Propagation. Cultivars. Uses. Pest control. Root productivity. Production. Costs. Industrialization. Cassava starch. Factories. Alcohol. Technology. Processing. Fermentation. Marketing. Consumption. Trade. Brazil.

The situation of the state of Rio Grande do Sul (Brazil) in relation to national cassava production is reviewed and its effect on agroindustry is discussed. The agronomic characteristics of cassava, its production and production costs, yield, and utilization are presented. A potential region for expanding cassava cultivation and the creation of a cassava alcohol agroindustry are described; the process is indicated in detail. Marketing, trade and commercialization of cassava and cassava products are analyzed. (Summary by M. de W.) J00

0472

24002 DAPHNE, P. 1984. Community organization through cassava production: towards a mobilization of the South African peasantry. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center.

pp.213-217. Engl., Sum. Engl., 2 Refs., Illus. [Univ. of Zululand, Private Bag X1001, Kwa Dlangezwa 3886, South Africa]

Cassava. Development. Climatic requirements. Socio-economic aspects. Technology. Technology transfer. South Africa.

A rural development program geared to the application of CIAT cassava technology in peasant farming systems in South Africa is examined. A brief history of land allocation and the colonization of Zululand is presented. An analysis of the tribal authority system, used by the British and adopted by the central government of South Africa as a form of control, shows this system to be a hindrance to development. The manner in which the cassava development program is being conducted aims at not only improving agricultural production but also at acting as a catalyst for organizational development. A considerable degree of organization has been achieved in the 18 mo. during which the project has been running. The strategy adopted in this project, community organization through physical programs, could be applied with other crops and in other parts of the world. (Author's summary) JOO

0473

23460 DE LA RIVE BOX, B. 1982. Casaberas y arroceras: Informe preliminar sobre estudio de casos. (Casave producers and rice growers: preliminary case study report). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 18p. Span., 19 Refs. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Casave. Processing. Labour. Socio-economic aspects. Rice. Cultivation. Income. Economics. Dominican Republic.

Rural women's participation in casave production and rice cultivation in the regions of La Sierra and El Pozo de Nagua, Dominican Republic, resp., was studied. In both places and jobs, women work for economic reasons. In the case of casave producers, working conditions are very hard and the technological changes introduced have only favored men, who are in charge of pressing the cassava before it is burned by women. In both regions, women wish to have other stable and better paid work alternatives. Technological improvements of the process that would improve working conditions for women and prevent the disappearance of this tradition are emphasized. Case studies are included. (Summary by M. de W.) JOO

0474

23485 FARQUHARSON, N. 1984. Trends in root crop production in Jamaica - 1972 to 1982. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.129-135. Engl., Illus.

Cassava. Production. Economics. Root crops. Costs. Prices. Climatic requirements. Development. Trade. Mathematical model. Jamaica.

Production trends of the most commonly grown root crops in Jamaica, among them cassava, during 1972-82 are presented and a brief overview of trends in world production and in the Caribbean is given. The main producing areas are identified to illustrate the spatial production pattern in Jamaica and the annual and quarterly production patterns for the considered period to indicate seasonal fluctuations. Some of the main factors that influence production are identified as well. In the case of cassava, the region of Saint Elizabeth produced approx. 25% in 1975 and 1980. Cassava only represented 11% of the total root crop production during this period; cassava production increased 28%, but yields decreased 8%. The largest cassava production occurs in the 1st and last quarters of each yr (Dec. and March). The main factors that affect production trends, other than agronomic ones, include rainfall, a good price the previous year, the current retail price of the crop, and the imports of agricultural products, especially rice. When analyzing these data in the regression equations, it was found that only in the case of cassava was there a relatively good fit. Rainfall was the most important factor and statistically significant in the determination of the amount harvested. A negative correlation between the amount harvested and the cost of production was seen. Production trends up to 1987 are given. The policies suggested for a stable growth in production include an increase in productivity, a decrease in the cost of production/production unit, and an increased price at the farm level to increase production, more loans to small producers, and a study of the effects of imports of other food crops. (Summary by M. de W.) J00

0475

23094 FEDERACION NACIONAL DE CAFETEROS DE COLOMBIA. PROGRAMA DE DESARROLLO Y DIVERSIFICACION DE ZONAS CAFETERAS. 1983. Programa de producción y comercialización de yuca en zona cafetera. (Cassava production and commercialization program in the coffee growing region). Bogotá. 33p. Span., Illus.

Cassava. Cassava programs. Development. Cultivation. Cultivars. Climatic requirements. Soil requirements. Cuttings. Land preparation. Fertilizers. Weeding. Pruning. Injurious insects. Injurious mites. Xanthomonas campestris pv. manihotis. Deterioration. Roots. Rosellinia. Harvesting. Income. Marketing. Trade. Research. Colombia.

The cassava project of the Federación Nacional de Cafeteros de Colombia is described. Its objectives are to promote cassava production with the present technology, increase the income return of the crop, prevent cassava cultivation on ridges on slopes higher than 5%, and encourage agroindustrial alternatives for cassava in specific zones of the country with more comparative advantages. The project will be basically carried out in the piedmont region of the Llanos Orientales, without neglecting the programs in the region of Viejo Caldas and northern Valle. The importance, production areas, beneficiaries of the project, production techniques (climate, soils, var., seed selection and treatment, land preparation, planting, fertilization, weeding, pruning, pests, diseases, harvesting, crop rotation), income return, marketing and commercialization, institutional support, research needs, and the national quinquennial plan 1984-88, are mentioned. (Summary by EDITEC. Trans. by M. de W.) J00

0476

23490 FORDE, B. 1984. Root crops in Guyana. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.233-237. Engl., 11 Refs. [Dept. of Crop Science, Univ. of the West Indies, St. Augustine, Trinidad]

Cassava. Root crops. Cultivation. Soil physical properties. Cuttings. Fertilizers. Herbicides. Silba perezi. Erinnyis ello. Phenacoccus manihoti. Vatiga illudens. Thrips. Cecidomyiidae. Atta. Cultivars. Uses. Cassareep. Cassava starch. Cassava flour. Feeds and feeding. Swine. Composite flours. Wheat flour. Guyana.

The situation of root crops in Guyana, the most important being cassava, sweet potato, yam, tannia, and taro, is briefly summarized. Cassava has received major emphasis over the past 8 yr. Cultural practices are indicated, and among the most important pests, Silba perezi, Erinnyis ello, Phenacoccus manihoti, Vatiga illudens, Corynothrips stenopterus, Latrophobia brassiliensis, Atta spp., and Acromyrmex spp. stand out. The Guyanese cassava germplasm collection currently has 63 cv. from Puerto Rico, Colombia, Brazil, and Guyana. As a result of cv. evaluations, the multiplication of propagation material and the distribution of promising materials to the farmers were initiated. A stem cutting machine and a 3-row planter have been developed. Soaking cassava cuttings in a 0.3% monocrotophos solution for 12 h before planting is recommended. Financial resources are the main constraint to research and development of cassava. Cassava is used in the production of cassareep, flour, and starch, and as a feed for pigs. CF, originally produced to be mixed in composite flours, is being used in the bauxite/Al plants. (Summary by EDITEC. Trans. by M. de W.) J00

0477

23280 GADEWAR, A.U.; ANANTHARAMAN, M.; RAMANATHAN, S. 1984. An experimental study of external and internal motivation on adoption behaviour of small farmers. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.61-62. Engl.

Cassava. Cassava programs. Development. Cultivation. India.

The effectiveness of the extension approach was assessed in one of the predominant cassava growing districts of Kerala, India. It was found that 70% of the farmers had medium to high mass media exposure, 55% had regular contact with the extension agents, and 65% had a reasonable knowledge of cassava cultivation. None of the farmers reported the use of any plant protection measures. (Summary by M. de W.) J00

0478

21184 GARCIA V., L.G.; RINCON A., H. 1976. Producción y mercadeo de la yuca en los departamentos de Caldas, Quindío y Risaralda. (Production and marketing of cassava in the departments of Caldas, Quindío, and Risaralda). Tesis Ing. Agr. Manizales, Colombia, Universidad de Caldas. 201p. Span., Sum. Span., 82 Refs., Illus.

Cassava. Cultivation. Land preparation. Planting. Cuttings. Cultivars. Spacing. Timing. Fertilizers. Weeds. Weeding. Injurious insects. Injurious mites. Bacterioses. Mycoses. Insect control. Mite control. Disease control. Harvesting. Production. Marketing. Packaging. Distribution. Costs. Colombia.

Cassava production and marketing in the departments of Caldas, Quindío, and Risaralda (Colombia) were studied. Based on preliminary surveys and interviews to producers and wholesalers, it was determined that the main cassava producing municipalities are: Chinchiná, Palestina, and Viterbo in Caldas; Armenia, La Tebaida, Montenegro, and Calarcá in Quindío; and Pereira in Risaralda. Most of the farmers own the land and a good technical level is used in cultivation. Chiroza Gallinaza is the most cultivated var. Av. production/ha in this area is higher than the national av. (23.72 and 10.00 t/ha, resp.). Wholesalers purchase the growing crop and assume collection, packaging, and transportation costs. The production satisfies the regional demand and great amounts of the product are sent to Bogotá, Cali, and Medellín markets. Merchants avoid crop losses through selection and classification. (Author's summary. Trans. by L.M.F.) J00

0479

23172 JEFFERS, J.P. 1982. Cassava research and development project. Barbados, West Indies, Inter-American Institute for Cooperation on Agriculture. 9p. Engl.

Cassava. Cassava programs. Development. Composite flours. Cassava flour. Wheat flour. Cultivation. Processing. Costs. Economics. Barbados.

The 1978-82 cassava research and development project in Barbados is described. Its objectives are to: stimulate the production of cassava in marginal lands of the island (St. Philip, Christ Church, St. Peter, and St. Lucy); reduce wheat imports by manufacturing a composite flour composed of 90% wheat and 10% CF; provide a cheaper raw material which with the use of additives can be used as a livestock feed and thus help reduce foreign exchange spending; and provide raw material for any agro-based industry which is economically feasible. For each phase of the project (phase I-1978, phase II-1979, and phase III-1980-82), the programs and financing, and required infrastructure and personnel are given. (Summary by EDITEC. Trans. by M. de W.) J00

0480

22767 KHAMOUI, T. 1984. Cassava for feed on Guam: review and analysis. Guam, University of Guam. Agricultural Experiment Station. Technical Report. AES Publication no.33. 36p. Engl., Sum. Engl., 56 Refs.

Cassava. Roots. Cassava leaves (vegetable). Animal nutrition. Feeds and feeding. Trade. Prices. Costs. Production. Guam.

A literature review on the use of cassava roots and leaves for feed is presented, and cassava trade, prices, and products in Guam are discussed. Costs of local production and of cassava imports, particularly from Thailand, are analyzed. In order to substitute the maize imports with cassava, the construction of a feed mill is necessary. (Summary by M. de W.) J00

0481

23197 OSPINA P., B.; BEST, R. 1984. Manual de construcción y operación de una planta de secado natural de yuca. (Guide for the construction and operation of a natural cassava drying plant). Cali, Colombia, Centro Internacional de Agricultura Tropical. 54p. Span., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava chips. Solar drying. Processing. Development. Costs. Production. Colombia.

The principal aspects that should be considered when constructing the min. infrastructure necessary for a cassava plant with a 500 m^2 drying surface and a capacity to dry 6 t/wk. are described in detail, in addition to the equipment (scales, chipper, and motor), and implements and tools (wheelbarrows, rakes and shovels for collecting chips, plastic sheets, and packing materials, among others). The steps and materials involved in the construction of the drying surface, chipping area, and storage warehouse, and in the fencing off of the drying surface, are specified. Organizational and operational aspects of the plant are discussed as well as plant output. Factors determining the appropriate dimensions of a cassava root drying plant, including cassava production in the area, prevailing climatic conditions, and amount of dried cassava to be produced, are indicated. Diagrams of the infrastructure of a natural drying plant, its cost as well as others involved in the process, are given. (Summary by EDITEC. Trans. by L.M.F.) J00

0482

22983 USPINA P., B. 1983? Aspectos prácticos y de ingeniería en la construcción y operación de plantas de secado natural de yuca. (Engineering and practical aspects in the construction and operation of natural cassava drying plants). Cali, Colombia, Centro Internacional de Agricultura Tropical. 20p. Span., Illus. [CIAT, Apartado Aéreo 6713, Cali, Colombia]

Cassava. Cassava chips. Drying. Development. Costs. Water content. Dry matter. Colombia.

The principal aspects that should be taken into account when constructing the min. infrastructure necessary for a natural cassava drying plant (installations, equipment, and tools) are summarized. The steps followed in the building of the drying floor, the chipping area, and the storage warehouse are given in detail. The need to fence off the drying area is indicated. Illustrations on the installations are included and the costs and theoretical aspects of the control of MC of cassava chips by a proximate method are annexed. (Summary by EDITEC. Trans. by L.M.F.) JOO

0483

23279 RAMANATHAN, S.; ANANTHARAMAN, M.; LAKSHMI, K.R. 1984. Constraints in the adoption of high yielding cassava varieties. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. p.61. Engl.

Cassava. Cassava programs. Development. Costs. Marketing. Economics. Technology. Cultivars. Hybrids. India.

Data collected in 1983 from farmers participating in the lab.-to-land program and from nonparticipant farmers, in Tamil Nadu, India, show that the most important constraints for the adoption of high yielding var. are high costs of cultivation, inadequate industrial exploitation of cassava, and lack of a proper marketing system. Recommendations to solve these problems are given. (Summary by M. de W.) JOO

0484

23484 RANKINE, L.B. 1984. Towards the development and design of an appropriate strategy to improve production and productivity in the root crop industry of the Commonwealth Caribbean. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.117-127. Engl., 10 Refs. [Dept. of Agricultural Economics & Farm Management, Univ. of the West Indies, St. Augustine, Trinidad]

Cassava. Root crops. Production. Development. Economics. Caribbean.

Issues involved in the development and design of an appropriate strategy to improve root crop production, among them cassava, in the 14 English-speaking countries of the Commonwealth Caribbean, are discussed. These improvements refer to increased production and productivity, higher income/profit levels of the producers, reduced unemployment, self-sufficiency in food supplies, improvements in food security, conservation of foreign exchange earnings, and strengthening of the bonds between agriculture and the rest of the economy. After analyzing the performance of the root crop industry and the advances in root crop research in the region, the elements of the strategy are discussed, and the conditions necessary for its achievement and the factors that have not allowed these conditions to be met, are indicated. A commodity-oriented approach is suggested as the basis of a strategy to be adopted. A resource allocation model which allows for a clear definition of specific objectives is analyzed. Assuming that the analytical model proposed gives positive signals to proceed with large-scale research on root crops, then such activities should proceed within an institutional framework that: (1) fosters coordination, monitoring, and continuous evaluation of all research activities; (2) possesses the required flexibility to disseminate the results to farmers and incorporate feedback into the general work program; (3) mobilizes and manages the financial resources required to operate the program; and (4) provides leadership that would inspire confidence toward the development of viable enterprises based on tropical root and tuber crops. (Summary by EDITEC. Trans. by M. de W.) JOO

0485

23017 RICHTER, N.M.; ADAMS, R.I. 1984. Competitividade da producao de cana-de-acucar e mandioca para fins energéticos em duas regioes do Rio Grande do Sul. (Production competition for energy fuel purposes between sugar cane and cassava in two regions of Rio Grande do Sul). In Gorgatti Netto, A.; Cruz, E.R. da. Experiencia brasileira de pesquisa economica em energia para o setor rural. Brasilia, Empresa Brasileira de Pesquisa Agropecuária. Departamento de Estudos e Pesquisas. Documentos no.11. pp.117-121. Port., Sum. Port., Engl.

Cassava. Alcohol. Production. Development. Economics.

Feasability of alcohol production within the state of Rio Grande do Sul, Brazil, was evaluated. Results showed that alcohol from sugar cane as well as from cassava can compete with gasoline. This production of alcohol could also contribute to regional development and increase the demand for labor with no detriment of food production. (Extracted from author's summary) JOO

0486

23492 ROBERTS, L.B. 1984. The potential for large-scale tropical root crop production in the Commonwealth Caribbean with specific reference to Trinidad and Tobago. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.255-263. Engl., 28 Refs. [Food & Agriculture Corporation, 37A Wrightson Road, Port-of-Spain, Trinidad]

Cassava. Root crops. Climatic requirements. Soil physical properties. Cultivation. Land preparation. Planting. Timing. Cuttings. Cultivars. Fertilizers. Insect control. Mite control. Disease control. Harvesting. Trinidad and Tobago.

The main factors that should be taken into account in large-scale tropical root crop production, among them cassava, in the Commonwealth Caribbean are reviewed. Temp., solar radiation, day length, rainfall, soil texture and pH are briefly discussed. In relation to crop management, the following are discussed: land preparation; planting material, time, and system; cv. selection; fertilizer application; crop protection against weeds and diseases; and harvesting. The edaphoclimatic situation of Trinidad and Tobago is briefly described and its possibilities for root crop production are analyzed. The feasibility of large-scale root crop production in the region is indicated and it is recommended that the existing mechanical planting and harvesting techniques be improved. Other research efforts that are required include the selection or development of suitable cv., the development of economical and effective crop protection measures, and the determination of optimum plant populations and adequate fertilizer use. (Summary by EDITEC. Trans. by M. de W.) JOO

0487

23458 ROSEBOOM, H. 1983. Almidón y harina de yuca amarga: ¿Qué cuesta y quién puede comprar? (Bitter cassava starch and flour: how much does it cost and who can buy it?). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 17p. Span., 7 Refs. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Bitter cassava. Cassava flour. Cassava starch. Wheat flour. Composite flours. Costs. Prices. Economics. Uses. Dominican Republic.

A report is given on the prices of bitter cassava starch and flour, the possibilities of selling these products in the Dominican Republic, and the calculations of the production costs of these products. Calculations indicate that raw material is the factor that most affects costs (62% for both products) and that the % of starch and flour obtained is a very important factor for the price of both products. Although it is technically possible to substitute imported wheat flour with cassava flour up to 20%, the possibilities of selling cassava starch or flour to the Dominican mills are limited by the relatively high prices of the products. However, cassava starch has several industrial applications as human food, animal feed, thickener, agglutinogen, stabilizer, and glue. (Summary by EDITEC. Trans. by M. de W.) JOO

0488

23459 ROSEBOOM, H. 1983. De yuca amarga a casabe; un estudio económico sobre el mercadeo y la elaboración de la yuca amarga en el área de Monción. (From bitter cassava to casave; an economic study of the marketing and elaboration of bitter cassava in the Monción area). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 93p. Span., 10 Refs., Illus. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Bitter cassava. Cultivars. Cultivation. Timing. Planting. Harvesting. Distribution. Costs. Production. Marketing. Prices. Factories. Casave. Processing. Peeling. Washing. Rasping. Pressing. Drying. Packaging. Income. Trade. Dominican Republic.

The production of bitter cassava (cultural practices, var., cultivated area, costs), and the marketing (producers, middlemen, buyers, transportation, prices), and processing of casave in the Monción region, Dominican Republic, are described in detail. Tables with the costs of production of the raw material and of the establishment of a casave factory are included. (Summary by M. de W.) JOO

0489

23491 SEESAHAI, A. 1984. Root crop production in Trinidad. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.245-249. Engl., 12 Refs. [10 Caroni North Bound Road, Centeno, Trinidad]

Cassava. Development. Production. Root productivity. Root crops. Research. Trinidad.

Domestic production and research on and development of root crops, among them cassava, in Trinidad are briefly described. Root crops only represent 0.59% of the total land area of Trinidad, less than 0.30% of the arable land. A preliminary investigation on the substitution of imported livestock ingredients, using cassava as a possible carbohydrate source, has been proposed. The constraints in root crop research include financial resources and inefficient coordination of research and development efforts. Further agronomic research is required in terms of land preparation, high yielding improved var., and fertilization, as well as a careful survey of insects and diseases. Efforts should focus on the development of harvesting aids for both small- and large-scale cassava producers. Markets have to be controlled to avoid overproduction. Recommendations for processing several root crops into flour, chips, and snack foods must be carried out. Finally, it is recommended that farmers presently involved in root crop production be identified and that a system for continuous monitoring of changes and agronomic problems which impede increased yield be established. (Summary by EDITEC. Trans. by M. de W.) J00

0490

23718 SELLERS, S.G. 1984. Diet patterns and nutritional intake in a Costa Rican community. Ecology of Food and Nutrition 14(3):205-218. Engl., Sum. Engl., 20 Refs., Illus. [Anthropology Dept., Washington Univ., St. Louis, MO 63130, USA]

Cassava. Human nutrition. Diets. Food energy. Economics. Production. Development. Costa Rica.

Data from a survey of 26 family farm households, regarding diet patterns in Costa Rica, were analyzed for energy and nutritional content; budget and farming strategies were also evaluated. Energy intakes were found to be most limited in relation to recommended intake. The diet staples, rice and beans, provided the largest caloric share while a significant proportion was supplied by cane sugar. While households varied considerably in the purchase, or home growing, of different foods, production of cash crops is shown to be advantageous in relation to subsistence production. The burden of food subsidies on the national economy may shift that arrangement and traditional carbohydrate sources (taro, cassava, maize, and bananas) might take on renewed importance. (Author's summary) J00

0491

23734 SRISILPAVONGSE, K. 1984. Agricultural policy. Bangkok Bank Monthly Review 25(4):132-139. Engl., Illus.

Cassava. Rice. Maize. Trade. Economics. Development. Thailand.

While rice policy in Thailand has been gradually adjusted over the last decade, other principal agricultural experts, with the exception of rubber, have gone through drastic policy changes only in the last 2 yr. In Nov. 1982 the government signed a 5-yr bilateral agreement with the EC limiting cassava export vol. at 5.500 MT in 1982 and it was to be reduced to an av. annual ceiling of 5.250 and 4.725 MT during the period of 1983-84 and 1985-86, resp. With the exception of the tapioca pact, which Thailand was pressured into signing, the shift in policy was brought about because costly price support programs were ineffective and because of the private sector free-trade advocates' strong criticism of government export control measures which achieved their goals in regulating exports but created market distortions. Free trade seems to be the only means by which Thailand can readily respond to the fast changing international trade. (Extracted from summary by World Agricultural Economics and Rural Sociology Abstracts) JOO

0492

23488 SUZMAN, L. 1984. The economic importance of tropical root crop production in the Dominican Republic. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.219-221. Engl. [Depto. de Cultivos de Raíces y Tubérculos, Oficina del Ministerio de Agricultura, Santo Domingo, República Dominicana]

Cassava. Cultivars. Root crops. Production. Research. Economics. Dominican Republic.

Economic aspects of the tropical root crop production in the Dominican Republic are briefly summarized. In vol., cassava has occupied the 1st place during the period 1973-80, with an approx. production of 175 t in 1973 and of 90 t in 1980. The institutional logistic support and some economic considerations are summarized and the research entities are mentioned. Regarding the latter, cassava has received the greatest support and there are several projects which utilize var. introduced from CIAT, highlighting CMC-40, to satisfy the increasing demand for cassava as a raw material in the agroindustry. (Summary by EDITEC. Trans. by M. de W.) JOO

0493

24000 SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS, 6th., LIMA, PERU, 1983. Proceedings. Lima, International Potato Center. 672p. Engl., Illus.

Cassava. Root crops. Development. Research. Cultivation. Plant breeding. Composition. Entomology. Diseases and pathogens. Post-harvest technology. Industrialization. Propagation. Tissue culture. Peru.

Original research papers, updates on procedures, literature reviews, and survey reports, presented at the Sixth Symposium of the International Society for Tropical Root Crops held in Lima, Peru, are given. Crops covered include aroids, cassava, potato, sweet potato, and yam. Areas covered were agronomy, botany, breeding, food quality and chemical composition, plant protection, postharvest aspects, and propagation and tissue culture. The papers related with cassava, presented at this symposium, are recorded individually in this publication under the following consecutive no.: 0312, 0313, 0315, 0320, 0323, 0339, 0346, 0348, 0349, 0357, 0358, 0366, 0374, 0380, 0383, 0395, 0402, 0404, 0424, 0429, 0447, 0451, 0456, 0472, 0502, 0503, and 0506. (Summary by M. de W.) JOO

0494

22076 WALTERS, P.R. 1979. The effects of transportation and government policies on international trade in root crop products, especially cassava. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.450-461. Engl., Sum. Engl.

Cassava. Pellets. Cassava starch. Development. Trade. Distribution. Feeds and feeding. Marketing. Economics. Thailand. Indonesia.

Cassava enters international trade in 2 main forms: as pellets for use in animal feeds and as starch for use in both the food and nonfood sectors. Thailand is the major world exporter of both these products. While the export of Thai pellets has increased rapidly due to favorable EEC regulations and advances in transportation, starch exports to the 2 major markets have stagnated due to government policies in Japan and transport difficulties to the USA. The trade in sweet potato slices to EEC is also compared with the Thai cassava pellet trade. These case studies highlight the problems in developing international trade in root crops, the necessity for thorough market research, and the need for adequate transport facilities and clear government policies in the exporting countries. Because of the difficulties in developing international trade in both the animal feed ingredient and starch markets, producers of tropical root crops should normally concentrate on their domestic markets. (Author's summary) JOO

0495

22009 WATSON, J. 1979. Importing root crops from the South Pacific islands for New Zealand markets. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.151-165. Engl., Sum. Engl.

Cassava. Root crops. Taro. Trade. Costs. Prices. Oceania.

The history of importing taro and other tropical root crops such as tarotaura, yams, ta'amu, kape, and cassava in New Zealand goes hand to hand with the increasing no. of Polynesian immigrants from Tonga, Samoa, Fiji, and Rarotonga. Shipment, pests and diseases, and marketing of taro are described and the difficulties of selling fresh cassava because of its rapid deterioration are discussed. (Summary by M. de W.) JOO

0496

23453 WIERINGA, ?. 1984. Yuqueros en Amapola: un estudio sobre la organización socio-económica de una comunidad productora de yuca en la República Dominicana. (Cassava producers in Amapola: a study of the socioeconomic organization of a cassava producing community in the Dominican Republic). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 87p. Span., 15 Refs., Illus. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Cultivars. History. Cultivation. Cultivation systems. Land preparation. Planting. Weeding. Harvesting. Inter-cropping. Production. Socio-economic aspects. Economics. Costs. Labour. Marketing. Trade. Dominican Republic.

The socioeconomic organization and the existence and functioning of farmers' associations in a cassava producing community located in the Espaillat province, Dominican Republic, were studied. The region is described geographically, socially and economically, and a brief history of the agriculture in the region is presented. Cassava, which economically is the most important crop in the region, was 1st planted for marketing in the 40's, and presently is cultivated more for marketing than for local consumption. Var. Zenon and Jibara Blanca are primarily used since they meet marketing requirements. Cultivation practices (land preparation, planting, weeding, harvesting) are described, and production costs and factors are given. Land tenancy systems, private property and share tenancy, hinder larger production. Small-scale production, lack of transportation means, and the ample network of wholesalers do not permit the direct sale without middlemen. However, the estimates from the present work indicate that the farmer receives a higher net margin of production and commercialization than the wholesaler or local buyer. Although there are 3 farmers' associations in the area, regional development is limited because they only represent a minority of the farmers of the region. (Summary by M. de W.) JOO

0497

23487 WILSON, L.A. 1984. Problems of utilization of tropical root crops for food in the Caricom region. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.189-197. Engl., 24 Refs., Illus. [Faculty of Agriculture, Univ. of the West Indies, St. Augustine, Trinidad]

Cassava. Root crops. Nutritive value. Vitamin content. Composition. Consumption. Trade. Socio-economic aspects. Distribution. Storage. Processing. Marketing. Caribbean.

The problems of the utilization of tropical root crops for food in the Caribbean Commonwealth region are discussed. Emphasis is given to problems related to: food and nutrition; handling, distribution, quality, and storage of fresh roots; and processing. The main food and nutrition problems include: limited regional and national consumption due to low availability, low seasonal production, postharvest losses, and poor regional trade; little convenience of its use in the preparation of foods due to poor quality and absence of commercial processing enterprises; and false notions about the nutritive value of root crops, among them cassava. Problems of handling, distribution, quality, and storage are due to: the large no. of unorganized small farmers and middlemen involved in the trade of tropical root crop products; damage and postharvest losses due to poor handling, packaging, and transporting procedures; absence of a relative classification and grading of roots; lack of confidence of the consumer in root quality; and inadequate root storage. Food processing problems include the failure to establish viable processing enterprises and the limited diversity of tropical root crop food products. It is predicted that efforts to increase the production, and hence the consumption of root crops in the region, will be frustrated unless the numerous problems previously discussed are solved. (Summary by EDITEC. Trans. by M. de W.) JOO

See also 0344 0351 0353 0397 0412 0413 0415 0427 0434 0445 0448 0451 0500

KOO OTHER ASSOCIATED COMMODITIES

K01 Rotational Schemes and Intercropping

0498

23457 BLOMER, E. 1983. Algunos métodos para medir la erosión; impresiones recogidas de la literatura. (Some methods to measure soil erosion; notions taken from the literature). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 34p. Span., 13 Refs., Illus.

[Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Erosion. Cultivation systems. Inter-cropping. Sweet potatoes. Beans. Soil conservation practices. Dominican Republic.

The methods, construction, operation, and application of the exptl. plot, the erosion bridge, and erosion stakes, as well as some rustic methods such as gully transects, bottle caps, and paint, are described for erosion measurement. The studies undertaken in La Sierra, Dominican Republic, are presented, and the system used to measure erosion on land with a 12% slope and cultivated with cassava intercropped with green beans and sweet potato, is described. (Summary by EDITEC Trans. by M. de W.) K01

0499

22992 CORREA, H.; ANDRADE, A.M.S.; ROCHA, B.V. DA 1982. Consorciacao e culturas intercalares. (Association and intercropping). In Empresa de Pesquisa Agropecuária de Minas Gerais. Projeto mandioca: relatorio 76/79. Belo Horizonte-MG, Brasil. pp.117-126. Port., Illus. [Escola Superior de Agricultura de Lavras, Caixa Postal 37, Lavras-MG, Brasil]

Cassava. Cultivation systems. Inter-cropping. Cultivars. Cultivation. Fertilizers. N. P. K. Agricultural lime. Planting. Spacing. Sorghum. Maize. Rice. Beans. Groundnut. Soybeans. Crotalaria. Leucaena. Root productivity. Brazil.

The association of cassava with soybean, bean, maize, rice, or peanut, with double rows of cassava, at 0.50 m, 0.60 m between plants, and 2.0 m between the double rows (among which the other crops are planted), was studied at the exptl. station of the Empresa Brasileira de Pesquisa Agropecuária of Minas Gerais, Felixlandia, Brazil. Cassava var. Riqueza was used in a randomized block design with 4 replications. Best results were obtained with cassava/beans or cassava/maize but production data were not obtained due to the severe attack of CBB in cassava. A similar expt. was conducted at VERAGRO; however, sorghum and the following fertilizer and liming treatments were included: an absolute check, and 3 treatments in which the application of NPK and Zn was maintained constant at 30-60-60-5 and lime was applied at 3 and 6 t/ha. Intercrops were affected by a period of drought and production was low. In general terms, intercropping affected cassava yield and the application of lime also reduced its production with 21,490, 22,370, 18,340, and 19,185 kg/ha, resp., for monocropped cassava without fertilization and liming, monocropped cassava with fertilization and no liming, monocropped cassava with fertilization and 3 t lime/ha, and monocropped cassava with fertilization and 6 t lime/ha. Another associated cropping system was evaluated with cassava planted in strips spaced at 1.0 m between rows, 0.5 m between plants, and 5.0 m between cassava strips with 5 rows/strip. Other crops included sorghum, beans, maize, soybeans, crotolaria, and leucaena, the latter 2 being used as green manure. The no. of plants of the associated crops was varied to determine the no. of rows corresponding to the equilibrium point. Yields of cassava intercropped with beans were 8330, 8260, and 7660 kg/ha for bean planting densities of 6, 4, and 3 rows, resp. Cassava yields when intercropped with maize were 7530, 8910, and 8560 kg/ha for 4, 3, and 2 rows of maize, resp. Soybean production was favored by higher density without considerably affecting cassava yields (7700, 7780, and 8470 kg/ha for 6, 4, and 3 rows of soybean, resp.); at its highest density, sorghum gave optimum yield but significantly affected cassava (4240, 7259, and 7280 kg/ha for 6, 4, and 3 rows of sorghum, resp.). With crotolaria, cassava yields were 9900, 6970. and 9020 kg/ha for 6, 4, and 3 rows, resp. Rapidly growing plants tended to favor cassava production, creating a better environment for its growth provided that the planting density does not affect cassava. (Summary by EDITEC. Trans. by L.M.F.) K01

0500

23454 LEESBERG, J. 1984. Yuca, habichuela y la erosión; pruebas adaptivas en gestación. (Cassava, green beans and erosion; adaptive trials in gestation). Santiago de los Caballeros, República Dominicana, Centro de Desarrollo Agropecuario. Serie Investigación Agro-Sociológica sobre Yuca y Arroz. 94p. Span., Sum. Span., Engl., 19 Refs., Illus. [Centro de Desarrollo Agropecuario, Zona Norte, Apartado 700, Santiago, República Dominicana]

Cassava. Cultivation systems. Inter-cropping. Beans. Groundnut. Erosion. Field experiments. Research. Soil conservation practices. Cultivation. Technology evaluation. Dominican Republic.

Three trials were carried out under small farmer conditions of cassava cultivation in the area of Monción, Dominican Republic. The 1st consisted in planting cassava in monoculture or in association with red beans, in 2 spatial arrangements, to observe the effect of intercropping on cassava productivity. A check trial was established at the Centro Norte de Desarrollo Agropecuario. Cassava/red bean intercropping showed economic advantages in 1 of the arrangements and weeds were reduced. In the 2nd trial, the erosion of cassava in monoculture was compared with that of the association (cassava + beans + sweet potato), using erosion plots according to Rocheleau's method. The reduction of erosion by the intercrop was not significant. On the other hand, the weed cover formed after weeding did have an important effect on the reduction of erosion. Finally, additional intercropping trials were conducted to observe the performance of other potential crops in association with cassava. Black beans and peanuts were selected; however, neither crop was promising. It was possible to demonstrate that the conductance of on-farm trials with farmer collaboration is feasible, allowing a better understanding of local agriculture as well as contributing to the development of a technology useful to farmers within the selected group of interest. Some recommendations are given on how to conduct on-farm trials using adaptive methodology. (Summary by M. de W. Trans. by L.M.F.) K01

0501

23433 MENESES, R.; MORENO, R.A. 1983. Efecto de diferentes poblaciones de maíz (Zea mays) en la producción de raíces de yuca (Manihot esculenta) al cultivarlos en asocio. 1. Aspectos agronómicos. (Effect of different maize populations on root productivity of cassava when planted in association. 1. Agronomic aspects). Turrialba 33(2):109-116. Span., Sum. Span., Engl., 15 Refs., Illus. [Centro Agronómico Tropical de Investigación y Enseñanza, Apartado 74, Turrialba, Costa Rica]

Cassava. Maize. Cultivation systems. Inter-cropping. Cultivation. Climatic requirements. Rainfall data. Temperature. Soil physical properties. Insecticides. Planting. Spacing. Root productivity. Productivity. Costa Rica.

The effect of 6 different plant populations of maize cv. Tuxpeño C-7 PB (0, 1, 2, 3, 4, and 5 plants/m^2) on the root yield of cassava cv. Valencia (1 plant/m^2) was studied on an Inceptisol, suborder Tropepts, in Turrialba, Costa Rica, under 2 levels of NPK fertilization: 120-200-150 (high level) and 90-200-75 (low level) kg/ha, resp. The total no. of roots, commercial roots, and roots/plant, and the av. root wt. decreased significantly with increasing maize populations, with a max. of 50% yield reduction at 5 maize plants/m^2. The levels of fertilization used did not significantly modify this trend of reduced cassava yields with increasing maize plant populations. However, the no. of roots was higher at low levels of fertilization as maize plant population increased from 1 to 5 plants/m^2. Maize yields increased with increasing planting density. At high levels of fertilization and according to the total relative yield index, cassava intercropped with 5 maize plants/m^2 was the most efficient in terms of land use; at low levels of fertilization, cassava intercropped with 2 maize plants/m^2 was the most efficient. (Author's summary) K01

0502

24010 OKEKE, J.E. 1984. Cassava productivity in intercropping systems. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.277-281. Engl., Sum. Engl., 7 Refs. [National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria]

Cassava. Cultivation systems. Inter-cropping. Maize. Cowpea. Yams. Rice. Climatic requirements. Planting. Spacing. Productivity. Energy productivity. Root productivity. *Phenacoccus manihoti*. *Mononychellus tanajoa*. Nigeria.

Performance of cassava in various associations with maize, cowpea, yam, and upland rice was evaluated in 2 ecological zones of Nigeria to determine suitable food crops for intercropping with cassava. Fresh root yields of monocropped cassava were significantly higher than the yields under the various mixtures. Cassava/cowpea and cassava/maize gave the lowest cassava yield reductions (11 and 15%, resp.). Cassava intercropped with maize, however, gave the highest energy yield which was significantly higher than the returns from cassava/maize/cowpea/rice polyculture. The highest LER was observed with the association cassava/maize. Planting cassava in double rows between 2 rows of maize, cowpea, or yam significantly improved cassava productivity over the cassava monocrop. Choice of proper planting time and plant densities could further improve efficiency of the double-row system. (Author's summary) K01

0503

24011 OKOLI, P.S.O.; WILSON, G.F. 1984. Effect of stem cut-back on yield and yield components of intercropped cassava. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983 Proceedings. Lima, International Potato Center. pp.283-286. Engl., Sum. Engl., 12 Refs. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivation systems. Inter-cropping. Maize. Cultivation. Land preparation. Fertilizers. N. P. K. Planting. Weeding. Harvesting. Pruning. Simulation models. Productivity. Root productivity. Leaf area. Branching. Stems. Plant height. Nigeria.

Investigations were carried out to determine the feasibility of mechanizing maize/cassava intercropping, using available planting and harvesting machinery not originally designed for this purpose. Cassava was cut back at 3 heights (80, 60, and 40 cm) at maize harvest to simulate the damage to it if the maize was to be harvested mechanically; in the control plot cassava was left uncut. Cassava was harvested 12 mo. after planting. For cassava planted in the 1st season (April-Aug.), cutting caused a significant decline in root yield and no./plant, but did not affect the LAI, stem diameter, no. of branches, and final plant height. For cassava planted in the 2nd growing season (Sept.-Dec.) there were no significant differences among treatments in all variables studied. The savings in labor costs adequately compensated for the yield decline in the 1st season. It is feasible to mechanize maize/cassava intercropping, and agricultural engineers should design machinery suitable for this and other mixed cropping systems. (Author's summary) K01

0504

23254 PRABHAKAR, M.; MOHANKUMAR, B.; NAIR, G.M. 1984. Fertility management in cassava intercropping system. In Central Tuber Crops Research Institute. Annual Progress Report 1983. Trivandrum, India. pp.21-25. Engl., Illus.

Cassava. Cultivation. Cultivation systems. Inter-cropping. Groundnut. Nutritional requirements. Fertilizers. N. P. K. Planting. Spacing. Irrigation. Beans. India.

To evaluate the nutrient requirements of a cassava-groundnut intercropping system, a field expt. was laid out in a randomized block design with 18 treatment combinations and 3 replications. The treatments consisted of NP levels ranging from 0:0 to 150:150 kg/ha with a graded interval of 25 kg/ha. A uniform dose of ca. 12.5 t FYM and ca. 100 kg K/ha was applied and cassava cv. H-1687 was used. Root yield of cassava was significantly influenced by NP levels; the highest yield (25.43 t/ha) was recorded at NP levels of 125:50 kg/ha and the lowest (12.06 t/ha), when no NP was applied. The NP treatment 125:50 also gave the max. biomass production (16.60 t/ha). To identify possible competition factors and their influence on the cassava-groundnut intercropping system, 10 treatment combinations were drawn based on 2 spatial adjustments of cassava, 2 levels of plant population in groundnut, and 2 levels of moisture and 20 kg K. The highest root productivity was obtained with cassava and groundnut spaced 90 x 90 cm, with 20 kg of K and irrigation. Cassava/French beans intercropping was also studied. (Summary by M. de W.) K01

0505

23431 RAMANUJAM, T.; NAIR, C.M.; INDIRA, P. 1984. Growth and development of cassava (Manihot esculenta Crantz) genotypes under shade in a coconut garden. Turrialba 34(3):267-274. Engl., Sum. Engl., Span., 9 Refs., Illus. [Central Tuber Crops Research Inst., Trivandrum, 695017, Kerala, India]

Cassava. Cultivars. Cultivation systems. Inter-cropping. Selection. Shading. Cultivation. Plant anatomy. Leaves. Stems. Branching. Leaf area. Photosynthesis. Plant physiological processes. Cuttings. Germination. Rooting. Planting. Spacing. Productivity. Root productivity. Dry matter. Starch content. Plant vascular system. India.

The growth and development of 12 cassava genotypes (M 4, H 2304, H 1687, H 1423, H 1253, H 648, H 226, H 165, H 97, H 97/2, CI 590, and CI 167) under the shade in a coconut plantation were studied. Internodal elongation, thin leaves, and absence of branching were the most significant morphological changes noticed under shade. Cross section of leaves of plants grown under shade showed poor starch deposition in the vascular region. Most of the photosynthates of shade-grown cassava were utilized for shoot growth, affecting root development significantly. Cv. H 165 and CI 590 recorded higher yields under shade when compared with other cv. Wider spacings of cassava in the coconut plantation resulted in higher root yield. (Author's summary) K01

0506

24012 RODRIGUEZ M., W.; LIEBER, D.C.K.; OÑORO, P. 1984. Performance in association of cultivars of cassava (Manihot esculenta Crantz) and cowpea (Vigna unguiculata Walp.) of different growth habits. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.287-294. Engl., Sum. Engl., 8 Refs., Illus. [Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba, Costa Rica]

Cassava. Cultivation systems. Inter-cropping. Cowpea. Soil physical properties. Climatic requirements. Rainfall data. Cultivars. Planting. Spacing. Timing. Soil analysis. Pruning. Harvesting. Dry matter. Leaf area. Stems. Leaves. Petioles. Plant height. Root productivity. Statistical analysis. Solar radiation. Photosynthesis. Costa Rica.

In a completely randomized block expt. the interaction effect of association on the growth habits of 4 different cassava cv. and 4 different cowpea cv., grown in all possible combinations in an intercropping system, was studied. Only in the 2nd cowpea cycle was there a significant interaction between cassava and cowpea growth habits; cassava height and the % of photosynthetically active light influenced the yield of cowpea planted 253 days after cassava planting. The performance in association of cowpea and cassava cv. of different plant types depended not only on competitive ability but also on yield capacity of the different components. Results are discussed in terms of general and specific compatibility of the growth habits under consideration. (Summary by M. de W.) K01

0507

23466 VILLAMAYOR JUNIOR, F.G.; PEREZ, R.D. 1983. Sweet potato as a weed control agent for cassava. Radix 5(1):10-11. Engl., 3 Refs., Illus. [Philippine Root Crop Research & Training Center, Visayas State College of Agriculture, Leyte, Philippines]

Cassava. Cultivation systems. Inter-cropping. Sweet potatoes. Weeding. Harvest index. Productivity. Root productivity. Philippines.

Cassava cv. Golden Yellow, grown alone or intercropped with sweet potato cv. BNAS-51, was harvested at 7 mo. after planting. Hand weeding was carried out at 3 and 8 wk. after planting. Biological and marketable root yields were highest in the hand-weeded plots (62.5 and 25.6 t/ha, resp.) and lowest when intercropped with sweet potato (27.9 and 8.6 t/ha, resp.). (Summary by Field Crop Abstracts) K01

0508

23481 WILSON, G.F. 1984. Improving the efficiencies of root crop production systems in the humid tropics. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.31-38. Engl., 19 Refs., Illus. [IITA, P.M.B. 5320, Ibadan, Nigeria]

Cassava. Cultivation. Cultivation systems. Inter-cropping. Maize. Cowpea. Yams. Fallowing. Mulching. Africa.

Intercropping, fallowing, and mulching are discussed as options to improve the efficiency of root crop production systems in the humid tropics, with emphasis on cassava and yam. Maize/cassava intercropping has a distinct advantage over any of the pure stands. Yield of the combination exceeds that of any of the crops in pure stands, and the energy output exceeds that of 2 crops of maize grown in the same year in areas where double cropping of maize is possible. Planting of cassava and maize can be simultaneous with a maize population of 30,000 plants/ha, without affecting cassava yields. Delays of up to 4 wk. after planting of maize do not damage cassava. Other combinations with high potential are cowpea/cassava and yam/cassava. Alley cropping is one of the most promising techniques in fallow management; currently it is being tested with cassava and sweet potato. The long growth period of cassava presents problems with this system. The use of in-situ mulch has been successfully evaluated for cassava. (Summary by EDITEC. Trans. by M. de W.) K01

0509

23480 WILSON, G.F. 1984. A new look at cropping systems research for the humid tropics. In Dolly, D., ed. Caribbean Regional Workshop on Tropical Root Crops, 1st., Jamaica, 1983. Rootcrops in the Caribbean: proceedings. St. Augustine, Trinidad, University of the West Indies. Faculty of Agriculture. pp.3-9. Engl., 14 Refs. [IITA, P.N.I.B. 5326, Ibadan, Nigeria]

Cassava. Cultivation. Cultivation systems. Shifting cultivation. Energy productivity. Mulching. Fertilizers. Cultivars. Soil physical properties. Africa.

Shifting cultivation is the predominant production system in the humid tropics and one of the basic crops, among others, is cassava. The system provides unsuitable conditions for pests and diseases, but there are some factors that limit high productivity. These are: poor soils; low energy input (although the use of energy is very efficient, the low input is reflected in a low output); use of inefficient cv.; soil erosion; unavailability of inputs, equipment, and associated infrastructure; and the lack of necessary marketing infrastructure. Some new concepts that are considered promising to solve these problems are discussed: no tillage or min. tillage, use of in-situ mulch, and of live mulch, alley cropping, multiple cropping, fertilizer efficiency in terms of soil OM, biological nutrient recycling and fixation, weed control, low energy tools, and more efficient cv. (Summa by EDITEC. Trans. by M. de W.) K01

See also 0336 0345 0352 0382 0410 0496

K02 Descriptive and Comparative Studies

0510

23713 LUCAS, B.; SOTELO, A. 1984. A simplified test for the quantitation of cyanogenic glucosides in wild and cultivated seeds. Nutrition Reports International 29(3):711-719. Engl., Sum. Engl., 6 Refs., Illus. [Univ. Nacional Autónoma de México, Facultad de Química, Ciudad Universitaria, México 20, D.F., C.P.04510, México]

Cassava. Cyanogenic glucosides. HCN. Analysis.

A simple, fast, and highly sensitive colorimetric method for the quantitative determination of cyanogenic glucosides in seeds, that does not require sophisticated equipment, is described. It is based on the Guignard reaction which utilizes picrate in paper strips that in the presence of HCN produces isopurpurine which can be detected by spectrophotometry after extraction from the paper strips. This procedure has formerly been used to measure cyanogenic glucosides in cassava. Several changes were introduced, mainly in the sample preparation, to avoid the loss of HCN previous to the determination. Appropriate wavelength, color stability, and effect of temp. and time were studied and optimum conditions were established. This method was used to evaluate the concn. of cyanogenic glucosides in 25 samples of seeds of cultivated and wild plants, detecting values from 0.50 to 233.00 mg HCN/100 g of sample. The qualitative and quantitative determination of cyanogenic glucosides was done using the same sample. (Author's summary) K02

See also 0322 0484

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 isease
CMV	Cassava African mosaic virus
CBB	Cassava bacterial blight
CBSD	Cassava brown streak disease
CEC	Cation exchange capacity
CER	CO_2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
COD	Chemical oxigen demand
concn.	Concentration
CP	Crude protein
CSL	Calcium stearyl lactylate
CSW	Cassava starch waste
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
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate (modified cassava starch)
HI	Harvest index
hp	Horsepower
IAA	Indoleacetic acid
IBA	Indolebutyric acid
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)
<u>l</u>	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
<u>M</u>	Molar
m	Meter(s)
Mal.	Malay
max.	Maximum
MC	Moisture content

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

Cumulative Author Index
1985

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