Section 1: Socio economic

Pages 1-8

Ex-ante cost-benefit analysis of biofortification of cassava roots in Nigeria

Bamire, A.S., V.M. Manyong, I.O. Sanusi and D.O. Awotide

ABSTRACT

Cassava roots, which are poor in micronutrients such as vitamin A, iron, and zinc, constitute a major staple in the diet of more than 60 million Nigerians. This paper applies a cost-benefit analysis to determine the likely economic benefits of improving the nutritive value of cassava roots through biofortification programmes. Results show that Vitamin A deficiency (VAD), which results in health problems such as night blindness, Bitot's spot, corneal ulceration, corneal scars, blindness, and premature deaths, causes a monetary loss of about $551 million per year among Nigerians. This is equivalent to about 1.7% of the annual gross national income of Nigeria for the 2001 period. The improvement of the provitamin A content of cassava roots through biofortification would result in an internal rate of return (IRR) as high as
129.6% in the pessimistic scenario and 181.6% in the optimistic scenario. Such a programme would bring gains from the reduction of the health burden amounting to about $27 million per year in the pessimistic scenario and about $90 million per year in the optimistic scenario. Reducing post harvest losses to 23%, increasing the technology coverage rate to 60%, and increasing the beta-carotene content to 35µg/g under the optimistic scenario reduces the total health lost due to VAD by 32.6%, 28.5%, and 24.4% respectively. This consequently increases the IRR by between 10.8% and 19.1% from the original assumptions. Simultaneous changes in these parameters resulted in more than 100% reduction in health loss with an increased IRR of 55.3%. A positive net present value with benefit-cost ratio >1 was recorded. Thus, breeding efforts aimed at increasing the micronutrient content of staple crops like cassava is an investment with high economic returns, requiring an integrated approach, which policy makers should vigorously embark upon.

Key words: cassava, economic impact, biofortification, vitamin A, Nigeria

Pages 8-17

Technologies from sweetpotato research in Uganda

Byamukama E., Mpembe I., Kayongo J.S., Gibson R., Adolph B. and Mwanga R.O.M.

ABSTRACT

A survey was carried out in Uganda to assess adoption of sweetpotato technologies in areas where participatory research on sweetpotato has been carried out for three seasons using established farmer groups. Training had been given on the cause, spread and control of sweet potato virus disease (SPVD) and control technologies tested included use of rouging in controlling SPVD and evaluating resistant varieties. The survey involved both group members participating in the research and non-group members in the surrounding villages. Results indicate sweetpotato was consumed by the most households in largest amounts and was at least mentioned by all households. Farmers interviewed had average acreage of 0.5 acres with coffee, maize and sweetpotato being allocated more land respectively compared to other crops. At least 50% of group and non-group members said sweetpotato production is on the increase and gave number of persons in the family, good varieties and hope to get market as the reasons for the increase. Before 2003, farmers were growing their preferred varieties, some of which were being planted at the time of the survey; however, the varieties taken by the project to farmers are being adopted by group members and a few non-group members. Significantly more group members recognized SPVD and gave it a descriptive name and more group members mentioned whiteflies and planting infected plants to be the cause of symptoms. Rouging and selection were the most mentioned actions to reduce SPVD incidence and were also being practiced. The knowledge of the control methods was reported to be mainly from project training for group members while experience and neighbors were sources of information for most non-group members. It may be concluded that technologies extended to farmers groups on SPVD control were understood and are being adopted, and are slowly spreading to the neighbors.

Key words: sweetpotato virus disease, SPVD, adoption, rouging, varieties, farmer groups

Pages 18-25

Status of potato production, marketing and utilization in Cameroon

D.A. Fontem, P. Demo and D.K. Njualem

ABSTRACT

Potato (*Solanum tuberosum*) is the most important and widely consumed tuber crop in Cameroon, although production figures are often underreported. A literature search and nationwide surveys were conducted to document potato production, marketing and utilization during 1998 to 2000 in Cameroon. The main production areas are localized in the highland zones of the west, northwest, southwest, Adamawa, far north and littoral provinces. In these zones potato contributes to poverty alleviation and also offers a significant opportunity for inhabitants to earn a living, as producers and/or traders. National production figures are estimated at 435,354 tons. Marketing channels are well established, with women playing the leading role in production and marketing. Although most of the crop is consumed locally within the farming communities to ensure food security, about 26 % is fresh marketed locally to generate family income and 1 % is exported to all the neighboring countries. Industrial processing is yet to develop in Cameroon, where tubers are mostly consumed in 'peel' and 'boil' form or as chips. The most important potato production constraints are damages due to diseases, absence or shortage of quality planting material and storage losses. The major marketing constraints are transportation problems, post harvest losses and poor road infrastructure to production sites and neighboring countries. The study indicates a necessity to introduce new disease-resistant varieties into the farming system, improve communication access to production sites and enhance transformation and storability of the product.

Key words: potato, processing, marketing, storage, utilization, Cameroon

Pages 26-33

Adoption and impact of improved cassava and sweetpotato varieties on food security in Malawi

S. Jumbo, N.M. Mahungu, A. Mhone, C.C. Moyo, V. Sandifolo, D. Siyeni, A. Nthonyiwa, K. Sichinga

ABSTRACT

The Southern Africa Root Crops Research Network (SARRNET), a SADC-FANR network executed by International Institute of Tropical Agriculture (IITA) promotes production of cassava and sweetpotato in Malawi and other countries within the SADC region such as Mozambique, Zambia, Angola, and Tanzania for food security and income generation. In the past nine years, one of its objectives was to develop new/improved sustainable agricultural technologies and practices and increase their adoption. Working in collaboration with the Ministry of Agriculture and other stakeholders, a number of improved varieties of cassava and sweetpotato were released in Malawi. This was followed by a comprehensive multiplication and distribution exercise in collaboration with a number of NGOs promoting food security in the country. A survey was therefore conducted in six districts in Malawi which are the SARRNET impact areas to assess adoption rate of improved cassava and sweet potato varieties and their impact on food security. A total of 834 households, which were randomly selected, were interviewed using a structured questionnaire. The survey was done in the month of June, 2003. The results of the survey indicated that improved varieties of cassava and sweetpotato gave significantly higher yields than the traditional varieties. Improved varieties of cassava yielded 5.7 metric tons higher than the traditional varieties while improved sweetpotato varieties yielded 1.2 metric tonnes higher than the traditional varieties. This means that adopters of improved cassava and sweetpotato varieties were technically food secure than the non-adopters. About 80% of the cassava growers indicated that they had enough food throughout the year compared to 22% of the non-adopters. Not only have these improved varieties improved yield, but they have also made food available 2-4 months before traditional varieties are ready for harvest. About 55% of the farmers interviewed mentioned eating cassava as one of the copping strategy during food shortages while 25% mentioned buying food. The remaining 20% mentioned food aid, relatives and reduced meals as copping mechanisms during food shortages. The results of the survey also showed that 61.39% of the farmers interviewed have adopted the improved sweetpotato varieties while 40 % have adopted improved cassava varieties. *Kenya (SPNO*) was one of

the highly adopted sweetpotato variety while *Sauti* and cleaned *Mbundumali* were the highly adopted cassava varieties. The improved varieties were preferred because of high yields, drought tolerant, and early maturing.

Pages 33-47

Economic profitability of improved yam production systems for sustainable agriculture in Central Benin (West Africa)

Mariki R., Amadji F. and Adje I.

ABSTRACT

A study on the evaluation of the economic profitability of improved systems for yam production was carried out in the savanna areas of Benin in the degraded and less degraded zones with the aim of promoting a better management of natural resources. The research was conducted in farmers' fields and comprised six treatments: rotation *Aeschynomene histrix*-yam on *Gliricidia* plot (G+Ae), rotation groundnut -yam on *Gliricidia* plot (G+Ar); rotation *Aeschynomene histrix*-yam (Ae), rotation groundnut - yam (Ar), old cleared fallow in the continuous cropping system (T); slash and bum (J) in the natural fallow. The shrubs of Gliricidia were used for organic fertilization and yam tuberization. Gliricidia density of 625 seedlings per hectare was recommended due to competition noted by farmers between Gliricidia and yam with a high Gliricidia density of 3333 plants /ha. The results of the study revealed that among the systems tested, the rotation Aeschynomene- yam and rotation Aeschynomene-yam on *Gliricidia sepium* plot showed relatively high yield on the degraded or less degraded soils compared to other systems. The system *Gliricidia sepium* with low density of shrubs in a rotation of yam with Aeschynomene allows a production of 22, 3 t/ha fresh yield (FY) of yam Gangni (*Dioscorea rotundata*) against 25, 6 t/h (FY) in the system of slash and burn. No significant difference between farmers traditional slash and burn and improved systems was observed at 5% level. The G+Ar induces a profit of 880.000 FCFA (by considering the commercial value of the seeds of *Aeschynomene histrix*) against 750.000 FCFA/ha on conventional system of slash and burn (either a rate of increase in 15%) with a workload

of 175 man- day/ha against 206 man-day/ha or a reduction of working time of 15% on the conventional system. The rotation *Aeschynomene*- yam allows a production of 24 t/ha (FY) of yam Gangni (*Dioscorea rotundata*) against 25.6 t/ha FY in the system of slash and burn. It induces a profit of 995.000 FCFA against 750.000 FCFA/ha on the system of slash and burn (either a rate of increase in 25%) with a workload of 128 man-day/ha against 206 H-J/ha or a reduction of working time of 27%.

Key words: Benin, durable management of the natural resources, participatory research, profitability, yam

Pages 48-58

Preliminary inventory of local market incentives for the improvement of cassava productivity and production in eastern of Democratic Republic of Congo (DRC)

Munyuli, T.M.B., Tete Tshisinda & Kashosi Kumbakumba

ABSTRACT

Cassava is one of the most important crops in the Democratic Republic of Congo (DRC). It is the most widely cultivated crop in eastern and western part of the country in terms of area devoted to it and number of farmers growing it. A large proportion of total production, probably larger than that of most staples, is planted annually for sale. Constraints in cassava production are biotic and abiotic factors: pests and diseases, agronomic problems, land degradation, shortage of planting materials, food policy changes, access to markets, limited processing options, and inefficient/ineffective extension delivery systems. However, there are many socio-economic attributes, which

make the crop to lend itself to a commodity-based approach to poverty alleviation. The socio-economic importance of cassava and the diversity of pests and diseases led various donors and agencies like FAO and IITA (International Institute for Tropical Agriculture), in collaboration with national research institutions and public services, to plan direct intervention in order to increase the productivity of the crop through cassava multiplication and productivity improvement projects since some years. The improvement of cassava productivity is very important but can only meet more attraction if it appears to be providing more revenue to farmers. Among components to explore for the improvement of cassava, the analysis of market opportunities appeared to be very relevant. Local market incentives for the improvement of cassava were inventoried in March-May 2004. These market incentives varied from a province to another one, and included (1) the existence of permanent traditional ores and mining places in all forests of Maniema, Oriental; and North and South Kivu provinces In Katanga, Ituri and Maniema provinces, (2) the existence of UN peacekeeper (3) the existence of several small scale entrepreneurs (around 1000), raising chicken in urban and peri -urban areas., (4) the existence of regional markets for cassava.

Keys words: - Mark characteristics- Market incentives- Cassava productivity- DR Congo

Pages 58-71

Market opportunities and quality of cassava starch in Kenya

Kadere T.T. and Makhoka O.A.

ABSTRACT

In Kenya, cassava is grown as an important root crop in the Following regions: Coast, Eastern, Western, Nyanza, some parts of Rift Valley and Central Provinces. This report presents findings on cornstarch and cassava starch market in the country. The estimated yearly production of fresh cassava tubers is 374,713 tones while that of starches is 22,490 tones. The prices of cassava chips ranged from Kshs. 28/Kg to Kshs 18/Kg. Quality assessment and the potential of cassava starch to substitute cornstarch for industrial use in

Kenya has also been carried out. Most companies including Farmers Choice, Glaxo Wellcome, Smith Kline, Unga group and Laboratory & Allied were willing to substitute 17, 80, 50, 10 and 100 % respectively of their cornstarch with cassava starch only if competitive prices and high quality starches was supplied. Results on chemical and microbiological analysis showed that cassava met most of the specifications provided by different organizations, which demonstrated the need for proper policy and market strategies to boost productivity and profitability.

Key words: cassava starch, cornstarch, quality, marketing, standards, Kenya, cassava chips and cassava flour.

Pages 72-82

Orange-fleshed sweetpotato - linking school and community - A case study of Cumbene, district of Marracuene

Andrade, Maria Isabel, Naico, Abdul and Ricardo, Jose

ABSTRACT

This paper describes an example of technology transfer process through a partnership involving institute of research, a NGOs and the institute of education. The project was developed by IITA Mozambique in collaboration with the National Agricultural Research Institute, Action Aid (NGO) and the Ministry of Education, and had its ground on orange fleshed sweetpotato (ofsp). The project's objectives were to raise awareness among students, especially children, about the importance and nutritional value of ofsp in a way that it could reach, disseminated and assimilated by local communities. In order to put the project running the first thing done was to understand the agriculture potential and socio economic of the targeted area and this was achieved through a preliminary study involving 50 local farmers that were inquired on production, consumption and market of sweetpotato. The following stage was the creation of a local association that was trained

on sweetpotato processing and then the selection of the primary school of Cumbene-Marracuene where the products would be sold/consumed.
Results of the preliminary studies have shown that in Marracuene and its surrounding, farmers are actively and happily involved in the cultivation of sweetpotato in general, and, in particular, ofsp, This is confirmed by extensive areas cultivated with these varieties at same time that these exhibit higher yield in comparison to local varieties. Among the crops most preferred for consumption in Maracuene, sweetpotato ranks third, after maize and rice. However, as per volume of sale, sweetpotato comes first, followed by vegetables.
As a result of the training on sweetpotato processing two products, namely, Fresh sweetpotato "Fiossis", and Fresh sweetpotato fries were identified for sale at the previously selected school. These were selected based upon the taste and because it was found to be good items to generate income that is, about half of the cost of production, when sold locally. The results of this partnership have clearly indicated that the sale of these products has not only contributed significantly for the reduction of students' absence in the classrooms but also improved their class performance, as well farmers and sweetpotato processors income.

Pages 82-93

An evaluation of the market potential of sweet potato processed products at the University of Eastern Africa Baraton

F.L. Mkandawire, J. Onyango, N. Angwenyi and J. Ogot

ABSTRACT

A study was carried out to assess the taste, texture acceptance and demand for cookies, *mandazi*, cakes and bread made from varying proportions of sweetpotato (SP) to wheat flour with the objective of adding value to sweet potatoes and reducing their bulkiness. Sweet potato flour was made from freshly dug sweet potato tubers. The tubers were cleaned in fresh water, peeled and placed in a basin of water. They were then grated with a kitchen grater and left in water to avoid oxidation. The grates were removed from water

and sun - dried for two to three days. Dried grated sweet potatoes were ground into flour which was used in the study. Sweet potato flour was mixed into three ratios (25:75, 50-50, 75:25) with wheat flour. Each of these ratios was incorporated into a standard recipe for bread cakes and cookies and baked in an oven at 180°C for one hour, 160°C for 40 minutes and 180°C for 15 minutes, respectively. *Mandazi* balls were deep fried in oil. The products were presented to a panel of randomly selected respondents for evaluation on a 5-point scale as follows: taste (1 = very poor, 2 = poor, 3 = average, 4 = good, 5 = very good) and texture (1 = very coarse, 2 = mildly coarse, 3 = average, 4 = soft, 5 = very soft).
Consumer preference was determined in the form of a questionnaire. Respondents were also asked to determine possible market price of the various products. In general, the test products were accepted by the respondents at varying degrees. Cookies with SP flour ratios of up to 50% had highest preference rating. Increasing SP flour to 75% produce coarse cookies. *Mandazi*, on the other hand, were preferrred at SP flour ratio of 75%, which was also the most expensive to make because of the amount of oil used. Preference for cakes and bread increased with decreases in SP flour. The most profitable sweetpotato products according to the economic analysis were cakes and cookies. Demand for the products was also influenced by the availability of similar products made from wheat flour. Chi-square test of goodness of fit showed that acceptance of the products was influenced by taste and texture as a result of the various proportion of sweetpotato flour to wheat.

Key words: Sweetpotato, sweet potato (SP) flour, processing, product, market.

Pages 94-102

Sweetpotato for food security and poverty reduction case study of Mukangu Bio-Banana Self Help Group (S.H.G) in Central Kenya

M. Muchui, L.W. Njuguna, P. Kiuru, J. Kibaki, B. Ndungu, L. Gitonga, C. Gathambiri, S.N. Kibe, P. Maina and R.W. Njeru

ABSTRACT

In the year 2000, Kenya Agricultural Research Institute (KARI) formulated the Agricultural Technology and Information response Initiative (ATIRI), to upscale the dissemination of agricultural technology and information by working with partners to make these technologies demand driven. The initiative is implemented through community based organizations (CBOs). This initiative was initiated at the National Horticultural Research Centre (NHRC) in the year 2001 where 14 CBOs were funded and more than 10 agricultural technologies were successfully disseminated.

Among the technologies disseminated was bulking of clean planting materials of sweet potato Mukangu Bio-banana self-help group located in Murang'a district in Central Kenya requested and was facilitated for this technology. Through this intervention the group was able to commercialize sweet potato production and enhance food security through improved production and diversified utilization. Other benefits included conservation of natural resources through inclusion of the sweet potato in the crop rotation programme in the farms. This paper discusses benefits and impact of sweetpotato before and after ATIRI intervention.

Pages 102-112

Systeme d'approvisionnement de la ville d'Abidjan en igname et Rentabilite des investissements dans le commerce de gros

Mahyao A., Doumbia S., Kouame C.N., Zohouri G.P., et Zoungrana P.

RESUME

En Côte d'lvoire, le principal centre urbain de consommation d'igname (*Dioscorea* spp) est Abidjan et la demande y augmente régulièrement compte tenu du fort taux de croissance de la population de cette ville. La variété précoce *Kponan* (D.c.r à 2 recoltes) est 1'igname la plus appréciée en milieu urbain (Nindjin et al. 2003) mais la plus chère sur les marchés. Abidjan étant essentiellement approvisionnée par la région de Bouna - Bondoukou, la satisfaction de la demande dans cette ville dépend de plusieurs facteurs dont 1'offre régionale à partir de Bouna-Bondoukou, Ie comportement des agents de la filière et surtout la rentabilité des investissements dans Ie commerce de gros. L'objectif de 1'étude est d'analyser ces différents aspects. L'étude a montré que dans la région de Bouna Bondoukou, les grossistes coilecteurs
collaborent avec des intermédiaires ruraux pour la collecte et le transfert de 1'igname. A Abidjan, un autre type d'intermédiaire intercède entre grossistes collecteurs et grossistes urbains au cours des transactions commerciales. Les commissions prélevées par l'ensemble de ces intermediaries (10 à 20%) grèvent les prix de vente de 1'igname à Abidjan. La pratique de certains producteurs qui consiste à transférer 1'igname aux grossistes d'Abidjan est désavantageuse car ils ont à supporter un coût de transport élevé (43 à 57%). Deux types de grossistes exercent à Abidjan. Les grossistes primaires ont la capacitéde recevoir d'importantes quantités provenant de la zone de production et les revendent aux grossistes secondaires. Chaque franc investi rapporte 2, 76 francs au premier et 3, 19 francs au second, soient des taux de rentabilité respectifs de 176 et 219%. L'importance des profits obtenus provient essentiellement de la vente des ignames de l'espèce Dioscorea *cayennensis rotundata*. L'investissement dans le commerce de gros de l'igname est rentable mais le fond de roulement est élevé. Toute politique visant à améliorer l'approvisionnement des marchés d'Abidjan en igname précoce, devra intégrer Ie regroupement des producteurs en coopératives de commercialisation, la réduction du coût du transport, la réduction de la marge bénéficiaire des intermédiaires et 1'accès des grossistes urbains aux prêts bancaires.

Mots clefs: igname, commercialisation, grossiste, intermédiaires, rentabilité.

ABSTRACT

Title: System of supplying yam in Abidjan and profitability of investments in yams' wholesaling.

In Côte d'lvoire, the main urban center of yam (*Dioscorea* spp) consumption is Abidjan and the high growth rate of his population increases the demand. The early *Kponan* (D.c.r with 2 harvests) yam variety, cultivated in Bouna and Bondoukou, is the most appreciated (Nindjin & al, 2003) and expensive that you find in Abidjan market. The satisfaction of demand depends on the availability of supply but only on behavior of sellers in commercial channel and the profitability of investments made by wholesalers in yam wholesaling. The objective of the study is to analyse theses different conditions. The study shows that wholesalers in Bouna and Bondoukou work with rural middlemen. They make the first stock and send it to Abidjan. In Abidjan, another type of middlemen

intercedes during the commercial transaction. Commission taken by these middlemen goes from 10 to 20% out of the total marketing cost according to the period. Most often, farmers send yams to wholesalers in Abidjan and the transport costs goes from forty-three to fifty-seven percent out of the total cost. Primary wholesalers receive important quantities of yams from the area of production and sell them to secondary one. Each invested franc gets a profit of 2, 76 francs to the primary and 3, 19 francs to the secondary one. Profitability's rates are 176 and 219%. The sales of *Dioscorea rotundata* yam specie available all along the period of commercialization, contribute significantly to increase wholesalers' profit. Wholesalers are able to have, more than twice the value of money invested by year. Investments in yam's wholesaling in Abidjan are profitable but working capital requirements is high. Measures aiming to increase consumption of yam in Abidjan should take into account the reduction of transport costs, the reduction of middlemen's activities and the access of wholesalers to loan. Farmers should make sales cooperative.

Key words: yam, commercialization, wholesaler, middlemen, profitability.

Pages 113-118

Contribution of sweetpotato to household food supply in Morogoro District, Tanzania

Y.C. Muzanila, A. Babu, and L. Karumuna

ABSTRACT

A study was conducted in Morogoro district, in Tanzania to evaluate the contribution of sweetpotato to the household food supply. An average yield of sweet potato was 853kg/acre and it is grown for food and cash. However farmers marked sweetpotato in 3rd and 4th position in order of importance, as compared to maize. The mean area per household used for growing sweet potatoes was 0.33 acres. About 60% of the farmers reported that they consume sweet potato 3-4 times per week during harvesting season and in most cases they use them for breakfast. Sweetpotatoes were processed by sun drying of

raw and cooked slices. Processing caused a significance loss ($P < 0.05$) of vitamin C, crude fibre and crude protein. The same trend was also observed on storage.

Key words: Sweet potato Cassava, Processing and Vitamin C losses.

Pages 118-127

Implications of root and tuber crops production, consumption and marketing in Kenya's Coast Province: a case of sweet potatoes in Kwale District

Dave J. W Nyongesa, Peterson Mwangi & Lusike Wasilwa

ABSTRACT

Sweetpotatoes (*Ipomea batatas*) are pivotal source of nutrition. In Kenya, sweet potato is an important crop towards household income generation, food security as tree cover and livestock fodder. This paper on the implications of root tuber crops production, consumption and marketing in Kenya's coast province, a case of sweet potatoes in Kwale district was undertaken in April 2004. It was to evaluate the production and marketing of sweet potato in Kwale District from 1999 to 2003. Specifically, it was to as certain the types and varieties of sweet potatoes grown, the production and yield levels; assess the socio-economic impact of sweet potato on the rural households in Kwale; examine the marketing and marketing arrangements for sweet potatoes in the District: suggest policy recommendations for improvement of sweet potato production and marketing in the District. Both Primary data obtained through group discussions and personal interviews; and secondary data from divisional and district agricultural office in Kwale was used. PCGIVE 10 and SPSS 11.5 computer packages were used in data analysis. The findings indicate that the average yield was 9.6 t/ha^{-1} but production of sweet potatoes in the

district gradually declined over the period. The decline was attributed mainly to erratic rainfall; wildlife menace and lack of inputs especially clean planting materials. However, due to good prices and availability of market, households received good returns as the district earned Kenya pounds 28,672,300 over the period. There was therefore need for increased research activities to develop new sweet potato technologies, agronomic and crop protection packages, post harvest and value adding activities to enable the farmers to benefit fully from sweet potato production and marketing in the province.

Pages 127-136

A socio-economic analysis of cassava production and marketing in Kenya: a case of Kwale District, 1999-2003

Dave J. W Nyongesa & Lusike Wasilwa

ABSTRACT

Cassava (*Manihot esculenta* Crantz) is one of the chief root and tuber crops. Since its introduction from Brazil by the Portuguese sailors many centuries ago, it has become a crop of great potential for food security, at the family, the community, as well as at the national levels in many countries. It sustains the lives of more than 500 million people in Africa, Latin America and Asia. This study, a socio-economic analysis of cassava production and marketing in Kenya, a case of Kwale District 1999-2003 was undertaken to evaluate the status of cassava in the district. Specifically, it were to: ascertain the types and varieties of cassava grown, the production and yield levels; assess the socio-economic impact of cassava on Kwale's rural households; examine the marketing and marketing arrangements for cassava, and suggest policy recommendations for improvement of cassava production and marketing in the District. The study used both primary and secondary data, which was obtained through personal interviews, focused group discussions and desk research. SPSS 11.5 and PcGive 10.0 computer packages were used in data analysis. The findings show that cassava cropland in Kwale had

decreased from 56% (2000) to 34% (2003), but average yield was 10 t/ha. The general decline was attributed to wildlife menace, erratic rainfall and cassava mosaic virus. The steady decline spells doom for the people of Kwale who may have to depend on food relief in future. Therefore there is need for comprehensive research to come up with disease-resistant and drought-tolerant plant cultivars to sustain cassava production in the district. Farmers should try to increase cassava production to take advantage of the existing demand for cassava.

Pages 136-143

A snack vendor to evaluate the potential market for pro-vitamin A-rich sweet potato snacks for improved vitamin A intake in rural Kenya: a case of Siaya District, Western Kenya

M.A Ogubi, S.J. Ochien G, Oiye S. Okoth and M Oudia

ABSTRACT

A total of 61 market snack vendors (all women except one man) from 7 markets within Siaya district of western Kenya were considered for the study. The vendors were interviewed using structured questionnaire and results analyzed and presented in tables and charts. Fried doughnuts (*mandazis*) and flat unleavened bread (*chapatti)* were found to be the most commonly traded snacks. Fried potatoes (chips and bahjia) were also upcoming snacks in the area. Wheat flour was found to the most suitable ingredient to partially substitute for pro-vitamin A rich sweet potatoes flour in *mandazis* and *chapattis.* All age groups from all economic classes consume the snacks. Difficulty in procuring ingredients and access to market are problems afflicting the snack vendors. Partial substitution of wheat flour for pro-vitamin A rich sweet potatoes flour in wheat flour based snacks and introduction of fried pro-vitamin. A rich sweet potatoes as novel snacks

can improve vitamin A intake. To further elucidate this potential, consumer acceptance tests need to be done. To intervene successfully, consumer awareness and product development initiatives in tandem will have to be considered.

Key words: Snacks, pro-vitamin A rich sweet potato, pro-vitamin A intake

Pages 143-151

The economic productivity of cocoyam (*Xanthosoma* Sp.) cropping system in Ghana

Regina Sagoe, Joyce Haleegoah and K. A. Marfo

ABSTRACT

Cocoyam (*Xanthosoma* sp.) and maize (*Zea mays*) are major food crops often grow in association. On-farm testing was conducted at Sunyani, Sankore and Begoro in the forest ecology of Ghana, to evaluate the agronomic performance and economic productivity of both crops grown as mixed crops and sole crop. The cropping system had a significant effect on the yields of the component crop. Maize yields were reduced by 10% for double row maize between single rows of cocoyam and 26% for double row cocoyam between single rows of maize in the intercrop systems. Cocoyam yields were reduced by 70% to 75%. The cost/benefits analysis gave gross farm gate benefits of 7.6 million cedis per hectare ($894/ha) for sole maize production to 20.9 million cedis per hectare ($2459/ha) for sole cocoyam production. All farm enterprises tested on farmers' fields were viable and profitable giving cost benefit ratios more than one. The results further showed that marginal rate of returns (MRR) for changing from sole maize to sole cocoyam, double row of cocoyam between single rows of maize and double row of maize between single rows of cocoyam are 1279 %, 348 % and 146% respectively. These are all greater than the Acceptable Minimum Rate of Returns, which range from 40% to 130% at the various locations. Residuals and cost/benefit ratio also follow similar trend. From the analysis the best farm enterprise would have been sole cocoyam but for some socio-economic reasons

and efficient land use, double row of cocoyam between single rows of maize is the recommended intercrop system within the limits of the experiment.

Keywords: Cost - benefit analysis, Cocoyam (*Xanthosoma* sp.), maize (*Zea mays*), Cropping system, Residuals.

Pages 151-158

Socio-economic determinants of yam varieties adoption: probit analysis in three major's yam production areas of Cote d'Ivoire

Toure M. , Amagbeto K. , Doumbia S. , Kouakou A.M., Asiedu R. , Zohouri G.P.

ABSTRACT

Yam (*Dioscorea* spp.) is an important food crop in several countries of West Africa sub-region. It plays a key role in food security and it's also an important source of cash income for fanners. However yam cultivation is facing many constraints such as post harvest losses, land pressure, degradation of soil fertility. Intensification and mechanization are some of the solutions that have been proposed to solve these constraints. Nevertheless, theirs costs are so high that they cannot be used by most of the farmers. Nowadays, the dissemination of improved varieties is one of the ways proposed to solve these constraints. The success of this type of research action needs a previous survey in order to examine farmers' preferences for varietals characteristics of yams and the mains factors that influencing their final adoption decision. Using a Probit model this paper determines the socioeconomic variables that affecting the adoption of the new yam varieties by the farmers. It is specifically about making a characterization of the culinary

attributes of pounded and boiled yam. The socioeconomic factors that determine the adopters' decisions are then discussed. Analyses are based on a sample of 300 farmers randomly selected and interviewed in three yam production areas. The preliminary results indicate that farmers with long farming experience, educated, having regular contact with extension service, facing with land availability constraints using chemicals and improved seeds for at least one crop are likely to adopt new yams varieties the probability of adopting new yam variety also high for households with reduced number of households' members. A raking method is then use to determine the preferred attributes for pounded and boiled yam. As no study has been conducted before in Cote d'Ivoire in relation to this topic, the results of this survey will help extension services and yams breeders to target efficiently adopters during dissemmation process by matching the characteristics of the improved varieties with farmers' preferences. Finally, propositions are formulated in order to promote yam cultivation in areas affected by September 2002 war. It is hypothesized that the introduction of new yams varieties will contribute to the increasing of yam production.

Keywords: Yam -Adoption - Cote d'lvoire-Probit- Preferred attributes

Pages 159-167

The Orange fleshed sweet potato: the review of policies in agriculture, nutrition and gender to assess their levels of integration in Kenya

Wasilwa L.A. Gitobu, J.K. Mukunya, D. Tauta, C. Kabutha, C. and Mitoko, G.

ABSTRACT

The orange-fleshed sweetpotato project (OFSP) was part of a two-year multi-country intervention in Ethiopia, Kenya, Peru, Tanzania and Thailand. The purpose of this intervention was to explore ways to strengthen women's contributions to reducing iron and vitamin A, and to a lesser extent iodine, deficiencies, by combining women's productive and reproductive roles. The current study was conducted to assess the nature and level of integration of agriculture, nutrition and gender of the OFSP, a community based nutrition programme, in Rongo, Rangwe, and Ndhiwa of Homabay District. The objectives were to assess the impact of the interventions on food security, nutritional status and gender, and assess the gains from linking agriculture, nutrition and gender, to determine existence of constraints, limits and opportunities to linking agriculture, nutrition and gender in the intervention, and to make a case for integration of these dimensions at the policy level. Both primary (qualitative) and secondary (quantitative) data were collected. Focus group discussions and key informant interviews were used to gather information. The Harvard Framework of Analysis and seasonal calendars were used to determine intake of Vitamin A. Although, results show that there were no integrated policies set in place to guide and direct the projects at community levels, there was significantly improved nutritional status by intake of vitamin A-rich foods in the OFSP intervention area. The assessment concludes that it was the integrated approach used that contributed the positive results. While the review concludes that it is possible to implement integrated programmes to address food insecurity and nutrition problems, it is however necessary to integrate these aspects at policy, programme, and community level, to enhance effective utilisation of available resources, community participation and sustainability of programmes. National policy guidance, resource allocation and developed tracking mechanisms are still needed to support sustainable activities at the program and community levels. The review therefore recommends that a strong case be made to the policy makers and program developers to advocate for the integration of agricultural production, nutrition and gender in all development policies and programs that address food insecurity and malnutrition.

Pages 167-182

Socio-economic factors for adoption of improved cassava in Western Kenya

Odenya, J.O, B.O. Odero, H.M. Obiero and M.A. Mudeheri

ABSTRACT

KARI-kakamega in partnership with other development organizations made an effort to multiply and distribute over 34 million cassava ministems of Migyera, SS4 and other preferred and selected clones of cassava in some selected districts in western Kenya. Despite, the effort made to multiply and distribute the disease free planting materials there is still low adoption of the improved cassava varieties by the farmers which has led to reduced acreage of cassava hence food insecurity and reduced household income. The purpose of the study was to investigate and describe the socio-economic factors that influenced the adoption of improved cassava varieties in western Kenya and also to determine the possible reasons for changes in acreage under cassava. The design was Ex-post facto. The population of the study constituted the Luos, the Luhyas (with 10 sub-tribes) and the Sabotis mainly from the 10 districts in western Kenya. The study targeted small-scale farmer who grow cassava. A multi-stage sampling technique was used to select 205 farmers for the study. The data collected was analyse using a computer based Statistical Package for Social Science (SPSS) programme. Both descriptive statistics and logistic regression where a logist model and logistics curve was used. The results of the study indicates that most known improved cassava varieties were SS4 and Migyera while the most grown cassava varieties were Adhiambo Lera, Serere, SS4, Matuga and Migyera. The main source of planting materials was the neighbors. Majority of farmer plant cassava after harvesting their cereals and practiced monocropping system. Farmers with small land sizes planted cassava twice as they intercropped cassava with cereals (either maize or sorghum) during the two growing seasons (long rains and short rains).The decision to plant cassava was made by the women who also provide the bulk of labor during cassava production. The decline in cassava acreage was attributed to inadequate or lack of planting materials. Fanners lacked knowledge and awareness of the existence of clean and disease free panting materials and their sources, and continue to plant local and diseased materials from their neighbors. The utilization of cassava stems as fire wood after harvesting the tuber was one of the causes of unavailability of planting materials. Fear of poisoning effect and possible death was a constraint to adoption of some improved varieties. The logit model showed that farm size, land tenure and type of variety were significant and influenced the adoption of improved cassava varieties, whereas educational level, source of income, labor, years of growing cassava, source of variety and utilization was not significant and did not influence the adoption of the improved cassava varieties. Since significant parameters are within the human capability, it would be important if the researchers, the extension agents and the policy makers lay emphasis in improving them the study recommends that due to seriousness of cassava mosaic virus disease and the cassava green mite, there is need for the cassava project to continue with multiplication and distribution with a view to restore farmer's confidence in

food security. The MOA and NGO'S who have an interest in food security and poverty alleviation should co-fund the multiplication and distribution of clean cassava planting materials since majority of the farmers have changed their attitude and are now seriously looking for planting materials for improved cassava varieties. And that the DAO'S of the MOA should identify land for multiplication of the improved cassava varieties to reduce the cost of transporting materials from either Kakamega or Alupe-Busia and that there is need for capacity building for both the farmers and the extension agents on utilization of cassava products. Capacity building for both the extension agents and the farmers on the utilization of cassava products and awareness to the farmers on the importance to preserve the cassava stems for re-planting to reduce shortages of planting materials it will be necessary to assist farmers to access better markets and market information so as to offer incentives for increased cassava production and to the sensitization of the farmers on the importance of men participation in other cassava activities other than land preparation for increased production.

Pages 183-190

Status of cassava production in Nigeria

C.I. Ezedinma, J. Lemchi, R. Okechukwu, L.Sanni, F Ogbe, M Akoroda and A. Dixon

ABSTRACT

Cassava is an important crop in Nigeria. The Government of Nigeria has shown interest in utilizing the crop as an industrial raw material in order to divert attention away from oil exports. But since the study by the Collaborative Study of Cassava in Africa in the 1990s there has not been a similar study to assess the trends in cassava production and commercialization. This paper presents results of a study by the Integrated Cassava Project of the International Institute of Tropical Agriculture using the same COSCA methodology a study was undertaken in 2004 in Nigeria. The 2004 survey revisited 46 of the 65 COSCA villages. Results indicate that the land area devoted to cassava production

in Nigeria has increased but yields remained stagnant despite the increasing use of improved varieties. The proportion of cassava produced for sale and the use of hired labor has increased. These new data provide convincing evidence of a rapidly increasing commercialization of cassava production essentially for the traditional food market since the size of the manufacturing/industrial market is small. Labor cost for cassava production has also increased implying that the current expansion in cassava production in Nigeria is achieved at great cost to farmers and such costs may not be competitive for industrial purposes. For the government of Nigeria to attain its objective of using cassava as a primary raw material in industry it needs to put in place benevolent policies that will support private sector investments in vertically integrated agribusiness ventures involving large commercial farms with smaller clusters and agro-industries within a globally competitive environment.

Pages 190

How integrated is the market for cassava in Nigeria: implications for commercialization and industrialization

J. Lemchi, J. Njoku, C. Ezedinma, A Dixon, R. Okechukwu, L.Sanni, M. Akoroda

ABSTRACT

The study examined the extent of cassava market integration in Nigeria with a view to understanding the interaction among prices of cassava products in spatially separated markets. Data were collected from a selection of 185 cassava products traders in 62 markets within the major cassava producing zones of Nigeria, as well as from market key informants. In addition to descriptive statistics, bivariate correlation based on retail prices of cassava products was utilized in determining integration coefficients Results showed weak integration in the prices of cassava products among the markets. For efficient transmission of both prices and supply of cassava products within the country, market information network should be improved such that both producers and consumers (final

and intermediate) have knowledge of priced and supply situations of cassava products in areas and markets outside their immediate environment.

Pages 190

Policy initiatives for private sector involvement in the commercial development of tropical root and tuber crops: the case of Irish potatoes in Kenya

J. N. Kabira, G. Maingi and A.M. Mugambi

ABSTRACT

In order to streamline the production, marketing and processing of potatoes, the Ministry of Agriculture in collaboration with the GTZ-Private Sector Development in Agriculture (PSDA) project consulted major stakeholders and came up with a draft policy document on the crop. Stakeholders' workshops internal meetings, formation of a growers' association, and surveys to gather views from farmers, transporters, middlemen, municipal councils, amongst others were facilitated by the Horticultural Division of the Ministry. Strategies outlined in the draft document included: Varietal development and other applied research; seed R&D; research-extension linkages; farmer empowerment; packaging and marketing; post-harvest storage; quality standards; processing and new product development; quality assurance (seed and ware potatoes); agronomy, and crop protection. Lessons learnt can be utilized to formulate appropriate policy guidelines for other root and tuber crops.

Key words: Government policy, potato growers' association, farmer empowerment, stakeholders' consultations, quality standards, research and development, extension strategies, private sector involvement.

The impact of dissemination of the varieties of cassava and orange fleshed sweetpotato in Mozambique. A case study: district of Chokwe-Gaza Province

Andrade, Maria Isabel and Naico, Abdul

ABSTRACT

In response to droughts and floods that affected the country, the Southern African Root Crop Research Network and the National Institute of Agriculture Research, in collaboration with the extension services and non -government organizations, carried out activities of multiplication and distribution of considerable amounts of cassava and orange-fleshed sweet potato (OFSP). Large quantities of planting material were distributed to many households and, parallel to this, activities on post-harvest, nutritional education and agri-business were carried out. An impact study was carried out with the objective to gather the information on the level of dissemination of these varieties and to understand the importance of the orange fleshed sweetpotato within the local farmers in areas where the project was established. Data collection was mainly collected between August and October 2003 in 27 selected districts of six provinces (Gaza and Inhambane representing the South of the country, Manica and Zambézia in the Centre, and Nampula and Cabo Delgado in the North) comprising 1269 questionnaires for cassava producers and 846 of the sweetpotato producers.

The data from this study show that cassava, maize, sorghum, cowpea, groundnuts and sweetpotato are crops that are more used for the consumption in surveyed provinces. The level of importance varies according to the province, though maize and cassava rate as the main crops. The overall analysis of the data show that about 2/3 of the interviewees have heard about the orange-fleshed sweetpotato and, more than half of these grow this crop. The probability of these varieties to reach more people is high as, on average, each

primary beneficiary offered the material to at least three more people. Concerning the varieties themselves, more than half of the interviewees said that these satisfied their expectations mainly with regards to food (62%), productivity (49%), resistance to diseases (33%) and establishment performance (21%). At the level of provinces, most interviewees from Cabo Delgado (64%), Nampula (87%), Zambezia (83%), Manica (64%), Inhambane (62%) and Gaza (96%) mentioned that they were fully satisfied with the distribution of the varieties. Most cassava farmers (90.6%) process cassava for products such as dried cassava (for flours), cooked and roasted cassava, as well as beverages. About a quarter of these producers process cassava according to improved technologies introduced with the project.

Pages 193-199

Sustainable commercial cassava cultivation: the case of Nigeria

Akoroda M.O., Dixon A.G.O., Ilona P., Ogbe F., Okechukwu R., Ezedinma C., Sanni L.O., Lemchi J., and Okoro E.

ABSTRACT

To make the root production efficient at highly reduced prices of tools is the main target of a commercial cultivation strategy. Two types of cassava cultivation systems would have to go on side by side in Nigeria. Household subsistence cassava cultivation focuses on meeting household food security with little surplus for sale. The second is competitive commercial cassava cultivation (CCCC) that is based on meeting commercial Targets. In the household cultivation (small farmer), farmers cultivate several small separate and scattered fields till fertility and weed situation arrest farther use of the land. In CCCC, one large piece of land is carefully developed over several years and best option in the use of farmland, soil, fertilizer, herbicides, minimum use of labor, and the use of science and statistics to guide the management actions of the farm enterprise. This paper raises questions as to: What size of land is commercial? What mix of machines/tractors/labor? The status of soil productivity and level of fertilizer needed to

compensate for nutrient losses during the high yield cultivation? Best stems of the best variety? Timely operations, skilful management and appropriate field practices? Science-based principles applied? It recognizes four key areas of intervention being:

People: able, skilled, trained, in enough numbers to cope with the challenge of managing the many commercial farms in business ways so that resources on the farm are optimized and effectively managed to give the highest ever output in the circumstances. Agronomists with field experience will be needed to take over the handling of the commercial farms.

Land: developed to get the blocks of the land in large enough area to warrant tractor work to be done. The area of each block of land is mapped as to area and the type of soil in it so that the manure and fertilizer application can be fine-tuned and the economy that cumulative use of small improvement in soils will create in the enhance cultivation and yields that result. The issue of cheap and available fertilizers to upgrade and raise the store of nutrients available in the soil for growing cassava plants is essential to the achievement the high yields that will drive commercialization for greater income and profit margins to producers. The soil should also be protected from erosion under rainfall from season to season. The planting of grass (vertivar) in the slope boundaries and bunds will help to conserve the land for as many years of use as is possible. Most (85%) of Nigeria soil has low to medium fertility as regards the three main plant nutrients in the soil.

Crop: variety to be planted must be that considered best for the end use we want, stem should be well selected and only healthy ones should be planted, management of any commercial farm requires a skilled farm manager versed in cassava agronomy. It is impossible to use residual knowledge of household subsistence farming to manage the large hectares.

Tools: tractor use must increase and the dependence on human labor must decrease. This is important to make the root production efficient at reduced prices. This also means that there would be greater production of roots with better control. Use of electric or fuel energy will be needed for lighting and for tractors for transport within the farm, equipment for cutting stems, for uprooting roots over large hectares, etc.

Pages 200-208

Study on cassava and sweetpotato yields in Mozambique

Andrade, Maria Isabel and Naico, Abdul

ABSTRACT

In Mozambique, cassava and sweetpotato play a very important role for food security, especially for the rural area. Major production areas are Nampula, Zambézia, Cabo Delgado and Inhambane provinces, for cassava; and Zambézia, Manica, Sofala and Gaza, for sweetpotato. Data of the inquiry on production carried out in 2002 show that exist more than a hundred cassava varieties and above fifty of sweetpotato currently under cultivation. Information until then available showed the same mean yield for all agro-ecological environments (about 6 ton/ha for cassava and 2 ton/ha, for sweetpotato). The current study aims to provide producers and scientists with reliable information on productivity of both cassava and sweetpotato in different zones of the country, through the analysis of data on the yields collected in the field for both crops. The study was carried out in August and September of 2003 in 27 districts, involving 1088 producers of cassava and 796 of sweetpotato in six provinces, namely, Gaza and Inhambane (in the South); Manica and Zambézia (in the Centre) and Nampula and Cabo Delgado (in the North). The results of the study show different yields for cassava in each zone and province. Despite that yields from the South (10.6 ton/ha) were closer to those observed in the Centre of the country (10.7 ton/ha), data on productivity for the provinces indicate that Zambézia, with 12 ton/ha, is the second largest producer after Nampula (14 ton/ha). The country average mean yield for this crop was 11 ton/ha. As for sweetpotato, the results show that there was a considerable increment in the productivity. On average, yields vary from 6-16 ton/ha against 2ton/ha as per official information available in the country. The average mean yield for the country was 13.7 ton/ha. The provinces of Manica (16.2 t/ha) and Zambézia (15.6 ton/ha), in the Centre, and Gaza (16.2 ton/ha), in the South, present considerably high productivity as compared to Nampula (10.8 ton/ha) and Cabo Delgado (10.4 ton/ha), in the North.

Pages 209-215

Minisett technique of seed yam production in two major yam producing states of Nigeria: a function of input availability and production objective

G.N. Asumugha, B.O. Ugwu, O.C. Aniedu, G.C. Orkwor and K. Amegbeto

ABSTRACT

This paper tries to assess the techniques of seed yam production as well as the determinants of the likelihood for adoption of the modified minisett technique in Delta and Benue States, two major yam producing states in Nigeria. The minisett technique (involving the use of about 25 gramme cut setts to produce whole tubers which serve as "seed" of yam) was developed to address the problem of high cost of seed yam as planting materials. Representative farmers were interviewed using well-structured interview schedule. Data collected include seed yam production techniques, production inputs by type and quantity, production objectives, and constraints. Data was analyzed using both descriptive statistics and probit regression models on factors affecting farmers likelihood of adopting the improved yam minisett technique of seed yam production. Results showed that producers who had separate plots for seed and ware yams had a higher likelihood of adopting minisett technique. Also producers for own ware yam production are more likely to adopt the minisett technique. Use of labour and inorganic manure is positively related to the adoption of yam minisett technique.

Pages 215-221

Evaluation of the production potential of seed potato (*Solanum tuberosum* L.) tubers stored for different durations in diffuse light conditions

Demo P., M.O. Akoroda, R. Asiedu and R. El-Bedewy

ABSTRACT

Lack of good quality seed is a major constraint to potato production in many Sub-Saharan Africa countries. Diffuse light (DL) store has been recommended for seed tuber storage. Little has been done to determine the optimum duration for storing seed potato in DL stores. In 2000, seed tubers stored in a naturally ventilated DL store for periods ranging from four to nine months were evaluated for tuber production under field conditions in the Northwest Province of Cameroon. The mean percentage of ground covered by crop foliage at 6 and 8 weeks after planting (WAP) was not affected significantly by seed storage duration. Mean number of above ground stems per plant from 7-month old seed was significantly greater than that from 4-month old seed by 34.9%. Seed tubers stored for 4, 6, 7, and 8 months consistently produced similar total tuber yields. However, 4- and 6-month old seeds out-yielded ($p < 0.05$) 9-month seed by 20.8% and 13.6%, respectively. Mean marketable yield decreased with increasing duration of seed storage, from 16.4 to 13.9 t ha^{-1} but this trend was not significant at 0.05 level of significance. Mean number of tubers harvested per plant was affected significantly ($p \leq 0.05$) by seed storage duration and cropping season. The first season crop produced 115.9% more tubers per plant than that of the second season. It was recommended that to minimize seed weight losses and achieve maximum tuber yields, seed potato tubers should be stored in DL stores for not more than two months beyond their dormancy period. Similar studies need to be conducted with different cultivars in different seed programs in order to generate accurate information under prevailing storage and crop growing conditions.

Pages 221-226

Integrated agronomic practices for cassava production: Effects of cultivar, stake weight and number of shoot per stand on the growth and productivity of cassava (*Manihot esculenta*)

O.N. Eke-Okoro

ABSTRACT

The effect of combining or integrating three independent agronomic practices or technologies (use of stake weight, number of shoot per stand and improved cultivars in cassava production) were studied for two years (1999/2000 and 2000/2001) in Nigeria. Plant height, number of root and fresh root yield were dependent on a combined use of agronomic practices or technologies irrespective of agronomic practice or technology. Significant variation in plant height, number of root and fresh root yield existed between the main effect of individual agronomic practice or technology and the combined effect of these practices. A combination or interactions of NR8082 X 875 kg/ha X 3 shoots per stand number of root and fresh root yield. The significant growth and yield differences among individual agronomic practice or technology and their combinations indicate the need to adopt the use of combined of integrated agronomic practices or technologies for sustaining and improving cassava yield in the tropics.

Pages 226-232

The relationship between leaf area and cyanogenic potential of tuberous roots of cassava planted in a wet and a semi-arid agro-ecological zone.

C.M. Githunguri, Kimani Waithaka, I.J. Ekanayake, and J.K. Imungi

ABSTRACT

Various environmental factors affect growth and accumulation of cyanogenic glucosides in cassava. Five cassava genotypes were planted in 2 agro-ecological zones in Nigeria, Minjibir the drier, and Ibadan the wetter, agro-ecological zones, and analyzed at 4, 6, 8, 10 and 12 months after planting for leaf area and root cyanogenic potential. Leaf area was highest at 4-6 months after planting, declining rapidly up to 8 months and then rising gradually thereafter, which compares closely with root cyanogenic potential. Whereas leaf area started rising after the 8th month, root cyanogenic potential leveled off thereafter at Ibadan, while at Minjibir cyanogenic potential rose rapidly to peak at 10 months and leveling off thereafter. Leaf area and root cyanogenic potentials highly positively correlated suggesting that they are related. However, regression analysis does not suggest a cause and effect relationship between them probably because cassava at Ibadan had significantly higher leaf area than at Minjibir, while cassava at Minjibir had the highest cyanogenic potential. Genotypes with low cyanogenic potential ought to be selected at the drier agro-ecological zone.

Key words: Cassava, leaf area, cyanogenic potential, agro-ecological zone, Ibadan, Minjibir

Pages 232-243

Effect of spacing on tuber yield of taro (*colocasia esculenta*) on vertisols of gedeo, Southern Ethiopia

Gobeze L., Legese H., Waga M., and Daniel Markos

ABSTRACT

Field experiment was conducted at on vertisols of Gedeo, for two years from 2002-2003 cropping season to determine optimum spacing for taro. The treatments involved in the experiment were 50, 75 and 100cm row spacing and 40, 50 and 60cm for plant spacing. Randomized complete block design in factorial arrangement replicated three times was employed in the experiment. Number of cormels was significantly responded to row spacing of which the highest number of cormels was obtained from row spacing of 100cm. Similarly row spacing had significant effect on marketable and total tuber yield of taro. Row spacing of 50 cm gave the highest marketable tuber yield. As to row by plant spacing interactions 75 x 40 cm gave the highest yield.

Pages 243-248

Effect of mineral fertilization on sweet potato in the Sudan savanna agro-ecological zone of Ghana

Issaka R.N., Buri M.M. and Alegibam B.

ABSTRACT
Sweet potato is a major non-traditional export crop in the Upper regions of Ghana. Tubers are exported to countries across the northern borders of the country. In addition, the crop is specially served during festivals and its vines are easily stored and fed to livestock during the dry season (lean season). In the light of the above, every effort is being made towards developing sustainable and cost effective ways of producing the crop. One major constraint to achieving higher tuber yields is the inherent low fertility status of these soils. A study to look at effective ways of increasing sweet potato production through the use of mineral fertilizer was therefore conducted. Results showed that both tuber and vine production were significantly reduced when P was limiting. Tubers were also generally smaller in the absence of P. At 45kg P_20_5/ha, both tuber and vine production and number of tubers/ha were significantly higher than the control. Both tuber and vine yields increased significantly over the control at 75 kg/ha N. Tuber yield, however, significantly decreased when N was increased to 90kg/ha. Increasing K levels from 0 to 90 kg/ha significantly reduced number of tubers produced and/or tuber size resulting in significant decrease in tuber yield. In order of deficiencies, phosphorus is the most limiting nutrient in theses soils for sweet potato production (P>> N > K). The following nutrient combinations gave comparable yield results: 30-45-60, 75-60-90 and 90-45-90 kg/ ha N, P_2O_5, K_2O - 293 - respectively. Tentatively 30-45-45 90 kg/ha N, P_2O_5, K_2O is recommended for further investigation.

Key words: Ghana, limiting nutrient, mineral fertilizer, Sudan savanna, sweet potato.

Pages 249-252

Viability and acceptability of the Mucuna pruriens fallow for the conservation of soil fertility in yam production

K.M. Sedzro, K. Apedoh and R.J. Carsky

ABSTRACT
Among the constraints of yam production in Togo, appears the poverty of the soils. The restoration of the soils fertility by practicing traditional fallow of more than 5 years in yam production becomes more and more rare or impossible because of the scarcity of the land related to the demographic density. The introduction of a fertilizing plant such as *Mucuna pruriens* in the production practices can contribute to improve the soil fertility (Akakpo et al, 1999, Anthofer, 1999). The goal of this work is to determine the effect of *Mucuna pruriens* cultivated like fallow on the soil fertility and thus on the output of the yam. The results indicate that it is more advantageous for the producer, in terms of output, to produce yam after one or two years of fallow of *Mucuna pruriens* than after one or two year of natural fallow. The 50% of the farmers agree to observe 3 years of fallow of *Mucuna pruriens* in order to make it possible to maintain the fertility of the soil for yam production and 60% think that the quantities of harvests compensate for additional farming work which the introduction of the fallow of *M. pruriens* involves. In terms of benefit the results indicate that after two years of continuous *M.pruriens* fallow the producer of yam gains 7 times that of two years of natural fallow and 60% the benefit from yam cultivated after 5 years of natural fallow. In terms of fallow duration, yam yield and the benefit obtained it is more advantageous for the farmer to adopt the *M. pruriens* fallow.

Pages 253-258

Investigations into cassava stem storage and its effects on sprouting and plant growth

C.C. Moyo, N.M. Mahungu, V.S. Sandifolo, S. Jumbo, A. Mhone and P.T. Mangirani

ABSTRACT
Shortage of cassava (*Manihot esculenta* Crantz) stems as planting material is one of the major constraints to cassava production in most of the Southern African countries characterized by one planting season. This is especially so in Malawi where cassava is grown for the fresh market as harvesting of roots is done even in the dry season (May to November) to take advantage of the high market prices. In such cases, the stems are left

in the field after harvesting with little or no effort to store them for the following season and yet in other countries the stems can be stored for up to 8 weeks before planting. A study has been conducted to determine the effect of cassava stem storage on sprouting rate and subsequent cassava growth. Treatments comprised three cassava varieties (Mbundumali, Mkondezi [Mk91/478] and Silira [TMS60142]), two storage methods (vertical and horizontal) and 6 storage periods (5, 4, 3, 2, 1 and (0 months to planting). Stem storage was done from July to December while planting was done on the 18th December 2003. The trial was laid out as a 3x2x6 factorial in Randomized Complete Blocks with 3 replicates. Plots were 4 ridges by 6.3 m long and ridges were 0.9 m apart. There were no significant differences in sprouting rate and plant growth among varieties or storage methods. Plant growth was not affected by storage period but sprouting rate was significantly reduced by the 5-months (July to December) storage, suggesting that even under good storage conditions (shade) cassava stems for planting should not be stored for this long.

Pages 258-267

Testing for linear and quadratic trends using a unified model rather than separate regressions - the case for three popular potato varieties in Kenya

J.N. Mwangi and C.M. Githunguri

ABSTRACT

In a fertilizer trial which includes two or more varieties, the tendency is to consider each fertilizer at each of the different rates as a type of a fertilizer and then analyze the data obtained as a factorial experiment. This approach obscures the main thrust of the trial which is to test for the optimal application of the particular fertilizer or fertilizers.

Another problem is that when one wishes to test for trends, it is usual for one to fit separate regression models to each of a given response variable. It is necessary to use a model that sufficiently fall and flexible to accommodate the wide range of patterns that are encountered in the separate regressions. Such a model is more efficient as it tests all the required regressions for a particular fertilizer using the same mean square error. Using data where three varieties of potato and four different fertilizers each at three rates, a unified model is developed that proves to be quiet efficient for such trials. Using this model it was found that only the treatment combination of goat manure and potato variety, Kenya Baraka showed a significant quadratic trend. All other combinations were not significant suggesting that a farther trial should be carried out with raised levels of the fertilizers in order to get the optimal applications for the fertilizers.

Pages 261-267

Degeneration and Yield Loss Associated With Different Sources of Sweetpotato Planting Materials in Western Kenya

Ndolo, P.J., H.O. Obiero and R.E Kapinga

ABSTRACT

Quality of planting material is an important constraint to sweetpotato production in Kenya. Experiments were conducted in Western Kenya to assess the degeneration rate over time of the tissue culture derived planting material and yield loss associated with different sources of planting material. The first trial assessed the degeneration rate of the pathogen-tested (PT) planting material of sweetpotato varieties. The second trial compared the performance of sweetpotato varieties planted with PT, virus-infected, randomly selected and apparently healthy planting material. The third trial evaluated the performance of PT and farmer-derived planting material. Root yields of virus susceptible varieties declined when the second generation of planting material was used while moderately resistant varieties declined after the fourth generation.

Planting of virus-infected and randomly selected cuttings resulted in 44.2 and 25.2% yield reduction respectively. Farmers registered a yield gain of 31.7% as a result of planting pathogen tested planting material.

Pages 267-270

Accelerated multiplication and distribution of improved healthy planting materials of cassava varieties in Western Kenya

Odero B.O, Obiero H.M, Ndolo P.J, Whyte J.B, Legg J.P, Malinga J, Magut T.

ABSTRACT

A virulent cassava mosaic virus disease devastated all the traditional cassava varieties in western Kenya in mid 1990s. In 1997 large cassava germplasm was introduced from regional germplasm at Serere in Uganda and was screened for resistance to the virulent cassava mosaic disease (CMD) across western Kenya region. Through participatory evaluation and selection for desirable genotypes at on-farm; fifteen genotypes were preferred and recommended for production. Since cassava has low seed multiplication factor, a three-tier (Primary, Secondary and tertiary) multiplication was adopted to enhance effective distribution of planting materials. In 1998 rapid multiplication scheme commenced to date; over 21 million cuttings have been distributed to farming communities in western Kenya, which has established over 21,000 hectares of land. This effort has benefited over 320,000 households in western Kenya. The recovery from pandemic is about 38%.

Key words: CMD (cassava mosaic disease), multiplication and distribution

Pages 270-275

Technology and extension gaps of cassava yield in Nigeria

Oladele O.I

ABSTRACT

This paper examines the technology and extension yield gaps as an assessment for determining the performance of cassava in Nigeria. This is based on the fact that cassava as the most important energy food crop enjoys relative popularity among other crops, such that intensive research and extension activities are on the crop. The transformation of the crop from being a famine reserve, through rural and urban staple food to livestock feed and industrial raw material confirms its importance. Secondary data on the potential yield, demonstration yield and farmers yield for cassava varieties were obtained and subjected to analysis to show whether differences exist in the potential yield and demonstration yield (technology gap) as well as differences between demonstration yield and farmers yield (extension gap). The results show that a high degree of variation exist on technology and extension gap for cassava in Nigeria. The extension gap is lower than the technology gap stressing the need to educate the farmers in the adoption of improved varieties.

Keywords: Extension gap, Technology gap Cassava, Crop Performance, Nigeria.

Pages 275-284

Yam production in the derived coastal Savannah zone of Ghana - past, present and future prospects

E. Otoo, R. Asiedu, S.A Ennin and E.O Ekpe

ABSTRACT

"Bodwease", a yam-producing area in the Efutu-Awutu-Senya District of Ghana, is touted as a "romantic town" due to several development initiatives being implemented by the Government of Ghana in the area, amongst them the President's Special Initiative (PSI) on cassava processing for starch. The area has unique characteristics that serve as a magnet attracting several local and foreign investors, as well as private investors and non-governmental (not-for-profit) organizations. It is very close (56 km) to Accra, the capital, and lies between the two major markets of Kasoa and Mankessim. It has unique climatic and soil characteristics making the area ideal for growing of pineapples (number one non-traditional export crop in Ghana), yams (second most important non-traditional export crop) cassava and maize. It also has a long history of producing yams of high quality and has some unique yam varieties found only in that area in Ghana. Yam production constraints and methods there are also unique, but production levels have been declining in recent times. This paper examines past and present yam production in the area. It also compares the economics of yam production in the derived coastal savannah zone of Ghana to that in the forest/savannah transition and the forest zones. The future prospects for yam production in the "Bodwease" area are discussed and measures to mitigate the challenges to this enterprise are recommended.

Key Words: Derived coastal savannah, Ghana, Yam

Pages 285-290

The effects of phosphorus, potassium and farm yard manure on post harvest characters of Irish potato (*Solanum tuberosum* L.)

Powon M.P., J.N Aguyo and V. Mwaja

ABSTRACT

Potato is a heavy feeder of plant nutrients in the soil and requires high supply of external mineral nutrients in the form of chemical fertilizers or organic manure. Potato production in Kenya is mainly constrained by poor soil fertility, and high cost of inorganic fertilizers. Soil nutrient deficit can be met from four sources: crop residue farmyard manure (FYM) and fixation by legumes and commercial fertilizers. The main objective of the study was to assess the potential for producing Irish potato yields and good quality through use of farmyard manure with reduced quantities of phosphorus and potassium fertilizers. Potato (Var. Asante) was planted for 2 season at National Agricultural Research Center - Kitale and on farm Psigiro (West Pokot District) in 2002 and 2003. The experimental design was Split-plot, arranged in a Randomized Complete Block (RCB), with three replications. The potassium rates (0, 83.3 and 166 K kg ha^{-1}), formed the main plots, while phosphorus (0, 52.2 and 100.4 P kg ha^{-1}) and farmyard manure (0, 10 and 20 MT FYM ha^{-1}) combinations formed the sub plots. Data were obtained on yield and potato quality. The results showed that, potassium had significant ($p \leq 0.05$) influence on potato tuber yield but not on tuber quality. Treatment without P showed the lowest total tuber yield. The optimum combination P and FYM application for seed potato production was obtained at any level of P with FYM rate of 10 MT ha^{-1}. High ware potato production was realized at application of at 20 MT FYM ha^{-1}. The highest CBR was realized in the application of; 100.4 P kg ha^{-1} at NARC-Kitale season 1, 50.2 Kg P ha^{-1} + 20 MT FYM ha^{-1} at NARC-Kitale season 2 and the application of 83.3 kg K ha^{-1} + 50.2 kg P ha^{-1} at the on farm site. Results indicate that the combined use of inorganic fertilizer and manure is feasible option for soil fertility improvement for potato production.

Pages 290-299

Effects of cassava mosaic disease and plant vigor on the yield and distribution of cyanogens in cassava (*manihot esculenta* crantz)

S.K. Tumwesigye, Y. Baguma, C. Ebong and G. Mpango

ABSTRACT

Cyanogenic plants, such as cassava, exhibit genetic resistance, which is associated with general defense signaling mechanism that responds to stress situations, and in the process release hydrogen cyanide. Cyanogen contents vary considerably with cultivar environment and plant age. Cyanogenic Potential (CNp) in given cultivar is influenced by Plant stress including cassava Mosaic Disease (CMD). The nature of response varies across varieties in a manner that is indicative of potential resistance to stress challenge. By contrast, from the nutritional point of view, cyanogens are toxic and lethal. As a corollary, these divergent aspects have translated into conflicting priorities on cyanogens research. Nonetheless, this study aimed to determine the effects of CMD status, cultivar resistance and plant vigour on Cyanogenic potential yield in cassava. About 400 and 36 cassava plants were studied in the field and greenhouse respectively, representing three different health status to cover health, moderately and highly susceptible genotypes. CNp were determined for samples from the three categories. We have shown that CMD and CNp are highly associated($r = 0.90$, $P<0.05$) with more than 70% increase in CNp yield. By contrast, low cyanogens accumulated in vigorous highly susceptible cassava than in the non-vigorous highly susceptible counterparts. The independent validation in the greenhouse good predictive association of CMD and CNp, but in this case CNp levels were lower compared to ones determined in field trials possibly due to temperature and nutrition functions. The implications and perspectives are discussed.

Key words: Cyanogenesis, Cassava mosaic virus

Abstract of agronomy and physiology

Response of Irish potato (*solanum tuberosum*) to coffee husk and diammomnium phosphate at damot galle nitisols of Southern Ethiopia

Legesse Hidoto, Waga Mazengia, Gobeze Loha
and Daniel Markos

ABSTRACT

The response of Irish potato to organic fertilizer (coffee husk) and inorganic fertilizer (DAP) interaction was investigated for three years (2000 - 2003) at Damot Galle Nitisols of southern region of Ethiopia to investigate the response of Potato to coffee husk and Diammonium Phosphate (DAP) fertilizer. The experimental design, randomized complete block in a four by four factorial arrangement was used and replicated three times. Coffee husk as factor A consisted of four levels (0, 3.4, 6.8, 10.2tons /ha) whereas DAP as another factor had four levels 0, 50. 100,150Kg /ha. Coffee husk alone didn't show any significant effect on potato tuber yield. However, tuber yield advantage of 10.2 tons/ha was observed due to the application of 6.8 ton coffee husk /ha over the control (neither coffee husk nor DAP applied plots). These tuber yield advantages are comparable with that of l00kg/ha DAP. Tuber yield significantly influenced by the application of DAP. The highest 32.6-ton potato tuber yield per hector was obtained from 150kg DAP/ha. On the other hand, the lowest tuber yield of 17.2 ton/ha was obtained from control. There is also significant response of potato to coffee husk and DAP interaction. Because of low nutrient content in the husk, a large amount is required which becomes bulky to transport to the point of application. On the other hand, the use of chemical fertilizers alone is costly. The result of this study revealed that Coffee by-product (pulp or husk) as an organic fertilizer integrated with chemical fertilizer can be an alternative to the poor and needy farmer.

Section III: Crop Improvement

Pages 301-304

Using public domain software for inexpensive and accurate measurement of sweetpotato storage root shape

Arthur Villordon

ABSTRACT

Shape measurements in sweetpotato research have been traditionally expressed as ratios. Digital image analysis using image capture devices and software enables objective quantification of storage root shape. The availability of public domain software and affordable digital cameras enables inexpensive but accurate quantification of sweetpotato storage root shape. We describe the procedures for analyzing shape using publicly available software in conjunction with a digital camera. We performed shape measurements on sweetpotato storage samples derived from a weed control study. We used the following publicly available software: Image J and Image Tool and detected significant differences in elongation, and compactness among US#1 storage root samples derived from plots subjected to various weed control treatments. The results demonstrate that measurement of sweetpotato storage root shape as well as similar samples can be undertaken inexpensively and accurately using public domain software applications.

Additional index words: Digital, image analysis, filters, segmentation

Pages 308-315

Participatory evaluation of orange fleshed sweetpotato varieties in Central and Eastern zones of Tanzania

N Luambano, R Kapinga, K Mtunda, M Yongolo and C Kitundu

ABSTRACT

Participation of farmers in selecting varieties in breeding activities is an advanced technology towards release of varieties acceptable to farmers. The uniform yield trial using promising varieties selected from advanced yield trial was conducted at Central and Eastern zones of Tanzania using ten (10) and thirteen (13) varieties respectively. Two local Orange Fleshed Sweetpotato (OPSP) varieties namely Mayai and Carrot-C were included for comparison during assessment. At the harvesting stage farmers were invited to assess the performance of the varieties in fields and to taste after cooking. Data on total weight, virus infection, number of plants harvested, plants with and without roots, marketable and non-marketable roots and their weight, weevil, rotting, cracking, root yield and dry matter were taken by breeders. Farmers were allowed to assess the varieties individually and then as a group to choose the best varieties and the least ranked varieties by pair wise ranking method both in fields and when cooked. Simama, Ukerewe, Resisto, 2001/261 and 2001/264 varieties were selected as the best in Central zone of Tanzania in field and when cooked. In Eastern zone, among thirteen (13) varieties planted. Ukerewe and Simama varieties were selected in field and when cooked while Sp 2001/261 variety was among the best in field. The same variety was least ranked when cooked. Other varieties highly ranked when cooked were Jewel Sp 2001/264 and Jonathan. This paper discusses the Results from breeders and that used by farmers in selecting the varieties acceptable to them for their sustainable development.

Pages 316-323

Yam (*Dioscorea rotundata* Poir. and *Dioscorea alata* L.) meristem culture optimization and phenotypic stability of micropropagated plants

O.J. Adeniyi, V.O Adetimirin, I. Ingelbrecht and R, Asiedu

ABSTRACT

In vitro culture media capable of regenerating plantlets from two yam species - *Dioscorea rotundata* and D. *alata* in a time shorter than the 24 weeks for the modified MS medium supplemented with 1 μM NAA, 0.6 μM BAP and 0.23 μM GA_3, presently in use were investigated. Arcsine-transformed data collected on shoot and plantlet formation at 3 and 8 WAC analyzed showed that direct plantlet regeneration, though better for D. *alata* than for D. *rotundata*, was low and ranged from 0 to 10% at 3 WAC and 0 to 30% at 8WAC. At 8 WAC, highest shoot regeneration was found in the MS medium supplemented with 0.1 μM NAA + 0.46 μM BAP and 0.46 μM BAP + 0.50 μM Kinetin for D. *rotundata* and D. *alata* respectively. Regenerates are similar morphologically to the mother plants. Phytohormone combinations that optimize shoot formation in D. *rotundata* and D. *alata* are species- dependent. High shoot regeneration, a halving of the time required for plantlet regeneration and morphological similarity of mother plants and regenerates achieved in this study will facilitate rapid regeneration of virus-tested true-to-type yam plantlets, thus enhancing germplasm transfer.

Pages 323-329

Genotype-By-Environment Interactions for Some Selected Sweet Potato Clones under Different Agro-Ecological Zones in Kenya

S.M. Agili, J.P.Ndolo, J. Korir and J.K. Mugo

ABSTRACT

Five improved breeding lines of sweet potato [(*Ipomoea batatas* (L)] clones 56682/03, 292-H.12, NK-L-22, 389a-H-12, and 91/218, and 5 locally collected clones K117, Namaswakhe, Odinga, Polista, SPK004 were evaluated in five agro-ecological zones in Kenya in order to assess genotype-environment interaction and to identify clones with desirable traits. A combined analysis of variance (ANOVA) was done on collected data to detect GXE effects. Stability assessments of individual clones were done using the Finlay and -H-Wilkinson (1963) regression coefficient (b=l). The genotype x environment interactions were significant (p=0.01) for number of large roots and total root yield. The storage yield of clones across the seven environments ranged from 12.74t/ha to 22.46 t/ha with a population mean of 16.96 t/ha. The high yielding clones in central highlands included K117, 91/218 and 5668203, while clones Odinga and NK-L-22 did poorly in the Lake Victoria Zone. Varieties 91/218, 389a-H-12, Polista and 292-H-12 with b values equal to or less than one and high root yield, could be considered generally adaptable or stable. These varieties may be recommended for production in all sweet potato growing areas of Kenya. Namaswakhe, 5668203, K117 and Odinga with high root yield and b value significantly above unity (b>1.0) were considered unstable, but high yielding in favorable environments.

Key words: *Ipomoea batatas*, regression coefficient, GXE interaction, stability analysis

Pages 329-335

Influence of soil water stress on vegetable growth and yield of cassava genotypes under screen house conditions

O.O. Aina, A.G.O Dixon, M.Akoroda and E.A Akinrinde

ABSTRACT

Cassava grown under field conditions is known to adapt to conditions of soil water shortage through various mechanisms such as shedding of leaves, stomata closure, osmotic adjustment, increasing the root length and decrease in leaf area. The influence of soil moisture stress on the vegetative growth and yield of nine newly-developed cassava genotypes *(Manihot esculenta* Crantz) were studied under screen house conditions in large polythene bags of 60cm length and circumference of 106cm. Plants were well watered until 4 weeks after planting when different moisture regimes were imposed by irrigating the plants to 75% (control). 50% and 2.5% field capacity (FC). A randomized complete block design with three replications in a split plot arrangement was used. Moisture regimes were main plots and genotypes were sub plots. Plant height and stem girth were measured at 4, 6, 8, 12, 14, 16, 18, 20 and 30 weeks after planting (WAP). Fresh storage root yield, root number and shoot weight were determined at 16 and 30 WAP. Results showed significant difference ($p<0.05$) among genotypes and moisture regimes for plant height, stem girth, root weight, root number and shoot weight. At 16 and 30 WAP, moisture regime of 25% FC led to a mean reduction (% of control) of 12.6% and 21.2% for plant height, 16.3 % and 21.7% for stem girth, 94.5% and 88.7% for root number, 93.3% and 94.9% for root weight, and 59.2% and 50.6% for shoot weight, respectively. The mean reduction of the genotypes at two moisture stress levels (25% and 50 FC) ranged from 12% (95/0211) to 31% (96/0326) for stem girth, between 9% (95/0211) to 36% (96/1632) for plant height, and between 74% (96/0016) and 100% (30572) for root weight. It was evident that soil moisture stress impaired the vegetative growth and limited the partitioning of assimilates for storage root bulking in cassava. As cassava cultivation is expanding into non-traditional areas such as the semiarid regions of sub-Saharan. Africa, concerted effort in breeding cassava for drought tolerance is more than needed. Germplasm introduction from Latin America (especially north-eastern Brazil) is providing unique sources of variability to further broaden the genetic base for drought tolerance in cassava.

Keywords: cassava, soil moisture stress, vegetative growth, root yield, and field capacity

Pages 335-341

Managing stem cuttings of cassava for optimum yields

Akoroda MO, Dixon AGO, Ilona P, Ogbe F. and Okechukwu R.

ABSTRACT

Hardwood stems of cassava are the chief component for the production of the new cassava crop. There are many aspects of quality handling of stem cuttings to consider for assuring a successful field production of a cassava crop. These aspects besides the choosing of a variety that is appropriate for the end-use, include: age of stems from which the cutting was taken (6-7 months), 20-30mm thick stems, a careful selection of stems from the stands in the farm to avoid those stems with symptoms of any pest or disease and injury. There is an essential need for adequate transportation within a few days from the cutting of long stems in the field in one location to actual planting in another location or site. All stem cuttings should be 25cm long with 5-7 nodes. To minimize insect and fungal damage causing rots of cutting it is imperative that cuttings are dipped into a mixed solution of fungicide and insecticide and allowed to air-dry before planting. Plantings of cuttings should be into moist soils with two-thirds of the length of cutting buried and the soil compacted around the stem. The cutting is placed inclined at an angle of 45 degrees nodal buds facing up to ensure few strong stems as well as ease of harvest and fewer better formed tuberous roots are obtained. Only whole intact un-split cuttings are to be planted within two days of severance from the main stem. Our experience is that very few farms in current cultivation apply these research-backed practices. The challenge is that of skill training to farmers to adopt and apply them to improve production and yields of roots and stem or shoots.

Pages 341-358

Relative growth performance of eight improved cassava genotypes and 4 popular improved checks in 3 diverse agro ecological zones in Guinea

Bah E.S, A.G.O Dixon, A Jalloh

ABSTRACT

Cassava (*Manihot esculenta* Crantz) is one of the most important food crops in sub-Saharan Africa (SSA). The crop is crucial to both food security and poverty alleviation, and accounts for approximately one-third of the total staple food production for more than 300 million people. In Guinea Conakry, it accounts for 11% of total cultivated area and provides 16% of calories consumed by the average Guinean against 26% of the calories consumed and 49% of the cultivated area of local rice. In 2003, the national production was estimated at 1,150,000 tonnes produced in 225 000 ha with a mean fresh storage root yield of 6.06 tonnes/ha. Cassava is increasingly becoming a basic food for the populations living in the dry areas zones with low soil fertility and for those having problems to produce other crops that are require high inputs that are scarce and expensive. A better understanding of the influence of the environment and its interaction with cassava genotypes for desirable traits is needed to enhance the development of improved cassava varieties for various agroecologies in Guinea. Multilocational trials were conducted at three experimental sites representing the three agro-ecological zones of Guinea (low altitude, high altitude, and savanna) for two cropping seasons years (2000/01 - 2001/02) to assess the relative growth performance of selected cassava genotypes at different harvest period and environments, investigate genotype x environment (G x E) interaction in cassava, and identify high yielding and stable genotypes. Data were collected starting from planting until harvest in all trials. Appropriate statistical analyses were carried out to determine, relative growth performance and to gain a better understanding of G x E interaction of cassava in Guinea. Results showed high G x E interaction, with Foulaya having the highest mean yield while

there was no significant difference in tuberous root yield among genotypes for the two years at Bareng thus suggesting that Bareng is an ideal environment for testing cassava tuberous root yield.

Pages 358-368

Development and identification of high-value cassava clones

H. Ceballos, M.Fregene, T. Sanchez, J.C Perez and Z. Lentini

ABSTRACT

Cassava is an important crop for the agriculture or many tropical and subtropical countries. It remains one of the most relevant commodities for subsistence farming as food security, and it is acquiring an increasing role in rural development as raw material for many processing pathways. Starch production from cassava roots is clearly one of the most important examples of industrial uses in cassava, particularly in Asia. One of the approaches taken to maintain this trend and make cassava more competitive is the increased emphasis on the search for value added traits/products. The cassava-breeding project of CIAT is actively working for the identification and/or the generation of new starch quality traits. A project for the production of homozygous doubled-haploid lines has just begun. The homozygous state will allow for the identification of recessive traits such as those controlling amylose content in the starch. Plants from irradiated seed in a mutation-breeding project (incorporating the TILLING system) have been transplanted to the field early in 2004. Conventional recurrent selection methods have also began, for a divergent selection searching to increase or reduce amylose content in the starch from the roots. Finally, CIAT is trying to set up a high capacity starch analysis laboratory to routinely screen the starch of the thousands of new genotypes it generates every year.

Keywords: TILLING, doubled haploids, recurrent selection

Pages 368-374

Evaluation of water yam (*Dioscorea alata* I.) genotypes for reaction to yam anthracnose disease

C.N. Egesi, S. Ogunyemi and R. Asiedu

ABSTRACT

Additive main effects and multiplicative interaction (AMMI) analysis was used to identify patterns of yam anthracnose disease severity in six genotypes of water yam grown for two years in nine environments in Nigeria. The proportion of variation of treatment sum of squares due to genotype, environment and genotype x environment (G x E) interaction effects were 34.3%, 35.6% and 30.1% respectively and all were statistically significant at $P<0.001$. The results showed that genotypes TDa 291 and TDa 294 were most resistant and most stable because they were the closest to the midpoint of the biplot and could be a durable source of resistance for use in water yam improvement. The highest interaction was shown by TDa 93-36 which also had a high severity of infection. The Jos 98 and 99 and Umudike 99 environments were placed around the midpoint of the biplot indicating that they were the most stable environments in terms of severity of infection with Umudike 99 exhibiting least support for disease development. The results showed that the Abuja and Ubiaja locations were highly responsive and could be considered as good sites for screening of germplasm for resistance to yam anthracnose disease in multilocational evaluation trials in Nigeria.

Key words: anthracnose, Dioscorea alata, disease severity scores, genotype, water yam.

Pages 375-385

On farm evaluation of Cassava clones at the coastal lowlands of Kenya

J.G. Gethi, C.K. Mutegi, E.N. Wambugu, P.Ndetei, S. Weru and C. Katama

ABSTRACT

Cassava is widely grown in Kenya, and is an important staple food crop in western and coastal regions of the country. Cassava is ranked the second most important food crop to maize in the coastal lowlands and in some areas, the only staple food available when the weather conditions are harsh. Cassava mosaic disease, (CMD), Cassava brown streak disease (CBSD) and pests such as cassava green mite (CGM) and cassava mealy bug (CMB), has ravaged cassava at the coastal lowlands. The most popular variety *Kibandameno* is sensitive to all these biotic stresses resulting in very low yields. A breeding program initiated in the mid 1990's developed and tested thousands of clones in an effort to address these constraints. Out of the clones tested, ten clones. Clone 2021, Clone 1366, 98/517, Clone 1380, 97/119, 2000/1260, Clone 1432, Clone 2085, Clone 1295, Clone 2059 were identified as potential varieties. These clones were planted on farm to test their performance on farm. The clones were planted in three districts in eight clusters chosen to represent cassava-growing zones in coast province. The clusters were Kinango and kikoneni in Kwale district, Chasimba, Kizingo, Ganze I (Mwaemba) and Ganze II (Ganze) in Kilifi and Malindi and Magarini in Malindi districts of Kenya. Each cluster consisted of four farmers each testing four clones and a local check. At the vegetative stage, participatory evaluation using over 200 farmers across the clusters selected clones 1366, 2021 and 2085 as superior to the local check, *Kibandameno*. At harvest, clone yields ranged from 1.5 t/ha for clone 97/119 at Kinango to as high as 63t/ha for clone 1280 at Malindi. Clones selected at vegetative stage were not similar to those selected at harvest. Sensory evaluation by farmers identified clones 2021, 1380,

1432 and 2059 as the most preferred, but only clones 2021 and 2059 were identified as potential varieties in all phases of selection.

Pages 385-393

A preliminary analysis of diversity among East African sweetpotato (*Ipomoea batatas*) cultivars using morphological and simple sequence repeats (SSR) markers

Gichuru Virginia, Aritua V. Lubega G.W, Edema R., Adipala E. and Rubaihayo P.R

ABSTRACT

On the basis of having a wide range of sweetpotato cultivars, East Africa is considered to be a secondary center of diversity. In this study, diversity among sweetpotato cultivars (mostly landraces) from Kenya, Uganda and Tanzania using morphological and simple sequence repeats (SSR) markers was assessed. Two hundred and sixty six cultivars collected from distinct agro-ecological locations were screened for morphological characters using the International Potato Centre (CIP Research Guide 36). Although several morphological characters were recorded, phylogenetic analysis using unweighted pair group method with arithmetic averages (UPGMA) showed a close relatedness amongst the East African sweetpotato cultivars since the majority of the cultivars had a 0.1 -0.5 Nei's genetic distance range from each other. However, the cultivars formed two major clusters irrespective of geographical origin. Based on the morphological analysis 57 cultivars that were fairly distant were further analyzed using four SSR primers specific for sweet potato. Each primer pair was able to generate between 2 and 5 polymorphic and clearly scorable fragments. Phylogenetic analysis of SSR loci revealed a close genetic relatedness amongst the cultivars. However, in both morphological and molecular analysis, cultivars from Tanzania displayed a subclustering

together, suggesting that they are morphologically and genetically distinct from the Kenyan and Ugandan cultivars. AMOVA performed on molecular data to further examine the relationships, however, indicated presence of a population structure which points to the fact that molecular data is able to detect variations at genome level unlike morphological data which did not find the cultivars to be distinct. These results suggest that morphological analysis done to examine diversity in sweetpotato should be substantiated with molecular data.

Key words: *Ipomoea batatas*, UPGMA, SSR, cultivars, diversity

Pages 394-399

Performance, foliage and root yield of sweetpotato clones at Katumani and Kiboko in Semi-Arid Eastern Kenya

Githunguri, C.M and Migwa Y.N

ABSTRACT

Sweetpotato production in Kenya is constrained by several biotic and abiotic factors. Katumani seeks to develop sweetpotato varieties that are widely adapted, high yielding, early bulking, drought tolerant, resistant to major biotic and abiotic stresses and have high dry matter and Beta carotene contents. Forty-eight sweetpotato clones selected from the clonal trial at Katumani were planted in Kiboko in September 2003. Two other trials consisting of 15 entries each of sweetpotato varieties developed at Kakamega and introductions by the International Potato Centre were established at Katumani during the 2003 long rain season. The best clones were selected based on their rate of establishment, vigour, number of roots, foliage and root yield. In the preliminary yield trial, clones NAJXSPK-023 had significantly higher root yields while NKA-006-008 had significantly better establishment than most clones. Results from the advanced yield trial indicate that clones 320/06, 91/218, 56682/02, 91/192, 56682/03 gave high root yield and dry matter

content and could be advanced for on-farm trials. Clones 56682/02, 91/218 and New Kawogo had significantly higher number of large roots than other clones. Clones 91/52, 91/52 had significantly higher dry matter content than the highest yielding clone 320/06, which had a dry matter content of 25.20%. In the National Performance Trial, the highest yielding varieties were K117, Odinga, Polista and 91/218. Clone K117 had the highest total yield, number and yield of large roots. Though establishment of cultivars is important, farmers could discard low yielding clones, which had high establishment. Conversely, high yielding clones that establish poorly are unlikely to be adopted by farmers. There seems to be a negative relationship between root dry matter content and total yield. There was a positive relationship between the number of roots and total yield, suggesting that breeders should select for high number of roots.

Pages 399-408

Evaluation participative de neuf genotypes de pomme de terre pour leur performance dans la commune de Buyengero:

D. Harahagazwe, A. Bararyenya, L.Niyongabo, et J.P. Baudoin

RESUME

La culture de la pomme de terre (*Solanum tuberosum* L.) connaît actuellement un essor très important malgré la crise socio-économique. Traditionnellement, la pomme de terre était confine dans la région de la Crête Zaïre-Nil. Maintenant, cette culture se rencontre partout à 1'exception de la plaine de L'Imbo. La pomme de terre connaît plusieurs contraintes qu'on peut regrouper en six catégories :les contraintes naturelles, agronomiques, technologiques, socio-économiques, financières et institutionnelles. C'est ainsi qu'en 2002, l'Institut des Sciences Agronomiques du Burundi

(ISABU) et l'ONG Concern Worldwide ont initié un projet de trois ans en vue de résoudre certaines des contraintes énumérées ci-haut en proposant des variétés à la diffusion et en formant les agriculteurs. Le projet s'exécute dans la commune de Buyengero. Le présent papier donne 1'état d'avancement de
ce projet. Sur base du modèle d'apprentissage participatif au champ, nous avons évalué un clone avancé du CIP (382171.4) en comparaison avec neuf variétés (Ndinamagara, Sangema, Uganda 11, Majambere, Rukinzo, Ingabire, Jubile et Victoria). Nous avons également formé 26 agriculteurs provenant de sept associations différentes en vue de devenir des formateurs. L'analyse des données a montré la supériorité du clone par rapport aux variétés testées en produisant 37.4 $t.ha^{-1}$ au moment où la meilleure des variétés (Uganda 11) n'a produit que 31.4 t. Les agriculteurs ont apprécié la performance de ce clone en confirmant les résultants d'analyse statistique. Désormais, ce clone s'appelle Ruhanyura, nom donné par les agriculteurs. Bien plus, 1'équipe de facilitation a apprécié le niveau de connaissances des agriculteurs lors des échanges sur les différents thèmes abordés au cours des sessions de formation.

Mots clés : Burundi, Pommedeterre,Apprentissage participatif au champ, Connaissances des agriculteurs.

ABSTRACT

Despite the social crisis, the potato crop (*Solanum tuberosum* L.) is being expanded in Burundi. It was initially grown in the highlands of Nil Zaire for several years. Now, farmers grow Irish potato in the whole country, except in the lowlands. The major constraints that the crop faces may be summarized in six categories: natural, agronomic, technologic, socio-economic, financial and institutional as well. In September 2002, the « Institut des Sciences Agronomiques du Burundi » (ISABU) and the NGO Concern Worldwide initiated a joint 3- year project in order to overcome some of the above challenges by releasing new varieties and enhancing the farmers skills. The project is based in Buyengero commune and this paper is a progress report. We adopted and adapted the Farmer Field School (FFS) approach when we tested eight varieties (Ndinamagara, Sangema, Uganda 11, Majambere, Rukinzo, Ingabire, Jubile, Victoria) with one clone (CIP382171.4) and trained 26 farmers. These participants were representatives of seven farmers' associations. The analysis of data revealed that CIP382171.4 is very promising with an average yield of 37.4 $t.ha^{-1}$ whereas the best variety (Uganda 11) yielded 31.4 $t.ha^{-1}$ only. The farmers appreciated the above clone and thus named it *Ruhanyura* in local language. Since then, this variety is in release in the national seed system. Furthermore, the research team found out that the participant farmers had sufficient knowledge to understand most of the themes developed during the training sessions.

Keywords: Burundi, Potato crop. FFS. Variety Release, Farmers' skills.

Pages 408-420

Relationship between traits measured at different stages of the selection process in cassava

G. Jaramillo, J.I. Lenis, F. Calle, N. Morante, E. Ortega, J.C. Perez and H. Cellabos

ABSTRACT

The evaluation and selection of segregating clones in cassava is a lengthy and expensive activity. Because of the slow multiplication rate it takes about 5-6 years to have enough planting materials for multi-location trials. A major bottleneck in the process is the need of a drastic selection in the first stage of the evaluation process, which is based in one or few plants in unreplicated trials. The current evaluation / selection process at CIAT involve: the Fl stage (plants germinated from botanical seed), Clonal Evaluation Trials or **CET** (one row with 7-8 plants). Preliminary Yield Trials or **PYT** (three replications of 10-plant plots), Advanced Yield Trials or **AYT** (three replications of 20-plant plots), and Multilocation Trials or **MLT** (three replications of 25-plant plots and more than one location) several variables are taken at each stage. The current study present the relationship between the same variable measured at different stages in the evaluation process as well as the relationship of different variables (measured early in the selection process) with fresh root and dry matter yields (measured late in the selection process). Results were obtained from the three main agro-ecosystems used by the cassava-breeding project at CIAT in Colombia (sub-humid, acid-soil savannas and mid-altitude valleys). Several "generations" of segregating materials were analyzed, involving thousand of data points. Dry matter content and harvest index can be efficiently identified early in the selection process. However, dry matter content tends to have a negative correlation with fresh root yield and harvest index did not have the high correlation with fresh root yield found earlier in Thailand. Fresh root yield in **CET**, on the other hand had a better

(although not necessarily satisfactory) predictive value for fresh or dry matter yields at **AYT** or **MLT**.

Pages 421-424

Association between zigzag stem habit and resistance/tolerance to cassava brown streak virus disease

Kanju, E.E, Mahungu, N.M., Whyte, J.A and Dixon A.

ABSTRACT

Cassava is an important food staple in the coastal provinces of east and southern Africa. However, its production is adversely affected by cassava brown streak virus disease (CBSD). CBSD first reported from Amani, Tanzania in 1936, is now considered to be one of the major biotic constraints to cassava production especially in the coastal lowlands. Efforts to develop resistant varieties as the major control measure for CBSD started way back in the 1940s. In efforts to improve breeding efficiency, some researchers have investigated the correlation between morphological traits and resistance to CBSD. The zigzag stem growth habit is one of the marker genes identified in cassava. Marker genes control the expression of traits which can be easily classified into distinct states, each controlled by a different allele, and whose expression is little influenced by the environment. There is evidence to suggest that a single recessive gene (zz) controls the expression of the zigzag stem trait. Field observations have now revealed that all the CBSD tolerant cultivars identified in Tanzania are heterozygous (Zz) for the zigzag stem trait. The varieties are: Kigoma Mafia (or Kigoma Red), Nanchinyaya, Kiroba, TMS 30001, Namikonga, Kitumbua, Kalulu (or Kalolo), NDL 90/34 and Amani 46106/27. In Kenya, two cultivars, Kaleso (Amani 46106/27) and Kahoteli, which are tolerant to CBSD, are also heterozygotes. Furthermore, in

Mozambique eight cultivars, Nikwaha, Mulaleia, Macia 1, Likonde, Mz 89001, MZ 89186, IMM 30025 and Mocuba, which are tolerant to CBSD, are heterozygotes. These observations imply that there is a strong possibility that the gene conferring tolerance to CBSD is linked to the "z" allele. So far no genotype has been found which is both tolerant to CBSD and homozygous dominant for the stem trait (ZZ). However, further evidence is required to prove this association. Rapid genetic progress will be made in breeding for tolerance/resistance to CBSD if this association is proved.

Pages 425-430

Application of transgenic technologies in cassava (*Manihot esculenta* Crantz) for resistance to cassava mosaic disease in Kenya

Mallowa S., Odero, B., Obiero, H., Murunga A., Ndolo, P., Gichuki, S., Odhiambo, B. Wakhusama S., Wangai, A., Taylor, N., Kahn, K., Kant L.and Fauquet C.

ABSTRACT

Cassava mosaic disease (CMD) is the most important biotic constraint to cassava (*Manihot esculenta* Crantz) production in Africa, responsible for suppressing yields across the continent. A recombinant strain of one such geminivirus called *East African cassava mosaic virus* Uganda (EACMV-UG) causes very severe disease and is associated with the current CMD pandemic in East and Central Africa. As a result of this pandemic many farmers are either abandoning or greatly reducing cassava production; leading in turn to increased research on management options to control the disease. Emergence of DNA technologies has facilitated the development of transgenic cassava in which, significantly enhanced resistance to CMD-causing geminiviruses species has been demonstrated when plants were mechanically inoculated in the greenhouse at the

Danforth Plant Science Center (DDPSC), a not for profit research institute located in St Louis, USA. To determine whether these plants are resistant to infection by CMD when transmitted by the natural whitefly vector in the African environment, a collaborative project was initiated between DDPSC and the Kenyan Agricultural Research Institute (KARI). A biosafety level 2 screenhouse was constructed at the KARI Kakamega station in Western Kenya and permission obtained from the Kenyan National Biosafety Committee to import five transgenic cassava lines plus two non-transgenic controls. The plants have been established in soil in the screenhouse and are currently undergoing challenging experiments with viliferous whiteflies collected from farmers' fields in Kisumu and Busia districts. Testing of these plants represents one of the first occasions that collaboration between two public research organizations has established a trial of transgenic plants in tropical African. Data generated from these tests will further collaboration between these two institutes to develop and apply this technology to integrate resistance into farmer preferred, CMD-susceptible Kenyan cassava landraces.

Pages 430-440

Combining the interests of farmers and scientists in a participatory approach to breeding for superior mosaic resistant cassava

Manu-Aduening, J.A., Gibson, R.W. Ampong-Mensah, G., Moses, E., Lamptey, J.N., Dankyi, A. and Lamboll, R.

ABSTRACT

In formal cassava breeding, farmers are usually involved only in the on-farm testing prior to the release of the potential accessions as a means of endorsing them for their official release. In Ghana, few cassava varieties developed using these systems have been widely

adopted by farmers. A Participatory breeding involving farmers in two communities in Ghana and scientists with different background from CRI, Ghana and NRI, UK was carried out with a view to identifying farmers' selection needs on cassava and to ensure that varieties released through this approach are adopted by farmers. A collaborative evaluation of seedlings/clones of 18 IITA half-sib families derived from crosses between landraces and mosaic resistant parents were carried out in communal fields in the two communities. All selections made by farmers and scientists at each evaluation were carried forward to the next stage of the evaluation. From an initial population of 1355 in both sites, 291 (21%) were carried to the second year whilst 124 (43%) and 31 (25%) were carried to the second and third years respectively. Farmers were consistent in their genotype selections from year to year. Farmers' selection criteria were similar in both villages and were mostly based on characters associated with yield, food quality and labor saving whilst scientists were mainly on disease and pest resistance, yield, canopy architecture, tuber conformity and food qualities. A healthy appearance of plants was important but not an overriding trait to farmer. Farmers' selections corresponded more closely with those of the breeder than of pathologists.

Pages 440-442

Breeding for root quality traits in cassava

J.Mkumbira, R. Okechukwu & A.G.O. Dixon

ABSTRACT

The diversity of cassava cuts across space time genotypes, ethnic groupings and uses. Consequently, root quality requirements are diverse in sub-Saharan Africa.nThe International Institute of Tropical Agriculture (IITA) has the largest collection of landraces collected in Africa, which are now widely used in its cassava improvement program to ensure that new improved varieties have acceptable root quality traits. The increased use of landraces has resulted in a significant reduction in cyanogenic glucosides potential for the new clones being developed by the breeding program at IITA. New clones developed in the late 90s have cyanogenic potential levels (9.1 ± 2.06 mg HCN^{-1}

l00g fresh weight) similar to the best landraces for this trait. They are better in mealyness compared to those cloned in the late 70s and early 80s. In addition, these new clones are also equally easy to peel as the landraces. In its noble effort of developing new high yielding cassava varieties that are resistant to major diseases and pests, IITA will continue to ensure that these varieties are as good as, or better than the landraces with regard to quality traits liked by the diverse African cassava farmers and consumers.

Pages 443-448

Evaluation of sweetpotato for early maturity in the eastern agro-ecological zone of Tanzania

K.J. Mtunda, S.N. Msolla, M.Muhanna, A. Ngereza, E. Masumba and A. Larsen

ABSTRACT

Trials were conducted in the humid and sub-humid lowland of Eastern agro-ecological zone of Tanzania in 2001 and 2002 to identify early maturing sweet potato varieties. Twelve genotypes (including a local check) were evaluated in two locations. Plants were sampled for tuber yield and other characteristics at 3, 4, and 5 months after planting (MAP). Sweetpotato is normally harvested at 4 MAP, so the fresh tuber yield, dry matter and biomass production of the genotypes at 3 MAP gave an indication of early maturing potential especially when compared with the yields of the local variety (the check) at 4 MAP. Using; these criteria, Mwananjemu, Elias, Simama, Gairo and Sinia (KBH) were identified as early - maturing in the humid and sub-humid lowlands.

Key Words: Dry matter, *Ipomea batatas*, maturity period, Tanzania, tuber yield

Pages 448-454

On farm performance and farmers evaluation of cassava brown streak tolerant variety "Kiroba"in the Eastern zone of Tanzania

M. Mahanna M. Raya R. Hillocks E. Kanju and H. Kiosya

ABSTRACT

Cassava Brown Streak Disease (CBSD) is a very serious disease in many cassava growing areas of the Eastern Zone of Tanzania. It is mainly confined to the lower elevations, mainly along the Coast. Yield losses of up to 74% occur as a result of CBSD infection in some parts of the Eastern zone. In the year 2001, a variety believed to be tolerant to CBSD was introduced in two villages Zogowale and Viziwaziwa in the Eastern zone in which CBSD is a big problem. The objective was to find out whether Kiroba will be tolerant to CBSD in these villages and later on replace the available susceptible varieties. The variety was planted in 5 farmers fields in each village. After one year the variety was harvested. In each field 15 plants selected randomly were uprooted. Roots were assessed on CBSD incidence and severity and farmers' views on CBSD and other pest problems were ranked using a scale with classes from 1 - 9 (1 - Most important problem, 9- Least important problem). The performance of the variety was also ranked by asking fanners whether it was good, poor or moderate in comparison to their commonly grown varieties. At harvesting disease severity on the roots of Kiroba was found to be very low (less than class 3) in both villages an indication that it can be a good variety in CBSD prone areas in all villages CBSD was considered to be among the major Cassava production problems. While at Zogowale it was ranked as the second production problem, in Viziwaziwa it was ranked as the most serious problem. In both villages majority of farmers were of the opinion that Kiroba is a good yielder and tolerant to both CBSD and cassava mosaic disease (CMD). Farmers also considered it to be tolerant to Cassava mealy bug, a pest of cassava. Results obtained from this study

indicate that Kiroba is a promising tolerant variety to CBSD and it is preferred by farmers, thus it should be introduced in other areas in the Eastern zone where CBSD is a serious problem.

Pages 454-462

Challenges and opportunities in the underutilized and neglected yam (*Dioscorea* Spp.)genetic resources of Kenya: outcome of a baseline survey in Eastern province

E. Mutegi, Nyamongo D.O.C, G.Ngae and G. Muthee

ABSTRACT

In an effort to gather information on diversity production, consumption, marketing and institutional frameworks on Yams for application in research and development priority setting, structured questionnaires were used to collect baseline data on yam diversity, production, consumption, marketing and institutional framework in Meru South, Meru Central, Meru North and Embu Districts of Eastern province. Data was gathered from 34 farmers from at least 20 yam-growing locations in the four districts. Yam traders in urban and other markets in Meru Central District were targeted for additional malting data. Data on existing institutional frameworks for yam research and development was gathered from either Ministry of Agriculture crops offices or roots and tuber research programmes in Kenya Agricultural Research Institute offices. Resultant data was then summarized and analyzed using Ms Excel spreadsheet. The survey revealed a general decline in the level of yam diversity in farmer's fields although between 1 and 17 farmer varieties were found in the sampled farms. Major constraints in yam production were identified as pests, diseases, and general lack of technical information on all aspects of cultivation. On

average each of the visited homesteads consumes 4.2 kgs of yam per week and an overwhelming majority grows the crop for income generation besides subsistence purposes. Yam demand in the four districts sampled was found to be on an increasing trend and so was the price. There are both wholesale and retail yam marketers in all the districts. In spite of the prevailing production challenges on the crop research activities are minimal. Moreover there is no conservation work on yam. The work has revealed that yam is an important crop and effort is needed now with a view to transform it into a priority economic and food crop in the country.

Keywords: Yams, diversity, production, marketing, institutional arrangements

Pages 462-477

Performance of yellow and orange fleshed sweetpotato in three major agroecological zones of Rwanda

J. Ndirigwe, P. Tukamuhabwa, R. Kapinga and P. Ndayemeye

ABSTRACT

Thirteen pre-released and introduced orange-fleshed sweetpotato (*Ipomea batatas*) cultivars were evaluated in multilocational trials for 2 years in 6 locations to study their performance and adaptation in diverse environments of Rwanda. Trials were conducted in each for the three main agro-ecological zones that subdivide the country following the East- west difference in altitude, temperature, rainfall and topography. These varieties were compared to two local check Mugande and Kwezikumwe to evaluate for the agronomic performance (yield), the stability of sweet potato in beta-carotene as well as other criteria established by farmers. The Additive Main Effects and Multiplicative Interaction effects (AMMI) model was used to examine the pattern of interaction of

clones over different environments. Combined analysis of variance showed significant genotype x environment interaction. However, there was a non significant variation for the main effects (environments and genotypes) as well as the GxE interaction effects for beta-carotene. The most stable environments recorded the lowest yields compared with the less stable environments. Considering the average across the three zones and during two years (2003 and 2004), Clone 2000-203 had the highest fresh root weight while 97-004 had the largest number of roots. Biplot representations of yield and yield stability identified 2000-203 and 2000-031 as high yielding and 2000-030, 2000-040 and 2000-024 as stable. The best yields were realized in middle altitude conditions for those thirteen varieties.

Key words: Agro-ecological zones, adaptability, AMMI, sweetpotato genotypes, beta-carotene

Pages 477-482

Analysis of sweet potato passport data using geographical information systems (GIS)

W. Njuguna, G.M. Muluvi, J. Machuka, S. Gichuki and A. Villordon

ABSTRACT

East Africa is the largest producer of sweet potato in Africa with Uganda taking the lead. The crop is said to have higher genetic diversity than other crops like cassava, yams, or coco yams. The short tropical day-length found in East Africa favors sweetpotato flowering leading to hybridizations and arising new varieties. This combined with its nature of dispersal from the Americas and vegetative propagation has created a vast number of cultivated genotypes. Collection and morphological characterization of this cultivated germplasm was done in a long term bid to conserve it. Conservation of this

cultivated germplasm is necessary for improvement of agricultural production. In this paper, we describe and analyze a georeferenced database of sweet potato accessions in Kenya. In addition, we will explore the various germplasm diversity-specific analytical and query tools that DIVA-GIS possess.

Key words: GIS, morphological characterization

Pages 482-489

Field competitiveness and farmer preference of orange-fleshed sweetpotato clones in apac district in Northern Uganda.

B. Odongo, F.A Opio, L. Serunjogi, D. Rees, H. Okurut Akol, R. Kapinga, L. Berga, and R.O.M Mwanga

ABSTRACT

Sweetpotato is a staple food in Uganda, and is grown and consumed throughout the country across socio-economic classes. Since 2001, the orange-fleshed sweetpotato varieties (OFSPV), which contain beta-carotene, have gained prominence as vehicles for reducing vitamin A deficiency, among the rural and poor communities. Because OFSPVs are new in the cropping and food systems of the country, they have to be evaluated for their competitive field and post-harvest qualities, to justify their adoption. The study objectives were to enable farmers to assess new OFSPVs and white-fleshed sweetpotato varieties (WFSPVs) on fields for farmers' perception of pest and disease resistance, root shape, skin and flesh colour and characteristics of cooked roots. Five OFSP and six WFSP were tested under farmers' management conditions. Naspot 1, Naspot 3, and Naspot 4 (WFSPV) were rated by farmers as having high resistance to pest attack. Ejumula and SPK004 had high resistance to sweetpotato virus disease. There was insignificant difference between OFSPVs and WFSPV on crop maturity, root shape and

size, skin and flesh colour and general appearance. However, variation was noted among gender categories (women, men, girls and boys) in rating for cooking qualities (taste, appearance, starch, fibre and general appearance). Study showed that OFSPV has comparable resistance to pests and diseases and had acceptable cooking qualities. Promotion of the nutritious sweetpotato varieties would contribute to reduced vitamin A deficiency.

Pages 490-494

Sweet potato vine selection programme in Kari - Lanet Nakuru, Kenya

Ondabu N., Irungu K.R.G, Tarus S. and Ontiti S.

ABSTRACT

Sweet potato vines (*Ipomea batatas* (L) Lam) contain high levels of protein and can be major source of high quality animal feeds. Sweet potato selection programme in KARI - Lanet focussed mainly on varieties suitable for vines. The relatively high cost of commercial concentrates and lack of suitable legumes to base productive pastures have prompted an examination of sweet potatoes as animal feed. In this study twenty three (23) sweet potato cultivars were tested for dry matter yield (DM), crude protein and drought tolerance. Rainfall precipitation at Lanet was Bimodal with a mean of 800 mm; altitude is 1920 m above sea level with relative humidity of 83%. The average maximum and minimum temperatures were 26°C and 10°C respectively. The soils are deep sand loam Dry matter yield per ha ranged from 5 tons/ha to 10.47 tons.ha and the crude protein from 16.47 to 22.6 CP. The Light green variety developed at Lanet had the highest DM yield 10.17 tons/ha while variety 99/1 collected from Kakamega had the highest CP of 2. 6. Varieties Wabolige, K049, K158, Mugande and ex- Mukurueni showed excellent tolerance to drought during the dry season. Helena collected from ILRI succumbed to viral infection. Most of the varietie collected from Kakamega, Embu and ILRI have

shown superior qualities at Lanet Nakuru. Further testing and evaluation on fann will rank them and give recommendation.

Pages 494-505

Varietal difference in the physicochemical, funtional,pasting properties and granule size of starches from different CMD resistance varieties

Onitilo, M, L. Sanni,B. Maziya-Dixon and A Dixon

ABSTRACT

Pre and Post harvest factors such as genetic factors, environmental conditions during the growth of the plant, and the method of starch isolation have been found to have a profound effect on the properties of root and tuber starches. The Physicochemical, Functional, and Pasting properties as well as granule Morphology of starches from 40 different new cassava varieties (36 CMD clones and checks comprising; TMS 30572, 4(2) 1425, TME 1 and 82/00058) from IITA Trial farms were investigated. Moisture content of the starches (dried) ranged between 3.59 and 11.53%, Ash content were from 0.03-.49%, protein content ranged from 0.23- 0.70%, percent sugar ranged from 0.51-3.46%, Starch content were found to be from 60.34 - 86.79%. While amylose and dry matter content range from15.24 - 30.20% and 88.47 - 96.41% respectively. The water absorption capacities ranged from 1271.74 - 1351.17, while solubility and swelling Power (at 85°C) ranged from 1.03 – 2.10% and 9.04 - 16.90% respectively. Starch damaged ranged between 0.39 and 2.10%, dispersibility ranged from 81.50 - 89.50%. While least gelation concentration ranged from 2.00 - 4.67%. The pH of the starches

ranged from 4.06 - 9.22 mers. The starches had peak viscosity of between 261.17 and 593.17 RVU. Peak time ranged from 3.36 - 4.25 minutes, while pasting temperature ranged between 63.75 and 65.65°C. Set back viscosity ranged from 19.04 - 79.92 RVU while breakdown viscosity ranged from 141.21 - 328. % RVU. The final viscosity of the starches ranged between 141.21 and 244.84 RVU. The granule sizes as viewed under microscope ranged from 12.5 - 23.83 μm with round shapes. There were significant differences in all the physicochemical properties of the starches except the amylose content while significant differences ($p < 0.05$) were recorded in all the functional and pasting properties of the starches except the least gelation concentration. There were no significant differences ($p > 0.05$) in the granule size of the starches. The study revealed that there were marked varietal differences in the starches from the different CMD resistance varieties.

Pages 506-511

Effects of location and age at harvest on the yield of cassava genotypes (*manihot esculenta* Crantz) in Rwanda

M.L. Rutikanga, D.S.O Osiru, J.K Makelele and C . Bayituliki

ABSTRACT

Thirteen cassava genotypes were evaluated in two locations of Rubona and Karama in Rwanda for yield performance and dry matter content. The cassava genotypes were planted in a randomized completely blocks designs (RCBD) with three replicates over two seasons March 2002B and September 2003A in Rubona and Karama. Harvesting was done at 6, 9 and 12 months after planting (MAP). The result showed significant ($P<0.001$) genotype, season, location and harvesting time effects on fresh root yield. The

interaction between genotype by season, genotype by location, genotype by harvesting time, location by harvesting time and season by genotype by location were also significant (P<0.001) effects on fresh root yield. Genotypes MM96/3920 and MM96/1961 had the highest fresh root yield (10 and 10.6 t/ha respectively), while genotypes MM97/1542 and MM96/7688 had the lowest fresh root yield (6.9 and 7.4 t/ha respectively). There were significant (P<0.001) genotype, season and harvesting time and interaction location by harvesting time effects on dry yield production. Genotypes MM96/3920 and MM96/1961 showed the highest dry matter yield 3.3 and 3.7 t/ha respectively, while genotypes MM96/7212 and MM96/7688 had the lowest dry matter yield 2.1 and 2.3 t/ha, respectively. There were significant (P<0.001) genotype and location effects on dry matter content. The interaction location by harvesting time was also significant
(P<0.001) effects on dry matter content in root tubers of genotypes. Genotypes MM96/7459 and MM96/1961 had the highest dry matter content 36.2% and 34.4% respectively in the two locations. Considering overall genotypes performance across location, harvesting time and season MM96/1961, MM96/3920 and MM97/7459 showed the best performance and hence for their high yielding and dry matter.

Key words: cassava genotypes, locations, yield, dry yield, dry-matter

Pages 511-520

Genetic improvement of Cassava in Sub-Saharan Africa: capitalizing on African Landraces

A.G.O. Dixon, J. Whyte, N. Mahungu, G. Ssemakula, J. Mkumbira, and P. Ilona

ABSTRACT
Genetic improvement strategies of cassava for target production and food systems in sub-Saharan Africa are presented here in relation to the varietal needs and utilization of African landraces. Variability generated by introgression from the African landraces has proven useful for improving breeding populations for multiple pest/disease resistance, improved postharvest qualities, wide agroecological adaptation, and greatly improved yield potential. Combined with the earlier improved IITA cultivars, and Latin American germplasm, the previously untapped African landraces have been used to further diversify and enhance resistance to the prevalent diseases and pests in the region and to expand the gene pool for agronomic and end-users' characteristics in breeding programs. Over 400 improved cassava genotypes have been developed for a range of agroecologies including the humid forest, moist and dry savannas, mid-altitudes and inland valleys. The characteristics of the new generation of cassava germplasm reflect the vision of an expanded future role of cassava in food, feed, and industrial applications. This improved germplasm is shared within the region as specific genotypes (certified as virus-tested) or improved seed populations for evaluation and selection under specific local conditions. This germplasm is at various stages of utilization in national programs.

Pages 521-525

Cassava mosaic disease in sub-Saharan Africa: variations in the pathogen, sources of resistance and host-plant resistance breeding for sustainable control

A.G.O Dixon, G Ssemakula, F. Ogbe, A. Ariyo, Y. Lokko, P. Ilona and J. Mkumbira

ABSTRACT

Cassava mosaic disease (CMD) is the most widespread and economically damaging disease of cassava in Africa. CMD causes severe yield losses ranging from 20 to 95% depending on the cultivar and occasionally total crop failure can occur. Estimated production losses in Africa are valued at $1.2-2.3 billion, annually. First reported in East Africa 1894, CMD is caused by the cassava mosaic begomoviruses (CMBeV), belonging to the family Geminiviridae. Is transmitted by the ubiquitous whitefly, Bemisia tabaci which feeds on young cassava leaves and is spread through infected vegetative propagules. Various researchers have provided evidence for the widespread occurrence of CMBeV species and strains in single and mixed infections on cassava in SSA. African cassava mosaic virus (ACMV), and the East African cassava mosaic virus (EACMV) have been reported in West Africa, East Africa, and some parts of Southern Africa, and the South African cassava mosaic virus has been limited to South Africa, but recently reported from Madagascar. The devastating Ugandan variant of the East African cassava mosaic virus (EACMV-UG2), which is a recombinant between DNA A of ACMV and EACMV and widespread in Uganda, has been reported in East and Central Africa. Another recombinant virus. East African cassava mosaic Cameroon virus (EACMCV) has been identified in Cameroon and Nigeria; and a distinct begomovirus from cassava in Zanzibar, the East African cassava mosaic Zanzibar virus (EACMZV), has been found in samples from the Kenyan coast. The most effective means of controlling CMD is by cultivating resistant genotypes. Breeding for resistance to CMD started in the 1920s in East Africa and Madagascar, and when IITA started resistant breeding for resistance to the disease in 1971, it took advantage of resistant material from the inter-specific hybridization in East Africa for EACMV resistance. Clone 58308, a selection from the resistant backcross derivative (46106/27), became the extensively used source for incorporating CMD resistance. This effort led to the development of several elite genotypes that combine high stable yields and consumer quality with acceptable levels of resistance to CMD. The delivery of improved germplasm to many national programs and testing under specific local conditions has led to the widespread and successful deployment of CMD resistant clones in several countries. As IITA was deploying these resistant materials, there was concern that the CMD-resistance traced to a narrow genetic base and with the discovery of new variants of cassava mosaic virus, the search for and utilization of additional sources of CMD resistance among African landraces was vigorously pursued to diversify and enhance resistance. Several and diverse sources of resistance were identified from West African landraces, and coupled with flowering capability at Ubiaja (Edo State, Nigeria), enabled their introgression into elite populations. A major breakthrough in the breeding program was the pyramiding of the new sources of CMD resistance, with the resistance genes of the earlier Tropical Manihot Selection (TMS) varieties, providing greater and more durable resistance. The 'new generation' of cassava germplasm developed combines enhanced CMD resistance with improved post harvest qualities, multiple pest/disease resistance, wide agro-ecological adaptation and greatly improved yield potential. This germplasm is shared with national

partners. To ensure fast delivery of these materials to farmers, a fast-track evaluation approach is recommended. This involves on-station multiplication, simultaneous and participatory multi-location testing and on-farm evaluation, and mass multiplication and distribution of certified planting material of the top-performing improved clones.

Pages 526-530

New cassava varieties for tropical semi-arid climate of Ethiopia

T. Anshebo, A. Tofu, E. Tsegaye, T. Tadesse, A. Kifle and Y. Dagne

ABSTRACT

The Government of Ethiopia has currently identified cassava as a number one food security crop in order to alleviate the prevailing food insecurity and recurrent drought. Moreover, cassava consumption has been well adopted by the people living in rural as well as urban areas of Ethiopia. Based on this, some seven selected cassava (*Manihot esculenta* Crantz) genotypes of diverse origin were evaluated for high root yield and other desirable characters at two diverse agro-ecologies for four consecutive cropping cycles. The results revealed that the clone 44/72 Red excelled others by recording significantly higher mean total root yield of 28.1t ha^{-1} followed by the clone 104/72 Nigeria Red which exhibited mean total root yield of 27.2 t ha^{-1}. Such high root yields were associated with tolerance to cassava mosaic disease. The results on sink parameters revealed that the clones 44/72 Red, 104/72 Nigeria Red and 159/72 Wolaita produced roots with significantly higher tuberous root girth (6cm, 5.7cm and 5.6cm respectively). Higher mean length of tuberous roots was produced by 44/72 Red (41.7cm), which is followed by 104/72 Nigeria Red (42.3cm). More number of tuberous roots per plant was exhibited by the clones 44/72 Red, 104/72 Nigeria Red and Awassa local (7, 6 and 6 respectively). Based on this study, the superior clones 44/72 Red and 104/72 Nigeria Red

were selected and currently they are under verification both on-farm and on-station for official release to users.

Key words: Manihot esculenta Crantz, Genotypes, Root yield. Sink parameters, Ethiopia

Pages 531-536

Development of early maturing sweetpotato (*Ipomoea batatas* I.) Varieties for various agro-ecologies of southern Ethiopia

A. Tofu, T. Anshebo, T. Tadesse, E. Tsegaye, T. Belihu, Y. Dagne and A. Kifele

ABSTRACT

Sweetpotato (*Ipomoea batatas* L.) is one of traditional root crops in Ethiopia. Its paramount contribution against household food insecurity and income generation for rural poor is bold. Following collection and introduction of new sweetpotato clones; grouping into maturity set and preliminary field trial had been conducted prior to 1997. Consequently, eleven promising clones from early maturing group subjected under multi-location trial over distinct sweet potato growing agro-ecologies. Based on root yield and other desirable traits two clones from the variety evaluation selected for verification at on-station and on-farms for one year so as to officially release. Among them the clone 192040-I with mean total root yield 18.4t/ha released officially by the name 'Belella' from in the year 2002 and also the clone 192009-VIII revealed 17.43t/ha total root yield was officially released in 2004 from Awassa Agricultural Research Center. The release of these varieties could complement some short comings of the existing varieties and also broaden the genetic base for wide agro-ecology.

Key words: Variety, selection, release.

Pages 536-539

Using public domain software to integrate sweetpotato accession collection data into a GIS database

A. Villordon, S. Gichuki, H. Kulembeka, S.C. Jeremiah, and D. Labonte

ABSTRACT

Africa represents a unique secondary site of genetic diversity for the sweetpotato [*Ipomoea batatas* (L.) Lam.]. A cooperative research project is currently underway to assess genetic diversity as well as help conserve sweetpotato germplasm in East Africa. A GIS database that enables access to spatial and temporal data by project investigators and other stakeholders has been developed to support the project. To ensure sustainability of the database, public domain software applications were given preference over proprietary applications in developing the desktop database as well as enabling Internet (World Wide Web) accessibility. Freely available base maps and other files were used to comprise the underlying GIS components. DIVA-GIS was used to convert extant spreadsheet-based accession and passport data into GIS-compliant files. ALOV Map, a freely available Java® application for publishing vector and raster maps, was used to provide the framework for a web-accessible GIS database. This demonstrates that the availability of publicly available software requiring minimal or flexible licensing costs provide a cost-effective alternative to institutions that are considering developing GIS databases as well as enabling web accessibility to such resources. We describe procedures, software, and other applications that we used to develop a publicly accessible web interface to a GIS database of sweetpotato germplasm collections in Kenya and Tanzania.

Key words: Ipomoea batatas

Pages 540-547

Strategic cassava production rehabilitation in the Democratic Republic of Congo through accelerated germplasm development and deployment.

Lema, K.M., A. Dixon, N. Mahungu, P.Ilona, S. Nluta, J. Kimfuema, S. Lukombo and S. Bidiaka

ABSTRACT

The Democratic Republic of Congo (DRC) is Africa's second largest producer of cassava. This crop is the most important in the food systems, is cultivated throughout the country, and is a staple food for over 70 % of the population. Both roots and leaves are used in various dietary preparations, providing carbohydrates, proteins, minerals and vitamins. Cassava is also an important source of income, especially in rural areas. Since the last 7-9 years, however, there has been a drastic decline of cassava production in DRC, due to resurgence of major diseases and pests, but essentially to cassava mosaic disease (CMD), that was exacerbated by a new highly virulent Uganda variant (*Ug*) cassava mosaic virus, as well as the African root and tuber scale. This reduction of the national cassava production resulted in several cases of food shortage and serious food insecurity in many regions of the country. In order to rehabilitate cassava production in DRC and thus ensure food security and income generation, a multi-agency and multi-investor for development project was developed, which aims at developing and transferring to farmers, improved production and post-harvest technologies. The emergency strategy consisted at deploying available improved varieties which were previously multiplied and distributed to farmers by SECID and FAO but with strong phytosanitation campaign to reduce CMD incidence while testing new selections from local and IITA germplasm.

After 3 years, IITA and the national program (INERA) have developed nine cassava genotypes with high level of resistance to CMD including resistance to the newly observed Ug virus variant. These varieties are being official released for multiplication and distribution to farmers to gradually replace previously released now CMD-susceptible varieties. In addition to the improvement of traditional post-harvest methods such as the drying of fermented roots, project partners are being trained in the production and utilization of unfermented cassava flour to prepare various food products, which are rapidly accepted by consumers both in the rural and urban areas. These products include composite bread, cake, biscuits, doughnuts, etc, and constitute an important source of income especially for rural households.

Pages 547

Evaluation of cassava clones in four agro-ecological zones of Mozambique

Andrade, Maria Isabel and Ricardo, Jose

ABSTRACT

From 1997, as a follow up of the selection work of cassava until then developed, several activities aiming at expanding the sphere of action of the project were carried out in four agro-ecological zones of the Country. Several trials were established in the following locations: Umbeluzi, Nhacoongo, Maniquinique and Chokwe in the south region; Namanjavira and Namacura in the centre of the country, Muecate, Nacala-a-velha and Memba, in the north region. The main stages in the process to implement the selection program were as follows: Establishment of seed nurseries, Clonal evaluations trials, preliminary yield trial, advanced yield trial, uniform yield trial, multilocational trial, and on-farm trials. The main objective of these trials is to increase the production and productivity through selection of high yielding varieties that tolerate or resist to pests, diseases and drought, that meet farmers' preference and with wide adaptation to different environmental conditions. As result, two tolerant clones (Mz 94009-17 and Mz 94 0034) were selected in Muecate, Namanjavira and Nacala-a-velha in the centre and north of

Mozambique. The selection was based upon their performance for the presence or absence of symptoms of cassava brown streak disease (CBSD), African Cassava Mosaic disease (ACMD) and other. There are several promising clones, currently under evaluation, in different parts of the country with certain tolerance/resistance ability to the main pests and diseases, particularly the ACMD and CBSD. Also ninety yellow-fleshed clones were selected and they are currently being tested.

Pages 548

Participatory on farm evaluation of improved varieties of cassava (*Manihot esculenta* Crantz) in the center of the Cote d'Ivoire

N'zue Boni, Zohouri Goli Pierre, Gnaore- Yapi Valentine, Kouame Christophe et Kouadio Krah

ABSTRACT

In Côte d'lvoire, cassava is cultivated on approximately 80 % of the territory and occupies the second place of food crops after yam. It constitutes at the same time a subsistence and income generation crop for the producers. However, its production remains of traditional type with a low level of intensification, of which the use of traditional cultivars often not very productive and sensitive to pests and diseases. To mitigate this insufficiency, the continuous provision of the farmers of improved varieties proves to be necessary. Thus within the framework of project WASDU, varietal tests of cassava were conducted from 2001 to 2002 in 4 localities (Kouakro, Niambrun, Tiengala and Ouokoukro) in central Regions of Côte d'lvoire. In each locality, a community field of 4000 m^2 was used. Measurements and observations related, inter alia, to the pests and diseases, yield and on the reaction of farmers with respect to the agronomic and sensory characteristics were also observed. The harvest of the tuberous roots having intervened 12 months after plantation. The cultivars used as control obtained an average yield (6 to

18 t/ha) comparable with that of the variety IM93, but lower than those of the other improved varieties; except for the locality of Ouokoukro. The analysis of the data including localities and varieties, indicated that the average yield varied from 9 (IM93) to 19 t/ha (IM84). The locality of Niambrun recorded the best yield with 26 t/ha whereas that of Kouakro recorded lowest yield with 8 t/ha. As a whole, the farmers, while referring to a certain number of criteria (yield, size of the tuberous roots, cooking and taste, painfulness of harvest and vegetation covering), selected improved varieties IM84, TMS4(2) 1425 and IM89.

Key words: Community field, cassava, farmers, project WASDU, improved variety

Pages 549

Participatory evaluation of sweetpotato varieties in central Kenya using the Farmer Field School (FFS) approach

Gathaara, V.N., Gichuki T.S., Ngugi J., Ngigi G.K, Miano, D.W. and Maina M.

ABSTRACT

Ndeiya division in Central Kenya is semi-arid, experiences very erratic rainfall and prolonged drought seasons. Severe food / nutritional insecurity and low income among many households are major household problems in the region. In a good year farmers' get a good maize harvest but due to lack of other source of income, the crop is usually sold on the farm as green maize, thereby living little or no crop for harvesting. Many households end up with no food even before the season is over and they have to depend on relief food from the government or other donor agents. A Participatory Rural Appraisal conducted by Ministry of Agriculture in 2002, recommended introduction of

drought resistance crops among them the sweetpotato as a way of addressing the food / nutritional security problem. Based on these recommendations, the Kenya Agricultural Research Institute through the McKnight Sweetpotato Project in collaboration with the Ministry of Agriculture extension services introduced the orange-fleshed sweetpotato into the area in the 2004 main season. Fanner Field School (FFS) approach with a total of 50 farmers (both men and women) was involved in the participatory evaluation of eight orange-fleshed sweetpotato varieties. Participatory Technology Demonstration (PTD) plots were set up where eight varieties with a local check were planted on four rows of ridge and four rows of flat. Agro-ecosystem Analysis (AESA) was used for data collection. AESA data collection was mainly based on the crop's agronomic performance in relation to the ecosystem.
The farmers observed that the ridging method was more superior to the flat method. Based on the agronomic performance and utilization techniques of the crop, the farmers ranked and selected the varieties to address different farmers' needs. The farmers also made recommendations on use of Indigenous Technology knowledge (ITK) to address various problems observed on the crop. The main objective of the study was to train farmers on proper sweetpotato production methodologies, variety selection and utilization.

Key words: Agro-ecosystem Analysis, Orange-fleshed Sweetpotato, Farmer Field School, Participatory

Pages 550

Yield, number of tuberous roots and top weight of cassava at Kambi Mawe in semi-arid Eastern Kenya

Githunguri, C.M and Migwa, Y.N

ABSTRACT
Cassava grows in areas with marginal to low soil fertility, and in humid to semi-arid agro-ecological zones. Although cassava is considered to be a hardy crop, its yield can be adversely affected by various environmental stresses. Eighteen cassava clones developed at KARI Katumani replicated thrice in a Randomized Complete Block Design were planted in an Advanced Yield Trial at Kambi Mawe in semi arid eastern Kenya, at the onset of the short rains in November 2002. Twelve cassava clones were also planted in the same place and season in a Uniform Yield Trial. Harvesting was done in November 2003; data on yield, number of roots per plant and top weight was collected and analyzed. In addition a panel of 20 farmers evaluated cooked cassava roots for taste, appearance, dry matter content and texture. Clones with the lowest number of roots performed poorly suggesting a positive association between number of roots per plant and yield. Vigorous top growth seemed to affect root yield negatively suggesting that a high harvest index might be a good selection criterion for cassava clones. According to farmers' evaluation only clones 820001, 990011, 990005, 990054, 880061and 990013 had a good taste and these are the clones that are likely to be accepted and adopted by them. Clones 990011, 990005, 990054, 880061 and 990013 had good taste, appearance, dry matter content and texture making them good candidates for adoption by farmers in Makueni. Clones 990054, 990005, 880061 had the additional advantage of being high yielders making them excellent adoption candidates.

Pages 550

Participatory evaluation of orange fleshed sweetpotato varieties in central and Eastern Zones of Tanzania

N Luambano, R Kapinga, K Mtunda, M Yongolo and C Kitundu

ABSTRACT
Participation of farmers in selecting varieties in breeding activities is an advanced technology towards release of varieties acceptable to farmers. The uniform yield trial using promising varieties selected from advanced yield trial was conducted at Central and Eastern zones of Tanzania using ten (10) and thirteen (13) varieties respectively. Two local Orange Fleshed Sweetpotato (OFSP) varieties namely Mayai and Carrot-C were included for comparison during assessment. At the harvesting stage farmers were invited to assess the performance of the varieties in fields and to taste after cooking. Data on total weight virus infection, number of plants harvested, plants with and without roots, marketable and non-marketable roots and their weight, weevil, rotting, cracking, root yield and dry matter were taken by breeders Farmers
were allowed to assess the varieties individually and then as a group to choose the best varieties and the least ranked varieties by pair wise ranking method both in fields and when cooked. Simama, Ukerewe, Resisto, 2001/261 and 2001/264 varieties were selected as the best in Central zone of Tanzania in field and when cooked. In Eastern zone, among thirteen (13) varieties planted, Ukerewe and Simama varieties were selected in field and when cooked while Sp 2001/261 variety was among the best in field. The same variety was least ranked when cooked. Other varieties highly ranked when cooked were Jewel Sp 2001/264 and
Jonathan. This paper discusses the results from breeders and that used by farmers in selecting the varieties acceptable to them for their sustainable development

Pages 551

Conservation et Valorisation De L'agrodiversite Au Nord Benin: L'exemple De L'igname Et Du Mais

Nasser Mohammed BACO

Justification de 1'étude (project de thése)

La biodiversité agricole, et plus particulièrement les ressources génétiques pour 1'alimentation et l'agriculture, constitue le réservoir d'où 1'humanité puise son alimentation (Biowatch, 2000). Pendant des siècles, les hommes ont utilisé des milliers d'espèces végétales pour se nourrir et en ont cultivé un grand nombre. Aujourd'hui, seulement 150 d'entre elles sont cultivées significativement dont 12% assurent près de 70% de notre alimentation alors que 4 espèces seulement (riz, maïs, blé, pomme de terre) contribuent à 50% de notre alimentation (FAO, 2001). C'est ainsi que de nombreuses cultures locales, traditionnellement Vitals pour l'alimentation, sont maintenant sous-utilisées ou négligées au profit de ces plantes alimentaires majeures ou à celui de cultures industrielles telles que Ie coton. Cette situation fragilise la sécurité alimentaire des communautés pauvres dans les pays tropicaux ou la societé reste dépendante de 1'agriculture vivrière locale. Plusieurs causes expliquent les sérieuses menaces pesant sur la diversité agricole. Déjà au début des années 60,1'agriculture avait été marquée par la révolution verte, caractérisée par 1'intensification de 1'agriculture et Ie développement de variétés adaptées à ce mode de production. Parallèlement à son succès, elle a fait émerger des dangers potentiels dont 1'érosion de la biodiversité à tel point que 1'Organisation Mondiale pour 1'Alimentation et 1'Agriculture (FAO) demanda dès 1965 àde nombreux experts d'analyser les causes et les dangers de 1'érosion génétique. Parmi les principales causes soulignées dans la Stratégic Mondiale de la Biodiversité (WRI, UICN, PNUE, 1992), on peut citer :

- les systèmes économiques et politiques ne prenant pas en compte 1'environnement et ses ressources:
- les systèmes législatifs et institutionnels favorisant 1'exploitation non durable ;
- la croissance élevée et non durable de la population humaine et de la consommation des resources naturelles.

En Afrique sub- saharienne, on note une croissance démographique galopante associée aux problèmes climatiques. Pour répondre à la demande alimentaire de cette population, on assiste à une extension de 1'agriculture commerciale modeme faisant intervenir des variétés hautement performantes. Dans les zones où le climat est aride ou semi-aride les écosystèmes comme les agrosystèmes se modifient continuellement, de même que les pratiques culturales notamment à travers la réduction des jachères et le développement des cultures de rentes. Selon Zoundjihèkpon et al., (1999), le développement du café et du cacao en Côte d'lvoire, du coton au Bénin et au Mali, conduit actuellement à des problèmes de conservation des ressources
génétiques. Les législations et les politiques nationales soutiennent ce type d'agriculture, souvent sous la pression d'accords intemationaux. D'autres facteurs contribuent aussi à 1'érosion de 1'agrobiodiversité et des savoir-faire s'y rapportant comme par exemple les nouvelles habitudes alimentaires, les innovations agricoles, les changements climatiques, les conflits politiques ou les guerres intestines et les mouvements de réfugiés qu'ils occasionnent. Toutes ces menaces s'opèrent dans un environnement marqué par les processus de mondialisation, régi par des conventions et accords intemationaux privilégiant le libre échange. Le risque d'une appropriation par des intérêts privés des ressources génétiques sauvages ou cultivées, dont le processus de production et leurs dérivés sont présentés comme des découvertes donnant droit à un dépôt de brevets sujet à diverses controverses, compromet la sécurité alimentaire au plan mondial comme au

niveau local. Dans ces conditions, il convient de renforcer la sécurité alimentaire (quantité, qualité, diversité et accessibilité, des denrées alimentaires) des populations rurales africaines où plus de 75% de la population vit avec moins de 2 dollars par jour (Banque Mondiale, 1999). Il convient également de promouvoir une gestion durable de 1'agrodiversité en consolidant les capacités des institutions du secteur agricole, pour leur permettre d'intégrer dans leurs politiques des approches qui tiennent compte des connaissances des agriculteurs. La présente étude contribuera à déterminer la place et le rôle de la conservation et de la valorisation de1'agrodiversité dans un monde de libre échange, alimentaire des ménages ruraux pauvres.

Pages 553

Determination of the farmers' selection criteria and evaluation of sweet potato (*ipomoea batatas* L.) varieties in Kyorimba, Meru North

E. Ngoroi, J.N Musyimi

ABSTRACT

The sweet potato (*Ipomoea batatas* L.) is the third most important root and tuber crop in Kenya after Irish potato and cassava. It is an important root crop for the smallholder farmers in Central and Eastern Kenya as it acts as a food security crop in the marginal and medium potential areas. However yields realized from farmers' fields are low due to use of low yielding varieties coupled with poor agronomic practices. The objective of this study was to evaluate with farmers some varieties that have a higher yielding potential. The four varieties evaluated were KEMB 10, KEMB 23, KEMB 20 and KSP 20 which were compared against a local cultivar. The study was conducted at Kyorimba in Meru North District between April 2003 and March 2004. Farmers gave taste, yield and size as

the most important criteria for variety selection in that order. The local variety was judged by the farmers to be most tasty followed by KEMB 23 and KEMB 10 while KEMB 23 had the best texture after cooking followed by KEMB 10 and local variety. KEMB 20 and KEMB 10 were judged by farmers as varieties with the highest yield while KEMB 20 was ranked as the variety with largest storage roots. This is in line with the biophysical yield data analysis, which indicated the two varieties KEMB 20 and KEMB 10 have the highest yields. Flesh color appeared not to be a determining criterion for selection. The final farmer's ranking of the varieties in the order of most preferred to least preferred were KEMB 10, KEMB 20, Local, KSP 20 and KEMB 23.

Pages 553

On-farm evaluation of promising sweetpotato clones in two major agro-ecologies of Uganda

Niringiye, C.S, Mwanga, R.O.M Namakula J. and Kigozi C.B

ABSTRACT

Sweetpotato (*Ipomoea batatas* (L.) Lam) is an important food security crops for both rural an urban-poor household. The crop is grown mainly by small holder farmers (particularly women), for food, rural employment and income generation. Most of the local cultivars grown by farmers have disappeared mainly due to susceptibility to sweetpotato (SP) virus disease complex; the few surviving ones are low yielding. To overcome this problem, on-farm evaluation and selection of improved varieties (with full farmer participation) was conducted in the districts of Kabale, Mpigi and Busia; Kabale represents highland, while Mpigi and Busia fall in the Lake Victoria Crescent agro-ecologies. The objective was to assess the agronomic performance and acceptance by farmers of five promising SP clones namely; TZ 3181, TZ/1927, TZ/309, NKA/21 and

23/60. Results showed that clone TZ/1927 was the most adapted to both environments, while clone 23/60 was the least adapted. Palatability tests (pair-wise comparisons and ranking) showed that clone TZ/309 was the best, while clone NKA/21 was the worst. The reasons given in favour of TZ/309 were: good appearance, sweet, mealy, good flavor and absence of fibres. Reasons for giving NKA/21 the lowest rank of were: bad appearance, not sweet, soft and presence of fibres. Although high root yield is important to ensure food security, our findings show that socio-economic attributes may be more important, when surplus produce is to be marketed to generate family income.

Key words: Sweetpotato, adaptation, acceptability, Uganda

Pages 554

Appraisal of sixteen clones of selected yam (*Dioscorea cayenensis-rotundata*) in two agroecological zones of Togo

E.K.N'kpenu, R. Asiedu, W. Tchala

ABSTRACT

Most of the cultivars of Guinea yam (D. *cayenensi-rotundata* complex) are highly appreciated especially for their suitability and above all their ability to pounding. However, they are not able to adapt to the deterioration of the production environment due to the extinction of forests and long lasting fallows. On the other hand, cultivars are susceptible to pests and diseases. As a result, yields have decreased to an average of 6 to 10 metric tons per hectare in Togo depending on the varieties. To overcome these production problems, improved varieties are being developed to fit into the current cultural practices. Sixteen (16) improved clones and two (2) landraces were evaluated in 2002 in two agroecological zones, Adeta in forest savannah zone with a bimodal rainfall

pattern and Kazaboua in Southern Guinea savannah with one rainy season. The objective of this study was to identify the best clones for these agroecological zones in terms of high yield and good cooking (food/culinary) quality. Data were collected on yield components and tuber yields. Tuber dry matter was determined at harvest and palatability test was conducted with fifteen tasters selected in each location. Three dishes (boiled yam, fried yam and pounded yam) were prepared with the eighteen yam genotypes and assessed by the tasters. Clones TDr 89/02665, TDr 89/02475, TDr 96/00304 and TDr 95/19156 were preferred because of their good yields respectively: 19.18, 13.20, 18.37 and 13.82 metric tons per hectare at Adeta. The same clones had lower yields at Kazaboua probably because of the late planting. However, these yields were higher than yield of others at this location. The quality of the three dishes made with the four clones was good at both locations. TDr 95/18894, TDr 89/02665, TDr 95/18988, TDr 95/19156, TDr 95/19158, TDr 96/00089, TDr 96/00304, TDr 89/02475, TDr 95/18531 and TDr 95/18922 were chosen on the basis of their better yield to be tested in other agroecologies. The clones TDr 89/02665 and TDr 96/00304 that showed good performance on both locations could be tested on farm.

Keywords: Yam, *Dioscorea cayenensis-rotundata*, varieties, genotype, clones, agroecologies, dishes.

Pages 555

Participatory evaluation and selection of improved high yielding, disease-free cassava genotypes in Western Kenya

Obiero H.M, Akhwale M.S, Ndolo P.J, Khizzah B, Ntawuruhunga P, Devries J

ABSTRACT

Cassava (*Manihot esculenta* crantz) is an important food security and income-generating crop for small-scale farmers in Western Kenya. The region accounts for 60% of the national cassava production. Farmers grow a wide range of landraces, which are late maturing, low yielding and susceptible to diseases and pests. The most devastating constraint in western Kenya is a virulent form of cassava mosaic disease, which attacked all traditional cassava varieties in 1994/95. By 1997 the situation was pandemic such that many farmers abandoned cultivation of cassava. This resulted to famine, hunger and poverty in the region. In 1997 Kenya Agricultural Research Institute (KARI) collaborated with International Institute of Tropical Agriculture (IITA) to mitigate the pandemic. Over 1 400 germplasm were introduced and evaluated for resistance to the virulent cassava mosaic disease at an open quarantine. Preliminary yield trials and advanced yield trials were subsequently conducted on genotypes which were selected at the open quarantine facility. Between 2002 and 2004, over 75 clones were selected from advanced yield trials and evaluated at on-farm trials on several sites. The fast track of most promising 14 genotypes were evaluated on-farm at seven sites in the year 2000/01. Variety SS4 and Migyera were included in the trial as checks and augmented design was adopted. The design has advantage of accommodating many entries at once. Farmers, extension agencies, NGO and CBO representatives who collaborate with cassava activities at on farm sites were also involved to participate in selection of preferred genotypes for the farming communities. No significant differences were observed for CMD severity at all sites. There were however significant differences between ranking of the clones since adaptability and acceptability varied from site to site. Criteria for selection of desirable genotypes were; resistance to cassava mosaic disease, high yielding, sweet and low to medium cyanide level. The widely grown genotypes now in western Kenya after participatory selection are; SS4, Migyera, MM96/4466, MM96/1871, MM96/3868, MM96/9308, MM96/5280, TME-14, MH95/0183, MM96/9362, MM96/7151, MM96/4684, MM96/7688, MM96/4884 and Unknown 2.

Key words: genotypes, participatory selection, on-farm, trials

Section IV: Integrated pest management

Pages 557-563

Genetic diversity among xanthomonas axonopodis pv manihotis isolated from the western states of Nigeria

A.A. Ogunjobi, A.G.O Dixon and O.E Fagade

ABSTRACT

Xanthomonas axonopodis pv manihotis is the causal agent of cassava bacterial blight (CBB) worldwide. CBB disease is a major constraint to cassava cultivation, and losses can be extremely severe in regions where highly susceptible cultivars are grown. To develop an efficient disease management policy, the genetic diversity of the pathogens population must be known. There is dearth of information on the genetic diversity of *Xanthomonas axonopodis pv manihotis* population in Nigeria. We used RAPD (random amplified polymorphic DNA) and AFLP (amplified fragment length polymorphism), a novel PCR-based technique, to characterize the *Xanthomonas axonopodis* pv *manihotis* isolates from the western States of Nigeria. Thirteen strains X*am* and 2 reference strains were tested with eight primers combination of AFLP and 4 RAPD primers. RAPD amplified DNA fragment data showed four major clusters at 80 % similarity coefficient level and two strains were not cluster by this analysis. Strains Kwa76A and Ond48A were also separated in the principal component analysis of the same data. Numerical analysis differentiated the AFLP patterns into four distinct clusters and grouped two strains separately at 66 % similarity. PCA assembly grouped the bacterial strains into 4 and one of the strains was singled out from the others. The two DNA analyses techniques seem to be complimentary to one another and informative on the genomic structure of X*am* population in Western Nigeria. The genetic analysis presented here contributes to understanding of the X*am* population structure in Western Nigeria.

Keywords: RAPD, AFLP, DNA, genetic diversity, dedrogram analysis and PCA

Pages 564-569

An assessment of the distribution, severity and prevalence of CBSD and CMD in Zanzibar

Saleh, H.H., Mohammed S.O., Thabit Z.O., Ali A.H. and K. Rajab

ABSTRACT

Cassava is the most important root crop grown in Zanzibar. It is grown by almost all rural households and is regarded as a food security crop. Cassava brown streak disease (CBSD) and cassava mosaic disease (CMD) are the major biotic constraints to cassava production in Zanzibar. The first CBSD survey in Zanzibar conducted in 1998, revealed the existence of the disease in most cassava growing areas of the Islands although its incidence was not high. Therefore in order to assess the latest distribution, yield loss and varietal reaction to both CMD and CBSD, a survey was conducted in November 2002 in 29 villages of Zanzibar (Unguja and Pemba). Forty (40) farmers were interviewed and 840 plants were sampled and inspected. Fully structured questionnaires were used to gather information from the farmers. The visual inspection of the infected parts of the plants with emphasis on leaves, stem and roots symptoms was made. The Statistical Programme for Social Scientists (SPSS) software package was used to analyze and compare the data. The results indicated that, the coral rag zones had the highest cases of both CBSD (27%) and CMD (32.4%). Micheweni district in Pemba had the highest incidences (71.7%) of CBSD symptoms, while the lowest incidences were in South district. On the other hand plants 10-12 months old had the highest cases of diseases symptoms. This paper highlights the findings of the study and gives the recommendations towards the appropriate control measures.

Pages 570-573

Cataloguing predators of *Bemisia tabaci* on a cassava mosaic disease resistance variety in Uganda

Asiimwe, P., Ecaat, J.S., Otim, M., Gerling, D., Guershon, M., Kyamanywa, S. and Legg, J.P.

ABSTRACT

A field experiment was set up at Namulonge, central southern Uganda to determine the predators of *Bemisia tabaci* occurring on the virus-resistant cassava variety SS4. Two field trials were set up, trial one planted during the dry season and trial two during the wet season. On these fields a simultaneous life table experiment to determine the contribution of predators to *B. tabaci* mortality was carried out. Starting at three months after planting (MAP), ten plants were randomly selected weekly and each plant was observed from the top to bottom including all leaves, petioles and stems and all known *B. tabaci* predators were counted on each plant over a period of six months. Five predatory groups were identified. These included: *Serangium* adults and larvae (Coleoptera: Coccinellidae), spiders, ants and syrphid larvae. In trial one the abundance of each predator peaked at a different plant growth stage. Ants were most abundant at 4 MAP, spiders at 5 MAP, syrphid larvae at 6 MAP and *Serangium* larvae at 8 MAP. In trial two, *Serangium* larvae, syrphid larvae and *Serangium* adults were most abundant with *Serangium* sp. peaking at 7 MAP, while the syrphid larvae peaked at 5 MAP. *Serangium* larvae, syrphid larvae and spiders were the most abundant predatory groups considering the whole period of the study. There was a general increase in predator numbers with age and number of leaves on the plant. There was also an increase in percent predation with number of predators and age of the plant. Current efforts are concentrating on species identification and determination of the most voracious predator of *B. tabaci* under laboratory conditions through total consumption and consumption rate studies. Preliminary results suggest that the coccinellid species, *Serangium* sp., is the most efficient predator of *B. tabaci* on cassava in Uganda. These studies will provide information on which is the most suitable for conservation and/ or manipulation for biological control.

Keywords: *Bemisia tabaci*, biological control, cassava, predators, *Serangium*, Uganda

Pages 574-582

Changes in population abundance of the African root and tuber scale *stictococcus vayssierei* Richard (homoptera; stictococcidae) on cassava in the bas-fleuve district in the democractic Republic of Congo

K. Tata-Hangy; R. Hanna; M.Toko, K.M. Lema and M. Solo

ABSTRACT

A two year follow up of the African root and tuber scale (ARTS) population dynamics was conducted on two cassava cultivars, a sweet variety Lueki and a bitter variety Mvuama, in a highly infested site of secondary agro-ecological forest zone of Bas-Fleuve District, in D.R. Congo. Both cultivars were infested throughout the period of the observations but significantly higher populations ($P \leq 0.01$) occurred on the sweet variety Lueki while the bitter variety Mvuama harbored less scales. Three planting dates (early, intermediate and late planting) were considered to follow the changes in the populations of ARTS on these two varieties. ARTS population development on the plant showed the same trend for the three planting dates on both varieties. The peaks in the population occurred at the onset of the main dry season, in May in the plots of the intermediate planting and, in June in the early and late planted plots, indicating seasonal effects. The late planting date showed the highest peaks and higher infestations throughout (Ps 0.05). Dramatic drops in ARTS populations occurred just after the peaks, from 700 individuals to < 100 individuals for the highest peak. Intrinsic mortality increased with the increase in population densities. No evidence of predation was observed. In addition to natural mortality, larvae migration/dispersal occurred. Such high mortalities coupled with migration/dispersal were attributed to the over-population of the ARTS on the plants, indicating density effects. These observations show that cassava cultivars, cultivation season, dry season effects, natural mortality and migration are major factors influencing ARTS population abundance on cassava.

Resume
Le suivi de la dynamique des populations de la Cochenille africaine des raciness et tubercules (CART) avait eu lieu pendant deux ans sur deux cultivars de manioc, la variété douce Lueki et la variété amère Mvuama, dans un site de forêt secondaire fortement infesté du District du Bas-Fleuve, en R.D. Congo. Tous les deux cultivars étaient infestés pendant toute la période d'observations, mais la variété douce Lueki était significativement plus infestée ($P < 0.01$) que la variete amere Mvuama. Trois différentes dates de plantations (plantation précoce, intermédiaire et tardive) étaient prises en considération pour suivre les changements intervenant sur les niveaux de populations de la CART sur les 2 variétés. L'évolution de la population sur la plante a montré une même tendance sur les deux variétés pour les 3 dates de plantation. Les pics étaient apparus au début de la saison sèche en Mai pour la plantation intermédiaire et Juin et Juillet pour les plantations précoce et tardive, respectivement, indiquant 1'effet de la saison. La plantation tardive a montré le pic et 1'infestation les plus élevés ($P \leq 0.05$). Une reduction brutale dans les populations de la CART (de 700 CART à < 100 pour le pic le plus élevé) est apparue juste après les pics. Une mortalité naturelle a augmenté avec 1'augmentation de la densité de population. Aucune évidence de predation n'était observée. En plus, une migration des larves a été observée. Des telles mortalités et migrations élevées ont été attribuées à une surpopulation de la CART sur les plantes, indiquant ainsi 1'effet de la densité sur la population. Ces observations indiquent que la variété, la saison de plantation, la saison sèche, la mortalité intransèque et les migrations des larves sont les facteurs majeurs influençant la population de la CART sur Ie manioc.

Pages 582-587

Effects of different rates of farmyard manure on the incidence of enset root mealy bug (*parapatu* sp.) on enset (*Ensete ventricosum*)

Mesele Gemu, Temesgen Addis, Shiferaw Mekonen and Matiyas Mekuria

ABSTRACT

Enset (*Ensete ventricosum*) is number one stapled food crop in the southern region of Ethiopia among all root and tuber crops grown in the region. *E. ventricosum* is a large banana-like plant, sometimes called "false banana." Unlike banana, however, the seedy, leathery fruits of enset are inedible. The corm, pseudo stem and leaf stems are the main sources of food. However, there are many constraints that limit the production and productivity of the crop. Currently, enset root mealybug (Parapatu sp.) prioritized as number one limiting factor for production and productivity, especially in the low land agro-ecological zone of the region. Enset root mealybug feed on the root and corm parts of the plant and the main symptoms of damage are stunt growth and gradual wilting of lateral leaves. To determine the effects of different rates of farmyard manure (FYM) on the incidence of enset root mealybug, very well decomposed FYM at different rates and the untreated control for the comparison were carried out at two hot spot areas of the region. Number of mealybugs, Pseudo stem circumferences and height of plant were considered as main parameters to evaluate the treatment effects. The incidence of enset root mealybugs was tested at the rate of O, 5.5, 11.0, 16.5 and 22.0 ton/ha of FYM. Results indicate that the highest number of enset root mealybugs was recorded from the untreated control followed by enset that received by other rates of FYM. The effect of higher rates of FYM (16.5 & 22 ton/ha) significantly increased pseudo stem circumferences and the height of plants. The results of this study indicate that application of well-decomposed FYM improved plant growth performance and this enabled the plant to withstand the attack of the enset root mealybug.

Pages 587-592

The status of cassava mosaic disease, bacterial blight and anthracnose as

constraints to cassava production in the pouma region of south Cameroon

Mwangi, M., Bandyopadhyay, R. Nolte C.

ABSTRACT

The three foliar diseases that threaten cassava production most are the mosaic disease (CMD), bacterial blight (CBB) and anthracnose disease (CAD). Deployment of resistant varieties has brought the diseases under control, but continuous monitoring remains necessary to forestall unforeseen outbreaks. Starting April 2003, the three diseases were monitored for one year as part of a diagnostic survey designed to investigate biophysical and crop management factors limiting cassava production in Pouma district, Cameroon. The study was carried out in 62 farmer-managed fields within which 10m x 10m areas were demarcated for data collection. Observations for disease were done at 3, 6, 9 and 12 months after planting (MAP). Disease data, evaluated on a scale of 1 to 5, were recorded from five randomly selected plants at each observation time.

CMD: At 3 MAP, 39% of the field plots were moderately infected while 61% of the plots had severe infection. At 6 MAP, field plots with moderate infection increased to 72% while those with severe infection reduced to 26%. At 9 MAP, plots with moderate infection increased to 93% while plots with severe infection reduced to 7%. There was no significant change in the level of infection between 9 and 12 MAP. CBB: The slight infection at 3 MAP increased with severe infection observed in 67% of the field plots at 6 MAP. At 9 MAP, the number of field plots with severe infection reduced to 55% and remained at about that same level even at 12 MAP.

CAD: There was no infection at 3 MAP. At 6 MAP 65% of the field plots showed moderate infection while 20% had severe infection. The number of field plots with moderate infection increased to 71% at 9 MAP and then reduced to 44% at 12 MAP. Data show that CMD severity generally decreased as plants aged and the disease is not a serious concern in Pouma. The increase in CBB and CAD infection between 3 and 6 MAP was most likely due to favorable wet weather and could make these diseases a concern, but only when prolonged wet weather prevails.

Pages 592-597

Effects of *steinernema karii* and *Hetrorhabdi indica* on sweetpotato weevil (*Cylas pucticollis*)

Sila M.M. G.H.N. Nyamasyo, J.H Nderitu

ABSTRACT

This study was carried out to determine the effects of *S.karii* and *H. indica* on the sweetpotato weevil under controlled conditions. Sweetpotato vines were planted on pots, and two months after establishment the plants were infested with, ten adult female weevils and 10 adult males. Two months thereafter, the plants were treated with infective juveniles of *S. karii* and *H.indica* at a rate of $0.5X10^{10}$/ha which translates to 500,000 infective juveniles per 25 liter capacity plastic pot each treatment being replicated three times. It was found that the larvae and pupae were more susceptible to both strains of nematodes fourteen days after treatment application ($P < 0.001$). Both species of nematode did not however have any significant effect on either male or female weevils but greater mortality was achieved in males compared to females (2.3% mortality in males compared to 1.1% in females). It was also noted that more male weevils were observed on the vines and leaves of the plants compared to females which were more abundant in the tubers. *S.karii* was more persistent compared to *H. indica* twenty-one days after treatment.

Pages 597-605

Biological control of cassava green mite in Tanzania

B.Pallangyo, R. Hanna, M.Toko, D. Gnanvossou, V. Mgoo, M. Otema, A. Onzo, F. Hountondji, E. Nsami and O. Mfugale

ABSTRACT

The cassava green mite *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae) is one of the most important pests of cassava, a main staple food crop in Tanzania. The International Institute of Tropical Agriculture (IITA) in collaboration with the Tanzania National Biological Control Program (NBCP) launched in 1998 the biological control campaign against cassava green mite in Tanzania with the release of the neotropical phytoseiid predator *Typhlodromalus aripo* DeLeon (Acari: Phytoseiidae), which had proven to be an efficient biological control agent of the cassava green mite in West Africa. The campaign consisted of new introductions and redistributions of *T. aripo* from infested cassava shoot tips, follow-up surveys to determine establishment, spread, and impact, as well as extension and farmer training on pest and natural enemy recognition and means of enhancing predator efficacy. *Typhlodromalus aripo* was first found in March 1998 in the Tanga region, most likely invading from the southern Kenya coast where it was released in 1996. Subsequently, the Tanzania NBCP in close collaboration with IITA has carried out numerous introductions and redistributions of the predator. Surveys conducted in the following 6 years revealed successful establishment, persistence and spread in five agro-ecological zones including the Lake (Mara and Kagera regions, except parts of Mwanza region), Western (Kigoma region except Shinyanga region). Southern Highlands (Mbeya and Iringa region), Eastern (Tanga and Coast regions) and Southern (Lindi and Mtwara regions) zones. Up to 2005, there was still no *T. aripo* in parts of 3 regions: Mwanza, Shinyanga and Ruvuma. Cassava green mite mean densities have declined to low levels (less than 20 actives per leaf) in all regions where *T. aripo* has been present. In on-farm impact assessment trial, *T. aripo* was capable of reducing population density of cassava green mite by 64.3% and increasing total and marketable cassava root weights by 61.2% and 71.7%, respectively. There was also a significant increase in total number of roots (25.4%), number of marketable roots (45.78%), stem weights (47.39%), and leaf weight (40.7%) where *T. aripo* was not eliminated. This report present evidence of the impact of biological control on cassava green mite populations and cassava yield in Tanzania, and recommends the use of exotic isolates of the fungal pathogen *Neozygites tanajoae*, which has been established in West Africa, as a complementary alternative approach in controlling further the cassava green mite in the remaining spots of high infestations.

Key words: *Mononychellus tanajoa*, predatory mite, *Typhlodromalus aripo*, *Manihot esculenta*, cassava yield.

Pages 605-613

Evidence for high evolutionary potential of *collectotrichum gloeosporioides*, the causal agent of yam anthracnose disease

M.M. Abang, R. Asiedu, P. Hoffmann, G. Wolf, H.D Mignouna, S. Winter

ABSTRACT

Anthracnose, caused by *Colletotrichum gloeosporioides* Penz., is the most severe foliar disease of water yam (*Dioscorea alata*) worldwide. Population genetic analyses can yield useful insights into the evolutionary potential of *C. gloeosporioides* and thus lead to the development of appropriate disease management strategies. The genetic structure of *C. gloeosporioides* populations from yam and non-yam hosts in three agroecological zones of Nigeria was investigated. Microsatellite-primed polymerase chain reaction (MP-PCR) markers, vegetative compatibility grouping (VCG), virulence phenotyping with five putative *D. alata* differentials, and the presence/absence of a *Glomerella* teleomorph in yam fields were used to infer the evolutionary potential of *C. gloeosporioides* on yam. We observed high VCG and MP-PCR haplotype diversity (GD = 0.99 to 1.00) for populations from all hosts and agroecological zones, with multiple pathogen genotypes in individual anthracnose lesions. Genetic differentiation was low among pathogen populations from different hosts (G_{ST} = 0.10, θ = 0.034), and agroecological zones (G_{ST} = 0.04, θ = 0.018), indicating significant gene flow. The fungus was recovered from several non-yam host species commonly found in yam fields but non-yam isolates caused only mild to moderate symptoms on yam. Eighteen *C. gloeosporioides* virulence phenotypes were identified among 122 isolates but there was a weak correlation (r = 0.02 P = 0.40) between virulence phenotype and MP- PCR haplotype. Consistent with the above findings, we observed the *Glomerella* teleomorph on anthracnose-infected yam plants for the first time in Nigeria, indicating that sexual

recombination might play an important role in anthracnose epidemics on yam. The implications of these findings for future studies on *C. gloeosporioides* evolutionary potential are discussed, as well as the consequences of rapid pathogen evolution for the development and deployment of effective and durable strategies for yam anthracnose disease management.

Keywords: *C. gloeosporioides, Dioscorea spp,* population genetics, epidemiology, evolutionary potential, molecular markers, resistance genes

Pages 614-622

Incidence and distribution of cassava diseases and pests in the Democratic Republic of Congo

K. Tata-Hangy, J.Legg, R. Hanna, M. Toko, K.M Lema, A. Dixon and N.M Mahungu

ABSTRACT

A countrywide survey on cassava constraints in D.R. Congo was initiated in 2002 and completed in 2004 with the aim of assessing the health status of cassava in various agro-ecological zones of the 11 provinces of the country. The survey permitted to update the list of diseases and pests that continue to threaten cassava production in the country. Among the diseases, cassava mosaic virus disease (CMD) was observed to be the most damaging and widely distributed. The incidence was high in all the provinces surveyed averaging 85%. Strains of the viruses responsible of the disease were identified, and included the African Cassava Mosaic Virus (ACMV), and the Uganda variant of East African Cassava Mosaic Virus (EACMV-Ug). Cassava bacterial blight (CBB) and cassava anthracnose disease (CAD) were also observed, however severe incidence and

damage were limited to some provinces. The root rot diseases were not frequently observed in the field during the survey. However,
a questionnaire was used, farmers in Bandundu,Kivu and Province Orientate complained that root rots were one of the major damaging constraints of cassava, particularly when cassava is harvested late (eg above 18 months after planting). Cassava brown streak virus disease (CBSD) was not observed in much of the areas sampled except in Kinshasa and Bas-Congo provinces where the incidences were rather low. Among the commonly known pests of cassava in Africa, cassava green mite (CGM) was the most widespread in DRC. However, its incidence and severity were low in the provinces where the exotic natural enemy predatory mite *Typhlodromalus aripo* had been introduced and is established. Cassava mealybug (CM) was also found in few locations in a limited number of provinces e.g Kinshasa, Bandundu, Kasai Oriental and Kasai Occidental. The low spread and incidence of CM recorded during the survey confirms observations that CM has effectively been controlled by the parasitic wasp *Apoanagyrus lopezi* De Santis that was released throughout the country in the 1980s. The resurgence of the pest in the few provinces cited above can therefore be attributed to several factors such as the susceptibility of cassava variety (induced by the severe mosaic disease), poor crop management and low soil fertility. A recently reported pest, the African root and tuber scales (ARTS), whose distribution is limited only to forest zones, was observed in Bas-Congo, Province Orientale and Nord-Kivu where the incidence was generally high. Two arthropod species, the Thrips and termites, known in the recent past to be secondary pests of cassava in DRC are now showing high incidence and alarming damages. The whitefly *Bemisia tabaci*, traditionally known as vector of the virus that cause the cassava mosaic disease (CMD) was observed in very high number inducing honeydew on the cassava leaves.

Pages 623-633

Distribution, incidence and severity of cassava diseases and pests in Mozambique

Muaka Toko, R. Hanna, J. Legg, M. Andrade, A. Jone, B. Agboton, M. Otema, G. Okao-Okuja, R. Obonyo and E. Mambo

ABSTRACT

Two countrywide surveys were conducted in April-May and May-June 2004 throughout the cassava growing belt of Mozambique including several provinces: Gaza, Inhambane, Sofala, Manica, Zambezia, Nampula and Cabo Delgado. Both surveys were planned to assess the distribution, incidence and damage severity of diseases and pests that affect cassava production inMozambique. Using the methodology developed by the International Institute of Tropical Agriculture (IITA), 202 and 175 cassava fields between 4-8 months old were sampled for pests and diseases in April-May 2003 and May-June 2004, respectively. The results of both surveys showed in the case of diseases that cassava mosaic disease (CMD) was found to be the most widespread disease in Mozambique although the distribution, incidence, and severity varied among provinces, among fields and within fields. The most severe damage was recorded in Gaza, Sofala and Nampula where the average scores were above 3 on a 1 -5 damage scale but only in a limited number of sample fields. In other provinces, the disease was either absent or damage symptoms were slight to moderate (2-3). The DNA analysis of the leaf samples collected in 2004 throughout the country revealed the presence of several strains of CMD virus including, the African Cassava Mosaic Virus (ACMV), the Eastern African Cassava Mosaic Virus (EACMV), and a combination of both African and East African Cassava Mosaic Virus (ACMV+EACMV) in 80.5% and 7.6% of the field samples respectively. The devastating East African Cassava Mosaic Virus - Ugandan Strain (EACMV-UG2) was absent from all sampled fields. The presence of cassava brown streak disease (CBSD) was confirmed as a serious threat particularly in two of the three Northern provinces of Zambezia and Nampula and at lesser extent in Cabo Delgado. However, the severity was the highest in Zambezia and in the district of Nakala in Nampula province. The other known common tropical diseases of cassava such as the cassava bacterial blight (CBB) and cassava anthracnose disease (CAD) were of minor importance. The cassava green mite (CGM), *Mononychellus tanajoa* Bondar remained a problem in the southern provinces (Gaza, Inhambane) where the exotic predatory mites *Typhlodromalus aripo* De Leon was not yet established. CGM infestations were followed by whitefly (WF) infestations in a rank-order hierarchy of infestation rates. Although generally known as vectors of the cassava mosaic disease (CMD), the high whitefly population densities recorded in some locations (>100 adults per plant, e.g. in Zambezia province), was considered a direct pest causing considerable leaf damage and covering plants with sooty molds. The incidence and damage severity of other common pests of cassava (i.e. cassava mealybug, termites, and grasshoppers) appeared insignificant.

Keywords: Cassava mosaic virus disease, cassava brown streak virus disease, whiteflies, cropping systems.

Pages 633-639

Pre-planting removal of host-plant residues to reduce African root and tuber scale infestations in cassava fields in Cameroon

M. Tindo, R. Hanna, L. Wijnans, C. Nolte, G. Goergen, A. Nguekam and J.M Ngeve

ABSTRACT

The African root and tuber scale (ARTS) *Stictococcus vayssierei* Richard is a subterranean insect originally infesting several native plant species in the forest zones of Central Africa. With help of the native ant *Anoplolepis tenella* Santchi, ARTS has recently emerged as a major constraint to cassava production. We conducted an experiment in 18 farmer fields in two villages in the Forest Margins Benchmark Area of Cameroon to test the hypothesis that removal from fallows of known host-plant residues prior to field establishment will reduce subsequent ARTS infestation on cassava. Two 20m x 20m plots ('treated' and control) were established in each of 18 fields. Both plots were prepared and subsequently managed by the farmer according to field practices prevalent in the area. In the 'treated' plot, however all host-plant residues were removed thoroughly prior to cassava planting. Densities of ARTS and its associated ant were determined on a sample often plants in each plot at three, six and nine months after planting (MAP). Overall average ARTS density per plant was not significantly different between treated and control plots. However, variation in ARTS densities between fields within a village was high, and in several fields ARTS densities were significantly higher in one plot compared with the other. ARTS densities were higher in control than in treated plots in 4 out of 18 fields, while higher scale densities occurred in treated compared with the control plots in one field. ARTS densities did not differ between plots in the remaining 13 fields. These results indicated that removal of host-plant residues before planting as it was practiced in this study cannot significantly reduce ARTS infestations on cassava. Explanations and recommendations are provided for further

testing of the impact of pre-planting host-plant residue removal on ARTS infestations in cassava fields in Central Africa.

Key words: Cassava, *Stictococcus vayssierei* vegetation management, fallow.

Pages 639-642

Mixed infections by biological variants of African Cassava Mosaic Virus and their associated severe symptoms on cassava in Nigeria

F.O. Ogbe, A.G.O. Dixon, J.d' A. Hughes and F. Alabi

ABSTRACT

A nation wide diagnostic survey was conducted between 2002 and 2003 to determine the status of cassava mosaic disease (CMD) and cassava mosaic begomoviruses in Nigeria. Of the 1106 leaf samples, 74.1% tested positive for *African cassava mosaic virus* (ACMV) alone, 0.3% for *East African cassava mosaic virus* (EACMV) alone, 24.4% for mixed infections by the two viruses and1.2% did not react with any of the primers used by polymerase chain reaction tests. Two biological variants of ACMV were observed inducing distinct symptoms on cassava. One of the variants induces yellow-green mosaic usually accompanied with mild leaf distortion while the other variant induces whitish/bleaching-green mosaic and in most cases accompanied with severe leaf distortion. The two variants mixed infected several plants as evidence by the combinations of the two symptom types. Most of such plants showed very severe

symptoms and on few genotypes multiple shoot formation was observed. The severe symptoms associated with mixed infections by the variants are comparable to some of the severe symptoms that usually accompany double infections by ACMV and EACMV in Nigeria. Mixed infections by ACMV variants and mixed or double infections by ACMV and EACMV predominate and are responsible for most of the CMD severe symptoms in Nigeria. This emphasizes the need to encourage farmers to cultivate resistant cassava genotypes to sustain cassava production in the country.

Pages 644-647

Distribution and abundance of cassava pests in Tanzania with a note on the spiraling whitefly

D. Gnanvossou, R. Hanna, B. Pallangyo, M. Toko, E. Nsami, and O. Mfugale

ABSTRACT

Two surveys were conducted in Tanzania in May-June 2003 and June-August 2004 to determine the incidence and severity of several cassava arthropod pests including cassava green mite, cassava mealybug, spiraling whitefly, *Bemisia* spp., cassava scale, red mite, *Zonocerus elegans*, and several species of termites. Cassava green mite densities were relatively low except in the Lake region in 2004. The introduced phytoseiid predator of cassava green mite *Typhlodromalus aripo* was found in all regions, with the highest abundance in the Eastern and Lake regions in 2003, and in the Eastern region in 2004. Cassava mealybug infestations were very low throughout the surveyed regions, while B. *tabaci* (probably in mixed infestations with B. *afer*) were found in all regions but never exceeding 5 nymphs per leaf. Termite damage was widespread but impact on plant growth and yield is not known. Cassava scale was found only in few fields in the Southern Highlands, Lake and Eastern regions, with damage severity ranging from 2 to 4

(on a scale of 1 to 5). The spiraling whitefly *Aleurodicus dispersus*, first recorded in Zanzibar in 2002, was found for the first time on the mainland, but only in the Eastern region and at low infestation levels.

Key words: Cassava green mite, whiteflies, biological control, predatory mites.

Pages 648-656

Influence of cultural and chemical methods on sweetpotato weevil (*Cylas* spp) incidence and damage in Western Kenya

Maling'a J.N., A.W., Kamau and J. M. Njoroge

ABSTRACT

The sweetpotato weevil (*Cylas* spp) is a major constraint to obtaining high sweetpotato (*Ipomoea batatas* (L) Lam) yields in Kenya particularly during the dry periods and in dry areas when weevil populations increase to high levels. Integrated pest management (IPM) remains the sustainable approach to manage sweetpotato weevils (*Cylas* sp.) in farmers' fields. An exploratory trial was therefore planted in a split plot design replicated three times at two sites in Kenya (Busia and Kakamega) for two seasons in 1998/1999. The objectives were to determine the effect of variety, insecticide, time and method of planting on sweetpotato weevil (*Cylas* spp) damage and yield of sweetpotato in Western Kenya which can be combined to form the basis for future comprehensive on-farm research to develop effective and economical IPM options. Yields of sweetpotato roots were significantly higher on Mwezitatu than Marooko at Kakamega in the short and long rains (1998/99) but the variety also suffered more weevil attack. Marooko had lower yields but significantly lower damage at Kakamega and Busia. Sweetpotato planted on ridged beds produced more roots at both sites during the short rains season. However, the

method of planting and insecticide use had no significant effect on weevil infestation and damage at both sites. Significant interactions between variety and planting method showed that planting Mwezitatu on ridged beds increased yields than that planted on flat while Marooko remain unaffected. Significant interactions between variety and time of planting showed that planting Mwezitatu one month late reduced weevil infestation than planting early at Busia during the short rains when high weevil pressure was present while Marooko was not affected. Marooko appeared to resist weevil infestation irrespective of planting dates and methods and could be used in areas of high weevil populations. There is scope to control weevils on by using less susceptible varieties and planting late by one month and on ridged beds.

Pages 656-664

Smallholder cultural practices in cassava production in Nigeria and their relevance in cassava plant protection

T.O. Ezulike and B.O Ugwu

ABSTRACT

In the sampling procedure, cassava growing areas in Nigeria were divided into zones, from where sixty-five cells were selected by systematic sampling. One village was selected from each cell by a random method. The farms were grouped into large-, medium-, and smallholder units. One farm unit was randomly selected from each

stratum. The pests, Cassava Mealybug (CMB) and Cassava Green Mite (CGM) were less spread than the diseases, African Cassava Mosaic Disease (ACMD) and Cassava Bacterial Blight (CBB). The incidence of CMB and
CGM was high in humid and sub-humid zones. The score for ACMD and CBB were high in all the climate zones (humid, sub-humid and non-humid). The incidence of ACMD and CBB were high under continuous, recurrent and shifting cultivation while reverse was the case for CMB and CGM. There were no differences in the incidence and severity of pests and diseases when cassava was intercropped with short duration crops like beans, maize and sweet potato. The incidence and severity of pests and diseases were lower when cassava was grown in rotation than when it was not. The incidence of CMB and CBB were lower than CGM and ACMD in areas where bush burning was practiced but the severity of the pests and diseases were higher where bush burning was practiced than where it was not practiced. The pests and diseases incidence and severity were lower in the improved cassava varieties than in the local varieties. The incidence and severity of CGM, ACMD and CBB were lower in areas where chemical fertilizers were used than where they were not used. The application of fertilizer did not affect the incidence and severity of CMB. The use of hired labour in terms of timeliness of farm operations, resulting in good crop hygiene reduced the incidence of pests and diseases.

Pages 665-669

Cassava mosaic viruses diseases in Western Kenya: diagnostic surveys, 1998-2004

Ajanga, S., Mallowa S., Obiero, H.M., Akhwale, M.S., Okao-Okuja G. and Legg, J.

ABSTRACT

Epidemic levels of a severe form of cassava mosaic disease (CMD) were reported threatening cassava production in western Kenya in 1994/95. An initial diagnostic survey was conducted in 1995 to determine the status of the disease by establishing the extent of spread and severity. This was followed up by similar annual surveys to monitor the spread of the severe form of CMD across the western Kenya cassava belt, between 1997 and 2004. The overall impression of CMD symptom severity was based on a scale of 1-5. The results of these surveys indicated that in the early years of 1995-98 the attack was extremely severe in the districts bordering Uganda: Teso, Busia and Bungoma while the districts towards South Nyanza showed mild attack. But in later years, 1999-2003, the reverse was true, as the severe form of CMD spread to South Nyanza and the situation in Western Province was ameliorated following the implementation of control measures. The primary control approach was the introduction and dissemination of resistant varieties. The situation had improved in areas early reported with the introduction of resistant varieties. During the later surveys polymase chain reaction (PCR) diagnostic tools were used on leaf samples for detection of *African cassava mosaic virus* (ACMV), *East African cassava mosaic virus* (EACMV) and the Ugandan Variant recombinant (EACMV-UG). EACMV-UG was found to be the dominant virus in Western Province from 1995-2001 and was associated with severe symptoms, while ACMV and EACMV, which were found to occur mainly singly, were associated with less severe symptoms. In South Nyanza districts during the same period ACMV and EACMV were the predominant viruses occurring singly and exhibiting mild symptoms. From 2001-2003, EACMV-UG spread to the entire belt running from Teso to the Tanzania border. The surveys also revealed that over 80% of CMD infections were primary while less than 20% were secondary indicating that planting material was the major source of infection although expansion of the EACMV-UG epidemic was associated with high levels of whitely borne infection.

Key words: CMD, diagnostic survey, PCR, ACMV, EACMV-UG

Pages 670-676

Postharvest fungi of sweetpotatoes in Kenya

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ABSTRACT

Postharvest deterioration of sweetpotato (*Ipomoea batatas* L.) limits its production, marketing and utilization of in the tropics. This study was carried out to identify fungi associated with the spoilage of sweetpotato roots during storage in Kenya. The fungi were isolated from naturally infected sweetpotato root collected from the main sweetpotato growing areas of Western Nyanza and Central Provinces. Diseased roots were also sampled from major markets in Nairobi and at the experimental plots at the Field Station, University of Nairobi. Six pathogenic fungi, *Botryodiplodia theobromae, Rhizopus oryzae, Rhizopus stolonifer Fusarium oxysporum, Macrophomina phaseolina and Ceratocystis fimbriata* were isolated from the naturally infected sweetpotato root samples**.** In addition, four saprophytic fungi, *Aspergillus niger, Mucor circinelloides, Mucor hiemalis* and *Penicillium* spp. were isolated and identified**.** The fungi were established as the ones currently responsible for postharvest spoilage of sweetpotatoes in Kenya.

Key words: Fungi, Roots, Spoilage, Sweetpotato Postharvest, Pathogen, Disease.

Pages 676-683

Yam anthracnose disease: field symptoms and laboratory diagnostics

M.A Ayodele, J.d' A Hughes and R. Asiedu

ABSTRACT
Anthracnose is one of the most serious leaf and vine epiphytotic diseases of yams, especially *Dioscorea rotundata* and D. *alata*, in Nigeria. The causal agent of anthracnose is the fungus *Colletotrichum gloeosporioides* Penz. Although, C. *truncatum* another causal agent of anthracnose was also isolated from some of the infected tissues, its role in anthracnose aetiology was not determined. The C. *gloeosporioides* complex on yams was investigated during the planting season over three years (2000, 2001 and 2003) in Abuja, Ikenne, Ubiaja and Ibadan in Nigeria. The disease affects not only the leaves and vines, but also the tubers. Severe infection results in vine die back, defoliation and tuber dry rot. In this presentation, field symptoms are presented as 7 spot types and 4 blight types. The mycelial growth patterns and fungal conidia are described. The objective of the work was to associate or match field symptoms to specific identified C. *gloeosporioides* isolates. These symptoms will not only be used for field identification of C. *gloeosporioides* isolates, but will also help to establish diagnostic characteristics for use in routine germplasm health tests, therefore facilitating the identification of C. *gloeosporioides* isolates causing the different blights and spots on yams during active growth inspection.

Pages 683-693

Survey of the distribution and current status of bacterial blight and fungal disease of cassava in Nigeria

B.A Bamkefa, T.J. Onyeka, A.G.O Dixon and R. Bandyopadhyay

ABSTRACT
A survey was made of 277 cassava fields in the derived savanna; humid forest, northern Guinea savanna, mid altitude, Sahel savanna, southern Guinea savanna, and Sudan

savanna agroecological zones of Nigeria. Each field was assessed for the incidence and severity of cassava bacterial blight (CBB), cassava anthracnose disease (CAD), *Cercospora* leaf blight (CLB), and brown leaf spot (BLS). Samples of root rot disease were also collected and used to identify associated pathogens. The survey for CBB showed 32.53% of the fields in the humid forest were infected. For other ecozones results were 66.43% (derived savanna) 95.45% (southern Guinea savanna), 90% (northern Guinea savanna), and 94.12% (Sudan savanna zone). CAD was observed in the humid forest and derived savanna zones but none of the other ecological zones. CLB and BLS were observed in all the zones; however, the severity of both diseases was generally low and they did not seem to pose a serious threat to cassava tuber yield. With the increasing production of cassava in Nigeria, disease management will become crucial as production expands to the marginal zones. Fungal pathogens isolated from root rot samples included *Aspergillus niger, Botryodiplodia theobromae, Fusarium* spp., *Rhizopus sp., Sclerotium rolfsii*, and *Trichoderma* spp. *Botryodiplodia theobromae* the pathogen most frequently isolated pathogen was obtained from 84.48% of the collected samples while *Fusarium* spp. was observed in 39.66%. The evaluation of the health status of stem cuttings from farmers' fields showed that 82.7% were infected with cassava mosaic disease (CMD). A multiplication and cutting sanitation program is needed from which clean improved planting materials could be supplied to farmers.

Pages 693-704

The spread and persistence of exotic phytoseiid, *typhlodromalus aripo* de leon (acari; phytoseiidae) and its effect on cassava green mite in Kenya

C.W. Kariuki, R. Hanna, M. Toko and B.M. Ngari

ABSTRACT
Cassava green mite, *Mononychellus tanajoa* (Bondar) has been a major pest of cassava since its accidental introduction in Africa. Studies conducted recently on its biological control in the major cassava growing areas in Kenya demonstrate definite establishment of *Typhlodromalus aripo* in Kenya. This exotic predatory mite was not only found to have established and persisted since its introduction in 1995/6, but have also over the years spread widely to far distant from the original release sites in western and coastal regions. Where present, T. *aripo* is still persisting with a percentage presence varying between 0.33 and 100% and with a mean density of approximately 0.1 to 8.9 adults per tip. Consequently, a general trend of decline in the CGM population has also been observed over the years from a mean of approximately 60 to less than 30 mites per leaf. A similar trend was observed with CGM infestation levels. However there are a few areas where it has failed or has temporary established possibly due to factors related to unfavorable weather conditions, lack of cassava on the ground or isolated cassava fields, and cassava variety with characteristics unsuitable in sustaining T. *aripo*. Studies have also shown its ability to establish in newly planted cassava fields and thereby reducing CGM population from approximately 80 - 300 adults per leaf to below 50 and maintaining it below this level until the time of harvest in both local and improved cassava cultivars.

Key words: Cassava green mite, *Typhlodromalus aripo, cassava, spread, persistence*

Pages 707-711

Efficacy of melody duo 69 (wg) in control of late blight of potatoes

Lungaho, C., Nyongesa, M.W and Njenga D.N

ABSTRACT
Potato late blight, caused by *Phytophthora infestans* (Mont De Bary) is one of the most devastating diseases of potato causing serious yield loses in Kenya. Contact and systemic fungicides are routinely used in the control of late blight. The objective of this study was

to determine the efficacy of Melody Duo (ipovalicarb and propineb) for control of late blight of potatoes. Field trials were carried out starting from the short rains of 2001 to the short rains of 2002 at National potato Research Centre, Tigoni (2100m). Melody Duo (WG) was evaluated along side Ridomil (WP), Milraz and Dithane M45. The treatments consisted application of Melody Duo the rate of 2.0, 2.25 and 2.5 , Ridomil (WP) at the rates of 3.0 kg/ha, Milraz at the rate of 2.5kg/ha and Dithane M45 at the rate 2.5kg/ha and an unsprayed checks. Two varieties, Furaha, which is susceptible to late blight, and Dutch Robjyn, which is moderately susceptible, were used as test varieties each in a separate trial. The treatments were laid out in a randomized complete block design and replicated three times. All fungicide treatments significantly controlled the disease in both years. Percent disease control in variety Furaha was 56.7 to 70% and 56.5 4.6 to 79.5% during the short rains of 2001 50.9 and 63.4% during the short rains of 2002 in variety Dutch Robjyn. The best foliar late blight control among Melody Duo 69 WG treatments was given by 2.25 and 2.5 kg/ha application rates in both varieties. Melody Duo 69 WG when applied at 2.5kg/ha attained the highest tuber yields in all the three seasons which ranged from 20.37 to 37.37 t/ha for variety Dutch Robjyn and 31.57 t/ha for variety Furaha. The results indicate that Melody Duo 69 WG is an effective fungicide for control of late blight of potato.

Pages 711-718

Enhanced symptoms severity and pseudorecombination of geminiviruses are important factors in possible breakdown of resistance to cassava mosaic disease

O.A. Ariyo, A.G.O Dixon, G.I Atiri, M. Koerbler, and S. Winter

ABSTRACT

This paper describes results obtained in cassava when biolistic delivery of infectious begomovirus clones and total DNA extracts from plants infected with well-characterized viruses were attempted. All major begomoviruses causing cassava mosaic disease (CMD) in Africa and *Sri Lankan cassava mosaic virus* isolate from India (SLCMV-[Ker]) were cloned and sequenced. Partial multimers of DNA A and B components were constructed and DNA preparations from infected plants were produced for coating of gold particles and bombardment onto cassava plants of three IITA-improved genotypes, 96/1089A, 96/0160, 96/0304, and two local landraces, TME 117 (highly susceptible to ACMV) and TME 4 (highly resistant to ACMV).

Homologous DNA A and B components of *East African cassava mosaic begomovirus virus* isolates from Kenya, EACMV-[Ke-Kilifi] (isolate CA 123) and (EACMV-UG2-[Ka]) reflecting the recombinant EACMV Uganda variant, were infectious only to the cassava genotypes, TME 117 (7/10 plants) and 96/0304 (4/10), resulting in infections with mild symptoms on the first 3-4 newly developing leaves 12-20 days post inoculation (d.p.i.). Biolistic inoculation of heterologous DNA A and B components from EACMV-[Ke-Kilifi] and

(EACMV-UG2-[K-a]), respectively, was infectious to the highly susceptible TME 117 and the IITA-improved genotype, 96/0304, resulting in very severe and persistent mosaic symptoms. This Chimeric pseudorecombinant virus also elicited infection symptoms with virus replication and symptom expression on 2-4 sprouting apical leaves of TME 3 and TME 4, which have been highly resistant to other virus constructs. Biolistic inoculation of total DNA extracts from plants infected with the respective viruses resulted in a higher efficiency of infections with symptom expression at a much earlier stage (10-12 d.p.i.). Simulated mixed infections between EACMCV-CM[NG] and SECMV-[Ker] resulted in serious infections becoming evident already 12 d.p.i., in TME 117,96/0304, and TME 4. Summarily, with mixed infections and pseudorecombinant virus construct used in this study, susceptible cassava genotypes reacted with much higher symptom severity and the resistant genotype (TME 4) was also infected with appreciable disease symptoms.

Although TME 4 was highly resistant to different virus species, the breakdown of resistance observed in this genotype, when challenged with pseudorecombinant virus constructs and simulated mixed infections, suggests the likelihood of resistance breakdown in the near future due to possible emergence of a more virulent virus strain. However, two IITA-improved cassava genotypes, 96/1089A and 96/0160, remained highly resistant to the pseudorecombinant virus and other virus isolates.

Key words: *Cassava genotypes, pseudorecombinant virus construct biolistic inoculation*

Pages 719-722

The status of fungal tuber roots as a constraint to cassava production in the Pouma District of Cameroon

Messiga A.J.N.A., Mwangi, M., Bandyopadhyay, R., Nolte C.

ABSTRACT

Fungal rots have been reported as a limiting factor to cassava production in the humid forests of Central and West Africa. Starting April 2003 tuber rots were studied for one year as part of a diagnostic survey designed to investigate biophysical and crop management factors limiting cassava production in Pouma district, located halfway between Douala and Yaounde in Cameroon. This paper reports the extent of root rot occurrence in the study area comprising of 62 farmer-managed trials. Root rot data was recorded at 6, 9, and 12 months after planting (MAP). At each sampling time samples of rotten tissue were collected for isolation and identification of the fungi. At 6 MAP, 41% of the field plots were free from rot symptoms and only little rotting was observed in 55% of the field plots. However, at this early stage of tuber development, more than 50% of root volume was rotted in nearly 2% fields. At 9 MAP rotting incidence and severity had substantially increased as compared to 6 MAP, but still only about 2% of the fields had up to 50% of the root volume rotted. At 12 MAP rot incidence was less than at 9 MAP, but severity had substantially increased with tubers in 11% of the fields having up to 25% of their total volume rotted. Pathogens isolated from rot specimens include *Botryodiplodia theobromae, Macrophomina phaseolina, Fusarium* sp.,*Armillaria* sp., *Aspergillus* sp., *Sclerotium rolfsii* and *Trichoderma* sp. Data obtained indicate that fungal rots could cause substantial loss to cassava production in the Pouma area. However, the loss is less if cassava harvesting is done at 12 months.

Pages 722-728

Effect of aqueous extracts of botanicals on the control of sweetpotato butterfly (*Aceraea acereta*)

M. Gemu, S. Mekomen and T. Addis

ABSTRACT

Sweetpotato (*Ipomea batata*) is the main stapled food of southern Ethiopia second to Enset (*Ensete ventricosum*). However, production and productivity of the crop at present time is limited due to various biotic and abiotic constraints. Among the biotic constraints sweetpotato butterfly (*Aceraea acerata*) causes complete crop failure at time of its appearance. Since, the pest is sporadic its outbreak time mostly related with environmental conditions. So far, in the region much work has not been done due to the sporadic nature of the pest, however chemical screening against the pest indicates that chemicals like endosulfan 35%E.C effectively control the pest. Many drawbacks of chemical insecticides restricted their use, so the safe and environmentally friendly alternative options as well easily available and affordable control measure to the farmers was carried out in the Awassa Agricultural Research Center laboratory for one cropping season to screen effective botanical (s) against this pest. The aquous extracts of Tephrosia vuglia, Datura stramonium, Chenopodium album, Casulina abyssinica, Azandirachta indica, Mellia azadirachta and Melletia ferruginea were considered for experiment. The third instar larvae of the pest were collected from hot spot area of the region and introduced into potted plants that were arranged in CRD in three replications in the laboratory. Then, respective aqueous solution of botanicals at the rate of 2001/ha was sprayed in the potted plant and the standard check (endosulfan 35% E.C.) and the untreated control were included in the experiment for comparison. The larval mortality and percent of leaf damage were assessed after 1,5,10, and 15 days of treatment application. The results indicate that M. ferrugenia, T. vuglia and A. indica treated plots showed superior performance in killing sweetpotato butterfly larvae within 24h treatment application. Early killing of larvae by these botanicals prevented sweetpotato leaf feeding by sweetpotato butterfly larvae. Treatments with other botanicals had no effect on larval mortality and preventing larval feeding of sweetpotato leaf compared to the untreated

control. The results of this study identified the potential botanicals to control sweetpotato butterfly

Pages 729-735

Two genetically distinct populations of *colletotrichum gloeosporioides* from yam (*dioscorea* spp.) in Nigeria

M.M. Abang, O. Fagbola, K. Smalla, R.Asiedu, S. Winter

ABSTRACT

Variation within *Colletotrichum gloeosporioides* Penz., the causal agent of yam anthracnose disease, is still poorly defined and this hinders epidemiological studies and breeding for resistance. Two morphotypes of C. gloeosporioides, designated as slow growing grey (SGG) and fast growing salmon (FGS), are associated with anthracnose disease of yam in
Nigeria. The morphotypes are distinguishable based on colony and conidial morphology, growth rate, virulence, as well as vegetative compatibility, but PCR-RFLP of the entire ribosomal DNA ITS1-5.8S-ITS2 region did not reveal any differences between SGG and FGS strains. Denaturing gradient gel electrophoresis (DGGE) of PCR-amplified small subunit (18S) rDNA fragments, BOX-PCR and microsatellite-primed PCR (MP-PCR) genomic fingerprinting were employed to provide a basis for molecular differentiation of the morphotypes. DGGE analysis revealed patterns that clearly differentiated isolates of the aggressive defoliating SGG from the moderately virulent non-defoliating FGS strains. Genetic analysis based on MP-PCR markers revealed highly significant differentiation between the SGG and FGS populations on yam (G_{ST} = 0.22; Nei's genetic identity - 0.85; $\theta = 0.28$, $P<0.001$), again indicating that the SGG and FGS morphotypes represent

genetically differentiated populations. The two morphotypes were not clearly distinguishable based on their BOX-PCR genomic fingerprints but BOX-PCR analysis confirmed that considerable variation exists within each morphotype. The results of the molecular typing using DGGE and MP-PCR analyses were consistent with the evaluation of the disease phenotype caused by the two morphotypes. Consequently, these molecular techniques might be used in epidemiological studies to monitor the pathogen populations and, at least partly, to replace time-consuming virulence studies on yam.

Key words: C. *gloeosporioides*, *Dioscorea*, molecular differentiation, morphotypes, DNA markers.

Current approaches and limitations of integrated management of bacterial wilt of potatoes in Kenya

Wakahiu M.W., Nyongesa, M.W., Otipa M.J., Kabira, J.N and Demo P.

ABSTRACT

Potato is a major food crop in Kenya. Its production is constrained mainly by bacterial wilt (*Ralstonia solanacearum* E.F. Smith) which not only is it widespread in all potato producing areas but inflicts great losses. Control of bacterial wilt requires an integrated approach involving breeding for resistance, production of good quality seed both formally and informally, disease surveillance, cultural practices and training of farmers on epidemiological aspects of the disease. Besides formal production of disease free planting material, a lot of effort is presently on the twin aspect of farmer training and

improvement of the quality of informally produced seed potato to limit spread of potato wilt disease. This paper reviews the achievements and limitations of these approaches towards control of bacterial wilt.

Key words: Bacterial wilt, *Ralstonia solanacearum, Solanum tuberosum*, Kenya

The status of fungal rot diseases as constraints to cassava production and utilization in Eastern Democratic Republic of Congo

Mwangi, M., Bandyopadhyay, R., Dixon, A.G.O., Tatahangy, W.

ABSTRACT

Tuberous root rots are known to be a constraint to cassava production in the humid forest and forest transition agro-ecologies of Central and West Africa. In early 2004, rots were studied as part of a diagnostic survey carried out to determine the occurrence and distribution of major pests and diseases limiting cassava production in the eastern area of DR Congo. A total of 61 fields were visited. In each area, the fields were selected at random along the main road routes. Data were collected by interviewing owners of the selected fields on their perception of the occurrence of cassava tuber rots in their fields. In addition, where fields with mature plants were available, ten plants were selected randomly, uprooted and examined for rotting. Of the farmers visited, 53% in Kivu provinces, 68% in Oriental and 100% in Maniema identified tuber rot as a major constraint. Yield loss was said to vary between 20 - 100%, and was higher in the forest areas of Oriental and Maniema provinces. According to farmers, harvesting immediately

after the tubers mature is an effective management strategy especially where firewood is available for drying of the cassava chips. More than 80% of farmers interviewed in the forest areas leave mature plants in the ground to harvest gradually but in Kivu areas, 47% of farmers preferred to harvest immediately after the plants are mature Only 53% of farmers visited in Kivu provinces practice fallowing or rotation to manage rots, as compared to over 90% of farmers in the forest areas. All the varieties grown are susceptible but the bitter varieties are more tolerant to rots. It is concluded that rots are a constraint production in eastern DR Congo but the disease could be managed by combining appropriate cultural practices and tolerant varieties.

Pages 737

Successful adoption of a seed-plot technique in the management of potato bacterial wilt by farmers in Njabini, Kenya

M.J. Otipa, Z.M. Kinyua, S.N Kihara, J.J Smith and J. N Wachira

ABSTRACT

Bacterial wilt (*Ralstonia solanacearum*) is one of the main production constraints in potato production, with an estimated yield loss of 50- 70% in Kenya. Poor health status of potato seed tubers has greatly contributed to the spread of the disease as well as limited options of its management. The disease has been managed effectively in Njabini area of South Kinangop division in Kenya through the use of a novel technology referred to as the seed plot technique. The technique, which focuses on maximizing tuber production per unit area of limited disease-free land through high planting density and facilitates intensive crop husbandry, was enthusiastically adopted by Jitegemee Self Help Group, whose members have greatly benefited from the premium price of Ksh.1900 per 50kg

bag of certified seed tuber. Bacterial wilt incidence has been lowered from 30 - 70% to 0 - 5% on individual member farms and neighboring fields due to the adoption of this technology. Five new CBOs have been formed as more farmers continue to embrace this technology. Such CBOs have often received framing from some Jitegemee group members. This has led to an overflow effect of about 2000 people benefiting directly or indirectly. Farmers in the area have become well informed about the use of clean planting material and the need to replace the old diseased, degenerated seed stocks. Availability of clean seed tubers to farmers in the area has greatly improved although the demand is still very high. Therefore, this technique should be embraced and applied for intensive bacterial wilt management in all potato-growing areas.

Key words: *Ralstonia solanacearum*, healthy potato seed tubers, seed plot technique, CBOs.

Characteristics of cassava landraces and their reactions to diseases and pests in Cameroon

Jacob M. Ngeve, R. Hanna, S.N Tenku and M. Tindo

ABSTRACT

A nationwide survey was conducted from February to July 2004 in forest and Chromolaena-derived fields in the major cassava growing areas (forest, western highland savannah and forest-savannah transition zones) of Cameroon. Fallow lengths varied from 2 to 20 years, with longer fallows found in the remotest areas of the forest zone. There was greater variability in morphological characteristics such as stem heights, branching habit, and root configuration among cassava varieties cultivated. More varieties (70%) were cultivated in the forest region than in the grassland and forest-savannah transition zones. Some 123 fields were sampled, and a total of 187 accessions were found in and collected from the fields sampled. There was an average of four varieties cultivated per

farm. Farmers cultivated both boilable (67%) and non-boilable (23%) types, although the latter, grown mainly for their high marketable yields, were found more in the grassland and forest-savannah zones. Cassava was used mainly as boiled roots, fermented boiled pastes ('miondo,' 'bobolo,' 'mintoumba'), and flour, later constituted into 'fufu.' The main field constraints were diseases and insect pests, declining soil fertility, and rodents. The main cassava diseases were mosaic, anthracnose, root rot and leaf spots, in descending order of importance. Bacterial blight was absent in all fields sampled. The main insect pests were the African root and tuber scale and to a much lesser extent the cassava green mite. Farmers still grow mainly local varieties in all zones. The resulting low yields have great implication on cassava productivity in the country. Root weights obtained from the fields sampled showed that in general cassava varieties exhibited remarkable resistance and tolerance to the major diseases and pests. The germplasm collected from the survey is being evaluated in two research station plots and will form a major base population for future breeding work in the country.

Key words: Cassava landraces, survey, fallows, diseases, pests, agro-ecological zones

Pages 738

Role of gender in potato production and bacterial wilt management in the Central Highlands of Kenya

J.M Ndubi, Muriithi, L.M and S. Amboga

ABSTRACT

Potato is a staple food and cash crop after maize and beans in the central highlands of Kenya. Bacterial Wilt and use of uncertified seeds have continued to threaten potato production in the region but the male and female farmers continue growing the crop due to its importance and demand. A survey was conducted with the objective of determining the use of indigenous and improved technical knowledge, agronomic and/or cultural practices in Bacterial Wilt management and the importance of gender in potato production in the region. Several methods were used to collect the data. Among them were household interviews, focus group interviews, key informants interviews, direct observation, oral narratives and secondary sources. Seventeen farmers groups were interviewed from three age group categories: Young (below 40years), Middle ((40-59) and elderly (Over 60 years). The results indicate that potato is an important food and cash crop in Meru and Embu districts. Asante and Tigoni are newly released varieties that are high yielding and resistant/tolerant to late blight but farmers still recycle planting materials instead of planting certified seed tubers. Farmers have access to potato management information like improved management; high yielding variety but they do not have resources to acquire the inputs. There are many diseases that threaten potato production and expansion such as late blight and leaf roll virus but bacterial wilt is the most limiting. A combination of indigenous technical knowledge and the scientist recommended management practices of bacterial wilt are used. These includes uprooting infected plants, rotation, fallowing, selecting clean seeds from known source, avoidance of infected fields are among the alternatives still popular among the farmers because they are cheap, affordable and familiar to them. On gender issues, female farmers perform most of the activities in potato production and disease management. The study therefore recommends that any potato interventions should target the women farmers who implements most of the potato production and disease management activities.

Pages 739

The potential of utilizing cassava landrace diversity resources for the effective management of pests and diseases of

economic importance in Democratic Republic of Congo

Munyuli, T.M.B., Tete Tshisinda, Legg J.P. Lema, A. Maina Mwangi Mahungu, N, Ntawuruhunga P.

ABSTRACT

Early challenges for improvement of cassava in Sub-Sahara Africa including DRC concentrated on finding sustainable ways of reducing or eliminating the effects of cassava diseases and pests. The incidence and persistence of pests (cassava mealybug, green mite, African root and tuber scale) and diseases (cassava mosaic virus disease) of economic importance greatly influenced the strategies used in germplasm enhancement and distribution in the region and in DRC. Many so called "improved clones" combining theoretically resistance to major diseases and pests with having desired agronomic characteristics and adaptation to various ecologies have been developed and maintained at research stations or spread in rural areas. Recent surveys conducted in February-March 2004 by 1ITA-DRC confirmed a current high prevalence of pests and diseases of economic importance. For example, various virus strains including the most virulent one, EACMV-UgV, were found to be present in Orientale, South and North Kivu provinces of eastern DRC and this despite the effort put in place by various organization including IITA, INERA, FAO in the distribution of high yielding and pests and diseases-resistant genotypes at farmers level since several years. However, during the survey, in major provinces of eastern DRC (Maniema, North-Kivu, South-Kivu and Orientale province). It was realized that there was a diversity of local varieties expressing different levels of susceptibility to pest and diseases. Around 200-400 genotypes were inventoried per province. Main landraces that expressed few conspicuous symptoms of susceptibility to pests and diseases of economic importance included: Nambiyombiyo, Baila, Kamegere, Kahunde, Kirota, Ndoliri, Mbongo, Mwesi Sita, and Kasusa. Local cassava genotype resources may be relevant sources of genes that breeders can use while breeding for resistance to pests and diseases instead of importing genotypes developed elsewhere and that are not necessary adapted to various environments of DRC. This is also important since the country lack of strong quarantine and biosafety policies.

Pages 741-746

The potential sweet potato vines as protein supplement for sorghum silage in smallholder diary farms in Nakuru District, Kenya

Ashiono,G.B., Oudal, J.O Kitilit, J.K. Irungu, K.R.G and Gatwiku, S.

ABSTRACT

Marginal areas in Kenya continue being resettled by small-scale farmers mainly practicing dairy farming. Feed shortage in these areas is a major limitation to milk productivity especially during the dry seasons. This study evaluated the nutritive value and productivity of sweet potato vines (SPV) and sorghum silage (SS) as feeds for dairy production in the dry highlands. Data on yield parameters of SPV and sorghum were also collected. On- station work involved evaluation of milk production by dairy cattle fed on varying proportions of SS with SPV while demonstration and popularisation of sorghum and SPV utilization technologies were conducted on farms. Grain and dry matter (DM) yields of sorghum were 4-7 and 17 - 29 t Ha^{-1} respectively. The dry matter (DM), crude protein, (CP) neutral detergent fibre (NDF) and acid detergent lignin (ADL) contents of SS were 267.3 - 350.7, 50.0 - 70.6, 60.8 - 640.8 and 55.0 - 67.3 g kg^{-1} respectively. Corresponding values of SPV were: 129.5 - 190.4, 83.4 -179.1, 300.9 - 383.5 and 61.5 - 68.0 g kg^{-1}. Daily milk yield ranged from 3.44 1 d^{-1} when SS alone was fed to 26 1 d^{-1} when combination of SS, SPV and home made dairy meal was fed to dairy cows. Most farmers preferred feeding sorghum regrowth as green chop besides SS especially during the dry season. Improved and sustained milk production on farms was observed indicating that sorghum fed together with SPV has great potential of enhancing milk production.

Key words: Sorghum, sweet potato vines, nutritive values, dairy production, silage.

Pages 746-748

Cassava post-harvest needs assessment survey in Nigeria

L. Sanni, C. Ezedinma, J. Lemchi, F. Ogbe, R. Okechukwu, M. Akoroda, E. Okoro, B. Maziya-Dixon, P. Ilona and A. Dixon

ABSTRACT

Cassava post-harvest needs assessment survey was conducted in Nigeria. For effective postharvest intervention, a purposive rapid rural appraisal (RRA) was employed to generate information at the community, institutional and market levels for the needs of cassava processors. The survey was carried out in nine communities from three Senatorial zones ofAbia, Imo, Bayelsa, Ebonyi, Rdo, Delta, Ondo, Rivers, Cross Rivers, Anambra, Enugu, and Akwa Ibom States. The most popular cassava product selected by these communities for the small medium enterprise projects in their locality is *gari* (74%). Cassava flour was selected by 14% of the prioritized communities. The major constraints to cassava processing were equipment related problems, drudgery of cassava processing, high costs of processing, low profit levels, bad access roads, insufficient supply of cassava roots, and low demand for cassava products. Recommendations on best strategies for postharvest intervention were suggested.

Pages 749-755

The demand for processed cassava food products in Lagos

A. Jumah, K. Adebayo, I. Ayinde, W. Dipeolu, L. Sanni, O. Oyewole

ABSTRACT

The study analyses the consumption of cassava-based products in the Lagos metropolitan area by means of the almost ideal demand system's (AIDS) technique. We examine how consumers of *fufu*, *gari* and *lafun* react to economic and demographic factors and how consumer reactions can be captured to bring about effective policy formulation for food security and poverty alleviation through value added agricultural production. The results establish that demographic factors such as religion and residential area help to explain perceived variations in the consumption of cassava-based products. Demand was found to be price inelastic for all cassava-based products examined. The recorded expenditure elasticities suggest that as total expenditure on cassava-based products increases, consumers tend to spend proportionately less on fufu and lafun (both of which are produced from fermented cassava flour) and more on gari. Also, in contrast to households of the other religious denominations, Christians were found to allocate a higher proportion of their expenditure on cassava-based products to fufu and lafun, whilst spending a lesser proportion on gari. Given that demand is price-inelastic for all cassava-based products examined in our study, theory dictates that price and total revenue facing producers will vary directly. This means that, declining prices stemming from a bumper cassava crop harvest will lead to less than proportionate increases in consumption of cassava-based products and corresponding declines in revenues for producers. In view of the high expenditure elasticities, therefore, a policy option that would boost productivity and incomes of consumers is considered desirable. Such a policy could be one that saps off excess farm labor through maintaining and promoting investment in the food-processing sector. Policy should also promote fufu and lafun in order to improve the food security situation of the poor.

Pages 756-762

Demonstration of processing orange-fleshed sweetpotatoes and linking farmers from Western Kenya to markets

Nungo R.A. P.J Ndolo, R. kaping, S. Wasike

ABSTRACT

Traditional methods of processing sweetpotato (*ipomoea batatas*) in Kenya have been limited to washing, peeling and boiling. Market opportunities have been limited to fresh white or cream fleshed roots for minimal amounts of money. Kenya Agricultural Research Institute (KARI) in collaboration with the International Potato Centre (CIP) developed a range of orange-fleshed sweetpotatoes (OFSP) with considerable dry matter good for processing. OFSP contain □eta carotene that is a precursor of Vitamin A. Processing reduces the bulkiness of sweetpotato, enhances shelf life and makes it available over long distances. Processing adds value to product, gives wider marketing, diversifies use and hence gives better price. This study was intended to add value to sweetpotato, create jobs for farmers and product promoters, link farmers to markets and increase incomes within households. The study comprised of participatory research that involved training demonstrations to farmers in quality dry chips processing, visits and discussions with different food processors, stakeholders discussions and selection of potential market, identification and selection of packaging material, identification and selection of transport delivery service and linking farmers to the market. Two farmer groups were trained in processing quality dry chips. Three food processors were visited and one was linked to the farmers. Lined gunny bags that could carry 120 kilograms of dry chips were identified and accepted. Partnerships between KARI and Africa NOW were strengthened by involving a new group in processing and marketing. Three transport deliveries were visited and one was selected due to affordable cost and mode of delivery at the processing site. Two farmer groups were linked to the market and a total of 1,478.9 kilograms of quality chips for Kenya shillings, 118,312, were sold. The study showed there was very high market potential for processed chips. The supply of chips is below the demand and there will be need to put more farmers on board for processing. The farmers will have to practice staggered planting to be able to supply according to demand.

Key words: farmers, link, market, packaging, partnerships, processing, sweetpotato, traditional, Vitamin A,

Pages 763-769

Improving the linkage between ware potato growers and food processors: the case of Narok District in Kenya

Walingo, A., J.N. Kabira, P.M. Kinyae, C. Lung'aho, S.K Nderitu and B Lemaga

ABSTRACT

Although potato processing can add value and improve marketability of fresh potatoes, many potato farmers are often left with substantial surpluses during bumper harvests, which are accompanied by very low prices and lack of markets. Processors have specific requirements for quality that most growers are unaware of due to poor linkages in the industry. One of the reasons for this contradiction in marketing is lack of proper linkage between the processors and producers in the absence of a growers association. There is therefore need to link growers to processors in a mutually beneficial inter-relationship where growers readily access the processing market to obtain good prices and processors obtain good quality fresh potatoes for processing throughout the year. The general purpose of the study was to explore the possibility of forging linkages between growers and processors on one hand, and researchers and extensions on the other to promote potato processing. Such linkages would help expand the market potential of table potatoes through improved supplies and good qualities to upcoming entrepreneurs. The findings of this study show that linkages can help increase supply of quality potatoes and stabilize prices for farmers by creating a ready market for their produce. Processors on the other hand can get assured supply of quality potatoes from the farmers. It was found that contract farming when properly implemented was beneficial to both growers and processors by ensuring a ready market for farmers' potatoes and a continuous of processing stock. Linkages could further be strengthened through formation of a potato growers and marketing association.

Key words: Potato growers, processors, researchers, extension, potato raw material for processing

Pages 770-777

Influence of storage conditions on the physio-chemical and sensory characteristics of dried sweetpotato chips

P.W. Ngunjiri, E.G Karuri and J.K Imungi

ABSTRACT

This study aimed at establishing the influence of storage temperature and relative humidity on the physical, chemical and sensory characteristics of dried orange fleshed sweetpotato chips. Sweetpotato roots of the variety SPK-004 were peeled by hand, dipped in solution of 2% sodium metabisulphite for 30 minutes, then chipped using a manual chipper. The chips were spread on drying tables at a loading density of about 1 Kg/m^2 then sun-dried to a moisture content of between 6 and 7%. The dried chips were packaged in 300-gauge polyethylene bags at the rate of 250g per bag and then stored at 22°C 30°C and 37°C and relative humidity of 40% 68% and 95% for each storage temperature, for a total period of six months. These conditions represent the average meteorological conditions prevalent in different parts of the country. Initially and in the subsequent six months of storage of the chips, the following parameters were determined: moisture content reduced ascorbic acid, β-carotene content, color and sensory characteristics. The data were subjected to multiple linear regression analysis in order to develop models for predicting the nutrient losses in the stored product. The chips lost 31.2% reduced ascorbic acid and 36.9% □-carotene during sun drying. During storage studies losses in reduced ascorbic acid and □-carotene ranged between 40-69% and 79-100% respectively. Moisture content increased from 6.55% to 15.50%.There was high correlation between β-carotene and the colour of the chips (r^2 = O.745 by sensory evaluation; r^2 = O.945 for the b component of the CIE color values) Chips stored at

22°C and all relative humidity conditions remained acceptable to the consumer up to the end of the six months storage period, while those stored at 30°C and 37°C reached their limit of acceptability after the fifth and fourth months of storage respectively. The study established that β-carotene and ascorbic acid retention would be maximized by storage at temperatures lower than 22°C. High relative humidity favored retention of β-carotene while accelerating loss of ascorbic acid.

Pages 777-787

Quality characteristics of cassava starches from Kenya, Uganda and South Africa in comparison with local and international set standards

Kadere T.T and Makhoha O.A.

ABSTRACT

Cassava cultivation in Africa dates back to 1558, however it was until about 1600 when its consumption was introduced to the people living along the African coasts and nearby islands. Cassava starch is an important raw material in the food, feed, paper and pharmaceutical industries. The immediate potential for cassava commercialization within ECA region lies in animal feed and food processing industries. However currently, cornstarch is preferred to cassava starch. Limited utilization of cassava starch is due to purported poor quality, unavailability and lack of proper policies. Samples used in this study drawn from Kongowea market-Mombasa-Kenya, NARO-Serere-Uganda and Amyral Cornstarch- South Africa. This paper focuses on the quality aspect of cassava starch sampled from Kenya, Uganda and the Republic of South Africa. Based on samples

analyzed in the year 2003, protein (0.17-0.26%); solubility (15.05-18.37%); pH (4.88-5.42); sulphated ash (0.34-0.53%); swelling volume (2.75-5.00); swelling power (12.55-19.65); free acidity (0.4-1.00); weight loss at 100°C (11.56-12.59%). The results for heavy metals were: copper (0.18-0.27 ppm), lead (0.11-0.62 ppm), iron (1.21-2.84 ppm), and mercury (0.01-0.03 ppb). Results for microbial analysis were: total viable count – (<1000 (count /g)), yeast and moulds- (absent), E. coli (absent), Staphylococcus aureus (absent) and Salmonella (absent). The arsenic levels were however too low to be determined. The results on chemical and microbiological analysis showed that cassava starch met most of the quality specifications set by European Union, Kenya Bureau of Standards and Glaxo Wellcome. This study therefore shows that cassava starch has the potential to compete effectively with other popular starches such as cornstarch. From the results, it is evident that the limiting factor is not quality but other factors: stigma, lack of appropriate policy and low productivity.

Key words: cassava, starch, quality, standards

Pages 787-793

Nutrient intake and digestibility by sheep fed three cultivars of sweet potato vines

K.R.G. Irungu, N. Ondabu, J.K. Kitilit, D.K. Changwony, R.S Kenana and J.N. Mwangi

ABSTRACT

Majority of Kenyan farms offer low quality fodder to their livestock which does not sustain adequate performance. The problem is compounded by inadequate fodder availability due to unpredictable weather conditions. The livestock performance can be

improved by growing nutritious fodder and supplementation with concentrates. Sweet potato is a suitable fodder as its vines are nutritious to livestock and its quality is stable over a long growing period. A study was done to determine the nutrient digestibility and intake where Red Maasai sheep were fed the three cultivars of sweet potato vines namely. Light green. Star leaf and Helena. Analyses of variance for a completely random design were done on vine digestibility and nutrient intake. Means were separated using least significant difference procedures. The nutrient digestibilities and digestible nutrient intake were similar between Light green and Star leaf but were lower than Helena. The digestibility values were DM 649.5, 674.4 and 700.7; OM 650.8, 684.9 and 725.2; CP 762.8, 719.9 and 809.3; NDF 516.1,618.2and641.3g per kg DM and digestible nutrient intakes were DDMI 65.5, 63.8 and 74.2; DOMI 53.4, 56.4 and 68.2; DCPI 11.8, 10.9 and 15.1;DNDFI 17.1,23.9 and 23.5g per $W^{0.75}$ by sheep on Light green. Star leaf and Helena respectively. The nutrient intake by sheep among the three cultivars was not significantly different. The intakes were DMI 93.1, 94.6 and 106.0; OMI 82.0, 82.3 and 94.1; CPI 15.5, 15.1 and 18.7; NDFI 33.1, 38.5 and 36.8 g per $W^{0.75}$ by sheep on Light green, Star leaf and Helena respectively. The high nutrient digestibility and intake by sheep make the three cultivars nutritious fodders. Additional research should be done to study the effect of age and wilting of vines on nutrient intake and digestibility.

Pages 793-798

Use of cassava flour by bakery industries in Malawi

D Siyeni, N.M. Mahungu, A. Mhone, C.C. Moyo, V. Sandifolo, A. Nthonyiwa, S. Jumbo

ABSTRACT

Cassava (*Manihot esculenta* Crantz) is an important root crop in Malawi and in sub-Saharan Africa. In Malawi, cassava has been produced mainly for household

consumption as staple diet in most parts of the northern and southern regions, and as a snack and substitute to bread amongst most households including those in the high-income category. Efforts in the past to commercialize cassava flour have not been very successful due to shortage of supply on one side and lack of market information on the other side. Other reasons are the low value crop status given to as a poor mans crop, limited cassava product development that could be suitable for both low and high-income people. Potential for use of cassava flour by bakery industries has not been fully exploited in Malawi and in the region because of lack of innovation on processing technologies. Lack of high quality cassava flour conforming to the grades and standards has been a major set back for local industries consumption. To promote cassava flour in the bakeries IITA/SARRNET has embarked in creation of awareness and demonstration on the potential of substituting partly wheat flour in bread making. The purpose of this paper is to highlight the experiences that have been made and strategies to be followed in commercializing high quality unfermented cassava flour for use by the bakeries in Malawi. The paper also highlights strategies to be followed in sustaining the market demands by the bakeries and the challenges that are likely to be faced in penetrating the market. Tests already carried out indicated that up to 32.5% cassava flour mixture have produced good bread with all the qualities. Hence there is need to sensitize bakery industries to start using cassava flour and embark on sensitizing farmers for processing high quality unfermented cassava flour that can meet the bakery standards and link them to markets.

Pages 799-803

Quality evaluation of homemade meads produced with cassava (*manihot esculenta*) floral honey in Nigeria

U.J Ukpabi

ABSTRACT
The need for utility diversification of cassava necessitated the evaluation of homemade meads produced from cassava floral honey in Nigeria. The domesticated bees that provided the monofloral experimental honey were kept in hives in a large cassava farm. Preheated and unheated dilute experimental honey (18 water: 10 honey v/v) samples were used to produce two types of mead. These samples were sulphited (1 ppm SO_2) and then fermented with inoculated yeasts for 21 days at 25 -26°C. Physicochemical, sensory and microbiological analyses of the resultant mead samples were carried out with standard methods. The produced fresh mead samples had amber colour, 12.70 -15.01% w/v, pH of 3.64 - 3.67, and were generally acceptable to the sensory assessors. However, the mead made from the preheated diluted honey preserved better (microbiologically) than the unheated one after 2 months of storage at ambient temperatures (24 - 32°C). For extended product shelf life, experimental results indicated the need for subsequent secondary decantation (or filtration) and proper anaerobic bottling of this alcoholic beverage from cassava floral honey.

Keywords: mead, quality evaluation, honey, cassava, Nigeria.

Pages 803-809

Potential of cassava leaves silage for dairy production in Eastern Coast of Tanzania

Kavana, P.Y., Kiddo Mtunda, Abass Adebayo and Vianney Rweyendera

ABSTRACT

A study was conducted from March to July 2004 to investigate the effectiveness of ensiling cassava leaves in reduction of free cyanogens and the feeding value of cassava leaves silage. Feeding trial was conducted in Tanga by involving 12 crossbred dairy cows (Friesian x Boran) owned by smallholder dairy farmers. Results indicated that ensiling of cassava leaves was effective in reduction of free cyanogens. Ensiling for one month reduced free cyanogens from 290 to 93 mg/kg of silage. Animals that were provided with cassava leaves silage produced more milk than the control group (9.4 vs 6.8 1/cow/day). Milk fat produced by cows during cassava leaves silage feeding period was higher than before silage feeding period (4.0
vs 3.3 %). No significant difference (P>0.05) was observed in terms of Solid Not Fat (SNF) content of milk between the two periods. It was envisaged that cassava leaves silage had high proportion of by pass protein that contributed to increase in milk production of the experimental animals. This study delineate that cassava leaves silage has a potential for improvement of milk production from crossbred dairy cows during the dry season. However, it has been recommended that more farmers should be involved in different locations so as to derive a general conclusion.

Pages 809-816

Sensory texture profiling and development of standard rating scales for evaluation of textural quality in pounded yam

Otegbayo, B.O., Aina, J.O., Sakyi-Dawson, E.O, Bokanga, M., Asiedu, R.

ABSTRACT

Pounded yam is a popular dish especially in the yam growing countries of West Africa. It is a glutinous dough, eaten with soup or stew, and is made by peeling the tuber, boiling,

pounding and kneading. Researchers have had to rely on rather cumbersome, time-consuming and subjective sensory evaluation for assessing textural quality of pounded yam and other food products from yam. This study focused on the use of sensory texture profile analysis as an objective method for textural quality evaluation of pounded yam. Panelists were carefully selected and trained to assess the textural quality of pounded yam. Standard rating scales were developed from local foods common in Nigeria and the foods were used as descriptors to exemplify the textural attributes being assessed. Reproducible and consistent results on the textural quality of the samples were obtained from the trained panelists. Sensory texture profile analysis can be used as an objective method for evaluating textural quality evaluation of pounded yam.

Key words: Pounded yam, sensory texture profile analysis, food descriptors

Pages 817-821

Nutritional value of cassava silage for daily cattle feed

A. Mhone, M. Phiri, N.M Mahungu, J. Whyte, V. Sandifolo, C. Moyo and S. Jumbo

ABSTRACT

Studies conducted in Malawi indicated that cassava can play a vital role in the feeding systems of dairy cows as silage. Nutritional value and safety in terms of cyanogens of cassava silage for four recommended varieties in Malawi were determined. Cyanogen levels of ready to feed silage in all the four cassava varieties were below the safety limit of 100 mg HCN equivalent per kg for animal feeds. The ADF and NDF values and the calculated DDM, DMI and the RFV suggest that cassava silage can be fed and provide good results to low yielding (<10 kg per day) and medium milk yielding (10-15 kg per

day) cows without extra protein supplement. Ensiling cassava silage in pits provided better nutritional value silage compared to silage ensiled in bags.

Pages 822-827

Promotion of sweetpotato marketing and utilization through improved chipping techniques: evidence from Abuket Sweetpotato Processors Association, Uganda

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ABSTRACT

Commercial processing of dried orange-fleshed sweetpotato (OFSP) chips was introduced to Abuket farmer field school (FFS) in Soroti by NARO's sweetpotato post harvest program in collaboration with International Potato Center (CIP), Vitamin A Diocese Integrated Development Organization (SOCADIDO).. In 2002 season, one ton of dried sweetpotato chips were sold to Maganjo Grain Millers Company in Kampala by the group. In 2003, the group scaled up production to 12 tons of dried chips but ended up lacking immediate market. Other potential markets such as UgaChick Poultry Breeders, still held reservations to integrate sweetpotato as an ingredient for poultry feeds because of un reliable supply of adequate amounts required in the feed production. The quality of the chips produced in reference to their beta-carotene retention was also questionable. Experience over the two years has shown that increased processing has positive bi-directional impact on both root production and processing. CIP and Kawanda post-harvest programme have continued to search and link farmers to possible markets.

Desperate for market, the group attempted to integrate sweetpotato into the traditional dishes by mixing dried chips with roasted maize and cassava sorghum to obtain composites for porridge and local bread called *Atap*. *Atap* is traditional bread made of millet or sorghum. Through knowledge acquired from the FFS the group tried developed different composite flour recipes by fortifying roasted maize, sorghum and cassava with varying proportions of dried sweetpotato chips. The developed composite was later sold for distribution to the people displaced by the war and living in camps around Soroti municipality. Up to 5 tones of this flour was distributed to these people. The composite's baking, texture and palatability characteristics have since been improved through incorporation of tamarind and soya flour. These innovations by the farmers are likely to lead into a bigger market of local consumers hence resulting into wider scale processing by the group. This case highlights both the importance of the need to promote production and corresponding marketing skills and the horizontal impact of all the stages in production to processing. It also demonstrates the crucial role of farmer understanding and participation, and the benefits of incorporating existing practices.

Key words: traditional knowledge, commercial processing, dried sweetpotato chips, value addition, link, participatory.

Pages 828-836

Cassava small scale enterprises in Brazil: lessons for the cassava industry in Nigeria

Patino M.T.O; Dixon A.G.O.; Ezedinma, C.; Lemchi, J.; Okechukwu R.; Sanni L., Akoroda, M.O.

ABSTRACT

The growth of the cities, the distance between work and home and accelerated system of human life are determinants of constant expansion for convenience food markets. In Brazil, one of the main cassava based fast food is “pão de queijo”, a kind of bread made of sweet and sour cassava starches, cheese and eggs. On the other hand, ten years ago, there was only one big enterprise selling a frozen cassava product similar to potato French fries in Brazil. Today, there are several frozen cassava and cassava-based products in the market, produced and distributed by different sized enterprises. This paper aims to describe the characteristics of cassava small-scale enterprises in Brazil and Nigeria and how these experiences can be used in creating and developing cassava small-scale enterprises in Nigeria. It was done using previous analysis about the production of cassava-based products with minimal processing operations in Brazil and Nigeria. Information of Brazilian enterprises was extracted from the work of Vilpoux and Ospina, (1999) and for Nigeria using the work of Knipscheer, H. et al (2003). Data from a Brazilian and Nigerian small-scale cassava enterprises were analyzed and some lessons for Nigerian cassava small enterprises pointed out. Brazilian production technologies should improve sour starch quality, reducing production cost and improving quality. These technologies are simples and could be adopted by small companies. Market information could also allow small companies to know the best places to sell their products. Brazilian demand of frozen cassava products will increase in the next years due to consumer increasing preferences for ready to eat food. However frozen cassava processing has to be improved in order to reduce production cost and consequently to reduce price for the final consumer. Similarly, the challenge for cassava industrialization/commercialization in Nigeria is to integrate the production and transformation into easily storable products that possess desirable quality attributes, and to market it at prices that consumers and other end-users are willing to pay. This involves the identification of market opportunities, the organization and training of clients, including farmers, processors and traders to respond to the demands of existing and potential market opportunities, and the development of market information systems to facilitate increased access to, and the use of improved agricultural inputs.

Pages 836-840

Innovative processing and utilization technologies for cassava in Africa

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ABSTRACT

Cassava has attracted various initiatives at national, regional and international levels. Most of these initiatives are top-heavy calling for expanded production capacities. A major challenge is the conversion of cassava roots (a highly perishable commodity) to more durable and commecialisable products. Processing is one of the methods being employed by cassava processors and researchers to enhance varied potentials of cassava as a means of sustaining food security, improved nutrition, and wealth creation. More recently, processing practices as a growing concern has witnessed remarkable modification in techniques by cassava processors. Current innovative approaches (grating, double-fermentation, double-packaging, extrusion technology, pelletizing, user friendly drying) to cassava processing are discussed in this paper with emphasis on those that promote greater significance to commercialization process. Some case studies of utilization technology for cassava in selected countries of Africa have also been highlighted. Current efforts towards innovativeness and utilization technologies for cassava by IITA are discussed. Emerging dominant tendencies (gender influence, clustering, commodity chain, technology push-pull, enrichment, adoption, export-import, quality hazards and environmental) towards making cassava a "goldmine" were examined and some strategies identified.

Keywords: Innovation, technologies, cassava, Africa

Pages 841-847

Bridging the gap between post-harvest technology development and commercialization of root and tuber crops in Africa

A.Westby, Q. van Oirschot, K. Tomlins, G. Ndunguru, T. Ngendello, L. Sanni, D. Pessey and O. Oyewole

ABSTRACT

The commercialisation of tropical root and tuber crops offers the potential for income and employment generation for rural and peri-urban processors. The promotion of rural agro-enterprises is, for example, the central focus on the Global Cassava Development Strategy. The key question addressed by this paper is how we move from technology development to actually achieve commercialisation. This paper examines some of the factors necessary to bridge this gap. Amongst the factors considered are: the importance of producing products for an identified market, the role of small and medium scale enterprises, the importance of an enabling environment and the importance of quality and reliable supply.

Pages 848

Brazilian lessons for the cassava industry in Nigeria

Patino M.T.O; Dixon, A.G.O

ABSTRACT

Brazil is one of the main cassava starch producer in the world, together with Thailand and Indonesia. Production in this country had been increased in the last years and the Brazilian Association of Cassava Starch Producers (ABAM, 2004) has production expectations of 1,500 tons by 2007. This paper was done using previous analysis about the cassava starch industry in Brazil and Nigeria. Information of Brazilian enterprises was extracted from the work of Alves e Vedovoto, (2003) and Cereda and Vilponx, (1995). Nigerian information is from the work of Knipscheer, H. et al (2003). Data from Brazilian cassava starch industry includes installation costs, cassava cost of production and cassava starch processing efficiency and costs. Some features of the Nigerian starch cassava enterprises were analyzed and some lessons and future expectations pointed out. There are about 73 production units and the total number of cassava starch companies is around 59, some of them running several units. Nigeria currently has two operational starch plants and the third one is scheduled to re-open next year. The key issue for these three plants is to reduce cost of raw materials. The Brazilian cassava starch industry had been developed over the last fifteen years and although there are still several constraints within the agricultural production and the industrial process for the cassava sector, the high potential of the market, especially for modified starch, explains the recent increase of competitiveness of the sector. The Nigerian cassava sector, characterized for an extraordinary production is still mainly devoted for human consumption. The development of the starch industry in Nigeria can be achieved by using the Brazilian expertise in both agricultural production of cassava and industrial extraction of cassava starch. However, the special characteristics and constraints faced by the cassava sector in Nigeria have to be taken in account in order to adopt a specific strategic for development of the cassava starch industry in Nigeria.

Pages 848-849

Utilization and processing of cassava in different regions of kenya: implications for commercial application

Anselimo O. Makokha and T.T Kadere

ABSTRACT

Cassava is one of the traditional staple foods in Kenya. However, the processing and utilization of this root crop differs according to region and community in the country. The paper discusses how cassava is utilized in the different regions across Kenya, and the implication of these differences for its commercial processing and utilization. In the coastal region, cassava is mainly utilized in its fresh form, where it is boiled or mashed as a main meal. It is also widely used as a snack in the form of fresh fried chips. In Eastern province, cassava is utilized fresh in the form of boiled or mashed cassava. It is not considered an important staple food, and the production of the crop is low. The same applies to most of Rift valley province, the largest province in the country and to Central Province. In Nyanza province, where most of the cassava is produced and utilized, the processing differs according to district. In Migori, heap fermentation is practiced, after which the cassava is dried and ground into flour. The same applies to Kuria district. In the two districts, most of the cassava flour is used to make the staple food, ugali. It is utilized as composite flour, mixed with maize or sorghum. In Western Province, the utilization of the cassava also differs according to districts. In Busia and Teso districts, fresh cassava is also mostly fermented and ground into flour, and utilized for making the staple food. In the other districts in the province, including Bungoma, Kakamega, Vihiga, Butere-Mumias, cassava is utilized mainly as a snack. The diverse forms of utilization of cassava in the country present some challenges for commercial processing and utilization. Different varieties of cassava are suitable for the different end uses and regions. The same varieties cannot be promoted across the country. Bitter varieties have been traditionally grown in the regions where fermentation is practiced, while relatively sweeter varieties have usually been grown in the regions where cassava is utilized fresh. Similarly, the predominant form in which cassava is sold in the market will vary from the fresh tubers at the coast to dried chips in Migori, Kuria or Busia. Processing requirements for the different regions and communities also differ. These differences adversely affect the commercial processing and utilization of cassava in the country. Relatively lower quantities of specific cassava products have to be targeted for each region. So far there has been negligible industrial utilization of the crop, perhaps partly because of these reasons. There is good potential for industrial utilization in the manufacture of animal feeds and starch