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# Mechanization: A critical gap in root and tuber technologies for wealth creation in Africa

Felix Nweke

ABSTRACT

In Africa, the potential for wealth creation through the production of root and tuber crops is high because the root and tuber crops are among the highest sources of starch which has wide industrial applications. In Africa, root and tuber crops can, as food, feed the rapidly expanding rural and urban populations and also, as raw material, they can feed the industries and feed mills thereby creating more wealth. Wealth creation through the production of root and tuber crops as livestock feed and industrial raw materials critically depends on mechanical and biological technologies and institutional innovations to drive down the costs of production, harvesting, and processing. Low production, harvesting and processing costs will make the derivatives competitive with maize in the global markets. Yield-increasing technologies must be supplemented with laborsaving mechanical technologies for root and tuber crops production, harvesting and processing in order to drive down their real prices to consumers, feed millers and industrial users. Root and tuber mechanization research program at the International Institute of Tropical Agriculture was thwarted by its premature termination in the early 1980s. There are no farm mechanization programs in the African National Agricultural Research systems. Without a question, there is a need for commitment to sustained long-term investment in biological and engineering Research and Development in order to develop and diffuse mechanical technologies for production, harvesting and processing of root and tuber crops in Africa.

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# Potatoes, sweet potatoes and the millennium development goals in sub-Saharan Africa

Charles Crissman, Regina Kapinga, Berga Lemaga, Michael Potts, Paul Demo, Peter Gildemacher

## ABSTRACT

During the last decade small farmers in sub-Saharan Africa increased their plantings of potato and sweetpotato at a rate faster than any other major food crop in the region. As a result these crops are poised to make important contributions to the Millennium Development Goals. With a focused strategy, their contribution can be expanded many fold. Sweet potatoes are grown in many food insecure regions and consumed by many nutrition insecure people. Potatoes are grown in many densely populated regions where farm sizes are small. Per unit area and time, both crops can supply larger amounts of energy and nutrition than grains. As a small holder commercial crop, potato plantings have mainly grown in response to increased urban demand. As a supplementary crop in most of Africa, sweetpotato plantings have grown in reaction to food security constraints through reduced subsidies to maize monoculture, cassava diseases, civil unrest and HIV/AIDS. Production growth for both crops is mostly through area expansion while yield levels are stagnant. Attaining their potential contribution to MDGs depends on improved on-farm productivity, expanded market opportunities and the adoption of orange fleshed sweet potatoes. OFSP contain high levels of beta carotene and can be a food-based source for reducing Vitamin A deficiency among 50M at-risk children. Organized supply chains for feed, fresh and processed products offer improved conditions for market participation by producers of both crops. Domestic markets are most important at present while regional trade will be important as infrastructure and other trade barriers declines. Dynamic potato and sweetpotato sectors can thus contribute to reducing poverty through improved incomes and expanded employment, reducing hunger through improved productivity and innovative cropping system management, and reducing infant and child mortality through the nutritional benefits coming from widespread diffusion of orange fleshed sweet potato.

*Pages 21-22*

# Recent Advances in Sweetpotato improvement in Eastern Africa

Gichuki S.T

## ABSTRACT

Sweetpotato is an important food crop in Eastern Africa. For several decades the crop was practically ignored with minimum investments in its research and development. But in the last 10 years there has been significant attention given to this food crop that has resulted in its improvement. Several factors have contributed to this turn of events. Key amongst these have been an improved research capacity in the region and the decline of cassava production in the Lake Victoria basin due to effects of extremely virulent strains of the East African mosaic virus. In addition recognition of the importance of sweetpotato and its potential contribution to solving the problem of rural poverty and nutrition enhancement has resulted in more funding being availed for the improvement of the crop. Current projects funded by various donors and the Eastern African governments have a goal of improving sweetpotato productivity and sustainability through collaborative researches on germplasm conservation, crop improvement, and development of technology for planting material propagation. Participatory rural appraisals and baseline studies have been conducted in several key sweet potato production regions in East Africa. Low crop yields, lack of high-yielding-early varieties, pests and diseases, poor management and marketing have been cited as major constraints to production. Promotion of drought-resistant crops, kitchen-gardens, and post harvest processing training has been suggested as potential interventions to address rural poverty in the region. Hundreds of sweetpotato varieties have been collected in the entire region and are currently being evaluated for monophological, agronomic and molecular characters. In addition hundreds of introduced superior varieties and products of the breeding programs have been evaluated across different agro-ecologies. To boost adoption of resultant technologies, farmer field schools for technology development and transfer have been initiated. In addition research centers have multiplied clean planting material for secondary multiplication and distribution by local NGOs and CBOs. Training and provision of support services has greatly enhanced the capacity of the local scientists and extension personnel to address the constraints to sweetpotato production. This has ranged from degree related training, short courses and field workshops involving farmers.

# Cassava the crop of the future in east and central Africa

Ntawuruhunga P., Dixon A.G.O., Anneke F., Okidi J. and Otim Okello F.

## ABSTRACT

Cassava is a major source of energy to more than 500 million people in Africa, Latin America and Asia. It is the most important root crop in the tropic, particularly in area where food security is constantly threatened by harsh environmental conditions. Cassava plays a big role in East and Central Africa (ECA) regions and forms the farmer's main source of energy. Cassava crop is well adapted to diverse farming systems of the ECA regions that are heterogeneous, withstands a wide range of biotic and abiotic stresses, and has high productivity per unit of land and labor. The crop has for long been considered the "poor mans crop" used as famine reserve in rural settings, especially and yet it has vast potential for commercialization. In the last decade over 300o clones of high yielding disease and pest resistant varieties with different end uses have been developed, released and distributed in the region. However, the problems of pests and diseases are still pronounced in some parts of the continent with new strains being identified. There is also problem of lack of appropriated processing technologies and marketing system in place. Therefore, in addition to the on-going national and regional cassava improvement programs across the continent, the region is strongly focusing on the potential areas of food, feed and starch industries to transform cassava into a broad-based commercial crop. This calls for development of varieties suitable for different end uses, strengthening research-extension-farmer linkage, adding value to cassava for higher financial returns, developing quality standards for cassava and cassava based products, private-sector involvement and building entrepreneurship skills among individual farmers, farmer and processing groups. Strong collaboration and networking among the different stakeholders in the sub-sector need to be built and strong policy governing value addition and trade need to be put in place. Looking at the market opportunities available in the region, and the research gains realized, cassava crop is destined as a future crop of East and Central Africa.

**Agronomy and Crop Management**

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# Biotification of root and tuber crops: a novel approach to improving health and nutrition in Africa

Maziya-Dixon, B., Dixon, A.G.O., Asiedu, R.R. Kapinga, M. Andrade, Bonierbale, M. and Ceballos, H.

## ABSTRACT

Globally, considerable efforts have been made to improve the nutritional status of vulnerable groups in the past 15 years. However, an alarming number of people in developing countries still do not have enough food to eat, and micronutrient deficiencies are on the increase. For example, prevalence of iron deficiency anemia globally from 32% in 1960 to 60% in 2000. A recent World Health Report by the World Health Organization indicated that among the top ten preventable health risks globally, malnutrition ranks first while HIV/AID is fourth. Furthermore, in 2002 childhood and material underweight was estimated to cause 3.4 million deaths globally, and 53% of these were in Africa. This should be a big concern for nutritionists and health workers in Africa. An estimated 180 million people in sub-Saharan Africa (SSA) are undernourished; and this number is predicted to be about 300 million by the year 2010. Vitamin A, iron, and zinc deficiencies are widespread in SSA, where diets are mainly plant-based and intake of animal products is low. The groups most vulnerable are women and children. Root and tuber crops are important food crops in sub-Saharan Africa in terms of area planted and contribution to food energy. The advantages of root and tuber crops are well documented and include: tolerance to drought, low demands on soil nutrients, capability of providing reasonable yields in agro ecological zones and seasons where other crops would fail, low requirements for external inputs such as fertilizers and flexibility in planting and harvesting periods. The occurrence of malnutrition and micronutrient deficiencies overlaps well with the areas where root and tuber crops are important staple foods. Developing cultivars of root and tuber crops with enhanced nutritional quality, especially micronutrient (pro-vitamin A, iron, and zinc) content could significantly improve the health and nutritional status of the poor, Breeding cassava, yam, and sweet potato for improved pro-vitamin A, iron, and zinc contents depends on the knowledge of the presence of adequate genetic diversity, stability of these micronutrients when grown in the same environment and across different environment, stability under different processing methods and their bio-availability when consumed. Studies have been conducted on the way forward in breeding for micronutrient-dense varieties in SSA. This paper discusses progress made to-date in breeding for micronutrient-dense varieties

of cassava, yam, and sweet potato and their utilization aspect in combating hidden hunger in SSA.

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# Deployment of high B-carotene sweet potato varieties with farmer preferred culinary qualities in East Africa

S.Tumwegamire, R. Kapinga, S. Agili, R. Mwanga, P. Ndolo, H. Saleh and E. Marandu

## ABSTRACT

The reported over 7 million t of sweet potato produced annually in Africa is principally from the East Africa region and the immediate neighboring countries of Rwanda and Burundi. This is the same region that manifests severe effects of vitamin A deficiency (VAD) effects among the rural poor communities. Since late 1990s sweet potato has been fronted in East African region as one of the promising food based approaches to combat malnutrition, particularly VAD. It has been shown by substituting white types with orange types of sweet potato by farmers in the region, 50 million children under the age of 6 years will not be affected by VAD. Thus efforts have been made by scientists and their development partners to develop and deploy sweet potato varieties that have high levels of B-carotene and farmer preferred culinary qualities. This paper therefore highlights results of these efforts. International Potato Centre, CIP has responded by introducing and distributing seeds and clones targeting high dry matter and high beta-carotene. To date ninety-three seed families and over 50 advanced clones have been introduced and distributed to over ten countries in sub-Saharan Africa. In East Africa national programs have received at least 15 of these clones and have been evaluated for adaptability and acceptability. Most preferred varieties have been identified in different countries and include Zapallo, Tainung 64, W-151, Jewel, Mafutha, Jonathan, and

Ejumula. Over a half million additional seeds produced in the region by Uganda national sweet potato program. Some local adapted varieties have been identified in the region and are being targeted by CIP for breeding programs. Seven local adapted from Kenya and one from Uganda have been cleaned up at PQS – Muguga, Kenya and are ready for CIP to distribute within the region. Thus, today, both farmers and development increasingly perceive sweet potato governmental and non-governmental agencies as a most contributing way to eradicate VAD related problems among the rural populations.

*Pages 23-24*

# Improved cassava varieties increase the risk of soil nutrient mining: an ex-ante analysis for western Kenya and Uganda

A.M. Fermont, H.M. Obiero, P.J.A. van Asten, Y. Baguma, E. Okwuosa

## ABSTRACT

Cassava production in Uganda and western Kenya has been hit hard by the cassava mosaic disease (CMD) epidemic. In response, CMD resistant cassava varieties are currently released on a wide scale. The new varieties yield up to 3 times more than the local varieties. These high yield levels will put major pressure on soil nutrient stocks. Using a local variety, an average farmer will harvest about 10 t $ha^{-1}$ fresh roots, thereby removing 26 kg N, 3 kg P and 19 kg $ha^{-1}$. Using a good CMD-resistant variety, the same farmer can harvest a 30 t $ha^{-1}$, thereby removing 83 kg N, 10 kg P and 47 kg K $ha^{-1}$. If stems are used for planting material and/or firewood, then removal increases to 216 kg of N, 22 kg of P and 102 kg of K per ha for CMD-resistant varieties. Soils in western Kenya and Uganda are predominantly Ferrasols, Acrisols and Nitisols; old weathered soils with small nutrient stocks. Without the use of fertilizers, the rapid depletion of soil nutrient stocks seems unavoidable with new varieties. This will eventually result in yield decline of cassava and rotational crops. The question arises if traditional cropping systems are suitable for cultivating crops with high nutrient demand. However, production levels of banana, the other important food crop in Uganda, have been sustained for over half a

century in several parts of the country, despite K requirements (142 kg $ha^{-1}$/yr) of good yielding bananas (25 t $ha^{-1}$ /yr) being similar to that of good-yielding cassava varieties. But, in contrast to cassava fields, traditional banana fields maintain their soil fertility through large amounts of organic inputs, on the expense of annual cropped fields and grassland. Due to the position of cassava in the farming system, it is unlikely that soil management strategies in banana can be successfully adopted by cassava farmers. However, rotating the improved cassava varieties with fertilized cash crops and introducing promiscuous leguminous inter- and relay crops in cassava fields are potential management options to improve the sustainability of the system. Nonetheless, the development of K deficits will remain a serious concern. The high yield levels of the new cassava varieties have already triggered its promotion as a cash crop. Provided that there is a good (industrial) market outlet, farmers can be motivated to use targeted organic & inorganic fertilizer to prevent soil fertility depletion.



# Impact of improved sweet potato varieties in western Kenya farmers' perspectives

M. Odendo, P. Ndolo and R. Kapinga

## ABSTRACT

Sweet potato is an important food security crop in western Kenya due to its ability to give satisfactory yield under adverse conditions. However, production of the crop is mainly constrained by lack of high yielding varieties with consumer acceptable attributes, lack of healthy planting materials, pests and diseases, and poor marketing. To improve sweet potato production, KARI in partnership with CIP, farmers and extension providers, introduced five improved sweet potato varieties, Mugande, Kemb 10, Pumpkin, SPK 004 and Kakamega 013 in western Kenya between 1994 and 1996 and also promoted sweet potato processing and utilization technologies as a means to improving market opportunities. In 2001, a survey was carried out to assess adoption of the improved

sweetpotato varieties, elicit farmer-based indicators of impacts and evaluate magnitudes of the impacts of the new varieties; and identify factors that enhance or lesson adoption and attainment of the impacts. The study involved semi- structured interviews of 192 individual farmers and eight focus group discussions. Adoption of the improved varieties ranged between 41 and 72 percent, whilst a paltry 10-20% adopted processing and utilization technologies. The most widely adopted varieties are Mugande, SPK 004 and Kemb 10. Sweetpotato varietal attributes, especially relatively high yield, early maturity, 'good taste', suitability for multiple uses, drought tolerance and long in-ground root storage explained the adoption. The adoption of the new varieties resulted in improved self-sufficiency in food supply by at least 20 percent, whilst root maturity period was reduced by between 14 and 30 days. The main constraints to attainment of even greater impacts were lack of appropriate planting materials on sustainable basis, and attack of roots by moles. We conclude that more involvement of farmers in sweetpotato breeding and variety evaluation, and addressing the constraints are likely to improve sweetpotato production.

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# The cassava challenge in sub-Saharan Africa: increasing productivity, market opportunities and profitability

A.G.O. Dixon, M.O. Akoroda, L. Sanni, B. Maziya-Dixon, C. Ezedinma, M. Patino and R. Okechukwu

ABSTRACT

The increasing population and urbanization, and competition for land in sub-Saharan Africa calls for innovations in food production and utilization technology to cater for food self-sufficiency to reduce hunger. At a time when a variety of approaches to poverty alleviation are being considered by African governments and their development partners, increased attention is being paid to the potential of cassava as a source of food security, as well as cash crop. Increasing cassava production will largely depend on the expansion of market opportunities for the crop. The development, transfer and promotion of sustainable market-oriented technologies in collaboration with the major sub-sector stakeholders will provide the necessary incentive to motivate producers to expand cassava production and increase productivity, and will in turn, sustain food security, alleviate poverty, generate income and contribute to socioeconomic growth and development. This will require a shift from a production-oriented research for development, where supply is the driver to a market-oriented research for development, where the market is the driver. The provision of a range of productivity-enhancing technologies and low-cost nutritious energy foods and other products from cassava, quantitatively and qualitatively competitive with imported items, and the entry of cassava into the animal feed industry and other industrial applications are desperately needed. This paper presents strategies to transform cassava into a broad-based commercial commodity through profitable cassava-based enterprises that are both responsive to markets and sustainable in terms of the environmental, economic and social aspects.

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# Bridging the gap between postharvest technology development and industrialization for roots and tubers in Africa

Andrew Westby

ABSTRACT

The commercialization 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 commercialization. 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.



# 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 is sufficiently full 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 further trial should be carried out with raised levels of the fertilizers in order to get the optimal applications for the fertilizers.

*Pages 25-26*

# 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 cultivars were evaluated in multilocational trials for 2 years in 6 locations and 3 agroecological zones to study their performance and adaptation in diverse environments of Rwanda. Trials were conducted in each for the three main agroecological zones who subdivide the country follow the East-west difference in altitude, temperature, rainfall and topography. The upper and lower limits of each zone constitute important transition points for Key agricultural systems. These varieties were compared to two local check Mugande and Kwezikumwe for agronomic performance (yield), adaptability, stability of sweetpotato 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 (environment and genotypes) as well as the G x E interaction for beta-carotene. The most stable environments recorded the lowest yields

compared with 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 2000-103 and 2000-203 as high yielding and 440031 and Kwezikumwe as stable. The best yields were realized in middle altitude conditions for those thirteen varieties.



# Productivity of sweetpotato (*Ipomoea batatas* I.) planted in a second season as influenced by tillage methods and number of nodes

N.U. Ndaeyo, E.O. Ekpe, B.A. Ndom and I.J. Okono

## ABSTRACT

The response of sweet potato (*Ipomea batatas* L.) to different tillage methods and number of nodes was assessed in the second planting seasons of 2001 and 2002. A split-plot design with 3 replicates was used. The tillage methods (no tillage, mounds, ridges and surface hoeing) constituted the sub-treatments while number of vines (2, 3, 4 and 5) constituted the main-treatments. Results revealed that sweet potato planted with 3 nodes had 4-17%, 9-14% and 5-10% more leaves at 2, 3 and 4 months after planting (MAP) than other number of nodes. The use of 4 nodes produced vines that were longer than others by 8-18%, 12-15% and 10-31% at 2, 3, and 4 MAP, respectively. Yield and yield components (tuber length and girth, number of tuberous roots per plant) were superior in plots planted with 3 and 4 nodes. Mounds and ridges produced better growth and yield parameters than no tillage and surface hoeing. In particular, per hectare yield was 12-35% and 10-30% higher in the mounds and ridges plots respectively. It appears that some degree of tillage and the use of 3 or 4 may be imperative for successful sweet potato production.

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# On-farm evaluation of promising sweet potato clones in two major agroecologies of Uganda

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

## ABSTRACT

Sweet potato (*Ipomoea batatas* (L.) Lam) is an important food security crop for both rural and urban-poor households. The crop is grown mainly by smallholder farmers 9particularly women), for food, rural employment and income generation. Most of the local cultivars grown by farmers have disappeared mainly due to susceptibility to sweet potato (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 agroecologies. 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 23/60was 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 reason given in favor TZ/309 were: good appearance, sweet, mealy, good flavor and absence of fibres. Reasons for giving NKA/21 the lowest of were: good performance, 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.

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# Increasing and sustaining sweetpotato production and farmers income in an inland valley toposequence in the western area of Sierra Leone

M.J. Tucker and D.S. Fornah

## ABSTRACT

Year-round production of sweetpotato in Sierra Leone occurs in the Inland Valley Swamp (IVS) bottoms, fringes, and upland continuum. Periodic leaf harvesting, scarcity of improved planting materials and poor cultural practices decrease the crop's productivity and farmers income. Trials were therefore conducted in farmers' fields in the IVS toposequence in the Newton key site in the Western Area of Sierra Leone during the 200/2001 cropping season aimed at increasing and sustaining the productivity of sweet potato and farmer's income. The upland trials evaluated the productivity of 4 to 5-node and normal length cuttings of three improved cultivars and the farmers' cultivar under fertilized and unfertilized conditions in the early and late cropping seasons. The dry season lowland trials evaluated the effect of time and frequency of leaf harvesting on root yield and net returns. 4 to 5-node cuttings produced root yields comparable to yields of normal length cuttings with 8 or more nodes. With the use of 4 to 5-node cuttings, larger acreages can be planted and the problem of vine scarcity can be minimized. Improved cultivars and fertilizer application resulted in significant increases in marketable root yields. However, at very high costs, fertilizer application may not be profitable. Leaf harvesting reduced root yields significantly, the extent depending on the time and frequency of harvesting. However, income from the sales of leaves largely compensated for loss in revenue resulting from reduction in marketable root yields. Leaf harvesting at

3 months after planting resulted in highest combined revenue from leaves and roots. Another leaf harvesting just before root harvesting at 4 months after planting can yield additional revenue. Through the introduction of improved, high yielding and adapted cultivars and cultural practices, and the appropriate timing and frequency of leaf harvesting, leaf and root yields of sweetpotato and farmers income can be enhanced. Since these are low-input technologies, sustainability is highly likely.



# Performance of potato varieties in different agroecologies in the highlands of Madagascar

Jean Marc Randrianaivoarivony

## ABSTRACT

Potato was introduced into Madagascar late in the 19$^{th}$ century. It has established rapidly since then in areas where ecological conditions are favorable. The favorable conditions lie between 1200-2000 m, with ferralitic and especially volcanic soil. Vakinankaratra region responds well to the crop requirements. Thirty years ago, FIFAMANOR project dealt among other activities with potato research and the development of its production. This research has been possible due to collaboration with CIP and PRAPACE in providing materials for testing at different conditions. Some outstanding varieties have been developed and released to farmers and several are at various stages of selection and testing under farmers' conditions. Yield achieved fluctuates as a function of region and season, but generally ranged from 10 to 40 t ha$^{-1}$. Therefore, local varieties have been progressively replaced by the new ones that are more productive and resistant to the major diseases. Two major planting periods exist in the country. These are the rainy season in the hills and the dry season in the rice field under irrigated conditions. Varieties with characteristics which generally suitable to these two cropping periods are more desired. Bacterial wilt caused by *R. solanacearum* is the major constraint in the highlands during the main rainy season that constitutes the main potato production season. Biovar 1 has been reported to be predominant in the country. The best solution being practiced by farmers to control the disease is the use of uncultivated lands and varietal resistance.

Currently there are some less susceptible varieties that are used as a component of the control measure.

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# On-farm evaluation of orange-fleshed sweetpotato varieties in North-Eastern Uganda

G.E. Omiat, E. Adipala, R.E. Kapinga, S. Tumwegamiire, and R.O.M. Mwanga

## ABSTRACT

Orange-fleshed sweetpotato (OFSP) varieties currently represent the least expensive, year-round source of dietary vitamin A available to poor families in Eastern Africa. Studies have confirmed that African mothers can be motivated to accept orange-fleshed varieties, thus dispelling the notion that African tastes preclude the use of all but white-fleshed cultivars. Sweetpotato is vital to destitute, small-scale farmers with limited land, labor and capital. One of its greatest assets is its being amenable to piecemeal harvesting as needed for home consumption or income generation. At present, the predominant sweetpotato cultivars in Eastern and Southern Africa are white-fleshed that contain negligible amounts of beta-carotene, a micronutrient that the body uses to produce Vitamin A. In North-Eastern Uganda, sweetpotato is one of the major staples in addition to cassava and millet. Hence the introduction and promotion of these noble varieties will not only contribute towards household food security rather rural incomes and improved health especially to women. An on-farm study was conducted in Soroti and Kumi Districts in North-Eastern Uganda to assess field and post harvest performance and acceptability of selected OFSP varieties for two seasons (2002/2003) by the International Potato Center (CIP) in collaboration with the National Agricultural Research Organization (NARO) and the farmers in the Farmer Field schools and on-ground NGOs.

Field performance attributes assessed included foliage coverage, resistance to diseases and pests, drought tolerance, maturity, yield of roots, shape of roots, size of roots, appearance of root flesh and general crop appreciation. Taste, flavor, starchiness, cooked root appearance and general acceptability are the post harvest attributes assessed during this study. The sweetpotato varieties used in this study were Ejumula, Kala, SPK004, Sowola 6, Sudan, 4-4 and Arivumaku. Farmer groups from different locations within the study area were selected to grow and evaluate the different sweetpotato cultivars. Both adults (men and women) and children aged between 7 and 10 years assessed the post harvest attributes. Results obtained showed that there were significant variations in field performance of the sweetpotato varieties over two seasons. Generally, overall field performance of the tested varieties was in the order Kala > SPK004 > Ejumula > Sudan > 4-4 > Sowola > Arivumaku. Consumer acceptance was in the order SPK004 > Ejumula > Sowola 6 > Sudan > Kala > 4-4. Varieties Ejumula, Sudan and SPK004 had the best overall performance in post harvest attributes. It was therefore concluded that varieties Ejumula, Sudan and SPK004 were generally acceptable to communities. At national levels, results from different locations have showed that Ejumula and SPK004 have been widely accepted by farmers, consumers and even processors hence have been officially released.



# In situ conservation of agricultural biodiversity on farm: a case study of yam (*Dioscorea cayenensis*/*D. rotundata* complex) in the northeast of Benin

A. Dansi, H. Adoukonou-Sagbadja, R. Asiedu, N. Baco and J. Mignouna

ABSTRACT

Seventeen villages randomly selected in the northeast (Bariba ethnic zone) of Benin were explored to assess, using four-square analysis, the distribution and the extent of the yam (*Dioscorea cayenensis*/*D. rotundata* complex) landraces cultivated by farmers. A total of 165 landraces (75 early maturing and 90 late maturing) were found in the study area. The numbers of landraces found per village varied from 14 to 43 and an average of 35 landraces were maintained and cultivated per village. The proportions of landraces at risk of disappearing (i.e. cultivated by few households on small areas) per village varied from 12.8% to 65.7% with an average of 38.35% for the study area. Factors (agronomic, social, cultural, economic, biotic and abiotic) influencing farmers' decision making to maintain diversity on-farm were identified. Traditional practices for maintaining diversity were inventoried and documented and the best among them were identified based on eleven key criteria. Because of the alarming rate of the genetic erosion, urgent and concerted actions are needed to conserve the existing diversity both in situ and ex situ. The results of the four-square analysis combined with six key selection criteria have led to the identification of the 20 best or high-performance cultivars of the Bariba ethnic zone in Benin. Both NGOs and the national Root and Tuber Crop Development Programme (PDRT) will use this pool of cultivars for development actions.

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# Effects of spacing on tuber yield of taro (*Colocasia esculenta*) on vertisols of Gedeo, southern Ethiopia

Gobeze Loha, Waga Mazengia, Daniel Markos and Legesse Hidoto

## ABSTRACT

Field experiment was conducted at Gedeo, Southern Ethiopia for two years from 2002-2003 cropping season to determine optimum spacing for Taro. The treatment involved in

the experiment were 50, 75 and 100 cm row spacing and 40, 50 and 60 cm for plant spacing randomized complete block design in factorial arrangement replicated three times employed in the experiment. Number f cormels were significantly responded to row spacing with the highest number of cormels were obtained from row spacing of 100 cm. 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 and closely followed by 50 x 50 cm.

*Pages 28-29*

# Response of cassava to soil nutrient variations in crop mixtures grown on an alfisol by continuous cultivation in eastern Nigeria

Asadu, C. L. A and A. G. O. Dixon

## ABSTRACT

In this study, a virgin forest on an alfisol was cleared in 1998 and grown to three common crop mixtures for four years. The aim was to assess the performance of the cassava component under continuous cultivation relative to soil nutrient variations. The crop mixtures were cassava + pigeon pea, cassava + pigeon pea + maize, and cassava + pigeon pea + maize + yam. In corporation of crop residues from each of the respective plots into the soils and the use of a legume (pigeon pea) served as means of restoring soil fertility. The experimental design was a randomized complete design (RCBD) replicated trice each year. Changes in eight selected soil fertility indicators were monitored for the period. An analysis of the nutrient content in the soils under the crop mixtures indicated narrow variations over the four years except in the cases of exchangeable Ca, Mg and Na where coefficients of variations of $\geq 50\%$ were obtained. Comparatively, year-to-year

variations were more substantial though not consistent. This is because in some years some nutrients decreased while others increased relative to the values obtained in the preceeding year. Except in 1999 when cassava root yields from all the crop mixtures decreased relative to their 1998 respective values, the trends in other years were not consistent in all the crop mixtures. While there was a slight yield increase (<10%)in both cassava + pigeon pea and cassava + pigeon pea + maize mixtures in 2000 relative to the 1999 values, there was up to 20% decrease in the cassava + pigeon pea + maize + yam mixture in the reference years. The study also showed that the soil parameters whose decrease or increase in comparative years accounted for the variations in cassava yields were total N, soil organic matter (SOM), available P and exchangeable K. Thus, adequate management of these soil factors would enhance the performance of cassava in the crop mixtures.



# Effect of time of harvest on the yield of five varieties of white yam (Dioscorea rotundata) in southwest Nigeria

B.A. Akinwande, I.A. Adeyemi, R. Asiedu, and B. Maziya-Dixon

## ABSTRACT

Five white yam varieties were planted at the beginning of the rainy season of 2003 at IITA, Ibadan and harvested at monthly intervals from four to eight months after planting (MAP) to determine the best time to harvest these varieties with respect to yield. Fresh and dry tuber yields increased steadily over the harvesting period till seven MAP and decreased after that. Mean tuber yields increased from 0.33 and 0.08 kg per plant at four MAP to 1.21 and 0.41 kg per plant, on fresh and dry weight basis respectively, at eight

MAP. The highest values of 1.37 and 0.42 kg per plant for fresh and dry yield, respectively, were obtained at seven MAP. The mean weight of tubers increased consistently in all varieties till six MAP but there was variation from six to eight MAP. The varieties differed in the number of tubers per plant but time of harvest did not influence this attribute. TDr 99-12 gave the best values in all the yield parameters that were measured except for number of tubers produced per plant for which TDr 99-3 recorded the highest. For all mean yield values, significant inter-varietal differences occurred only from four to six MAP.



# Sustainable management of the fertility of soils: effect of the improved fallows on the production of the yam

N'goran K.E., Yao N.T., Zohouri G.P., Kouakou A.M., and Yoro G.R

## ABSTRACT

Yam cultivation requires very fertile soils. That increases the need for a long fallow period in the traditional slush and burn cropping system. The scarcity of the forests as well as the reduction of the length of the fallow, due to the strong demographic pressure doesn't permit the practice of the existence system of yam production anymore. Studies conducted with the shrubby and herbaceous legumes as *Gliricidia sepium*, *Pueraria phaseoloides* and *Mucuna pruriens* showed that these legumes have a good potential to improve soil fertility of the fallow in a short period. Trials were conducted at Tanda in the Northeast of the Côte d'Ivoire to study the improvement brought by a fallow of *Pueraria phaseoloides* to the output of the yam. Six varieties of yam that are 123, 429, C18 and Florido (*Dioscorea alata*), NDRBD10 and Krengle (*D. Cayenensis*) were evaluated have been valued in Tanda during three years (2000, 2001 and 2002). The

results in 2000 showed that the fallow of *Pueraria phaseoloides* gave an average gain of 5 t $ha^{-1}$ as compared to the fallow of *Chromolaena odorata.* On the sanitary level, the fallow of *Pueraria phaseoloides* increased the development of *Collectotricum sp;* casual agent of the *anthracnosis*, as compared to the fallow of *Chromolaena odorata.* With regards to soil, the fallow of *Pueraria phaseoloides* improved the organic content of the soil. Results of trials conducted in 2001 and 2002 confirmed the tendency that the fallow of *Pueraria phaseoloides* increases the yield of the yam varieties and the level of fertility soils, but increase the disease incidence.



# Response of hybrid yams to N, P and K fertilizer rates on ferric acrisol of southeastern Nigeria

G. O. Chukwu, M. I. S. Ezenwa and R. Asiedu

## ABSTRACT

The response of three hybrid yams of *Dioscorea rotundata* Poir species to nine rates of N, P and K fertilizer combinations on a ferric Acrisol (Aquic Paleustalf) in southeastern Nigeria was evaluated under field conditions in 2002 and 2003. The treatments were laid on a randomized complete block design with three replications. Source of N, P and K were urea, single super phosphate and muriate of potash, respectively. Yam minisett technology was adopted. The yams were harvested at seven months after planting. Data collected were analyzed using analysis of variance. Results showed that the percentage establishment was not significantly (P=0.05) influenced by the yam factor but fertilizer did. Seed harvest multiplication ratio was not significantly influenced by the treatments. Economic fertilizer rate was established as 60 kg N, 8 kg P and 50 kg K $ha^{-1}$ because higher fertilizer rates did not result in higher significant tuber yields.

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

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

## ABSTRACT

Most of the cultivars of Guinea yam (*D. cayenensis-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 the 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 at 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 tuber yields and yield components. 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 t $ha^{-1}$ at Adeta. The same clones had lower yields at Kazaboua probably because of the late planting. However, these yields were higher than the others at this location. The quality of the three dishes made with the four clones was good at both locations. Therefore, 10 good yielding clones were chosen on the basis of the results and

will be tested in other agroecologies. The clones TDr 89/02665 and TDr 96/00304 that showed good performance on the two locations could be tested on farm.



# Yield, number of tuberous roots and top weight of cassava at Kambi Mawe in Semi-Arid Eastern Kenya

Githunguri, C. M

## ABSTRACT

Cassava grows in areas with marginal to low soil fertility, and in humid to semi-arid agroecological 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, 880061 and 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.



# Performance, foliage and root yield of sweet potato clones at Katumani and Kiboko in semi-arid eastern Kenya

Githunguri, C. M

## 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 root, 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 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.



# Optimizing cassava and maize plant production for improved productivity of the intercrops in an inland valley swamp ecology in Sierra Leone

A.J. Moifula and A. Jalloh

## ABSTRACT

Cassava and maize are important food staples in sub-Saharan Africa. Both crops are widely grown either sole or in mixture on the uplands. The Inland Valley Swamps (IVS) are increasingly being used to grow these two crops during the dry seasons to supply flesh cassava leaves that are used as vegetable and fresh maize mainly eaten in the boiled and roasted forms. The IVS have residual moisture and the often shallow water table is accessible through wells during the dry season. Also, fertility is replenished through erosion of the adjacent uplands thereby serving as a reliable ecology for the sustainable production of crops all year round. However, optimum intercrop plant populations of cassava and maize have not been identified for the IVS unlike the upland. This study was therefore conducted to determine the optimum intercrop plant populations of cassava and maize have not been identified for the IVS unlike the upland. This study was therefore conducted to determine the optimum intercrop plant population of cassava and maize that will produce the most profitable output. Cassava and maize were therefore intercropped at a total intercropped plant population of 50,000 plants $ha^{-1}$. Cassava was planted at

10,000, 20,000, 30,000 and 40,000 plants $ha^{-1}$ and intercropped with 40,000, 30,000, 20,000 and 10,000 maize plants respectively and vice versa. Cassava tuberous roots were affected by rot due to flooding in July while maize was mature and harvested before the flooding. However, before the floods at 4 months after planning, as much as 8.8 t $ha^{-1}$ was produced by cassava variety Slicass 4 significantly outyielding Slicass 3. Increasing cassava plant population above 30,000 plants $ha^{-1}$ resulted in yield reduction while maize grain yield increased as maize plant population increased from10, 000 to 40,000 plants $ha^{-1}$. The most profitable plant population combination was 20,000 cassava plants intercropped with 30,000 maize plants $ha^{-1}$. The results also indicated that productivity of the system can be improved by growing higher yielding cassava varieties despite the relatively shorter growing period compared to the uplands.

## Breeding and crop improvement

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# Farmer participatory sensory evaluation of promising yam genotypes in Ghana

E. Otoo and R. Asiedu

ABSTRACT

Farmer Participatory Breeding has been identified as a major approach in developing and recommending new varieties to farmers. Individual consumer preference is also an important criterion used by farmers for choosing yam varieties to grow. Eight yam genotypes identified from three populations of yam germplasm as promising with respect to pest and disease assessment and yield parameters from three years of study (2000-2002), were evaluated on-farm under farmer-managed farmer participatory conditions in three agroecologies in Ghana. The harvested genotypes were assessed for consumer preference on important parameters such as enzymatic oxidation, colour attractiveness,

aroma, taste, texture and general acceptance in relation to farmer checks (Dente, Brass, and Dorban). KUP2000/001 (an accession of local yam variety Pona belonging to the Kponan varietal group) was the overall best genotype with respect to general acceptability in all agroecologies followed by TDr 89/02665, 2000/001, TDr 89/02660, TDr 95/19177, Dente, Brass, Dorban, TDr 95/01932, TDr 95/01544 and TDr 98/02877 in that order of preference.



# Pre-empting a virulent cassava virus attack on Nigeria: Fast track selection approach

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

## ABSTRACT

The pre-emptive Management of the Virulent Cassava Mosaic Disease in Nigeria Project has as one of its tasks the establishment of strategic stocks of cassava mosaic disease (CMD) resistant genotypes for food, feed, and agroindustrial uses. This task requires a quick and aggressive replacement of cassava varieties currently being grown by farmers in the country that are susceptible to CMD. It also requires development of commercial farmers whose primary objective is to supply fresh roots to industries. The International Institute of Tropical Agriculture have developed several multiple pests and disease (including CMD) resistant genotypes with fresh root yields of 25-40 t $ha^{-1}$ and dry matter of 30-40%. The Project is currently pushing 40 of these genotypes for cultivation and use by Nigerians. The National variety release committee will officially release these

genotypes after two-year data of their superior performance is assembled. The variety release process in Nigeria requires several years of testing materials on-station, at least two year of out-station trials as multilocational trials, demonstration trials, and on-farm trials before evaluation, selection, and release. The threat of the new Ugandan virus strain (EACMV-Ug2) entering Nigeria is real in that the two virus strains which can recombine (ACMV and EACMV) to produce the EACMV-Ug2 have been spotted in Nigeria. Thus, a "fast track approach" to selection of genotypes that combine resistance to the virus and have high root yield be sought. This paper using root dry yield, CMD incidence and severity, from the 2003/2004 year field trials presents the Project's "fast track selection approach" and shows that deductions that will be made from this procedure will be enough to provisionally multiply the genotypes found to be locally adapted to each of the 12 States where the Project now operates.

*Pages 35-36*

# Appropriate methods of sampling and selecting orange-fleshed sweetpotato to improve vitamin a status

G. Mulokozi and R. Kapinga

## ABSTRACT

Vitamin A deficiency remains a public health problem in many developing countries. Food based measurers constitute the most sustainable intervention strategy of alleviating the problem. Plant sources of vitamin A such as orange-fleshed sweetpotato contain β-carotene a provitamin A carotenoids with the highest vitamin A activity. Promoting increased production and consumption of orange-fleshed sweetpotato with high levels of β-carotene could improve the vitamin A status of vulnerable groups in areas where vitamin A deficiency is a problem. Sampling of orange-fleshed sweetpotatoes for laboratory analysis and determination of β-carotene content are important steps in

selecting varieties with high levels of β-carotene content for promotion. In this study, methods of assessing β-carotene content in orange-fleshed sweetpotato, which include qualitative by color observation, semi-quantitative by spectrophotometry and quantitative by high performance liquid Chromatography (HPLC) were assessed. Results indicated that different varieties of orange-fleshed sweetpotato contain variable contents of Total carotenoids and β-carotene content ranging from 22,000 to 132,000 µg/100g and from 11,000 to 117,000 µg/100g respectively. There was a positive correlation between the intensity of the orange colour, absorption of ultraviolet and visible light spectrum and β-carotene content. In conclusion, orange-fleshed sweetpotato varieties comprising almost exclusively of all-*trans*-β-carotene can be quantified by extracting and determining the concentration of β-carotene spectrophotometrically. However, for varieties with substantial amount of other components quantification by HPLC is necessary.



# Assessing food quality in farmer participatory Varietal Selection of Water Yam (*Dioscorea alat*a L)

C.C Okonkwo, C. Egesi, R. Dossou, K. Zoupoya, E. N'kpenu, E. Otoo, A.Y. Alhassan, C.A Echekwu and R. Asiedu

## ABSTRACT

The suitability of the yam tuber for food preparation is a major criterion for accepting new yam varieties by farmers and consumers. The identification of high yielding clones with good tuber eating quality as well as resistance to pests and diseases would encourage expansion in the production and utilization of water yam in West Africa. As part of on-station participatory varietal selection of water yam in West Africa, a sensory evaluation of boiled yam was conducted with farmers. Fifteen to 20 farmers (men and women) from villages near the stations and field staff evaluated twenty improved clones from IITA and

at least two local landraces of water yam at each location for suitability as boiled vegetable. A four-point scale of very acceptable, indifferent and not acceptable was used for taste, texture (mealiness), and colour. The farmers also rated clones for overall acceptability. Significant differences ($P < 0.001$) were found among the clones for colour, taste, texture and overall acceptability. All the clones were rated as being suitable as boiled vegetable but TDa 291, TDa 99/01169, TDa 99/00395, TDa 99/00528, TDa 297, and TDa 98/01166 were ranked as the top six. Taste and texture accounted for about 90% of the variation in overall acceptability. All the quality parameters had high correlations with preference ranking. The Kendall's coefficient of concordance among farmers was highly significant (0.65**) at all locations. The rank correlation between farmers' and breeders' average rankings was highly significant. Quality assessment through sensory evaluation of a major food product by farmers can be valuable contribution to the varietal selection process.



# Effect of genotype x environment interaction on the amylose content and granule size of cassava starch

O. Safo-Kantanka, E. Baafi, K/ J. Tetteh, Grace Mensah, A. W. Ayimadu and Danso Okaikoi

## ABSTRACT

The functional properties of cassava such as its cooking quality and pasting characteristics are known to be greatly influenced by the amylose/amylopectin ratio and the size of the starch granules. Studies were undertaken to find out the extent to which these important characteristics of cassava starch are influenced by Genotype x Environment interaction. Four elite cultivars, NKZ-009, NKZ-015, WCH-037 (IFAD) and DMA-002 (NKABOM) were grown at six different locations in the forest and forest savannah transitional ecozones and harvested at monthly intervals from 12 to 15 months. The soluble amylose content of the starch and the starch granule size and distribution

were determined at each harvest. In another study, the same traits were compared between the four elite varieties and four released varieties grown at two locations and harvested at 12 months. Statistically significant differences were established between the varieties, the location and age at harvest in the soluble amylose content as well as the granule size and its distribution. The soluble amylose content ranged from 2.16-2.9%, which compares favorably with reported levels in the literature. The granule size also ranged from 11.95-14.69 μm. The implications of these findings on the industrial utilization of cassava are discussed.



# Sweetpotato vine selection programme

Naftal Ondabu, Irungu K. R. G, Solomon Tarus, Silvester Ontiti

## ABSTRACT

Sweetpotato vines (*Ipomea batatas* (L) Lam) contain high levels of protein and can be a major source of high quality animal feeds. Sweetpotato selection in KARI-Lanet focused 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 sweetpotatoes as animal feeds. In this study twenty three (23) sweetpotato 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 per ha ranged from 5 t $ha^{-1}$ 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 t $ha^{-1}$ while variety 99/1 collected from Kakamega had the highest CP of 22.6. 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 varieties collected from Kakamega, Embu and ILRI have shown superior qualities at

Lanet Nakuru. Further testing and evaluation on farm will rank them and give recommendation.

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# New cassava varieties for tropical semi-arid climate of Ethiopia

Teshome Anshebo, Assefa Tofu, Tesfaye Tadesse 1 and Yared 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 agroecologies for four consecutive cropping cycles. The results revealed that the clone 44/72 Red excelled others by recording significantly higher mean marketable root yield of 28.1 t $ha^{-1}$ followed by the clone 104/72 Nigeria Red which exhibited mean marketable 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 159/72 Wolaita, 104/72 Nigeria Red and 44/72 Red produced roots with significantly higher tuberous root girth (6.5 cm, 6.3 cm and 5.8 cm respectively). Higher mean length of tuberous roots was produced by 44/72 Red (49.3 cm), which is followed by 104/72 Nigeria Red (47.5 cm). More number of tuberous roots per plant was exhibited by the clones Awassa local, 44/72 Red and 104/72 Nigeria Red (9, 7 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 for official release to users.

# Development of medium and early maturing sweetpotato varieties southern Ethiopia

Assefa Tofu, Teshome Anshebo, Engida Tsegaye, Terefe Belihu and Yared Dagne

## ABSTRACT

Sweetpotato (*Ipomoea batatas* Lam.) is one of the traditional root crops in Ethiopia. Its paramount contribution to household food security and income generation for rural poor was long recognized and given some attention. Following collection and introduction of new sweetpotato clones, preliminary yield trials had been conducted prior to 1997 in various maturity groups to select promising ones. Consequently, four promising clones from medium maturity group and nine early maturing clones were subjected to multi-locational trials over distinct sweetpotato growing agroecologies. Based on root yields and other desirable traits, two clones from each group were selected and verified on-station and on-farms in 2004 for final evaluation before release. The clone 192026-II from the medium maturity group with a mean root yield of 18.7 t $ha^{-1}$ was released and obtained a varietal name *Beletech*, and from the early maturing clones 192040-I with 18.87 t $ha^{-1}$ mean root yield and 192009-VIII with 18.57 t $ha^{-1}$ mean root yield were also released. Theses were named Bellela and Temesgen, respectively. The release of these varieties partially removes some limitations of the previous varieties and also broadens the genetic base to fit to the various agroecologies.

# High root protein content in accessions of wild Manihot species and Manihot esculenta land races from Guatemala

N. Morante, T. Sanchez, J. Marin, C. Ospina, J. Gutierrez, E. Barrera, H. Ceballos, A. Alzate, S. Moreno, M. fregene

## ABSTRACT

High root protein (fresh weight basis) of between 10 to 18% was observed in the storage roots of several accessions of *Manihot esculenta* sub spp. *flabellifolia* and *M. tristis*. These wild species were crossed extensively to elite parents of cassava gene pools and more than 30 $F_1$ families were obtained. Protein content in these progenies ranged from 5 to 10% and root sizes also ranged from very thin roots to commercial size storage root. Backcrosses to elite cassava parents were conducted this season and seeds are being harvested for establishment and subsequent evaluation. BSA will be performed on the $BC_1$ families to identify markers for marker-assisted introgressions of the high protein genes. The amino acid profile was evaluated for 2 wild accessions and two inter-specific hybrids and they revealed a very high amount of free arginine, aspartate, and glutamate amino acids, but very low levels of free cysteine and methionine, both sulphur containing amino acids. SDS-PAGE analysis of crude protein extract, using several extraction methods, produced several bands that have been excised further analysis and protein identification via GC-MS methods. This is the first examples of the implementation of an advanced back cross QTL (ABC-QTL) for the introgression of genes, in this case high protein content from wild relatives into cassava gene pools. Similarly, protein content between 5-8% (fresh weight basis) was observed in a group of 33 genotypes, predominantly from Central America, Guatemala had the highest number of genotypes. Some of these accessions were introduced to Crop Research Institute (CRI), Kumasi, Ghana, and protein evaluation of roots at 5 months after planting revealed protein content of between 5-7% suggesting that the trait is stable across environments. SDS-PAGE analysis of crude protein extract also revealed several bands that are analyzed further for protein identification. Genetic crosses between these high protein accessions and elite progenitors of the cassava gene pool are being made for identification of markers for marker-assisted selection (MAS) as well as transfer of the trait into elite cassava germplasm.

# Rehabilitation of the cassava production in the Democratic Republic of Congo through germplasm development and deployment, and the promotion of new food products

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

## 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 the roots and leaves are used in various dietary preparations, providing carbohydrates, protein, 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 dramatic decline of the cassava production in DRC, due to traditional diseases and pests, but especially to the cassava mosaic disease (CMD), that was exacerbated by a new highly virulent cassava mosaic virus, as well as to the African root and tuber scale. This reduction of the national cassava production resulted in several cases of famine 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. This paper reports on germplasm improvement and post-harvest technologies. After 3 years, the project has developed five cassava genotypes

with high level of resistance to CMD including the new virus. These genotypes are being officially released for multiplication and distribution to farmers in replacement of the susceptible existing and released varieties, which were preciously multiplied and distributed to farmer communities as an emergency strategy. 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 readily accepted by consumers both in the rural and urban areas. These products include composite bread, cakes, biscuits, doughnuts, etc, and constitute an important source of income especially for rural households.



# A preliminary analysis of genetic diversity among East African sweetpotato cultivars (Ipomoea batatas) using simple sequence repeats DNA markers

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

## ABSTRACT

A study was carried out to determine the genetic diversity of sweet potato cultivars from selected areas of Uganda, Kenya and Tanzania. Theses cultivars were subjected to Polymerase Chain Reaction (PCR) analysis using four SSR primers. The primers were found to be [polymorphic to the sweetpotato genome and were able to distinguish between the cultivars as well as identify duplicates. These studies suggest genome as indicated by the polymorphic bands. However, UPGMA analysis of the SSR scores indicated that the genetic base for the East African sweepotato is narrow.

## CROP PROTECTION

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

JM Ngeve, R. Hanna and M. Tindo

## ABSTRACT

A nationwide survey was conducted from February to July 2004 and *Chromolaena-derived* fields in the major cassava growing areas (forest, western highland savannah and forest-savannah transition zones) of Cameroon. Fallow lengths varied form 2 to 20 years, with no longer fallows found in the remotest areas of the forest zone. There was greater variability in stem heights, branching habit, and root configuration among cassava varieties grown. Most varieties (70%) were grown in the forest region than in the grassland and forest-savannah transition zones. Some 123 fields were sampled, and a total 187 accessions were found in and collected form the fields sampled. There was an average of 4 varieties grown per farm. Farmers were seen to grow both boilable (67%) and non-boilable (23%) types although the latter, grown mainly for their marketable yields, were found more in the grassland and forest-savannah zones. Cassava was used mainly as boiled tubers, fermented boiled pastes (miondo, bobolo, mintoumba) and flour, later constituted into 'fufu'. The main field constraints were diseases, crickets 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 root scale and the green mite. The shoot mealybug was sporadic in occurrence and was confined to the forest-savannah transition zone. Root weights obtained from the fields sampled showed that, in general, the cassava varieties grown 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.

# Efficacy of Ridomil Gold 68WG (metalaxy/mancozeb) fungicide in the control of late blight of potatoes

Lung'aho, C., Njenga, D.N and Nyongesa, M.W

## ABSTRACT

Late blight of potato caused by *Phytophthora infestans* (Mont de Bary) is a devastating disease in major potato growing areas in Kenya. Field trials to evaluate the efficacy of Ridomil Gold 68WG, a combination product consisting of metalaxyl and mancozeb in the control of late blight of potatoes were carried out during the long rain seasons of 2001 and 2002 at the National Potato Research Centre, Tigoni (2100 masl). Ridomil Gold 68WG was evaluated along side Ridomil Gold 68WP, Milraz and Dithane M-45. The treatments consisted application of Ridolmi Gold 68WG at the rate of 2.0, 2.5 and 3.0 kg $ha^{-1}$, Ridolmi Gold 68WP at the rates of 2.5 and 3.0 kg $ha^{-1}$,Milraz MZ at the rate of 2.5 kg $ha^{-1}$ and Dithane M-45 at the rate 2.5 kg $ha^{-1}$ and an unsprayed check. Varieties Kerr's Pink and Furaha which are susceptible to late blight and Dutch Robjyn which is moderately susceptible to the disease were used as test varieties in separate trials. 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 ranged from 55 to 70% and 44.6 to 81% in variety Dutch Robjyn while in variety Kerr's Pink the range varied from 39.8 to 51.8%. The unsprayed checks had final late blight disease scores of 80, 83 and 100% in varieties Furaha, Kerr's pink and Dutch Robjyn respectively. In 2002, the best foliar late blight control among Ridomil Gold 68WG treatments was given by the rates of 2.5 and 3.0 kg $ha^{-1}$. Ridolmil Gold 68WG when applied at between 2.5kg $ha^{-1}$ and 3.0 kg $ha^{-1}$ attained

the highest marketable and total tuber yields in all the three varieties. The highest gross and net revenues among the Ridolmi Gold 68WG treatments were obtained when the fungicides was applied at between 2.5 and 3.0 kg $ha^{-1}$. It is concluded that Ridolmi Gold 68WG at application rates of between 2.5 and 3.0 kg $ha^{-1}$ is an effective fungicide for control of late blight of potatoes.

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# The status of fungal tuber rots as a constraint to cassava production in the Pouma district of Cameroon

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

## ABSTRACT

Tuberous root rots are known to be a constraint to cassava production in the humid forest and forest transition agroecologies 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 manure 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 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 to cassava production in eastern DR Congo but the disease could be managed by combining appropriate cultural practices and tolerant varieties.



# 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

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 Yaoundé 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 at12 months.



# Towards control of severe form of cassava mosaic virus disease in western Kenya; A diagnostic survey for cassava mosaic geminiviruses

Ajanga S, Obiero H.M, Akhwale M.S, Legg J.P, Okuja-Okao, Sally M.

## ABSTRACT

A severe form of cassava mosaic virus disease threatened cassava production in Western Kenya in 1994/95. A survey was conducted in 1995 to determine the status of cassava mosaic disease and particularly to know the extent of spread, severity and types of strains available hence target control measures. Five more subsequent diagnostic surveys have been conducted on yearly basis since 1997 through 2003. The overall impression of Cassava Mosaic Disease (CMD) symptom severity based on a score scale of 1-5 was recorded as mild, moderately severe or severe. In 1995-1998 the attack was extremely severe on cassava crops in the districts of western province neighboring Uganda especially Teso, Busia, Bungoma while the attack was mild in the districts of southern Nyanza. Between 1999-2003 the situation was the reverse. Polymerase chain reaction

(PCR) tests were conducted on the leaf samples using nucleotide primers for detection of ACMV, EACMV and EACMV + UgV recombinant. EACMV+UgV was the dominant species in Western Province districts in 1995-2001 while ACMV and EACMV occurred singly. In the southern Nyanza districts during the same period EACMV and ACMV was detected to exist singly and in mild form. Between the years of 2002-2003, recombinant EACMV+UgV had attacked all available traditional cassava varieties in the entire region. Most of the plants, which were doubly infected, with two or all the three strains were characterized by severe symptoms. Samples of whitefly vectors were also taken tested by PCR. The diagnostic survey findings also revealed that over 80% of CMD infections were predominantly primary while less than 20% of the CMD attack was by secondary infections. Most farmers therefore use infected planting materials. Propagation is major source of the problem. Over 1,400 cassava germplasm have been introduced over the years and screened against CMD and other important agronomic characteristics. Desirable resistant cassava genotypes have been rapidly multiplied and availed planting materials to farmers in Western Kenya.



# Evaluation of melody Duo 69 (WG) for the control of late blight of potatoes

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

## ABSTRACT

Potato late blight caused by the oomycete *Phytophtliora infestans* (Mont.) de Bary is an important disease in Kenya. Field trials to determine the efficacy of Melody Duo in the control of late blight of potatoes were carried out starting from the short rains of 2001 to the short rains of 2002 at National potato Research Centre, Tigoni (2100 m). Melody Duo 69 (WG) was evaluated along side Ridomil (WP), Milraz and Dithane M45. The treatments consisted application of Melody Duo 69 (WG) the rate of 2.0, 2.25 and 2.5,

Ridomil (WP) at the rates of 3.0 kg ha-1, Milraz at the rate of 2.5 kg $ha^{-1}$ and Dithane M45 at the rate 2.5 kg $ha^{-1}$ and an unsprayed checks. The test varieties were Furaha which is susceptible to late blight and Dutch Robjyn which is moderately susceptible to the disease. 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 ranged from 56.7 to 70%. In variety Dutch Robjyn the percent control ranged from 56.5 to 79.5% during the short rains 2001 and 50.9 and 63.4% during the short rains in 2002. The best foliar late blight control among the Melody Duo 69 WG treatments was given by the 2.25 and 2.5 kg $ha^{-1}$ application rates. Melody Duo 69 WG when applied at 2.5 kg $ha^{-1}$ attained the highest tuber yields which ranged from 20.37 to 37.37 t $ha^{-1}$ for variety Dutch Robjyn and 31.57 t $ha^{-1}$ for variety Furaha across the three seasons. It is concluded that Melody Duo 69 WG is an effective fungicide for control of late blight of potato when applied at the rates of between 2.25 and 2.5 kg/ha.



# 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 DRC was initiated in year 2002 through 2004 in order to assess the cassava health status in various agroecological zones of the 11 provinces of the country. The survey permitted to actualize the list of cassava diseases and pests. Among diseases, CMD was observed the most damaging and widely distributed. The incidence was high in all provinces surveyed. Strains of the viruses

responsible for the disease were identified, comprising the African Cassava Mosaic Virus (ACMV), the East African Cassava Mosaic Virus (EACMV) and the virulent strain Uganda variant (Ug-V)-, Cassava bacterial blight (CBB) and cassava anthracnose disease (CAD) were also observed, but severe incidences and damage of these two diseases were limited to some provinces. The root rot diseases were not frequently observed in the field during the survey. However, farmers in Bandundu, Kivu and Province Oriental complained about the rots as one of the major damaging constraints of cassava, particularly when cassava is harvested late (eg above 18 months after planting). Cassava brown streak disease (CBSD) was not seen too, but was observed later in Kinshasa and Bas-Congo provinces with low incidences. Among the commonly known pests, cassava green mite (CGM) was the most widespread. However, low incidence and severity were observed in provinces where the exotic predatory mite *Typhlodromallus aripo* the natural enemy of CGM was introduced and established. Cassava mealybug (CM) was also found in few locations of some provinces eg Kinshasa, Bandundu, Kasai Oriental and Kasai Occidental. CM has effectively been controlled by the parasitic wasp *Apoanagyrus lopezi* De Santis in the 1980s. The resurgence of the pest in those locations can be attributed to several factors. These factors may include 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 Oriental and Nord-Kivu. Its incidence was also high. Two arthropod species, the Thrips and termites, known in the recent past to be of secondary importance on cassava were found showing high incidence and quite alarming damage. The whitefly *Bemisia tabaci*, traditionally known on cassava only as the vector of the virus of the cassava mosaic disease (CMD) was observed in very high number inducing honeydew on cassava leaves.

# Development of a polyclonal antiserum against Uganda isolate of sweetpotato chlorotic fleck virus

V. Aritua, E. Barg, E. Adipala and H.J. Vetten

## ABSTRACT

Since the first isolation from Peru in 1992, Sweetpotato chlorotic fleck virus (SPCFV) has been found affecting sweetpotatoes in several countries including Uganda, Kenya, Peru, Japan, China, Cuba, Panama, Bolivia, Colombia, Brazil, Philippines and Indonesia. SPCFV is a filamentous virus with 750-800 x 12 nm particles, encapsidated by a polypeptide of Mr 33.5 kDa. Serological analysis done using antiserum against the Peruvian isolate suggested occurrence of several strains of SPCFV. To improve the sensitivity of detection, a polyclonal antiserum was raised against a Ugandan isolate and used to study serological relationship among East African isolates and those from other countries in this study. Since most viruses infecting Sweetpotato occur as multiple infections in Uganda, the risk of an unintentional mixed infection was minimized by selecting an isolate Hoima 4, which showed a mixed infection only with SPCFV and sweetpotato chlorotic stunt virus (SPCSV). By mechanical inoculation on *Nicotiana occidentalis* susp Obliqua, SPCSV was eliminated and SPCFV virions purified using a modified method of Lisa et al (1981). A rabbit polyclonal antiserum was then prepared by intramuscularly injecting equal volumes of the purified virions and Freund's adjuvant complete into a hip muscle of a rabbit, followed by two booster injections, with Freund's adjuvant incomplete. Gamma ($\gamma$)-immunoglobulin G (IgG)s were isolated from the crude antiserum of the first bleeding by using four times dialysis against half strength phosphate buffered saline and labeled with alkaline phosphate (AP) for use in Double Antibody Sandwich-ELISA. Fresh virus preparations and purified virions were clearly decorated by this antiserum. The antiserum had a high virus-specific titre, with optimal dilutions of coating IgG and AP-labeled IgG as both 1:1000. No host-specific reactions were observed in concentrations higher that this. In decoration tests, SPCFV particles were decorated to an equal degree when treated with the homologous antiserum but to a limited level of dilution with heterologous antiserum against isolates from Taiwan and the Peru. However, similar degrees of decoration titre to heterologous antigens from East Africa were obtained, indicating the East African isolates are serologically similar.

# The emergence of Bemisia tabaci (*Hemiptera: Aleyrodidae*) as a direct pest threatens sustainable cassava production in Uganda

C.A. Omongo; J. Colvin; A. Bua; T. Alicai; J.P. Legg; Y. Baguma

ABSTRACT

The superabundance of *B. tabaci* currently evident on some of the CMD) resistant cassava varieties released to farmers in Uganda poses a significant threat to their sustainable production, and efforts to control the CMD pandemic. Damage includes development of sooty mould on leaves, petioles and stems, reduction of leaf sizes, distortion of leaf shape, mottled chlorosis on upper leaves and general plant stunting. Preliminary assessments indicated substantial losses of fresh tuberous roots. Yield losses of approximately 40% were recorded for Nase 12, a variety that has received wide acceptability amongst farmers due to its good tuberous root quality and resistance to CMD. Moreover, a recent survey in Uganda jointly undertaken by NARO and 11TA-ESARC has recorded serious whitefly problems in over 50% of the major cassava growing districts. In mitigation, the Uganda National Cassava Programme has embarked on a search for host-plant resistance. To date, over 450 cassava clones have been evaluated in Uganda for resistance to *B. tabaci* in collaboration with NRI and 11TA-ESARC. Initial results suggest the existence of both local and exotic resistant genotypes. The most promising clones are being evaluated further in both on-station and multi-location on-farm trials. Host-plant resistance to African B. tabaci will have the twin benefits of preventing physical damage to the crop and reducing the frequency of virus transmission.

# Association between zigzag stem habit and tolerance to cassava brown steak 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 90/034 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 three cultivars, Mulaleia, Nikwaha and Macia 1 which are tolerant to CBSD are heterozygotes. Furthermore, in Mozambique these observations imply that there is a strong possibility that the gene conferring tolerance to CBSD is linked to the "z" allele. 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.

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# Incidence of potato bacterial wilt in relation to latently infected tubers and seed-flow channels in Kenya

Z.M. Kinyua, S.N. Kihara, M.J. Otipa, O.M. Olanya, J.J. Smith, S. Pirou, and J. Karinga

## ABSTRACT

Proper understanding of the prevailing circumstances that promote the spread and persistence of *Ralstonia solanacearum* would enhance integrated management of potato bacterial wilt. Field assessments and on-farm interviews in Kenya's major potato-producing regions between 2001 and 2003, coupled with laboratory analyses of sampled tubers, revealed that bacterial wilt was still a major limitation to the realisation of the full potential of potatoes as a result of plant death in cropped fields and reduced store, life emanating from post-harvest rotting of tubers. The disease was recorded in 77.3% of the farms across all the regions, with 55-90% bacterial wilt incidence in severely affected farms. NCM-ELISA of tubers sampled from ware potato fields, farm-produce markets and potato seed farms showed that latent infection levels within tuber samples were in the range of 20 to 100%. The main pathogen distribution pathways, which were sustained by acute shortages of disease-free tubers, were recognised as on-farm seed recycling, inter-farm seed exchange and open market sales of tubers from infested sources. Efforts to deal the bacterial wilt situation in the country included the generation of basic seed by KARI, production of certified seed by individual farmers and corporate organisations, and production of –'high-health' seed in community-managed tuber-multiplication plots. However, the vicious cycle of bacterial wilt appeared to persist due to inadequate awareness on bacterial wilt management strategies among farmers and the lack of effective, large-scale multiplication and distribution systems for certified seed potato tubers.

# Molecular variability of African isolates of sweetpotatoes virus Y

E.M. Ateka, E. Barg, R.W. Njeru, H.J. Vetten

ABSTRACT

The biological and molecular properties of a sweetpotato virus isolate formerly known as Sweetpotato virus 2 were determined. The virus has flexuous filamentous particles, induced cylindrical inclusions in infected cells and was experimentally transmitted by *Myzus persicae*. Sequence analysis of its coat protein and 3 non-translated region revealed that the virus is a distinct potyvirus, for which the name Sweetpotato virus Y (SPVY) is proposed. Sweetpotato chlorotic stunt crinivirus (SPCSV) in Ipomoea setosa in mixed infections. Unlike plants that were infected only with SPVY or a Kenyan isolate (KY-38) of SPCSV and largely showed no symptoms of SPVY infections. Comparisons of coat protein CP gene sequences of geographically diverse isolates of SPVY revealed amino acid sequence identities ranging from 86 to 100%. The results strongly suggest the existence of biologically and genetically diverse strains of SPVY from southern Africa.

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# 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 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.

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# Evidence for high evolutionary potential of *Colletotrichum gloeosporiodes*, 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, $\theta$ = 0.034)), and agroecological zones ($G_{ST}$ = 0.04, $\theta$ = 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 deploy of effective and durable strategies for yam anthracnose disease management.

# Practical application of virus diagnostics in 'cleaning-up' yam and cassava genebank accessions

J D'A Hughes, B O Odu and V Mahalakshmi

## ABSTRACT

The genebank at the International Institute of Tropical Agriculture (IITA) has 3,428 accessions of *Dioscorea* spp. and 2,385 of *Manihot esculenta.* These are maintained wherever possible as virus-tested *in vitro* plantlets. However, many accessions are virus-infected, or are in the process of field rejuvenation and therefore their health must be re-assured as they are taken back into tissue culture for long-term conservation and subsequent multiplication for international germplasm distribution. The most important viruses infecting cassava in Africa, and prevalent in some of the genebank accessions, are the cassava mosaic geminiviruses. Other viruses are also present in Africa, including *Cassava brown streak virus,* but many others are found in Central and South America. *Dioscorea* spp. worldwide are infected by over 12 viruses, of which at least six are found in Africa, with *Yam mosaic virus* genus *Potyvirus* being the most prevalent. Most viruses affect the growth of infected plants, reducing vigour and yield. Viability of propagules is also usually adversely affected. Diagnostic tests for the viruses infecting cassava and yams used in the clean-up of genebank accessions through meristems-tip culture include both protein-based and nucleic acid-based tests. The protein-based tests are serological tests, which are usually direct or indirect enzyme-linked immunosorbent assays, using monoclonal or polyclonal antisera. The nucleic acid based tests are a range of polymerase chain reaction (PCR) tests to detect both RNA and DNA viruses. These tests, with meristems tip culture and in vitro conservation, permit IITA's genebank accessions to be virus-tested, certified by the Nigerian Plant Quarantine Service and to be available for international distribution.

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

Haji H. Saleh

## ABSTRACT

Cassava is the second most important crop in Zanzibar. By acreage it occupies the biggest area under cultivation and it is grown by almost all rural households in the Islands and it is regarded as a food security crop. Cassava Brown Streak Disease (CBSD) and Cassava Mosaic Disease (CMD) are the major constraint to cassava production in Zanzibar. To assess the magnitude of yield loss due to CMD and CBSD, to identify the varieties that are mostly attacked by the disease and to assess the distribution of the diseases in different zones of Zanzibar, a study (survey) was conducted in November 2002 in 29 villages of Zanzibar (Unguja and Pemba). Forty (40) farmers were interviewed and 750 plants were sampled and inspected covering the 5 farming system zones of Zanzibar. Fully structured questionnaires were used to collect information while the visual inspection of the infected parts of the plants with emphasis on leaves, stem and roots symptoms was made. During sampling the plants were categorized at different stages of development. The SPSS software package was used to analyse and compare the data. The result has shown that, the coral rag zones have the highest cases of both CBSD (27%) and CMD (32.4%). Micheweni district in Pemba has the highest cases of CBSD symptoms 71.7% while the lowest cases was in South district, on the other hand the age range of plants between 10-12 months was observed to have the highest cases of diseases symptoms. This paper highlights the findings of the study and gives the recommendation towards the appropriate control measures.

# Effects of aqueous extracts of botanicals on the control of sweetpotato butterfly (*Acerea acerata)*

Mesele Gemu, Shiferaw Mekonen and Temesgen Addis

## ABSTRACT

Sweetpotato (*Ipomoea batatas*) 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 (*Acerea acerata*) cause complete crop failure at time of its appearance. Since, the pest is sporadic; it's out break 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 indicate that most of organophosphorous insecticides are most effective. 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 *Tephrosia vuglia; Datura stramonium, Chenopodium albem, 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 aquous solution of botanicals at the rate of 200I $ha^{-1}$ was sprayed in the potted plant and the standard check (actellic 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.

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# Mode d'action et contrôle de Lasiodiplodia theobromae (Pat) Griff. Et Maubi, agent de la pourriture du manioc (*Manihot esculenta* CRANTZ) au Togo

Tchabana B., Kpemoua K.

ABSTRACT
According to the results of a histological research on cassava, *Lasiodiplodia theobromae* grows preferentially in the phloem in the phloem and could overgrow outwardly the cortical parenchyma and inwardly the outer parts of the xylem. In addition, among the fungicides tested on the development of the pathogen, only Benlate and Topsin-M are proved efficient in inhibiting the growth of the parasite. Furthermore the progression of the pathogen is less fast in the tissues of the apical part (base and middle of the stem).

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# 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 that had symptoms, 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 and 1.2% 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. Several plants were doubly infected by the two variants as evidence by the combinations of the two symptom types. Most of such doubly infected plants showed very severe symptoms and on few genotypes multiple shoot formation was induced. The severe symptoms associated with mixed infections by the variants are comparable to some of the severe symptoms that usually accompany mixed infections by ACMV and EACMV in Nigeria. Mixed infections by ACMV variants and by ACMV and EACMV predominate and are responsible for most of the CMD severe symptoms in Nigeria. This emphasises the need to encourage farmers to cultivate resistant cassava genotypes to sustain cassava production in the country.



# Effect of African cassava mosaic disease severity on the yield and yield components of four cassava varieties in Sierra Leone

A.E. Samura, M.D. Thomas and S.I. Kamara

ABSTRACT

Cassava plays an important role as household food through the utilisation of its tuberous roots and leaves rich in protein and provides income for farmers. However, production is limited by a number of biotic (disease, insect, mite, weed) and abiotic (soil, climate and agronomic) factors including the African cassava mosaic disease (ACMD). The disease causes chlorotic blotches on the leaves, with various degrees of leaf distortion and reduction in leaf area. The effect of ACMD severity on the growth and yield of four cassava varieties (Slicass 1 (resistant), Slicass 2 (moderately resistant), Slicass 3 (susceptible) and a local check, Munafa (susceptible) were evaluated at two locations in Sierra Leone in 1999 and 2000. The results showed significant difference between the resistant variety Slicass 1 and the susceptible varieties Slicass 3 and Munafa in terms of disease severity. This trend was observed for most of the 11-month sampling periods starting at 1 month after planting. The resistant variety Slicass 1 had Area under disease progress curve (AUDPC) significantly lower than the susceptible varieties. The implications of these findings in the epidemiology and management of ACMD are discussed with suggestions for future research.

*Pages 50-51*

# On farm performance and farmers evaluation of cassava brown steak tolerant variety "Kiroba" in the eastern zone of Tanzania

M. Muhanna, M. Raya, R. Hillocks and H. Kiozya

## 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 in the Eastern zone in which CBSD is a big problem. The villages were Zogowale and Viziwaziwa. The objective was to find out wheather Kiroba would 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 farmers 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 and 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.



# Yam anthracnose disease: Field symptoms and laboratory diagnostic

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

## 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.



# Characterising the response of sweetpotato to infection by sweetpotato virus disease

D.W. Miano, D.R. LaBonte and C.A. Clark

## ABSTRACT

Distribution of *Sweetpotato feathery mottle virus* (SPFMV, genus *potyvirus,* family *potyviridae*) in sweetpotato is highly is highly variable, with more tolerant materials showing higher variability in distribution, at times leading to absence of the virus in an increasing proportion in the growing shoots. Understanding the response of sweetpotato to infection by Sweetpotato virus disease (SPVD), a result of synergistic interaction between SPFMV and Sweetpotato chlorotic stunt virus (SPCSV, genus *Crinivirus*, family *Closteroviridae*), may explain this variability, leading to an understanding of the characteristics of an SPVD-resistant plant. This research describes efforts towards characterizing the response of resistant and susceptible materials in terms of SPFMV and SPCSV distribution within the plant, virus multiplication and virus movement, and the role of other potyviruses in SPFMV multiplication and disease development. Preliminary findings using real-time PCR to study SPFMV and SPCSV distribution, and the role of other potyviruses in SPFMV multiplication are discussed.

*Pages 51-52*

# 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 varietal needs and utilisation of African landraces Variability generated by introgression from the African landraces has proven useful for improving breeding populations for multiple pest/disease resistance, improved post harvest qualities, wide agroecological adaptation and greatly improved yield potential. Combined with the earlier improved 11TA 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. These improved germplasm are 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 are at various stages of utilisation in national programs.

# Farmer participatory clonal selection of water yam (*Dioscorea alata*) in West Africa

C.C. Okonkwo, C. Egesi, R. Dossou, K. Zoupoya, E. N'kpenu, E. Otoo, A.Y Alhassan, C.A. Echekwu and R. Asiedu

## ABSTRACT

Lack of access to and information about new high yielding clones of yams are major limitations for resource-poor farmers in West Africa. Recognizing this, and in view of the important role water yam is playing in the livelihood system of farmers in West Africa, IITA in collaboration with NARS partners in sub-region initiated farmer participatory varietal selection (PVS), which was conducted at seven sites in three different yam growing agroecologies in the sub-region. The trials were conducted at five research stations - two in Ghana, and one each in Nigeria, Benin, and Togo. The objectives of the study were to identify farmers' cultivar selection criteria; enable farmers to assess the performance of 20 improved clones alongside their preferred locals; and to rapidly identify clones superior in yield, agronomic traits, pest resistance and consumer acceptance. Fifteen to 25 farmers from villages near the stations were invited to participate in the evaluation of the trials during the active vegetative growth period and at harvest to evaluate the different test clones according to their own criteria. At the vegetative stage farmers used canopy cover, leaf colour, level of cracking of soil surface near plant base, vigour of shoot growth, percentage sprouting and freedom of the leaves from spots as major parameters for selection. Yield, tuber size, shape, and smoothness of the tuber skin were clearly the most important criteria mentioned by all groups at harvest. Kendall's coefficient of concordance and the Spearman rank correlation coefficient were used to analyse the agreement of rankings of the clones among farmers, among breeders and between breeders and farmers.

# Effects of *Steinernema karii* and *Heterohabditis indica* against the sweetpotato weevil (*Cylas puncticollis*)

M.M. Sila, G.H.N. Nyamasyo, and 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 weevils and 10 adult males. Two months thereafter, the plants were treated with $0.5X10^6$ infective juveniles of S. *karii* and H. *indica* 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. High mortality was observed on pots treated with H. *indica* compared to S. *karii*. Both species of nematode had a significant effect on both males and female weevils ($P<0.001$) but greater mortality was achieved in males compared to 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. The results indicate that there is potential in the use of H. *indica* and S. *karii* in biological control of sweetpotato weevil.

# Impact of *Rigidoporus lignosus* on the association culturable rubber tree-cassava

Wahounou P.J., Zohouri G.P., Gnagne M., Boko M.C.E.T Kouame N.C.

ABSTRACT

In an intercropping trial of the rubber tree and cassava, the rate of attack of the fungus *Rigidoporus lignosus* and its impact on the two plants varies considerably according to the distances to the source of infection. On the young rubber trees, the rates of attacks are of 44.0%, 18.7%, 5.6%, respectively for the distances of 50 cm, 100 cm and 150 cm. On the plantations of cassava crops, the attacks appear a lot more important, with rates of 81.0%, 46.8% and 15.6% for the same distances. These affections on cassava result in decreases of production of 52.1%, 49.0% and 16.6%, in the ascending order of the distances. On the whole, 40% of production loss are recorded on the sites infected compared to the healthy sites. The decay of production is bound, on one hand, to the weak development of the tubers, and on the other hand, to the defection of good number among them.

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# Changes in the population abundance of the African root and tuber scales on cassava in the Bas-Fleuve district of the Democratic republic of Congo

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

ABSTRACT

A two year follow up of the African root and tuber scales (ARTS) population dynamics on 2 cassava cultivars, a bitter variety Mvuama and a sweet variety Lueki, was conducted in cassava plots in a highly infested sites in a secondary forest agrozone of Bas-Fleuve, in DRC. High populations occurred on the sweet variety Lueki while the bitter variety Mvuama harboured less scales. Three planting dates were considered to follow the changes in the population of ARTS on these 2 varieties. The population build up showed the same trend for the 3 planting dates on both varieties. Data collected in each of the plots after the plants were well rooted (3 months after planting MAP) show more larvae at fast (at the beginning of the population build up). The picks in the abundance appeared between 3 and 5 MAP regardless of the season. At first, the dry season was suspected to be responsible for the population build up. Factors influencing the changes in the population were assessed. Results show that the changes in the population were mostly density dependent.

*Pages 54-55*

# Biological control of cassava green mite in Kenya-spread and persistence of the predatory mite *Typhlodromalus aripo*, and impact on cassava green mite and cassava root yield

Charles W. Kariuki, R. Hanna, M. Toko, and B.M. Ngari, R. Irungu


# ABSTRACT

Cassava green mite, *Mononychellus tanajoa* (Bondar) has been a major pest of cassava since its accidental introduction in Africa. Studies conducted in recent years on its biological control in the major cassava growing areas in Kenya demonstrate definite establishment of *Typhlodromalus aripo* DeLeon 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 places 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 active mites per leaf. A similar trend has been observed for damage score on cassava leaves. There are, however, a few areas where it has failed or has only temporary established possibly due 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 involving exclusion experiments method have demonstrated the effect of T. *aripo* on CGM populations, infestation and damage on local and improved cassava varieties. The presence of T. *aripo* has been shown to reduce the abundance of CGM on cassava from approximately between 170-180 actives to 60-100 actives per leaf T. *aripo* has also been shown to have significantly affected the yield of two cassava varieties in the field. In plots without T. *aripo,* root yield for two varieties ranged between 12 and 25 t $ha^{-1}$, while in plot with T. *aripo* it was 33 to 40 t $ha^{-1}$. These studies have demonstrated that biological control of cassava green mite with T. *aripo* has the potential of increasing cassava production in the country by reducing the yield losses associated with CGM, and that it is effective in both local and improved varieties with suitable plant characteristics. Studies on climate matching in Kenya have demonstrated the possibility of establishment of a fungal pathogen, *Neozygites tanajoae* in areas where T. *aripo* has failed. Also current and future collaborative work with breeders will assist in introduction of cassava varieties suitable in suitable in sustaining T. *aripo* for effective management of CGM.

*Pages 55-56*

# The status of cassava green mite biological control in Mozambique

Abu Jone, I. Zannou, R. Hanna, M. Toko, B. Agboton, and E. Mambo

## ABSTRACT

Cassava ranks the second most important food crop after maize in Mozambique. In recent years, a great deal of progress has been achieved in improving cassava productivity, but the crop continues to suffer, with variable degree, from various pests and diseases. The cassava green mite CGM) *Mononychellus tanajoa* (Bondar) is widely distributed in Mozambique where it has been considered a major pest of cassava; however, CGM infestations have declined considerably in recent years due to a successful biological control campaign carried out by the International Institute of Tropical Agriculture in collaboration with Mozambique NARS and local NGOs. The neotropical predatory mite Typlodromalus aripo DeLeon, which had proven successful in CGM control in West Africa, was introduced into several provinces of Mozambique over a period of 4 years - from April 1999 to June 2003. In addition, predators were redistributed to numerous locations from sites where they had established. The predatory mite initially established in Nampula, Zambezia, and Cabo delgado provinces through new introductions – the latter province was probably colonized also from southern Tanzania. By June 2004, T. *aripo* had become widespread in nearly all cassava growing regions of Mozambique, except for the southern provinces of Gaza and Maputo where CGM infestations are generally minor. The distribution of T. *aripo* is also limited in southern Inhambane province where CGM continues to be a problem. Pre- and post - release surveys conducted from 1999 to 2004 to access T. *aripo* impact on CGM showed that this predator significantly reduced CGM populations from 207.5 to 155.0 (25% reduction) the first year, to 110.9 (46% reduction) the second year to 43.6 (71 % reduction) in the third year, and to 22.1 individuals of per leaf (88% reduction) during the fourth year after establishment. However, CGM population densities remain high (> 100 active mites per leaf) and leaf damage above 3 (1-5 scale) in central and southern Inhambane province and in the Nacala Velha area of Nampula province. Alternative interventions to reduce mite populations in the areas not yet covered by T. *aripo* are discussed.

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

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

## ABSTRACT

The African root and tuber scale (ARTS) *Stictococcus vayssierei* is a subterranean insect originally infesting several native plant species in the forest zones of Central Africa. With the help of the native ant *Anoplolepis tenella,* ARTS has become in the past 20 to 30 years a significant pest of cassava in several areas of its native habitat. We conducted an experiment in nine farmer fields in each of two villages in a Forest Margins Benchmark area in southern Cameroon to determine the effect of removal of host plant residues prior to field establishment on subsequent ARTS infestations of cassava. Two plots, removal or non-removal of host plant residues, were set up in each of the 18 farmer fields. Vegetation cover, composition, and densities of known ARTS host plants were established prior to field preparation in the selected planting sites and in the surrounding vegetation three months later. In addition, ARTS infestations on the known host plants in the fallow were categorized according to severity. After planting, the fields were managed by the farmers according to common practices. ARTS populations were determined on a simple of ten plants in each plot at three, six and nine months after planting (MAP). Overall mean scale densities per plant were not significantly different between the two villages at three MAP, but there were more scales per plant at six MAP in Akok compared with Awae, and more in Awae compared with Akok at nine MAP. Mean scale densities per plant varied considerably between fields within village. Some fields were free of scale. The highest mean scale densities of 588 ± 179 per plant were recorded in Akok at six MAP. One field remained free of scale throughout the experiment. Mean scale densities per plant in plots with host-plant removal ('treated') were not significantly different from 'untreated' plots during any of the census periods. In addition, ARTS densities on the planted cassava were not correlated with the densities of potential hosts in the preceding fallow and in the surrounding vegetation, contrary to expectations. It appears from this one year experiment that removal of host plant residues prior to planting cassava after fallow does not affect ARTS populations in the cassava crop. However, the outcome of this study was probably affected by various factors such as a significant interaction between plot and farmer field within village, indicating a considerable heterogeneity in treatment effect. Indeed, comparisons of ARTS densities in all three pooled censuses showed that ARTS population densities in 'untreated' and

'treated' plots were similar, higher, and lower, respectively in 12, 21, and 21 censuses. The heterogeneity in treatment effects could be due to such factors as (among others) variations in initial scale population densities, proximity of the plots to the surrounding vegetation, and ant abundance.



# The African root and tuber scale problem in Central Africa: the nature of the problem and the search for control options

Racgid Hanna, M. Tindo, L. Wijnans, G. Goergen, K. Tatahangy, K. Lema, M. Toko, J.M. Ngeve, A. Dixon, and J. Gockowski

## ABSTRACT

The African root and tuber scale (ARTS) *Stictococcus vayssierei* Richard has increasingly become a major pest of cassava in the Congo Basin since it was first described as a species in 1971. This insect pest has been reported from Cameroon, Gabon, Central African Republic, Democratic Republic of Congo (DRC), Equatorial Guinea, Republic of Congo, and most recently from extreme western Uganda. Yield loss trials in DRC and Cameroon showed that high scale densities could lead to losses of over 60% of cassava root yield. Farmer surveys in Forest Margins Benchmark Area in south-central Cameroon indicated that S. *vayssierei* ranked very high as a major pest concern, and was considered to be contributing to approximately 30% of cassava losses. The rise in the pest status of S. *vayssierei* presents an intriguing case study on how a native insect - which was not considered a pest when it was first described thirty years ago - has evolved into a major problem on an exotic crop plant. Previous and on-going research initiated in the last few years by IITA in collaboration with national programs from Cameroon and DRC has shed some light on some of the factors that may have led to the increase in abundance and severity of the scale. Present evidence indicates that S.

*vayssierei* abundance is affected by land use patterns prevalent in the forest zone of Central Africa. Scale densities are higher in cassava fields planted after short fallow than in fields planted after long fallow or after secondary forest. Several indigenous host plants and particularly volunteer cassava were more common in short fallow vegetation compared with long fallow and forest vegetation. These plants are thought to serve as reservoir for S. *vayssierei* infesting cassava fields planted after short fallow. Moreover, scale abundance in cassava fields was positively related to the degree of disturbed forest cover, and to the frequency of occurrence of a closely associated ant, *Anoplolepis tenella* (Santchi), which is vital for scale survival and dispersal. A major effort is presently underway to identify and characterize biotic, agronomic, and environmental factors that affect scale abundance, and to develop sustainable practices for scale management on cassava and other affected food crops. Results of some of the on-going studies will be highlighted and discussed.

## Food science, postharvest technology and utilization.

*Pages 57-58*

# Sweetpotato processing into baking flour at semi-commercial level in chipinge District of Zimbabwe

Nyakudya, E; Mvumi, B.M; Mpofu, A; Mupanda, K; Manzungu, E. and Rukuni, T.

ABSTRACT

In Zimbabwe, sweetpotatoes are widely produced and recognised as both a food security crop and a cash crop. In Chipinge District, sweetpotatoes are produced all year round because of the favorable climatic conditions. Previous surveys established that there is negligible processing of sweetpotatoes at farm gate level and that farmers are not aware

that sweetpotatoes can be processed into various products such as flour for diverse uses. To assess the potential of processing sweetpotatoes at semi-commercial level, the roots were collected from Chipinge District, and processed into baking flour using substitution ratios of 1:3, 3:7, 2:3 and 0:1 (w/w) sweetpotato flour to wheat flour respectively. Conventional electrical and wood-fired ovens were used to bake the bread. Sweetpotato bread was subjected to sensory evaluations. Various bread attributes were scored using a scale of 1-10. The substitution ratio 3:7 produced the best bread. Generally the electric oven produced better bread than the wood-fired ovens. There is potential for partial substitution of wheat-based flour with sweet-potato flour.



# Appropriate cassava processing equipment for improved products standards by smallholder farmers in Malawi

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

## ABSTRACT

In Malawi, smallholder farmers have been using a traditional way of producing cassava chips. These chips are big, bulky and take long time to dry resulting into low quality chips colonized by moulds, which result in low quality flour below the grades and standards required by confectionery. Small chips and gratings take a short period of time to dry and maintain white flour and the chips and the gratings are not bulky thus they produce good quality flour. This can be achieved through the use of appropriate cassava processing equipment such as chippers with smaller holes on the chipping plates and grating rollers. Therefore, IITA/SARRNET has recommended and introduced appropriate cassava processing equipment for smallholder farmers in Malawi. This equipment include motorized chippers and graters. These machines have been tested in rural areas

and have reduced processing labor and time with an output range of 3.2 kg/min to 7.0 kg/min for graters powered by 3.5 and 5.0 HP engines respectively and 15 kg/min for chippers powered with 5.0 HP engines. The grater has also been tested in starch extraction with an average extraction rate of 17.4%. Each machine is operated by one person.



# Introduction of improved solar drying of high ß-carotene sweetpotato: Evaluation of product quality and socioeconomic considerations in Siaya District, Kenya

M.A. Ogubi and S.J. Ochien'g

## ABSTRACT

White-fleshed sweetpotato is a well-established crop in Siaya both as food and as a source of cash. This district has one of the highest infant mortality rates in Kenya due to various reasons including vitamin A deficiency (VAD). To reduce VAD-related diseases, utilisation of orange-fleshed sweetpotatoes that contain β-carotene is being promoted. The content, however, can be affected by the method of sweetpotato chips drying. Two methods of drying i.e. traditional and solar were demonstrated within the study group. Sweetpotatoes were dried using direct sunlight and a solar drier. The study compared the amount of β-carotene retained in sweetpotato and other sources of VA. β-carotene analysis was done using the recommended method. Weaning foods were prepared from reconstituted products. Household (HH) surveys were conducted to collect information

on food drying practices. Women preferred light-weight wooden dryers. In general, samples dried in the enclosed solar dryer retained more of their beta-carotene content (between 58 percent and 87 percent) than those dried using the traditional open-air direct sun drying (between 49 percent and 65 percent). The highest proportion of β-carotene was retained in the samples of cowpea leaves, and orange-fleshed sweetpotato. Weaning foods made from high β-carotene sweetpotato had high levels of available pro-VA. In enclosed dryer, women did not have to spend time keeping animals and birds away from the drying food, as in the open drying. The overall time required to dry a batch of food was shorter because of the high temperatures created and retained inside the dryer, thus creating an opportunity to produce more. Solar dryers are affordable and are in demand. Enclosed solar drying technology is an appropriate method for ensuring the year-round availability of pro-VA foods. Enclosed dryers produce more hygienic food product, decrease losses due to wind, birds, and reduce women's workloads. Solar dried food retained more pro-VA caroteniod than foods dried using traditional technology. This study was supported by PRAPACE.

*Pages 59-60*

# The demand for processed cassava food products in Lagos

Adusei Jumah, Iddris Ayinde, Kolawole Adebayo, Wale Dipeolu, Olusoye Oyewole, Lateef Dimeji

## ABSTRACT

The study analyses the consumption of cassava-based products in the Lagos metropolitan area by means of the almost ideal demand system (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 indicate that demographic factors such as religion and residential area help in explaining

observed differences in the consumption of cassava-based products. For all cassava-based products examined, demand was found to be inelastic, ranging from -0.67 for *lafun* to -0.98 for *gari*. Expenditure elasticities were found to be quite high for all products. With expenditure elasticities ranging between 0.71 for *lafun* to 1.21 for *gari*, Nigeria's demand for cassava-based products will increase at high rates as incomes continue to grow. In view of the fact that the expenditure elasticity recorded for *gari* is greater than unity, whilst those recorded for fufu and lafun were smaller than unity, the results suggest that gari is el luxury food-product, whilst fufu and lafun are necessities, i.e., as total expenditure on cassava-based products increases, consumers tend to spend proportionately less on fufu and lafun and more on gari. Also, Christians were found to allocate a higher proportion of their expenditure on cassava-based products to fufu and lafun (fermented foods) than to gari, as compared to households of the other religious denominations. 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 emanating 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 strategy would contribute to more than proportionate increases in consumption of the given products and resultant increases in revenues for producers.

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# Sweetpotato-cocoa beverage

Ibok Oduro, W.O. Ellis, S.K.A. Bediako and F.K. Amagloh

## ABSTRACT

Sweetpotato tubers obtained from Afram Plains in the Eastern Region of Ghana were processed into pregelatinised flour. This flour and raw cocoa powder were mixed in

various ratios after which other ingredients namely icing sugar, skimmed milk powder, cream milk powder, whey powder, lecithin, malt extract and vanilla in fixed amounts were added to formulate the beverage. Physicochemical and sensory analyses were carried out on the four different formulated beverages in addition to the control which was the popular cocoa powder beverage, an instant drink taken as breakfast or snack by Ghanaians. The proximate analysis carried out on the pregelatinised sweetpotato flour indicated a high total carbohydrate content (86.40% wt/wt) and relative reducing sugars content (14.71% wt/wt). The formulated product (sweetpotato-cocoa beverage) relative to the cocoa powder beverage was high in protein (8.90 - 12.03% wt/wt and 7.17% wt/wt respectively) while for reducing sugars and total carbohydrate there was no significant difference ($P<0.05$). Some rheological properties studied such as the Wettability and dispersability rates of the four samples increased on their solubilities as the pre-gelatinised flour levels increased in the formulation. For the mineral contents, K ranged from 2320.50 to 2377.00mg/kg, Na (843.00 to 903.50mg/kg), Ca (3190.00 to 4435.00mg/kg), Mg (1121.50 to 3381.50mg/kg), Fe (22.80 to 32.45mg/kg) and P (67.50 to 259.38 g/kg). Vitamin A activity of the formulate beverage ranged from 1057.68 to 3236.00mg/100g relative to 2300.00mg/100g of the cocoa powder beverage. The sensory evaluation analysis indicated that the mean values of the formulated sweetpotato-cocoa powder beverages showed a better preference compared to the cocoa powder beverage. The addition of the pre-gelatinised sweetpotato flour to the cocoa powder beverage improved the thickness (body) and the sensory properties of the beverage.

*Pages 60-61*

# Cassava, Production, Distribution, processing and utilisation in Kenya

C. M. Githunguri

ABSTRACT

Cassava was introduced into East Africa in the middle of the 18th Century. About 63%, 30%, 5% and 2% of the total area under cassava is in Western/Nyanza, Coast, Eastern and Central/Rift Valley Provinces respectively. Looking at cassava production area in Kenya, it seems there is a relationship between the level of processing and utilization of cassava with the level of production. In the Western region where 63% of cassava production occurs, farmers process cassava into a composite flour, which is used for *ugali* and *uji*. *Amala* or cassava/sorghum/maize *ugali* is a popular meal in western Kenya. In some areas of western Kenya, heap fermentation of cassava, a process that detoxifies high cyanide cultivars, is also practiced. During heap fermentation of cassava, fungal growth occurs which is said to convert the gelatinous nature of cassava *ugali* into the desirable mealiness found in maize *ugali*. It is only in western Kenya, where farmers process cassava into a dry product (flour) in appreciable quantities, thus improving its shelf life and value appreciably. In addition farmers also boil cassava roots and consume them for breakfast. Cassava leaves are consumed as vegetables. At the Coastal region, where 30% of production occurs, cassava is not appreciably processed into secondary dry products like flour. Cassava crisps are the only dry product that are processed from cassava tuberous roots and are consumed as snacks. However, there is appreciable utilization of cassava tuberous roots in there fresh form. Coastal communities have developed several cassava recipes e.g. fried chips, spiced crisps (*kachili*), ordinary crisps, boiled cassava in either coconut or groundnut sauce and *kimanga*. Like in western Kenya, cassava is accepted as food in the Coastal region. In addition, some communities also eat cassava leaves as vegetables. In the Eastern region, which currently accounts only for 5% of production despite being a semi-arid area where cassava is an ideal crop, cassava is mainly chewed raw as a snack or boiled for breakfast or dinner. In the rest of the country, which accounts for the remaining 2% production, cassava is mainly boiled or roasted and eaten as a snack. Looking at cassava production and distribution in Kenya, the relationship between processing and utilization and production is inescapable. As suggested above, 63% production is in western Kenya where cassava is processed into flour and utilized mainly as *ugali*. 30% of production is at the coastal region where several fresh cassava recipes have been developed and accepted the coastal communities as food. 5% and 2% production is in the eastern and highlands regions respectively where cassava is either chewed raw or boiled as a snack. This paper discusses some policy implications and suggests a way forward.

# Comparative effects of four botanicals and gibberellic acid on the reduction of post-harvest losses in yam (*Dioscorea rotundata*) in storage

S.C. Eze, J.E. Asiegbu, B.N. Mbah, G.C. Orkwor, R. Asiedu

## ABSTRACT

An investigation was carried out to determine the effects of four edible botanicals and the chemical gibberellic acid ($GA_3$) on dormancy, sprouting and rot incidence in yam [D. *rotundata*) during storage. Tubers of the yam cultivar Nwaopoko were stored in a barn at the National Root Crops Research Institute Umudike. The botanicals - leaf of *Azadiractha indica*, fruit of *Xylopia aethopica*, leaf of *Occimuum graticimum* and stem tuber of *Zingiber officinale* - were applied as aqueous and ethanolic crude extracts at two levels of concentration 250 mg/ml and 500 mg/ml while $GA_3$ was applied at 150 mg/litre of water. Storage parameters monitored included dormancy period, sprouting, sprout growth rate, sprout relative weight, tuber weight loss and rot incidence. With the aqueous botanical extracts, the yam tubers that were not treated sprouted earlier than others at 70 days after storage while those treated with $GA_3$ were the last to sprout at 91days from the start of storage. *Azadiractha indica* was next to $GA_3$in suppressing sprouting. This trend was maintained with ethanolic extracts except that these extracts were more efficacious in delaying the initiation of sprouting. The percentage number of tubers that showed soft or dry rot was similar in all the treatments. Tuber percentage weight loss and relative sprout weight were higher in the control than with the botanicals and $GA_3$ treatments. The aqueous extract was as good as the ethanolic one and therefore is preferred since it is cheaper, easier to use and would have no adverse effects on the tubers. These however need more rigorous studies to confirm our observations.

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# Quantification of exposure to cyanide from cassava food

Oluwole O.S.A and Onabolu O.A

## ABSTRACT

Cassava is a major source of calories in many communities in the tropics, but there is concern about its safety because all cultivars of cassava have been shown to contain cyanogenic compounds, which often remain in cassava foods because the methods of processing cassava are not completely efficient. This study was done to quantify the level of exposure to cyanide from *gari*, the most popular cassava food in Nigeria. All sources of cyanide or thiocyanate, from foods and tobacco, were withdrawn from 12 healthy adults during two weeks washout period. The level of cyanogenic compounds in freshly made *gari*, which was obtained from a commercial cassava processing centre, was determined. The *gari* was stored at -20 °C until the experiment was completed. Venous blood was withdrawn from subjects, after overnight fast, to determine baseline levels of cyanide. 150 g of *gari*, from which 128 μmol of cyanide ions could be released, was soaked in 500 ml of cold water for each subject to drink within 5 min. Following the meal of *gari*, samples of venous blood were withdrawn at 30 min, 1 h and hourly for four hours, and two hourly until 12 hours. Subjects were allowed to drink only water until the eighth hour after the meal of *gari*, when they were given a meal of chicken and rice that was prepared by the Investigators. They were kept in the laboratory until the final collection of blood sample at 12 hours. Mean age of subjects was 24 years (SD 4.5, range 19 - 32), and mean body mass index (BM1) was 19 (SD 4.5, range 16 -21). Mean concentration of cyanide in the plasma was 6 μmol/1 (95% Cl 2 -10) at baseline, 12 μmol/1 (95% Cl 6-17) at peak, and 6 μmol (95% Cl 2 -10) 12 hours after the meal. Mean amount of cyanide that was absorbed into the plasma was 13 μmol/I (SD 12), while the transit time of absorbed cyanide was 7.3 hr (SD 2.1). This study shows that cyanogenic compounds that are present in *gari* could cause exposure to cyanide. The amount of cyanide that can be absorbed from a usual meal of *gari* is, however, too small to cause acute toxicity. Although accumulation of cyanide could follow repeated intake of *gari*, it appears that detoxification is adequate in healthy individuals. Since some medications that release much higher levels of cyanide ions have been shown not to cause acute toxicity of cyanide when given repeatedly, it is unlikely that usual meals of *gari* will cause acute toxicity of cyanide.

# Reduction of cyanogenic compounds in cassava food during storage

Onabolu A.O. and Oluwole O.S.A

## ABSTRACT

*Gari,* which is one of the major cassava foods in Nigeria, has been shown to contain cyanogenic compounds that can cause exposure to cyanide. Although *gari* can be eaten by just soaking the granules in cold water, it is usually processed to *eba*, which is made by adding boiling water to *gari*, after variable storage period. This study was done to determine if there are changes in the level of cyanogenic compounds in *gari* during storage and after it is processed to *eba.* Samples of freshly made *gari* were obtained from processors that were located in different parts of southwestern Nigeria. The samples were analyzed for linamarin, cyanohydrin, and free cyanide at baseline and weekly for four weeks. Baseline levels of cyanogenic compounds were determined within 24 hours of production of the *gari*. The samples of *gari* were stored on the shelf in the laboratory at room temperature for the duration of the study. Each sample of *gari* was made into *eba*, in three replicates, by adding boiling water. 15 samples of *gari*, 9 of which were processed using long fermentation method and 6 of which were processed using short fermentation method, were studied. At baseline mean cyanogenic compounds was 4.7 mg HCN eq/ kg dry weight (95% CI 1.5 - 7.8) in short fermentation *gari*, but 15.0 mg HCN eq/ kg dry weight (95% CI 10.2 - 19.7) in long fermentation *gari*. After four weeks storage mean cyanogenic compounds was 1.7 mg HCN eq/ kg dry weight (95% Cl 0.0 - 2.9) in short fermentation *gari*, but 7.4 mg HCN eq/ kg dry weight (95% Cl 4.6-10.2) in long fermentation *gari*. At baseline mean cyanogenic compounds in *eba* from short fermentation *gari* was 3.2 mg HCN eq/ kg dry weight (95% CI 0.5 - 5.9), but 9.6 mg HCN eq/ kg dry weight (95% CI 5.2 - 13.8) in *gari* from long fermentation method. After four weeks storage mean cyanogenic compounds was 1.3 mg HCN eq/ kg dry weight (95% CI 0.0 - 2.3) in *eba* from short fermentation *gari*, but 3.2 mg HCN eq/ kg dry weight (95% CI 1.4 - 4.9) in *eba* from long fermentation *gari*. The findings of this study show significant reduction in the levels of cyanogenic compounds in *gari* after four-week storage. This finding indicates that *gari* stored for a few weeks is less likely to cause exposure to cyanide than freshly made *gari*. The finding of significant reduction in the level of cyanogenic compounds when *gari* is made into *eba* indicates that *eba* is less likely to cause exposure to cyanide from than *gari*.

*Pages 62-63*

# Varietal differences in the physiological, Functional, pasting properties and granule size of starches from different CMD resistant varieties

Omitilo, 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 305872, 4(2) 1425, TME 1 and 82/00058) from 1ITA 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 from 15.24 - 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 KVU while breakdown viscosity ranged from 141.21 - 328.96 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.

## Land and water environmental conservation

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# Global cassava development strategy Implementation Overview

Lutaladio NeBambi

## ABSTRACT

The strategy presents a vision that cassava will spur rural industrial development and raise incomes for producers, processors and traders and it will contribute to the food security status of its producing and consuming households. The essence of the GCDS is to use a demand-driven approach to promote and develop cassava-based industries with the assistance of a coalition of groups and individuals interested in developing the cassava industry. The GCDS was endorsed with the following key points highlighted: It should be demand driven and/or market oriented and take advantage of market opportunities for traditional and new products; It should follow an integrated approach involving simultaneously production, processing and marketing; It should have catalysts and champions to facilitate cassava development; It needs to be applicable to a wide range of stakeholders and implemented at various paces and levels starting from national, through regional to global; It should address issues of sustainability, gender and equity, and potential environment impact; It should address food security concerns for disaster mitigation and recovery situations. The Implementation Plan provides a basic mechanism to facilitate the design of cassava development activities, spanning around three main areas, namely coordination; information and promotion; and linkages and integration. The undertaking of activities in the three areas will need commitments from a range of institutions and groups of stakeholders. The presence of catalysts and champions to help and promote the implementation of activities and global action plans is crucial for the successful implementation of the Strategy.

*Pages 63-64*

# More yams (*Dioscorea* spp.) for more Africans

R. Asiedu

## ABSTRACT

Yams remain very important as source of food and income in the lives of millions of people in the tropics and sub-tropics, particularly in West and Central Africa that account for about 95% of world production. There is good potential for the crop to contribute to a lot more to improved human welfare in sub-Saharan Africa within and outside this major production zone, especially when its characteristics are associated with those of the other root and tuber crops. The abilities of cassava to withstand drought once the plant is established, of sweetpotato to escape it through short growth duration and of yams to sprout even in dry soil and tolerate drought conditions during the field establishment phase make the trio unbeatable in ensuring food security in regions prone to unpredictable and damaging periods of dry weather. Research over the past decade has led to significant advances in knowledge on the crop in several disciplines. The associated moderate increase in human resource capacity for research and development in West Africa during the past decade augurs well for the years ahead. Partnerships among programmes, facilitated by financial assistance from a few dedicated development investors have been crucial to this progress. Major gaps in basic knowledge remain that hamper progress in improving the crop or disseminating products from research using new techniques such as those in biotechnology. Yam researchers have to respond more effectively to the challenges of developing technologies for sustaining productivity of yam cultivation in the face of a declining resource base. We also need to explore opportunities for increased competitiveness of yam products in existing and new markets, keeping in mind the changing socio-economic circumstances of producers and users as well as trends in regional trade. Research and development workers have the responsibility to champion the effort towards unleashing the full potential of yams to contribute significantly to food security and wealth creation in Africa.

**Plant physiology**

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# What controls duration to flowering in D. *alata* and D. *rotundata* -short-days, long-days or rate of change of photoperiod

Elsie Ile, C. Egezi, P. Craufurd and R. Asiedu

ABSTRACT

White (D. *rotundata*) and water (D. *alata*) yams are widely thought to be short-day plants (SDP) in respect of the duration from vine emergence (VE) to flowering (bud or spike appearance), though this has never been shown unequivocally. The objective of this work was to determine whether D. *alata* and D. *rotundata* are indeed SDPs. Field experiments were conducted with several clones of D. *alata* and D. *rotundata* at a number of sites in Nigeria over several years, including serial sowings at Ibadan. The number of flowering plants and their date of bud appearance were recorded. Durations from VE to flowering (FL) were converted into thermal times or cumulative temperature sums (°Cd, Tb=10°C), to allow for variation in mean temperature, and then regressed against photoperiod (P) at VE or rate of change of photoperiod (*d*P) at VE. Flowering D. *alata* clones were all quantitative SDP wherein FL occurred sooner in short- than long-days. In contrast, in D. *rotundata* clones TDr 131 and TDr 99-9, flowering was hastened by long days indicating that D. *rotundata* is apparently a quantitative long-day plant (LDP). However, variation in FL in TDr 131 and TDr 99-9 could also be explained by variation in the rate of change of photoperiod (*d*P) at VE wherein flowering occurred sooner when days are getting shorter, quicker (i.e. *d*P is negative).

# Is the yam (Dioscorea spp.) tuber-head the primary nodal complex (PNC) and the origin of the vine, feeder root and tuber? A mini review

Elsie Ile, P.Q. Craufurd, R. Asiedu and N.H. Battey

ABSTRACT

There is an increasing recognition of the Tuber-head i.e. the corm like structure attached to proximal region of the tuber, as an organ/bud that produce the vine, roots and tuber(s) during visible vegetative growth. The observation originates either from the conception that the Tuber-head functions as a shoot bud and/or the increasing interchangeable uses of the words PNC and Tuber-head to refer to the Tuber-head. Thus the objective of this work was to evaluate whether the Tuber-head is the same as the PNC in structure and to assess whether the Tuber-head is the source of the vine, feeder roots and tuber(s). This work emphasizes that the yam Tuber-head and the PNC are different structures. It also highlights the lack of any evidence to suggest that the Tuber-head functions as a source of the yam vine, roots and tuber(s). Further, it suggests that the yam vine and feeder roots (and possibly the tuber) emerge from some part of the sprout (which is known to occur on headless tubers as well as on the Tuber-head of intact tubers) perhaps the PNC. The benefits of present views, as against that of the former, in the advancement of methods for manipulating yam tuber dormancy are discussed.

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# Water consumptive use research on root crops at national root crops research institute, Umudike, Nigeria: A review.

G.O. Chukwu and K.I. Nwosu

ABSTRACT
Root and tuber crops are mostly produced in Nigeria in the wet season under rain fed agriculture. Increasing demand for these crops for domestic use and export necessitates dry season production through irrigation, to supplement output from rain fed agriculture. Data on water consumptive use are basic for judicious water management and efficient irrigation development. The paper reviewed research on water consumptive use of roots and tuber crops at the National Roots Crops Research Institute, Umudike, which has national mandate to improve these crops in Nigeria. Results showed that methodological approach adopted was mainly crop water modeling, using short-term and long-term meteorological data. Water consumption uses of carrot, ginger, potato, radish and sweetpotato have been established. Gaps in knowledge are highlighted and suggestions made for improvement.

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# Yam (*Dioscorea rotundata* Poir. And *Dioscorea alata* L.) meristem culture optimisation and genetic stability study of micropropagated plants

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

ABSTRACT
Formulation of *in vitro* culture medium capable of regenerating plantlets from two yam sprees – *Dioscorea rotundata* and *Dioscorea alata* in a time shorter than the 24 weeks for the medium (1 μM 1-Napthalene acetic acid + 0.6 μM 6-Benzylaminopurine + 0.23

μM Gibberelic acid) presently in use was studied. Three factorial experiments of either an auxin and a cytokinin or two cytokinins were involved. Data (%) were collected on shoot and plantlet formation at 3 and 8 weeks after culture (WAC). Analysis of variance was carried out on arcsine-transformed data. Direct plantlet regeneration, though better for D. *alata* than for D. *rotundata*, was low and ranged between 0 to 10% at 3 WAC and 0 to 30% at 8WAC. The two species differed in their response ($p<0.05$ - $p<0.01$) with respect to shoot and plantlet formation in all the three experiments except in the experiment with two cytokinins where differences were not observed. Significant differences ($p<0.01$) was observed among the various concentrations of phytohormones in the experiments involving an auxin and a cytokinin but not in that involving two cytokinins. Regenerated shoots were sub-cultured in a proliferation medium and developed into plantlets within 3 to 4 weeks, reducing the plantlet regeneration duration to 11-12 weeks. Analysed morphological characters scored on both the mother plants and the regenerates showed differences in the growth vigour, stem diameter, internode length and petiole length implying that the mother plants were much more vigorous than the regenerates. This study ascertained phytohormone combinations that optimize shoot formation in D. *rotundata* and D. *alata* are species-dependent. High shoot regeneration and a halving of the time required for plantlet regeneration achieved in this study will facilitate micropropagation of virus-tested yam plantlets, thus enhancing germplasm transfer. Genetic stability of micropropagated D. *rotundata* and D. *alata* observed in this study also gives a reasonable level of confidence in obtaining a true-to-type while employing micropropagation as a rapid propagation tool in tissue culture of these yams.

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# Intercropping effects on sweetpotato growth, yield and insect population

R.W. Njeru, M.W.K. Mburu, J. Kitonyi, J.N. Gachara and R.W. Gibson

ABSTRACT
Sweetpotato is an important food and feed crop in the tropical regions where it is grown both in monoculture and polyculture production systems. In the latter system it is grown together with the prevalent crops. In central Kenya, sweetpotato is intercropped with maize, A field experiment was conducted at the University of Nairobi, Kabete Field Station for two seasons; November 2002 to April 2003 (season 1) and January to June 2003 (season 2) to determine the effects of intercropping three sweetpotato varieties (Kembu 10, Ex Shimba and Bungoma) with maize (hybrid 513) under sub-humid conditions. The sweetpotato varieties and maize, either sole or intercropped. The maize and sweetpotato inter and intra row spacing was 75 cm x 30 cm respectively, both in the sole and intercrop. The experimental design was randomized complete block design replicated three times. Canopy photosynthetically active radiation (PAR) interception was determined using sunfleck ceptometer (SF -80 Decagon, Pullman, Washington) in the season. Whitefly and aphid populations were determined using traps for seven weeks. The sweetpotato and maize were harvested after five months. At harvest maize grain yield, sweet dry matter, tuber mass and harvest index were determined. Maize gram yield and harvest index were determined. Maize grain yield and harvest index were not significantly influenced by intercropping with sweetpotato. Intercropped sweetpotato total dry matter, tuber yield and harvest index were significantly reduced by intercropping in both seasons. Maize intercepted 90 to 98% incident PAR late in the season in the two seasons hence only a small percentage of incident PAR was available to sweetpotato by the end of the season. More light was available early in the season but the sweetpotato canopy was too small to take advantage of the light. Sweetpotato varieties significantly influenced interception of the transmitted PAR in the intercropping system; Bungoma and Kemb 10 intercepted the highest amount while Ex Shimba intercepted the least. It is probable that both light and water severely limited sweetpotato yield.

## Planting material production and seed systems

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# Safe and effective international movement of vegetatively propagated crops in sub-Saharan Africa

Hughes, J. d'A., Asiedu, R., Ayodele, M., Dixon, A.G.O and Tenkouano A.

## ABSTRACT

Cassava, yams, and plantain are three of the major staple carbohydrate crops in sub-Saharan Africa. All three crops are vegetatively propagated and, as such, risk carrying pathogens and pests from one generation to another and from area to area with movement of propagules or produce for consumption are high. Improvements through conventional breeding have produced higher yielding and disease-resistant varieties. Plantlets are currently produced in tissue culture to ensure that they are free of pests and diseases for international distribution. However, successful establishment in the field of the *in vitro* plantlets often results in considerable losses. At the International Institute of Tropical Agriculture (IITA) attempts are being made to develop protocols for the production of disease-free mini stakes, tubers and corms that will comply with recommendations of regional plant protection organisations while ensuring that the recipients can grow the plants successfully. It is well known that movement of vegetative material of these crops occurs regionally across permeable borders; however transfer of improved germplasm from International Centers must be done following rigorous procedures. The suggested procedure for cassava is to grow virus-tested *in vitro*-derived plantlets in a vector-free environment and in sterile soil; mini stakes can then be collected for distribution. Virus-tested yam plantlets can also be transferred under similar conditions and mini tubers harvested to be distributed internationally. Virus-tested plantain can also be multiplied in vector-proof environments in sterile growing medium and small suckers could be collected for distribution. These protocols would ensure greater establishment rates of the propagules in the receiving countries and thus, by removing some of the current constraints to moving improved germplasm of these crops internationally, contribute towards improved food security and poverty alleviation in sub-Saharan Africa (SSA).

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# Dissemination of improved potato cultivars in the Mount Elgon area of Uganda

W.W. Wagoire, J.J. Hakiza, B. Lemaga, I.N. Kashaija and R. Kakuhenzire

## ABSTRACT

Improved potato production technologies were evaluated on farmers' fields in the Mount Elgon area of ganda using participatory methods for three consecutive seasons during the period of 2001 to 2002. In the first season, 2001 A, a recommended potato production package that included an improved variety, planting on ridges, proper earthing, and control of pests using pesticides and fungicides and dehaulming at full maturity was compared to farmers' practice that was constituted by unimproved variety of poor quality seed and very wide uneven spacing and no fertilizer application on six farmers' fields. The mean yields of 20.0 t $ha^{-1}$ and 9.2 t $ha^{-1}$ for the "recommended practice" and "farmer practice" respectively were highly significantly ($P < 0.001$) different. During 2001B and 2002A the released varieties, NAKPOT 1, NAKPOT 3, SANGEMA, VICTORIA, KABALE and CRUZA, in addition to the promising cultivars 387121.4 and 388575.5 were evaluated in farmer managed trials at Wanale in Mbale district and, at Kere Agricultural Development Centre in Kapchorwa district. The experiment was replicated three times at each of the sites using a plot size of 4-rows of 4.5 m length, and 0.7 m apart and within row spacing of 0.3 m. A blanket application of NPK (17:17:17) fertilizer was given at planting at a rate of about 80 kg of N $ha^{-1}$ Analysis of variance for mean tuber weights showed significant differences between the genotypes at Wanale ($P>0.01$) and Kere ($P>0.05$) and also when combined across the sites ($P>0.001$). Despite these significant differences both within and across sites, the genotype 388575.5 gave the best yields at both sites. There was also a significant Location x Genotype interaction ($P>0.05$) for the mean tuber number. In Wanale 88% preferred white colored tubers compared to Kere where the majority preferred red/pink colored. These results point to the importance of multi-locational variety evaluation as well as farmers' participation in technology development.

# Minisett technique of seed yam production in Delta and Benue states of Nigeria: a function of input availability and production objective

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

ABSTRACT

This paper tries to assess the techniques of seed yam production as well as the determinants of the adoption of the minisett technique in Delta and Benue States of Nigeria. The paper is based on data generated in these areas as part of the 1FAD / WECARD / 11TA poverty alleviation and enhanced food availability studies. Representative farmers were interviewed using well-structured interview schedule data collected include seed yam production techniques, production input by type and quantity, production objectives, marketing and constraints. Data was analyzed using both descriptive statistics and probit models on factors affecting farmers' likelihood of adopting the unproved yam minisett technique of seed yam production. Results showed that producers who had separate plots for seed and ware yam had a higher likelihood of adopting minisett technique. Also producers for own ware yam production are more likely to adopt the minisett technique. Uses of labour and inorganic manure are positively related to the adoption of yam minisett technique.

# 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 sweetpotato planting material like in many crops is important in optimizing productivity. Two sets of experiments were conducted in Western Kenya between 1999 and 2004 to assess the yield loss associated with different sources of planting material and the degeneration over time of the tissue culture derived planting material. The first trial compared the performance of tissue culture (TC)-derived-planting material with cuttings taken from virus-infected plants, randomly taken cuttings and apparently healthy cuttings. The second trial assessed the degeneration rate of the TC-derived planting material of sweetpotato varieties Mugande, Kemb 10, KSP20 and Zapallo. The use of virus-infected and randomly selected cuttings resulted in 30 and 12% reduction in root yield, respectively. The tissue culture derived cuttings from the varieties Mugande and Kemb 10 were grown for five seasons without significant decline in yields. The performance of Zapallo declined by 46% in the second season due to higher susceptibility to virus diseases.

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# A rapid field immuno-chromatographic assay for certification of yam planting materials

Hughes, J. d'A, Eni, A.O and Rey, C.

## ABSTRACT

*Dioscorea* spp; yams of family *Dioscoreaceae*, are one of the major staple foods in the humid tropics, contributing more than 200 dietary calories per person each day for millions of people in Africa, where the 'yam belt' of West and Central Africa produces over 95% of the world's yams. Major constraints to yam production are availability of planting materials, pests (nematodes, beetles, termites, weevils and rodents) and diseases caused by fungi, bacteria and viruses. Yam viruses cause a reduction in tuber yield and quality and can prevent the international exchange of germplasm due to quarantine restrictions. As yams are generally cultivated through vegetative propagules (seed yam or planting sets), the use of virus-infected planting material affects future yield. Development of a certification method for the yam vegetative propagules would permit farmers and crop protection personnel to determine the health status (and concomitant implications on yield) of potential planting material. Management of yam virus diseases, which can be best implemented through the use of healthy, disease-resistant planting material, requires sensitive and specific virus diagnostics. The most useful diagnostics are those that indicate the presence or absence of a specific virus. Laboratory-based tests can give quantified information but are often laborious, require well trained staff and require specialized instrumentation that is dependent on services such as electricity, refrigeration and maintenance which may not always be available in developing countries. There is therefore a need for simple, rapid, robust, standardized and user-friendly diagnostic tools that could be used by research scientists, extension officers, seed yam producers, quarantine, officers or farmers. The immuno-chromatography assays are a logical extension of the technology used in the latex agglutination tests. The principle is to detect the target virus (es) using antibodies bound to a support phase such as dyed microspheres or colloidal gold which can then be detected visually. Although these immuno-chromatographic tests (lateral flow tests) have been used in developed countries, this is the first attempt to develop simple, disposable lateral-flow virus test kits foe detecting yam viruses in the field. It is hoped that these kits will be used both to improve the health of yam planting material available for purchase, through some form of certification (either formal or informal) and also to facilitate the safe international movement of germplasm.

# Managing stem cuttings of cassava for optimum yields

Akoroda M.O., Dixon A.G.O, Ilona P. Okechukwu R and Ogbe F.

## 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 endues, include: age of stems from which the cutting are taken (6-7 months), 20-30 mm 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. The tools used should give a sharp cut of stem with transverse surface rather than slanty cuts. All stem cuttings should be 25 cm 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. Planting 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 with 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 unsplit cuttings are to be planted within two days of severance from the main stem. Our experience is that few farms in common 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.

# Challenges in the provision of clean planting materials of root and tuber crops in sub-Saharan Africa

Berga Lemaga, J. Nsumba, C. Crissman, R. Kapinga and M. Potts

## ABSTRACT

Arable land in Sub-Saharan Africa is continuously declining due to increasing population pressure, worsening the already existing food shortage. This scenario has compelled the people in the region to resort more to tuber and root crops that produce more food per unit area and time. On the contrary, however, the availability of clean planting material of these vegetatively propagated crops ahs been and will be, at least in the near future, the single most important constraint to increase both area under these crops an their productivity. Provision of clean planting material is hampered by abiotic, biotic, social, economic and institutional factors. The most important abiotic factor in the region has been the recurring drought that has made it very difficult to maintain planting material *in situ* from one season to the other and storage is impossible because of the perishable nature of the planting material. Among the biotic factors: diseases caused by bacteria, fungi and viruses as well as insects and other pests are the most rampant. In SSA, all different the different diseases co-exist and this calls for finding a solution not only to one but to several concurrently. The fight against biotic and abiotic unfavorable conditions has been disadvantaged by the poor economic standards of the people and the increasing fragile environment in the region. These coupled with unfavorable policy towards tuber and root crops, poor institutional support to the sub-sectors, civil unrest and gender inequity have made provision of clean planting materials of these crops very difficult and far from satisfactory. Moreover, the traditional belief that root and tuber crops are mainly for household food security has encouraged farmers to give out planting material free of charge, causing the system to be of less commercial value. This paper discusses the different challenges faced in providing clean planting materials of tuber and root crops and proposes strategies for improvement.

## Posters

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# Identification and distribution of viruses infecting sweetpotato in Kenya

E.M. Ateka, R.W. Njeru, A.G. Kibaru, J.W. kimenju, E. Berg, R.W. Gibson, and H.J. Vetten

## ABSTRACT

Four hundred and forty-eight symptomatic and 638 asymptomatic samples were collected from sweetpotato fields throughout Kenya and analyzed serologically using antibodies to *Sweetpotato feathery mottle virus* (SPFMV), *Sweetpotato chlorotic stunt virus* (SPCSV), *Sweetpotato mild mottle virus* (SPMMV), *Cucumber mosaic virus* (CMV), *Sweetpotato chlorotic fleck virus* (SPMSV), *Sweetpotato latent virus* (SwPLV), *Sweetpotato caulimo-like virus* (SPCaLV), *Sweetpotato mild speckling virus* (SPMSV) and C-6virus in enzyme-linked immunosorbent assays (ELISA). Only SPFMV, SPMMV, SPCSV and SPCFV were detected. Ninety-two percent and 25% of the symptomatic and asymptomatic plants respectively tested positive for at least one of these viruses. Virus-infected plants were collected from 89% of the fields. SPFMV was the most common and the most widespread, detected in 74% of the symptomatic plants and 86% of fields surveyed. SPCSV was also very common, being detected in 38% of the symptomatic plants and in 50% of the fields surveyed. SPMMV and SPCFV were detected in only 11% and 3% of the symptomatic plant samples respectively. Eight different combinations of these four viruses were found in individual plants. The combination SPFMV and SPCSV was the most common, observed in 22% of symptomatic plants. Virus combinations were rare in the asymptomatic plants tested. Incidence of virus infection was highest (18%) in Kisii district of Nyanza province and lowest (1%) in Kilifi and Malindi districts of Coast province.

# Promoting participatory technology transfer of sweetpotato processing and utilization in Nigeria

Meludu, N.T

## ABSTRACT

Sweetpotato is a crop that is recently being promoted in Africa as complement or supplement to toasted cassava granules (*gari*). Initially Nigerians mostly consume sweetpotato by boiling and roasting. Awareness on different processing and utilization techniques had not been diffused to the farmers (root crop processors) and consumer. Adequate processing and utilisation of sweetpotato is important for sustainable food security. Interestingly there is increasing awareness on selection of sweetpotato clones derived from IITA, Ibadan, Nigeria resulting in cultivation of different varieties. Twelve varieties planted by University of Ibadan student were processed with no additives or chemical acids added and the level of acceptability was very high from the sensory evaluation conducted. Participatory methods of technology transfer of processing six sweetpotato varieties into roasted granules (SPARI) were demonstrated to the *gari* processors in Ajibode, Oyo State. The product was preferred to gari especially for drinking. One variety fried into chips was recorded to be more hunger quenching and more sustaining than plantain chips. This is will help to reduce the intake of gari which has a lot of cyanide acid. Also sweetpotato processing and utilization technology should be promoted for sustainability, food security and poverty alleviation.

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. All ridges were 0.9 m apart. There were no significant differences in sprouting rate among varieties or storage methods. However, sprouting rate was significantly affected by storage period with the 5-month period (July to December) giving significantly the least sprouting rate, suggesting that stems for planting should not be stored for more than 4 months before planting.

# 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 and thirteen 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 to weight, virus, number of plants harvested, plants with and without roasts, marketable and non-varieties 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, 2001/261 and 2001/264 varieties were selected as the best in Central zone of Tanzania in filed and when cooked. In Eastern zone, among thirteen (13) varieties planted, Ukerewe and Simama were selected in field and when cooked while 261 and W-151 varieties were among the best in filed. The same varieties were least ranked when cooked. Other varieties highly ranked when cooked were Jewel 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.

# Potential for, and constraints to large-Scale Cassava Farming in Nigeria

J.J Olobashola

## ABSTRACT

Small-scale farmers account for the bulk of cassava production in Nigeria, which has placed the country as the current world's leading producer. Average farm size, at the moment, ranges between 0.5 and 2.5 ha under a mixed cropping system. Productivity is still low, with an average yield of 9.5 t $ha^{-1}$, ranking the country $50^{th}$, amongst 102, on the world's chart for this measure of cassava productivity. The scale of production and level of mechanization are two major factors influencing profitability of cassava farming. In large-scale mechanized farming, production cost per unit of tubers could be as low as 30% of that of the small-scale low resource farmer. With more than 30 million hectares of total arable land. Nigeria has a huge potential for large-scale agricultural production, cassava farming inclusive. The dearth of appropriate machineries for the entire range of field production operations, scarcity of skilled manpower to establish and manage farms, using modern production technologies, are notable constraints. Others include limitations in options for utilisation of cassava that would transform the commodity into an industrial crop, and the poor states of infrastructure in the production zones that are principally in the rural areas. With the current increased drive for cassava production, targeting the export market, through the Government of Nigeria's Presidential initiative, there is need to address these issues in order to provide the necessary environment to promote and encourage large-scale mechanized cassava cultivation. Cassava cultivation would then become more profitable, attract more investments and the produce would become consistently available in desired quantities at affordable prices to make its products highly competitive in the world market.

# Participatory evaluation of sweetpotato germplasm in southwestern Kenya

Korir, P.K., Kwach J.K. and Dymphina A.

## ABSTRACT

The sweetpotato is not only the most widely grown tuber crop in S.W. Kenya but also an integral component in the diet of the local community. The major constraints facing sweetpotato production are pests and diseases (especially sweetpotato weevil and sweetpotato feathery mottle virus respectively). Currently grown varieties are low yielding (<6 t $ha^{-1}$) against a potential yields at least 15 t $ha^{-1}$ largely owing to their susceptibility to pests and diseases. A participatory germplasm evaluation was undertaken in an attempt to assess 5 new / improved vis-à-vis the local checks in three sites namely; Rangwe, Ndhiwa and Kabondo using two Farmer Fields Schools and two Farmer Research Groups. Preliminary results showed that two varieties (Kembl0 and SPK 004) were preferred across all the three sites, by, farmers, even though the two were not the highest yielding. The highest yielding varieties (white fleshed) were rejected by farmers because of poor skin and flesh colours besides culinary characteristics. The preference for orange fleshed was probably due to the taste and appearance which would be important attributes in home consumption and marketing.

# Increased potato production by community based organisations through bulking and use of clean planting material

Gitonga LN, Muchui MN, Kibaki JM, Njuguna LW, Kiuru PN, Ndungu BW and Githambiri CW

ABSTRACT

In Kenya, the potato sector has been adversely affected by inadequate use of improved varieties and high cost clean seed. This has resulted in low yields or no production at all. This has been due to lack of accessibility to the source of clean planting seed, lack of improved production methods and lack of credit to purchase the very expensive seed. Kenya Agricultural Research Institute (KARI) through the Agricultural Technology and Information response Initiative (ATIRI) provided a grant to a Kwaheriya Kuonana self help group in Central Kenya. Through the initiative farmers were able to source two varieties improved and released by KARI; Asante and Tigoni and multiply within regulations outlined by the Kenya Plant Inspectorate Service (KEPHIS) and distribute to group members and non members and hence became a source of the new varieties in the project area. This paper outlines the successful implementation strategies of this project.

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

Kossi Sedzro, Koumah 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.

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# Enhancing sweetpotato production and utilisation through processing among the rural families in Kiambu District in central Kenya

Gathaara, V.N., Gichuki, T.S., Priscillia, K. and Ngugi, N

ABSTRACT
Sweetpotato is one of the world's most important food crops and which performs well under wide climatic conditions. Sweetpotato is high in food value and in terms of calories a hectare of sweetpotato can feed twice as many persons as rice and five times as many as maize. In Kenya, utilisation of sweetpotato is limited to use of the tubers in the flesh form and feeding of the vines to the livestock. In the flesh form majority of the households either boil or roast the tubers. It is now becoming evident that inclusion of processing and market oriented development of agricultural sector is needed if farmers were to reap full benefits from the sweetpotato. What today is an element of household food preparation may tomorrow be an interesting processing for entrepreneurship. Market orientation and diversification in agriculture combined with processing and marketing can considerably contribute to reduction of food losses, improvement in food and nutrition, income generation at household level and over all stimulation of agricultural production, which remains the backbone of Kenyan economy. Development in root and tuber processing technologies arises from the need to diversify on the utilisation of sweetpotato at the household level to address the food and nutrition security and poverty alleviation. A total of 49 farmers (27 male and 22 female) have been trained on processing and utilisation of orange-flesh sweetpotato. Fourteen orange-fleshed sweetpotato products were developed, evaluated and ranked though the Farmer Field School. The FFS was involved in hands-on product development while evaluation of the products was based on taste, color, palatability and general acceptability and ranking was based on the product's use(s) as either for subsistence, income generation or both.

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# Evaluation of four botanical extracts and three types of storage bags for yam chip storage

S.C. Eze, J.E. Asiegbu, B.N. Mbah, R. Asiedu, and G.C. Orkwor

## ABSTRACT

A study was conducted to evaluate the effects of four botanical extracts, no-extract control, and three types of storage bags as alternative options to the use of chemical insecticides and farmers' jute bag, for storage of dried yam chips. The chips were obtained from commercial processors in Shaki area of Oyo State, Nigeria. The botanical extracts were prepared from *Azadirachtha indica* (leaf), *Xylopia aethiopica* (pod), *Ocimum gratissimum* (leaf) and *Zingiber officinale* (stem tuber). The storage bags were 0.5 mm gauge polythene bags, 0.05 mm polythene-lined jute bags, and jute bags used by farmers. The storage experiment was conducted in a research laboratory at the University of Nigeria, Nsukka. After three months of storage, weight loss of chips treated with A. *indica*, 0. *gratissimum,* or Z. *officinale* was low at 1- 2% compared with 13% where no botanical was applied. At three or six months of storage, insect damage was always important, but was significantly less on chips treated with botanicals. The type of storage bag did not significantly improve the various criteria measured at either 3 or 6 months. However chips stored in polythene bags always appeared to suffer lower insect damage and were higher in chip quality assessment score. Treatment with A. *indica* followed by 0. *gratissimum* always gave higher chip quality score. Correlation analysis revealed that chip weight loss was higher and positively related with insect damage (r = 0.92) and highly but negatively related with quality assessment (r = 0.89). Insect damage was also highly negatively related with chip quality score at the end of storage.

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# Consumption pattern and cyanide estimation of fermented cassava product (AKPU) among university students in Owerri southeast Nigeria

Offor, E.A and Ogbonna J.O

ABSTRACT
Factors affecting consumption behavior of University Students towards fermented cassava product (akpu) and residual cyanide levels as consumed were investigated with the use of questionnaires and duplicate samples for chemical analyses. A sample size of 220 students was randomly selected from among a population consuming akpu at four designated eating points in Imo State University during lunch hours Results shows that 77% eat akpu regularly of which 69% and 9% take it once and twice daily respectively while 23% do not consume the cassava product at all. Reasons for liking akpu included durability (32%, culture (21%) and good taste (14%). The preferred traditional sauce (soup) that is taken with it was Ofe Owerri (27%) vegetable (19%) and melon soup (18%). Common complaints that affect consumption included fatigue (26%) stomach upset (20%) and offensive odour (19%). Only 13% found akpu completely acceptable. Proximate and cyanide level were found to be 24% and 0.2% for moisture and ash but 24%mg HCN eq/ kg for cyanide. Body man index analyses indicated the presence of undernutrition (5.5%) and overnutrition (17%). The study reveals a need for an akpu improvement research to minimize cyanide toxicity and other objectionable features to ensure widespread acceptability among youths and university students to take advantage of its rich energy source. A rigorous \risk assessment data on the health implication of variable continuous intake is presently of outmost importance to our knowledge of akpu and cassava product.



# Increased cash and food security through improved storage methods for fresh sweetpotato in south west Kenya

Kidula N.L., Miruka M., Okoko E.N.K and Koriri P.K

ABSTRACT
Sweetpotato storage methods were evaluated with six women group in Kabondo, South west Kenya. The treatments were underground storage with straw, underground storage with ash, and in-ground storage [farmers practice]. Harvested roots of sweetpotato variety 'Kalamb nyerere' were cured and stored under treatments. The roots were sampled every two weeks for a period of four months and analyzed for changes in cooking and eating quality, incidences of rooting and pest attack. Farmers indicated a preference for underground storage with ash as well as straw. They explained that taste was not lost with these two types of storage. In-ground and mound storage increased in fibre content with time and became tasteless.



# Pasting characteristics of starches and flour of some cassava (*Manihot esculenta*) genotypes with reference to their uses in food formulations

P.N.T. Johnson, E. Sakyi-Dawson, G.A. Mensa, K. Asante, C. Oduro-Yeboah, J.A. Lamptey and A. Nyarko

ABSTRACT
The Brabender pasting characteristics of flour and starch from 16 cassava (*Manihot esculenta*) genotypes were studied. Pre-treatments used in the cassava flour production were blanching and partial fermentation. Peak viscosities, setback and final viscosities differed significantly. The potential uses of the different starches and flour, from the sixteen cassava genotypes, in the formulation of specific tropical foods have been discussed.

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# Adding value to the cassava commodity chain in Nigeria: A breeders perspective

Ilona P.C., Dixon, A.G.O and C.I Ezedinma

## ABSTRACT

A value chain analysis for *gari*, the most popular food from cassava in Nigeria, was carried out. The gross margins (income above variable cost) of one ton of fresh cassava roots, to a farmer, gari processor, and food vendor were calculated. The results of the study showed the current challenges to breeders from the perspective of the value chain realities. Income to the farmer increased as root yield increased, and as root rot and weeding frequency decreased. Income to the processor increased as root dry matter, beta-carotene content increased; and as root fibre content, peeling losses and peeling time decreased. Further discussions on ways of reducing variable costs for higher profits *in gari* production are presented. The paper concludes that in order to create and sustain superior performance in the cassava industry there must be efficiency at each level of the value chain.

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# Acceptability and Nutritional value of soyayam flour/cowpeayam flour as a probable diet for diabetes patients

Olayiwola, I.O and Oladejo, A.O

ABSTRACT

Yam flour prepared from D. Rotunda by peeling, parboiling subsequently sun drying and milling was fortified by Soya flour and cowpea flour at 10%, 15 and 20% level of fortification to prepare composite yam flour. The whole yam flour was used as control. The flour samples were subjected to proximate analysis, sensory evaluation among 40 panels of diabetic patient and statistical analysis. The result shows that blend from 20: 80 fortification of yam flour with Soya flour was most acceptable from the sensory evaluation. Also there was increase in protein (15.75g% ± l), fat(4.58%),and fiber (1.5g%) content at this level, while there was a significant decrease of total sugar, carbohydrates, moisture and bulk density at 20:80 fortification. Based on the decrease in total sugar and carbohydrates the product is recommended for diabetic patient in Nigeria and also its high nutritional value has a commercial potential as it can be taken by non-diabetic people.

*Pages 77-78*

# Nutritional status and micronutrient deficiencies in children under-5 in Nigeria: Results of the Nigeria food consumption and nutrition survey in 2001-2003

B. Maziya-Dixon, I.O. Akinyele, E.B. Oguntona, S. Nokoe, and E. Harris

# ABSTRACT

Undernutrition, micronutrient deficiency, or generalized, protein-energy undernutrition, (PEM) directly impacts a country's productivity, growth, work force, cognitive development of children, and the overall health status of the population, including the incidence of H1V/AIDS. Undernutrition over a period of years among children leads to stunting and reduced anthropometric measurements, including height-for-age and weight-for-height. Micronutrient deficiencies have a significant impact on human health and on the economic development of communities and nations. Major deficiencies of global public health significance are vitamin A, iron, zinc, and iodine. The deficiencies of these micronutrients cause stunting, anemia, weak immune system, reduced work capacity, learning disabilities, and premature death. The International Institute of Tropical Agriculture (IITA), in collaboration with the Federal Government of Nigeria (FGN), the United States Department of Agriculture (USDA), and various universities and institutions in the country conducted a nationwide food consumption and nutrition survey. The objectives of the survey were to determine the nutritional status and micronutrients deficiency (vitamin A, iron, and zinc) of children under-5 among others. A total of 12 States, 72 Local Government Areas, and 216 Enumeration Areas, 6480 households with a mother and child pair were covered during the survey. Biological (blood and urine) were collected for the determination of serum vitamin A, iron, and zinc levels. The data showed that 42% of these children were stunted, 25% were underweight, and 9% were wasted. Out of the 42% that were stunted, 25% were classified as severe. Additionally, of the 25% classified as underweight, 8% were severe while more than double (17.1%) were moderately underweight. Results indicate that nationwide 29.5% of children under-5 was vitamin A deficient. The level of vitamin A deficiency was high at 31.3% in the dry savanna, 24.0% in the moist savanna, and 29.9% in the humid forest. The distribution of vitamin A deficient children under-5 was 25.6% in the rural, 32.6% in the medium, and 25.9% in the urban sectors. At the national level, approximately 36.3% of children under-5 was at different stages of iron deficiency, with 13.4% already having depleted iron stores (serum ferritin value of less than 20 ng/ml) and 22.3% having serum ferritin concentrations less than 10 ng/ml, suggestive of iron deficiency. Iron deficiency (serum ferritin concentration < 10 ng/ml) was highest in the urban areas (27.8%) followed by the medium (23.0%) and rural (18.7%) areas. For zinc, 20% of children under-5 are zinc deficient nationally. Zinc deficiency was highest in the moist savanna zone (36.5%), intermediate in the dry savanna (26.0%), and lowest in the humid forest (6.3%). The prevalence of zinc deficiency was higher (26.0%) in the rural sector than in either of the other two sectors (17%). In conclusion, both malnutrition and micronutrient deficiencies are a public health problem in Nigeria. While the proportion of

children suffering from malnutrition and micronutrient deficiencies varies agro-ecologically and across sectors, it is a significant public health problem in all agroecological zones and sectors.

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# Brazillian lessons for the cassava industry in Nigeria

M.T.O. Patino and A.G.O. Dixon

## ABSTRACT

The introduction of high yielding varieties and the adoption of several technologies and practices determine the world leadership position for the Nigerian cassava production. This paper shows some characteristics of the cassava starch sector in Brazil that can be used in designing appropriate strategies for the cassava starch industries in Nigeria. Cassava crop occupies the seventh position in the cultivated areas of Brazil, the ninth in production value and the second in volume, behind sugar cane production. Brazil used to be cassava's most important producer but now the production is highly concentrated at the fresh and the industrial markets. Cassava starch prices in Brazil remain competitive and the largest companies are trying to stabilize production and guarantee a minimum price to the farmer in order to stimulate cassava production. These companies also regulate supply with their own production of cassava. In general, the competitive advantage of the Brazilian cassava starch industry is based on its high cassava productivity and the starch content of the roots.

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# Preliminary survey of entomopathogenic fungi associated with the African root and tuber scale *Stictococcus vayssierei* Richard (Hemiptera: Stictococcidae)

L. Wijnans, Maurice Tindo, and R. Hanna

ABSTRACT

*Stictococcus vayssierei* Richard is a subterranean scale insect indigenous to the Congo Basin, where it is considered a major constraint to cassava production. A preliminary survey was undertaken in Cameroon to identify entomopathogenic fungi infecting S. *vayssierei*. 1230 adult scales were collected from 46 locations across Cameroon. Collections were made during a 3-months period at the end of the dry season and the beginning of the wet season (February 2004 - April 2004). *Metarhizium anisopliae* (Metschnikoff). Sorokin and *Metarhizium* sp. were isolated from three locations; overall infection levels were lower than 1%. In one of these locations collections were repeated early wet season. Infections levels had risen to 23.5%. More studies are clearly necessary to understand the importance of these fungi in the natural control of the scale and the role that environmental factors play in their persistence.

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# Millipedes - a new threat to root and tuber crops production in Nigeria

U.E. Inyang

## ABSTRACT

Millipedes are not commonly listed amongst the constraints to root and tuber crops production. However, in recent years, reports show that this diplopod has evolved into a major pest of these crops in Nigeria. Field surveys were undertaken in millipede outbreak areas of South Eastern Nigeria and laboratory studies conducted to determine the pest characteristics of millipedes as they affect root and tuber crops. Results showed that all root and tuber crops are hosts to millipedes. The most vulnerable stages of the crops to damage were the planting and maturity stages. The population trend of millipedes showed that peak field population synchronized with presence of the vulnerable stages of the crops to damage. They caused primary damage by biting and chewing the epidermal layers of host tissues. For cassava, they showed preference to the sweet varieties and the bud points. They characteristically bore holes proportional to their body width in roots and tubers and predispose them to secondary rot organisms. Under high infestation, millipedes inflict aggressive damage at night and recede to hideous locations at day. Two months' delay in harvesting resulted in 100% damage of every root and tuber crop on an infested field. Under outbreak condition, every root and tuber crop component of the mixed cropping was completely devastated. Estimated numbers of the most prevalent species in the study area, *Spirostreptus assiniensis* Attems was 120,000 $ha^{-1}$ and result of laboratory tests suggest that these numbers can devastate 6 ha of planted cassava cuttings within 24 h.



# Distribution of bacterial blight and fungal diseases of cassava in Nigeria

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

## ABSTRACT

Two hundred and seventy seven cassava fields were surveyed 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 for the identification of associated pathogens. CBB was observed in 32.53% of the fields in the humid forest, 66.43% of the fields in derived savanna zone, and 95.45% of the fields in southern Guinea savanna, 90% of fields in northern Guinea savanna, and 94.12% of fields in the Sudan savanna zone. CAD was observed in the humid forest and derived savanna zones but not in any of the other ecological zones, CLB and BLS were observed in all the ecological zones, however the severity of both diseases was generally low and 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*, *Trichoderma* spp, and B. *theobromae* which was the 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% of cuttings from farmers' fields were infected with cassava mosaic disease (CMD). There is a need for multiplication and cutting sanitation program from which clean improved planting materials could be supplied to farmers.

*Pages 80-81*

# Effectiveness of different artificial virus transmission techniques in screening cassava for resistance to cassava mosaic disease

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

## ABSTRACT

Production of cassava (*Manihot esculenta* Crantz) in Africa is usually limited by cassava mosaic disease (CMD), caused by several whitefly-transmitted begomoviruses. Advancement in cassava breeding for virus resistance is hampered, because screening for resistance to CMD is tedious, relying on natural infection conditions and on virus types at a given time and location. Therefore, developing an efficient inoculation technique with defined viruses at an early stage in breeding for resistance would provide a major improvement in resistance breeding. All major begomoviruses in African cassava genotypes were collected, typed by sequence analysis and maintained as reference in cassava cultivars. For inoculation of begomoviruses into cassava, a graft inoculation approach and biolistic inoculation of DNA extracts from virus infected plants or constructs of partial multimers of DNA A and DNA B components of several begomoviruses were developed. Graft inoculation technique was only effective in inducing cassava with defined viruses at a later date and the mosaic symptoms been elicited 3 weeks post inoculation, in plants with successful graft union. Although, 100 percent of the treated plants survived after biolistic inoculation experiments, the delivery of cloned viral DNA was not sufficiently effective to reach higher number of infected cassava plants compared to the delivery of DNA extracts from plants with defined virus infection. Occurrence of infection symptoms was earliest in cassava plants biolistically inoculated with DNA extracts (10 days post inoculation) and much more delayed with inoculation of infectious virus clones. Leaf samples from new flushes of grafted cassava lines and two to four leaves following the bombarded ones tested positive for virus infections in PCR and EL1SA. However, EL1SA revealed remarkable variation in virus concentration among cassava breeding lines. The effectiveness of biolistic inoculation of DNA extracts over other virus transmission techniques in screening cassava genotypes is discussed.

# Evaluation de la mosaique Africaine du manioc en Guinee

Bah E.S., A.G.O. Dixon, P.Ilona

ABSTRACT

This study was carried out at three agroecological zones over the country representing low, mid and high altitude in September 2003. Cassava fields from 1 month to 6 months after planting were evaluated after each 30 km along the main roads. 30 plants were aleatory evaluated along the two diagonals in each field. Data collected were geographical coordinates, region, site, date, size of next plot, village, mixed crops, variety (local or improved), age, mosaic severity, cutting infection, white fly infection, total infection. Data collected were subjected to statistical analysis using the general linear model (GLM) procedure of the SAS institute (SAS, 1996). The results showed improved varieties represent 12% of total fields surveyed, white fly infection represent 16.4%, cuttings infection represent 35.6%, incidence of mosaic was estimated at 52.4%, and severity of mosaic was 2.8. These results showed clearly that Cassava Mosaic Disease can be controlled by sanitation and using clean planting material with out any symptom of cassava mosaic disease in Guinea.



# Screening for resistance to *Scutellonema bradys* in *Dioscorea* species

B. Bamkefa, R. Asiedu and B. Fawole

# ABSTRACT

Yams (*Dioscorea* spp.) are traditional food crops of great antiquity in cultivation, grown in many parts of the tropics and some parts of the sub-tropics. The yam nematode, *Scutellonema bradys* is one of the most difficult pest problems encountered in the production of yams. The primary importance of S. *bradys* is the direct damage it causes to the tubers in storage that leads to dry rots. To identify sources of host plant resistance to this pest, 133 varieties of D. *rotundata*, 22 of D. *alata* and two of D. *dumetorum* were screened in 2001 and 2002. The experiment was planted in an augmented design in the field with six susceptible varieties as checks. The yam varieties were inoculated with approximately 10,000 individuals per stand using yam peels infested with S. *bradys*. The varieties were harvested six months after planting. The tubers were assessed for S. *bradys* damage at harvest and three months after harvest (3MAH), using a scale of 1-5 (where 1 represents < 5% damage and 5 >75%). S. *bradys* populations in the tubers were also counted at those times. At harvest, tubers from 75.2% of the D. *rotundata* varieties had the lowest damage score of 2.0. S. *bradys* population ranged from 89 to 867 individuals/100 g peel weight and the reproductive index from 0.9 to 8.7. At 3MAH tubers from 25.4% of the varieties scored 2.0 to 2.9 while 73.5% scored 3.0 to 3.9. The S. *bradys* population ranged from 386 to 2400 individuals/ 100 g peel weight and the reproductive index from 1.0 to 7.0. For D. *alata* the tubers from 81.8% of the varieties had the lowest damage score of 2.0 at harvest. The S. *bradys* population ranged from 161 to 849 individuals/100 g peel and a reproductive index from 1.6 to 8.5. At 3MAH tubers from 86.4% of the varieties scored 3.0 to 3.7, 9.1 % scored 27 to 2.9 while the rest scored 4.0 to 4.7. The S. *bradys* population ranged from 537 to 2307 individuals/per 100g peels weight and the reproductive index ranged from 1.5 to 6.6, Tubers from the two varieties of D. *dumetorum* did not show any damage symptoms and no S. *bradys* individuals were isolated from them. The increase in S. *bradys* populations and damage score in tubers of D. *rotundata* and D. *alata* confirm the rapid multiplication of the nematode and the attendant increase in losses during storage. While the two varieties of D. *dumetorum* showed high levels of resistance to S. *bradys* all varieties of the relatively more important D. *rotundata* and D. *alata* were shown to be susceptible to the nematode. There is need to continue the search for host plant resistance to S. *bradys* in these species.

# Cataloguing predators of *Bemisia tabaci* on a cassava mosaic disease resistant 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 Nase 4. Starting at three months after planting (MAP), ten plants were randomly selected weekly and each plant was observed from the top to the bottom, including all leaves, petioles and stems. All known B. *tabaci* predators were counted on each sampled plant over a period of six months. Five predatory groups were identified. These included: coccinellid adults and larvae, spiders, ants and syrphid larvae. 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 coccinellid larvae at 8 MAP. Ants and spiders were the most abundant predator groups considering the whole period of study. There was a general decline in predator numbers at 7 MAP. This was attributed to a hailstorm that resulted in the loss of more than half of all leaves. The general increase in predator numbers that occurred at 8 MAP was associated with an increase in B. *tabaci* numbers, which followed the emergence of fresh new leaves. 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 predator for conservation and or manipulation for biological control.

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

Beatrice Pallangyo, R. Hanna, D. Gnanvossou, E. Nsani and O. Mugale

## ABSTRACT

Two surveys were conducted during May and June 2003, June and July 2004 to assess the incidence and severity of cassava pests in Tanzania. The surveys covered four agro ecological zones, including the Lake (Mara, Mwanza and Kagera regions). Western (Kigoma and Shinyanga areas), Southern Highlands (Mbeya and Ruvuma regions) and Eastern (Tanga and central and southern coast regions) zones. A total of 193 and 94 fields were surveyed in 2003 and 2004 respectively. Six arthropod pest species (mites and insects) were recorded, including cassava green mite *Mononychellus tanajoa* (Bondar), cassava mealybug *Phenacoccus manihoti* (Matile-Ferrero), spiralling whitefly *Aleurodicus dispersus* (Russels), the whitefly *Bemisia tabaci* (Gennadius), the white scale *Anidiomyticus albus* (Ckll), the red spider mite, and several species of termites. The elegant grasshopper *Zonocerus elegans* (Thunberg) was not found in any of the surveyed fields. Low infestations of cassava green mite were found in all regions except in the lake zone (Mwanza region), where high infestations (> 100 mites/leaf) were recorded. The exotic predatory mite *Typhlodromallus aripo* DeLeon was found in all regions, with the highest infestations (>80%) occurring in the Eastern zone (central and southern coast regions) and the lowest (<18%) occurring in the Lake zone (Mwanza region). Low to moderate infestations (9-72%) of cassava mealybug were recorded in the Lake (Mara, Kagera and Mwanza regions). Western (Kigoma region), and Eastern (coast region) zones. High infestations (80-100%) of spiraling whitefly, a first record (found only in 2004) of this species on mainland Tanzania, were recorded in the Eastern zone (Tanga and central and southern coast regions). *Bemicia tabaci* (probably in mixed infestations with *Bemicia* afer) were found in all regions, with the highest infestation occurring in the Lake and Western (Kigoma) zones. Low termites infestations were found in all regions, while white scale and red spider mites were found only in few fields in the Lake (Mara area) and Eastern (Tanga area) zones. The results of the two surveys are used to highlight regions where interventions are needed to address continuing and emerging important biotic constraints of cassava and the recent invasion by the spiraling whitefly.

# Farmers' participatory perspectives on sweetpotato cultivars in Kathiani Division of Machakos District, Kenya

Githunguri, C.M

## ABSTRACT

Sweetpotato is an important dual-purpose crop in Kenya. Various communities in Kenya consume sweetpotato roots in various forms while the foliage is usually fed to livestock. The importance of sweetpotato is now recognized in Kenya and the Kenya Agricultural Research Institute is placing increasing importance on research and development of this crop. Seven Katumani developed elite sweetpotato clones were planted in Kathiani division of Machakos district of Kenya. The farmers evaluated the clones based on foliage coverage, resistance to diseases and pests, drought tolerance, maturity period, shape and size of roots, appearance of root skin and flesh, and general crop appreciation. The clones were subjected to a subjective ranking score. Female farmers in the Kisambalau Women Group gave clones Bikiramaria, Cemsa 228 and Mugamba the highest-ranking when evaluated in the field while Kanziga 1-1 was ranked lowest. They then ranked Kanziga 1-1 among the best cultivars when cooked. Male farmers also rated Kanziga 1-1 low in the field but when cooked the rating changed to one of the highest ranked clones. Female farmers in the Itui Sya Mutavi Women Group, ranked Tororo and Kanziga 2-1 highest when evaluated in the field. However, when cooked, Kanziga 1-1 was ranked highest. Similarly, the male farmers ranked clones Tororo and Kanziga 2-1 highest when evaluated in the field. When cooked, clone Kanziga 1-1 had the highest score. All the clones were rated from good to very good across the two sites. These results suggest that both female and male farmers ranked sweetpotatoes differently, implying different selection criteria. Ranking in the field of some of the clones, especially Kanziga 1-1, changed drastically on being cooked. Therefore, final recommendations should be based both on the sweetpotato crop in the field and its cooked potatoes

# Screening cassava varieties for drought tolerance

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

## ABSTRACT

The Southern African countries, and particularly Malawi, are a drought prone region. With the recurrent droughts experienced for the past decades, coupled with recurrence of El Nino effects, it is imperative that drought tolerant crops such as cassava be promoted as a mitigation strategy. Although cassava (*Manihot esculenta* Crantz) is dubbed as a drought tolerant crop, varieties respond differently to soil moisture stress. Of late several high yielding, disease and pest tolerant varieties have been released in Malawi but have not been evaluated for drought tolerance, which has of late been a problem in the country. Therefore a study was conducted to screen cassava varieties for their resistance to drought. Stress induction at 7, 11 and 15 weeks after planting was imposed on cassava genotypes Gomani, Mbundumali, Sauti (CH92/077), Mkondezi (MK91/274), Ba95/070, TME 1 and MK95/054 in a split-plot design in Complete Randomized Blocks, with three replications. Plots consisted of three plants (one per pot) in 14 inch-diameter flower pots. Plants were watered once a week with 1 liter of water per pot up to the time of drought induction when watering was stopped. Results indicate that there were varietal differences in response to drought with TME 1 being the most tolerant and BA95/070, Mbundumali and Gomani being the most sensitive to water stress, in that order. It is therefore important to use varieties that are tolerant to water stress where rainfall is a problem like in the Shire Valley and some parts of the Lakeshore areas of Malawi.

# Water yam (*Dioscorea alata*), a neglected crop with high potential in West Africa

C.C. Okonkwo, M.O. Adeniji and R. Asiedu

ABSTRACT

Water yam production in West Africa has been on the increase in last three decades. Nevertheless, the crop's potential has yet to be fully realised as it suffers great neglect in terms or research and development. This paper analyses the potential of water yams with respect to propagation, yield, chemical composition and utilisation for food. The crucial roles of the crop during the 'hunger periods' of the year, and the present problems of the crop are also highlighted. Past trends and future prospects for water yam in African food systems are discussed by presenting a synthesis of secondary data, a review of the available literature and results of unpublished participatory research reports. Major emphasis is given to overcoming limitations in organoleptic qualities and other constraints to processing and utilizations as they, along with the availability of appropriate germplasm, will influence the possibility of future increases in water yam production and utilisation in the sub-region.

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# Estimating the forage yield of 43 cassava mosaic disease resistant genotypes under three agroecologies of Nigeria

Aribisala, O.S., M.O. Akoroda, A.G.O. Dixon, R.U. Okechukwu and P. Ilona

ABSTRACT

Cassava provides food to man and feed for animals. Several reports are available on cassava root yield but scanty data exist on its forage yield in Nigeria, A multilocational trial was conducted at three locations viz: Warri (southeast) Mokwa (north central) and Ilorin (southwest) to estimate the forage (leaf, petiole, green stems and stump) yields of 43 cassava clones at 12 months after planting (MAP). Dry forage yields ranged from 0.4 (cassava clone 99/2123) to 17.8 t ha $85^{-1}$ (99/6012) at Warri; 1.78 (M98/0028) to 590 t $ha^{-1}$ (82/00058) in Mokwa and 0.11(97/4779) to 3.31 t $ha^{-1}$ (99/6012) at Ilorin for all four with added fertiliser (N.P.K 300kg $ha^{-1}$, 3MAP). Percent improvement of CMD genotypes over the three widely cultivated genotypes used as checks was low (31.1%; 30.7%) for cassava clones 96/0603 and 96/1565 respectively; moderate (55.8%) for 98/0581 and high (115.6%) in 99/6012. Preliminary report showed that genotype 99/6012 appeared promising and could be recommended for good forage yield, however, the trial would be repeated next season to confirm the outstanding performance.



# Use of improved cropping systems and AM fungi to increase yam productivity in degraded soil of derived savanna zone in western Nigeria

Oyetunji, O.J, Osonubi, O, Ekanayake, I.J.

ABSTRACT
Humid and sub-humid tropical soils are degraded and characterized by low nutrient availability. In a tungya agroforestry system, the application of chemical and mulching and legume intercropping were investigated in order to improve the tuber yield of both breeder selected cultivars and unselected landraces of *Dioscorea rotundata* Poir, D. *alata* and D. *cayensis* in a derived savanna zone. Gliricidia septum trees were used as live stakes and its leaves served as manure, the yams were either inoculated (M+) or not (M-) with either Glomus mosseae, G. clarum, G. etunicatum or G. fasculatum. NPK fertilizer and zero fertiliser applications were factors investigated. The results showed that mycorrhizal inoculated yams yielded high than both manured and fertilized yams, though they enhanced more tuber yields above the yams without any soil amendments. Combined AM and fertiliser applications proved to the best soil amendment for enhancement of yam yields followed by AM+manure application, the results of manure and fertiliser applications were always similar. The yields under the legume intercrops were always higher than the other soil amendments. Among the foru AM fungi strains used, G. clarum and G. etunicatum appeared to be the best, though in some cases these AM fungi semeed to be host specific in confining enhancement of tuber yield. Our trials showed that yam cultivation can be made profitable leading to increase in income of the resource-poor farmers.



# Genetic diversity and productivity of cassava screened for adaptability in an inland valley swamp ecology in Sierra Leone

F.B. Massaquoi, M.A. Carankay and A. Jalloh

ABSTRACT
Cassava is a major food security crop in sub-Saharan Africa with an expanding production. Even though cassava is well known for its appreciable productivity in infertile soils, the declining soil fertility on the uplands in the region is limiting the production of this crop. The Inland Valley Swamps (IVS) that are relatively more fertile than the uplands as a result of erosion of the adjacent uplands are increasingly being used to grow cassava during the dry season to produce fresh leaves that cannot be obtained from the uplands due to water stress. However, the major constraint faced by cassava growers in this ecology is the flooding of the valleys during the rainy season that leads to leaf fall and rotting of the tuberous roots. There is therefore need to identify varieties that will bulk faster and produce more leaves during the short growing season and could tolerate the adverse waterlogging conditions. Therefore, 17 cassava clones in the advanced stages of evaluation on the upland in the breeding programme of the Institute of Agricultural Research were evaluated for adaptability in the IVS. Large genotypic variation was observed among the genotypes for all the traits assessed. The results suggest that, root number, rooting pattern and rapid bulking are essential for obtaining high root yield during the short period available for the growth of cassava in the IVS. Scatter diagram and principal component scores of the 17 genotypes for the first two principal components scores which together accounted for over 80% of the total variation of all the traits grouped the genotypes into 5 distinct groups of clusters. TME 1 produced the highest tuberous root yield (8,3 t $ha^{-1}$) at 4 months after planting while about 60% of the genotypes produced more than 5 t $ha^{-1}$. Genotype 97/4472 was identified as the most tolerant to flooding due to less rotting of the roots. Some of these genotypes show appreciable adaptability to IVS conditions and hold promise for increased production of cassava.

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# Yield of marketable and Non Marketable Roots of Cassava in Semi-Arid Eastern Kenya

Githunguri, C.M

ABSTRACT

Cassava can adapt to diverse climatic conditions, survive long dry spells, and can be harvested and stored on a flexible time schedule, all of which qualifies it as a food security crop. There is critical need to sensitize people, especially in the semi-arid eastern Kenya, on the enormous potential of cassava as a cheap source of carbohydrates, proteins and cash income. Forty cassava clones were planted at Karumani in the preliminary yield trial at the onset of the short rains in November 2002. During the same season and site, 12 elite cassava clones were planted in a uniform yield trial. Both trials were harvested in November 2003. Data on yield, number of marketable and non-marketable tuberous roots was collected and analyzed. Mean yield of all the clones in the preliminary yield trial was 19.3 t $ha^{-1}$. Clones 01/0234, 01/0289, 01/0355, had significantly higher root yield than clone 01/0212. It was noted in the uniform yield trial that clones 990175, KME1, Muel, 990067, 990127, 990183, 990054, Mutisya, 990084 significantly out-yielded clones 990130, 990086 and 990056, Clones 990175, KME1, Muel, 990127 had significantly higher marketable weight than the other clones. Clones 990067,990175, KME1 and Muel had significantly higher marketable roots than the other clones. It seems clones 990175, KME1, Muel, 990067 and 99012" performed very well. KARI Katumani root and tuber crops programme seems to have produced four clones, 990175, Muel, 990067 and 990127 that were performing equally as well as KME1, the local check, giving farmers more choice. Clones with the highest number of roots per plant seem to have the highest yield suggesting a positive relationship between the two parameters. The highest yielding clones also seem to have the highest number of marketable roots per plant.



# Participatory on-farm evaluation of sweetpotatoes in south west Kenya

J.G. Gethi, Charity K. Mutegi, Elizabeth N. Wambugu, Dau Mwakina and Peter N. Ndetei

ABSTRACT
Majority of farmers in southwest Kenya are resource-poor farmers. These farmers experience food shortage 3-4 months every year. In addition the vulnerable groups in the community (pregnant and lactating mothers and children 2-4 years) lack vitamin A which can lead to blindness. Sweetpotato is one of the major food security crops which could reduce food shortage when sorghum and maize are in short supply. However, sweetpotato production is low whereby farmers obtain 2-5 t $ha^{-1}$compared to research yield of more than 10 t $ha^{-1}$. The low sweetpotato yield are attributed to several constraints such as planting of late maturing local varieties, high incidence of sweetpotato weevil attack, heavy erratic rainfall followed by prolonged drought, negative attitude towards sweetpotato (women's crop), limited utilisation of tubers (boiling). Therefore on-farm trials were initiated using farmer participatory approach (FPR) and farmer field schools. The objectives of the study were to introduce and evaluate orange-fleshed pro vit A sweetpotato varieties to scale up adaptable and farmer acceptable varieties to more farmers in the region. The varieties evaluated included, kemb 10 kemb 23, SPK 004, SPK 013 and farmer variety '*Nyathin Odieyo*. Results obtained from this study indicate that kemb 10 and SPK 004 gives significantly higher yields (8-15 t $ha^{-1}$) than other varieties. Farmers also ranked these varieties high because they are early maturing, not watery, have a good taste and are liked by children. Use of participatory approaches of FPR and FFS also has increased the demand for this technology because farmers are actively involved in all stages of technology development and dissemination. Currently sweetpotatoes production has changed from being a woman's crop to a commercial crop for generating income at household level. Increased production has led to low local market prices therefore farmers should form marketing association, and also set up cottage industries to process sweetpotato products that will generate more income at household level.



# Participatory on-farm testing of cassava clones in coastal lowlands of Kenya

J.G. Gethi, Charity K. Mutegi, Elizabeth N. Wambugu, Dau Mwakina and Peter N. Ndetei

## 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 at the coastal lowlands has been ravaged by Cassava Mosaic Disease, (CMD), Cassava Brown Streak Disease (C BSD) and pests such as Cassava Green Mite (CGM) and Cassava Mealy Bugs (CMB). The most popular variety Kibandameno is sensitive to all these biotic stresses resulting in very low yields. A breeding program initiated in the mid 1990s 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 with superior characteristics were identified. These clones were planted on farm to test their performance under different environments and test their acceptability by the farmers. 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 $ha^{-1}$ for clone 97/119 at Kinango to as high as 63 t $ha^{-1}$ for clone 1280 at Malindi. Sensory evaluation by farmers conducted at harvest time identified clones 2021,98/517,2085 and 2059 as the most preferred. These clones are being multiplied for release to the farmers.

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

O.O. Aina, A.G.O. Dixon 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 25% 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.

# Experiences in implementing a farmer-based seed potato system in Kenya

C. Lung'aho, P.M. Kinyae, A. Walingo and J.N. Kabira

## ABSTRACT

Increased demand for food due to rapid population growth and urbanization cannot be sufficiently sustained by the low yields normally found in the traditional farming systems. Improved varieties which have to pass efficiently from research stations to farmers' fields are required. Projects to deliver seed potatoes to farmers in Kenya have been in place since the country attained independence four decades ago. The formal seed system has had limited success in providing certified seed potatoes with only 1% of the effective seed demand having been met. Starting in 1994, a pilot farmer- based seed potato multiplication system was implemented in the country as a way of improving access to good quality planting material by the majority of potato growers. Over 300 self help groups, community-based organisations, cooperatives and individual farmers were involved in the seed initiative at various times. Current production stands at an average of 3000 tonnes of clean seeds per year. Lessons learnt showed that designing and managing a well-functioning farmer-based seed system is a challenging task. The level of incomes by the resource-poor farmers who are the majority in potato farming does not justify strict enforcement of current seed certification standards. Access to micro-credit, marketing support, and technical training by potential seed entrepreneur was found to be crucial for start-up and continued survival of seed enterprises. Our experiences suggest that more open seed markets that generate better quality seed for potato farmers at prices that they can afford should be promoted. For this to be realized, good market prices for ware potatoes are a pre-requisite because when more farmers become cash-oriented, then there is greater possibility of them becoming customers for the better quality seed which in itself helps create a self- sustaining seed system.

# Elimination of disease and regeneration of four popular sweetpotato varieties using callus induction technique

Mimano L.N., Macharia C.W. and Githunguri, C.M

## ABSTRACT

Sweetpotato is an important crop in Kenya. It can grow in almost any type of soil and can have high yields with very little input. The crop is threatened by virus infection, which interferes with ability to photosynthesize and therefore low foliage and tuber yields. The most important sweetpotato disease in Kenya is the sweetpotato virus disease which is capable of causing major crop loses of between 50 to 80% especially when in combination with other sweetpotato viruses such as the sweetpotato chlorotic stunt virus. There is therefore, a need to develop sweetpotato varieties resistant to SPFMV. Genetic engineering offers a means to introduce into sweetpotato, genes, which may confer tolerance to SPFMV. Stem cuttings were taken from young plants of four popular sweetpotato varieties SPK 004, Japonese, Zapallo and Simba Hills, surface sterilised and grown on Murashigae and Skoog medium (1962) supplemented with myoinosital and sucrose (MS). Leaf explants from the sterile cultures were placed on callus induction media containing 2,4-D, at a dilution of 2.0 mg/L Benzyl aminopurine (BAP) was used at a concentration of 0.5 mg/L. The cultures were kept for 4 weeks at 29°C in the dark. Calli were then transferred to embryo production medium (MS with 0.25 mg/L zeatin, 1 mg/L IAA and 90.1 mg/L myo-inositol), and incubated at 25°c in 12/12 h light/dark photoperiod, for 8 weeks during which time cultures were examined for embryo production. Data on the popular local sweetpotato varieties that can be regenerated is necessary for transformation work for control of viral diseases. All four sweetpotato varieties are in the process of successful regeneration. This means they can be transformed and disease resistance introduced through genetic engineering using the agrobacterium *Tumerificians*. Since farmers tend to grow their preferred varieties, their genetic modification as a method of enhancing food security may be the way forward.

# Participatory approach to the management of sweetpotato virus disease in Kenya

R.W. Njeru, E. Obudho, T.L. Munga, R.W. Gibson

## ABSTRACT

Most farmers in Kenya lack accurate knowledge on the cause, spread and management of sweetpotato virus disease (SPVD). This knowledge gap was addressed through participatory approach to demonstrate to farmers the role of vectors and the benefits of rouging, using isolated fields and virus-free vines in the control of SPVD. During the crop cycles, farmers became conversant with SPVD symptoms and became able to make accurate diagnosis of the disease. In addition, the pivotal role of diseased cuttings as inoculum source was observed while abiotic factors were disapproved as causes of SPVD. During monitoring, progressive disease spread was noted only in fields where rouging was not carried out and, as farmers observed that diseased plants produced no marketable tubers, they embraced rouging as a justified management practice in restricting disease spread within and between fields despite the inevitable loss of the plants. Because the farmers observed the role of vectors and virus infected plants in disease transmission and spread, they could correlate disease incidence to insect vector population levels. As a result, they appreciated the potential benefits of isolating young crops from mature ones. The impact of empowering farmers with the epidemiological knowledge to better understand the virus, host and vector interactions in SPVD development and management is discussed.

# Occurrence of four major potato viruses in three main potato growing areas in Kenya

Machangi J.M., Olubayo F.M., Njeru R.W., Nderitu J.H; El-Bedewy R, Yobera D.M and Aura J.A

## ABSTRACT

A survey was carried out in 60 farms during the month of December 2001 to determine the occurrence and distribution of four major potato viruses in Tigoni, Njabini and Molo areas in Kenya where the potato crop is widely grown. Twenty potato fields were randomly selected in each area with preference on seed potato farms. During the survey, potato leaf samples were collected from the potato fields and later indexed for the presence of potato leaf roll virus (PLRV), potato virus Y (PVY), Potato virus X (PVX) and Potato Virus S (PVS) using the Double antibody sandwich - enzyme linked immunosorbent assay (DAS- ELISA), utilizing polyclonal antibodies. ELISA results indicated that all the four viruses were present in this region. The most commonly encountered potato viral infection was PVS (79.1%) followed by PLRV (34.9%), PVY (8.5%) and the least encountered was PVX (7.0%). On average, the prevalence of viral diseases was highest in Tigoni (47.1%), and lower in Njabini (25.6%) and Molo (25.0%). Multiple infections of the 4 viruses were also present. One of the collected samples had a multiple infection involving all the 4 viruses. 6.2% had triple infection involving PVS and two of the other 3 viruses (PLRV, PVY and PVX). Double infections were common (27.1 %) while samples with only one single virus infection accounted for 54.3% of the samples with PVS as the most frequently encountered singly (46.5%). All the sample (100%) collected and analyzed from Tigoni area were infected with at least one of the 4 viruses, while 88.4% of the samples from Molo and 76.7% from Njabini also had positive reaction to at least one of the viruses. On average, 88.4% of the samples in the whole survey area were infected with at least one of the 4 viruses or their different combinations. The survey results have revealed that viral diseases are prevalent in potato fields in Kenya, hence the need for emphasis on research of viruses on potato with a focus on proper management of these virus diseases for sustained potato production in the country.

# Identification of DNA markers linked to resistance to the sweetpotato virus disease

D.W. Miano, D.R. LaBonte and C.A. Clark

ABSTRACT

Sweetpotato virus disease (SPVD) is a serious threat to sweetpotato production in East Africa and the world over. The disease is a result of synergistic interaction between *Sweetpotato feathery mottle virus* (SPFMV, genus *potyvirus*, family *potyviridae*) and Sweetpotato chlorotic stunt virus (SPCSV, genus *Crinivirus*, family *Closteroviridae*). Interaction of SPCSV with other viruses especially poty viruses such as Ipomoea vein mosaic virus (IVMV) and Sweetpotato virus G (SPVG), and Sweetpotato leaf curl virus (SPLCV) also result to SPVD. Optimal control of SPVD is mainly by use of resistant sweetpotato cultivars. Developing resistant materials takes time and is made difficult by the genetic nature of the sweetpotato plant. Early identification of resistant sweetpotato would save time in selecting materials for use in breeding programmes. Understanding the response of such resistant materials to infection by the main viruses causing SPVD will be an important step towards developing resistant lines. Use of DNA marker technology and discriminant analysis in identifying trait-linked molecular markers for SPVD will greatly help in early identification of resistant germplasm and also accelerate the time of developing resistant cultivars.



# The potential of utilizing cassava landrace diversity resources for the effective

# management of pests and diseases of economic importance in Democratic Republic of Congo

Munyili, T.M.B., Tete Tshisinda, Legg, J.P., Lema A., Mwangi, M., 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 IITA-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. Howvever, during the survey, in major provinces of eastern DRC( Maniema, North-Kivu, South-Kivu and Orientate 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, Cigaja, Lubona, Namale, Kabunga, Kamegere, Karerezi, Mushikuzi.Kachumbwe, Mwaka moja, Mwezi Kenda, Kahunde, Mweso, Kakiru, Merci, Kisai, Kirota, Merci, Kibututu, Kirota, Ndoliri, BaBitora,Kimbebe, Kivarwa, Balulu, Kimbambu, Kisiko, M'vuama, RAV, Mamayenga, Bandande, Ngela, Mbungo, Kelenga, Bazande, Kaniabo, Kelenga, Mbongo, Pano, Kimbotela, Kelenga, Nzongu, Muleka.Nzogu, Mwesi Sita, Butamu 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. Mainstreaming cassava improvement strategies in DRC include, targeting ecologies, farmers' varietal needs and local cassava socioeconomics realities. The study highlighted the need of developing across the country, many germplasms and collections of local cassava genotypes, assessing them for their resistance to pests and diseases of economic importance and determining, through molecular tools their genetic characteristics, as well

as isolating interesting genes that can be used in the improvement of varieties to be released in rural areas. These will have to incorporate multiple pest and disease resistance and the desired traits of early vigor in plant growth for high foliage yield, appropriate plant architecture, and early bulking of storage roots, with high dry matter content, low cyanide, high carotene, ease of peeling, acceptable root shape and food quality. Cassava genetic resource bases of the national germplasm collections and conservation should be greatly enriched at provincial level. The genetic relationships among all national landraces to be collected from different parts of the country have to be assessed by both agrobotanical traits and molecular markers, based on cluster analysis (AFLP and RAPD). Molecular characterization followed by cluster analysis for the national germplasms will lead to the selection of representative landraces to be conserved both in-vitro and in-situ, wheel agronomic evaluation will have to follow and lead to the selection of some promising genotypes for release. It was also proposed that several field and vitro gene banks be created and maintained at research centers and stations for various users by stakeholders (national agricultural research centers, universities, regional organisations, commercial companies, NGOs, CGIAR centers);for agronomy, breeding, basic research, applied research, training.



# Incidence and distribution of cassava pests and diseases in Mozambique

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

## ABSTRACT

Three countrywide surveys were conducted in April-May and September-October 2003, and in May-June 2004 throughout the cassava growing areas of Mozambique including, Gaza, Inhambane, Sofala, Manica, Zambezia, Nampula and Cabo Delgado. The April-

May 2003 and May-June 2004 surveys were planned to assess the distribution, incidence and damage severity of diseases and pests that could affect cassava production. Although the September-October survey also included the evaluation of pests and diseases, its main purpose was to determine the impact of the main pests and diseases identified in April May 2003 on cassava production. Using the methodology developed by IITA, 202 and 175 cassava fields between 4 and 8 months old were sampled in April-May 2003 and May-June 2004, respectively. The results indicated that cassava whiteflies (WF) appeared to be the second most important pest in Mozambique after cassava green mite. Generally known as vectors of the cassava mosaic disease, the populations of whiteflies were so high that they caused heavy black sooty mould covering the whole canopy. This was particularly severe in the northern Zambezia province. The incidence and severity of other known common pests of cassava such as cassava mealybug, termites, and grasshoppers were insignificant. The cassava mosaic virus disease (CMD) is the most common cassava disease in Mozambique. However, except in Gaza Inhambane, Sofala and Nampula, where severe damage symptoms (> 3 on a 1-5 scale) were encountered the disease was either absent or present with only slight to moderate (2-3) damage severity. Of the CMD- causing viruses, the African Cassava Mosaic Virus (ACMV) was the most common particularly in Inhambane/ Zambezia and Nampula, but was absent in Cabo Delgado and Gaza. Mixed infections of African Cassava Mosaic Virus (ACMV) and East African Cassava Mosaic Virus (EACMV) were found in about 34% of the fields, while 17% of the fields were found harboring the East African Cassava Mosaic Virus (EACMV). The devastating EACMV-Ugandan variant (EACMV-UG2) was not found in any of the fields during the April-May survey, but 4.8% of the fields sampled in September-October 2003 showed the presense of EACMV-UG2, but only from Nampula province. The incidence of cassava brown streak disease (CBSD) was high but only limited to the Zambezia, Nampula and Cabo Delgado provinces; damage severity was highest in Zambezia and in one district in Nampula. Other foliar diseases - e.g., cassava bacterial blight and cassava anthracnose - were insignificant. Nematodes were present throughout but their severity varied from low to moderate. Root rots were common particularly in the CBSD infected provinces. Although we did not find a clear relationship between damage severity of pests and diseases in the April-May survey and cassava yield parameters at harvest in September-October, we found increasing dry root rot incidence with increasing CBSD incidence and severity, but only in Nampula and Cabo Delgato provinces. The results of the two surveys are used to target interventions for the management of lingering and emerging pests and diseases of cassava in Mozambique.

# Diversity studies of sweetpotato cultivars (*Ipomoea batatas*) from selected areas of East Africa using morphological markers

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

ABSTRACT

A study to determine the diversity of sweetpotato cultivars from selected areas of Uganda, Kenya and Tanzania from distinct agroecologies was subjected to morphological analysis using the CIP Research Guide 36. This analysis is based on many variations in plant type, leaf shape, vine length and other phenotypic variations. Phylogenetic analysis using UPGMA grouped the cultivars into two major clusters. The first subcluster comprised of cultivars from Kenya, Uganda and Tanzania. Within this subcluster, the Tanzanian cultivars showed a tendency to cluster more closely together as compared to the cultivars from the other two countries. The second subcluster had six cultivars from Uganda and three cultivars from Tanzania. Synonyms were also identifiable. These results suggest a close relationship within the East African sweetpotato germplasm and close evolutionary relationships.

# Genetic diversity among different sources of resistance to the cassava mosaic virus disease using SSR Markers

Yvonne Lokko, Alfred Dixon, Sam Offei, Eric Danquah and Martin Fregene

## ABSTRACT

This study was conducted to determine the organization of genetic diversity within a collection of 78 African cassava accessions resistant and susceptible to cassava mosaic virus disease (CMD), to identify genetic relationships among these accessions and to predict different sources of resistance to CMD using SSR markers. Sixty-eight resistant accessions including the resistant genetic stock, 58308 which have been the main source of resistance in breeding, 4 improved accessions, 53 landraces and 10 landraces susceptible to the CMD were analyzed with 18 SSRs markers which had previously been shown to display a high degree of polymorphism. Nei's genetic distance analysis of the SSR loci identified cluster five groups, suggesting five sources of resistances and also identified possible duplicates in the collection. Genetic diversity, as assessed by the average gene diversity. $H_e$, was high in all the groups with an average heterozygosity of 0.4473 ± 0.026. The estimator of inbreeding ($F_{is}$=-0.262 ± 0.142) revealed a low level of inbreeding within groups. Gene diversity among accessions was 51.4% and 46.6% was due to diversity within cluster groups while 4.8% was due to diversity between groups. Genetic differentiation ($G_{ST}$ = 0.096) was lower than what is expected for outcrossing, plants. The high level of heterozygosity and the low levels of genetic differentiation detected imply a poor genetic structure. The results further suggest that using any combination of resistant accessions to recombine different favourable alleles will not reduce the overall diversity of the breeding population.

# SSR based genetic linkage analysis of resistance to the cassava mosaic begomovirus in cassava

Y. Lokko, M. Gedil and A. Dixon

## ABSTRACT

The cassava mosaic disease (CMD) causes severe yield losses to cassava (*Manihot esculenta*) in Africa. The most extensively used source of resistance to CMD, derived from *manihot glaziovii*, is under polygenic inheritance. Recently new sources of resistance from the landraces, which exhibit a different mechanism of resistance, have been identified. To initiate marker-assisted selection (MAS) in breeding for resistance to CMD, we developed SSR based linkage maps in two cassava populations, TMS I30572 X TME117 (old source of resistance X susceptible accession) and TMS I30555 X TME 3 (susceptible accession X resistant landraces) and identified putative QTLs affecting CMD resistance. The populations, each consisting of 132 genotypes were evaluated over two years in Nigeria. The SSR markers mapped in 19 linkage groups in both populations and QTL analyses were performed with simple linear regression and the Kruskal-Wallis analysis in MapQTL. Mean disease severity scores (MDSS) were used for QTL analysis. Five highly significant ($p<0.001$) marker-associated QTL effects, explaining between 10.47 and 12.15% of the total phenotypic variation, were detected by regression in the old source of resistance. The Kruskal Wallis analysis further detected four highly significant marker-associated QTL effects. In the new source of resistance, the Kruskal Wallis analysis yielded four highly significant ($p<0.005$) marker-associated QTL effects. Significant marker trait associations were due to markers donated by both parents, which confirms the polygenic and recessive nature of this source of resistance.

# Advances in cassava yield improvement at IITA

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

ABSTRACT

The role of cassava is rapidly changing from the traditional human food commodity to a cash crop/industrial raw material. Varietal improvement for higher yield and root dry matter content is therefore bringing additional cash income to a greater number of small farmers in Sub-Saharan Africa. We report the achievements made at IITA in the development of high yielding cassava varieties in the past three decades (1971 - 2001); Five-year data for clones developed over three decades has been used to assess the genetic gain. The results show positive genetic gain for cassava root yield, number per plant and dry matter content. When the mean of the best five landraces is compared to that of the best five improved clones cloned at the end of the last decade, root yield has increased by 88 percent, number of roots by 70 percent and dry matter by 2.6 percent. The analysis clearly shows that cassava root yield will continue to increase. In addition to a number of other important factors, the increased numbers of roots per plant and large root sizes (32% increase) produced by the new improved varieties have a bearing on the improved cassava root yield. These achievements have been possible as a result of broadening the genetic base used in cassava breeding at IITA

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# Breeding for root quality traits in cassava

J. Mkumbira, R. Okechukwu and 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. The 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 glucoside potential for the new clones being developed by the breeding program 1ITA. New clones developed in the late 90s have cyanogenic potential levels (9.1 ± 2.06 mg $HCN^{-1}$ kg 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 efforts 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.



# Use of single nucleotide polymorphisms (SNPs) of expressed genes as a marker system to merge existing linkage groups in hexaploid sweetpotato

Ericka A. Pestana, Maria Berenyi, Albert Kriegner and Kornel Burg

ABSTRACT
The most popular markers (AFLP,RAPD,etc.) used in developing linkage maps can not identify homologue chromosomes in hexaploid organisms like sweetpotato [*Ipomoea batatas* (L.) Lam. 2n=6X=90|]. In order to overcome this drawback Single Nucleotide Polymorphisms (SNP) were identified in selected genes, in order to use them as markers

for merging and anchoring existing linkage groups in the ‘Tanzania’ x 'Beauregard' mapping family; and to elucidate the type of inheritance of sweetpotato. Three genes were selected for the study: The 'Cold Induced Gene', Lycopene β-Cyclase and the FarnesyI- diphosphate Synthase. SNP sites were validated by using the SnaPshot Multiplex Kit, and direct sequencing reactions. All SNPs were tested for goodness of fit simplex (1:1), duplex (3:1, 4:1, 19:1), and double simplex segregation ratio (presence: absence) according to the three alternative cytological theories of sweetpotato using a $\gamma 2$ test. The type of ploidy was analysed based on homologous simplex markers by comparing the observed progeny genotypic distribution with the expected distribution for Autohexaploid (hexasomic), Tetradiploid (tetra-disomic) and Allohexaploid (disomic) inheritance. Segregation analysis in the 192 individuals Tanzania x Beauregard mapping population detected 7 simplex and 6 triplex-markers for the Cold Induced gene. These 7 simplex-markers could be separated into three segregation groups, representing three different homologous alleles. For FPP gene 10 simplex markers were detected. All the 10 presented exactly the same segregation pattern. 3 simplex-markers and 4 double-simplex markers were found in the Lycopene β Cyclase gene. All 3 simplex markers presented the same segregation pattern; however the double simplex markers could be separated into two different segregation groups, showing no association with the simplex markers. The type of ploidy (autopolyploidy or allopolyploidy is uncertain in sweetpotato and was examined in this study using the simplex markers obtained from the Cold Induced Gene. The study supported an Autopolyploid type of inheritance.

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# Comparative analysis of gene expressing in drought sensitive and tolerant sweetpotato genotypes

Joanna Jankowicz, Maria Berenyi, Kornel Burg, Jerzy Kruk

ABSTRACT
Abiotic stresses, and ways to adapt to them are numerous and interlinked. Limited tolerance to extremes in temperatures have traditionally restricted the cropping alternatives available to farmers and threatened the sustainability of agriculture industry. Drought is known as the most significant limiting factor for plant agriculture worldwide. By the reason of salinity and draughtiness of the soils in the next 25 years 30% worldwide reduction of the cultivated area is predicted. Plants have to exploit their immediate environment to maximum effect. Their inability to move swiftly means that the best way of dealing with many stresses is through physiological or morphological changes. We can observe these changes either at protein or gene expression level. In our study cDNA microarrays were used to identify genes involved in immediate drought-stress response as well as in acclimatisation to drought conditions of sweetpotato plant, Sweetpotato is one of the economically important basic food crops in Asia and Africa. There are drought-tolerant sweetpotato varieties available; however this tolerance is mostly not accompanied by other good agronomic qualities. The results of this work will deepen our understanding in drought response of sweetpotato and will also provide data for marker-assisted breeding to achieve better quality phenotypes through inducing greater tolerance for environmental stressor. The set of 3072 unigene cDNAs were spotted on aminocoated slides. Plant material was collected from sensitive as well as from tolerant sweetpotato genotypes at 1, 3, 7 and 14 days after drought-stress induction (desert climate). Isolated RNA was reverse transcribed, fluorescently labelled and hybridized to microarrays. Analyses were performed using commercial software packages (GenePix, GeneSpring, and Bioconductor). The gene expression profiles of the sensitive (Mugande) and tolerant (CN 1517-139) genotypes were compared by cluster analysis and differentially expressed genes identified. The expression profile of a selected set of these genes has been confirmed by quantitative RT-PCR such as lipid-transfer proteins, mannose-binding lectin, sporamin, cinnamoyl-CoA reductase, transferases and epoxide hydrolase.

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# Genetic gain in cassava disease resistance

Okechukwu, R.U., J. Mkumbira, A.G.O. Dixon, and A.Y. Kamara

ABSTRACT
The International Institute of Tropical Agriculture (IITA) since 1970 have developed cassava germplasm with emphasis on high yield potential and durable disease and pests resistance for different agroecologies in Africa. This study examines genetic gain in disease resistance from 1970 to 2000 in cassava bred for Nigeria agroecologies. The results showed that yield was significantly ($P<0.05$) correlated with cassava mosaic disease ($r=-0.52$), and positively correlated with cassava bacterial blight ($r=0.22$). There was genetic gain in fresh yield (1.3% $ha^{-1}$ per year), dry yield (1.2% $ha^{-1}$ per year), cassava mosaic disease resistance (0.65% per year), and cassava anthracnose disease resistance (0.21% per year). There was however, a net negative genetic gain (-0.03% per year) in cassava bacterial blight (CBB) resistance. This suggests that selection did not improve resistance to CBB. Further breeding activities should emphasis resistance to CBB.

## Socioeconomics and marketing

*Pages 97-98*

# Establishing the impact of participatory research in the adoption of new technologies in sweetpotato research in Uganda

Byamukama E., Mpembe I., Kayongo J., Adolph B., Gibson R.

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. Participatory work involved testing use of roguing in controlling SPVD and evaluating improved varieties using established farmer groups. Also training was done on cause, spread and control of SPVD. The survey involved both group members participating in the research and non-group members in the surrounding villages. Results indicate sweetpotato had the highest number of households consuming it in largest amounts and was mentioned by other households at least at some level. Farmers interviewed have 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, which some were being planted at the time of the survey, however, the project varieties taken to farmers are being adopted by group members and few non group members as farmers said they are planning to grow them. Significantly more group members recognized the SPVD and gave it a name describing SPVD. Also more group members mentioned whiteflies and planting infected plants to be the cause of symptoms. Roguing and selection were the most mentioned actions to reduce SPVD incidence and also being practiced. The knowledge of the control methods mainly was reported to be from project training for group members while experience and neighbours were sources of information for most non-group members. It may be concluded that technologies extended to farmers on SPVD control in groups were understood and are being adopted, and slowly are spreading to the neighbours.

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# Promotion of pro-vitamin a sweetpotato variety among smallholder farmers in southwest Kenya: the case of rangwe division

Obonyo J.A., Oduwo A.O., Cottina G.O., Kosambo L., Korir P., Kwach J., Odhiambo J., Okeyo K.

## ABSTRACT

In sub Saharan Africa, 3 million children under the age of five suffer blindness caused by lack of vitamin A. vitamin A is produced by the body when it has sufficient quantities of a precursor known as beta-carotene. When it doesn't the body cannot produce sufficient vitamin A and blindness can result. Pregnant women and children are more vulnerable. CIP and its partner organizations have taken a different but complementary approach to fight vitamin A deficiency: the promotion of orange-fleshed sweetpotato growth and consumption. Orange fleshed sweetpotatoes contain high amounts of beta-carotene, which is largely responsible for the color of the flesh. This approach compliments supplementation /fortification approach, is accessible to isolated small rural communities and can sustain itself over time. Building on this knowledge the community mobilization Against Desertification (C-MAD), the ministry of Agriculture and the ministry of Health (extension providers) and the Kenya Agricultural Research institute (KAR1-RRC Kisii) and Kenya Industrial Research and Development Institute (KIRDI) developed a collaborative partnership technology transfer project to take advantage of sweetpotatoes nutritional value. The overall goal of the project was to improve household food security and health of target communities and the purpose was to improve nutritional status and family incomes of the target community. As a result of this project availability of pro-vitamin-A sweetpotato varieties has increased as evidenced by an increase of 50% of land under sweetpotato production and yield increase from 9-14 t $ha^{-1}$ in 654 households and 142 farmers engaged in processing. There was the change of perception by farmers of sweetpotato from being a woman's crop to a crop with a great potential to generate income for the households.

# A socioeconomic analysis of cassava production and marketing in Kenya: A case of Kwale District, 1999-2003

Dave JW Nyongesa and 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 $ha^{-1}$. 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.

# Implications of root and tuber crops production, consumption and marketing in Kenya's coast province: a case of sweetpotatoes in Kwale district

Dave JW Nyongesa, Peterson Mwangi and Lusike Wasilwa

## ABSTRACT

Sweetpotatoes (*Ipomea batatas*) are pivotal source of nutrition. In Kenya, sweetpotato 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 sweetpotatoes in Kwale district was undertaken in April 2004. It was to evaluate the production and marketing of sweetpotato in Kwale District from 1999 to 2003. Specifically, it was to: ascertain the types and varieties of sweetpotatoes grown, the production and yield levels; assess the socio-economic impact of sweetpotato on the rural households in Kwale; examine the marketing and marketing arrangements for sweetpotatoes in the District; suggest policy recommendations for improvement of sweetpotato 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 sweetpotatoes 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 sweetpotato technologies, agronomic and crop protection packages, post harvest and value adding activities to enable the farmers to benefit fully from sweetpotato production and marketing in the province.

*Pages 101-102*

# Preliminary inventory of local market Incentives for the improvement of cassava productivity and production in Democratic Republic of Congo

Munyuli T.M.B., Tete Tshisinda, Kashoso Kumbakumba

## ABSTRACT

Cassava is one of the most important crops in 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 deli very 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. In terms of food security and food production incentives there has been no policy consistency from the government up to now. Therefore, it appeared to be relevant to inventory local market incentives for the improvement of cassava by scientific community. Incentives to look at are those with are endogen, generated by the dynamic of the population activities without influence from the government. During an on-going IITA cassava pests and diseases monitoring survey conducted in eastern DRC, it was realized a certain number of incentives for cassava productivity in DRC. These market incentives varied from a province to another one. Initially, the availability of permanent traditional ores and mining places in all forests of Maniema Orientale and North and South Kivu provinces had a potential for the increase of cassava productivity. Infact, in these areas (around 1500 mining places counted), the demand for cassava flour was estimated at 1 - 3 tone per day. Farmers surrounding such points have high demand for cassava products such as the even fail to feed their own family at the household level. In Katanga, Ituri and Maniema provinces, the existence of UN peacekeeper is another incentive for cassava production. In fact, several extensive and intensive (zero grazing)

pork production systems were observed in villages surrounding UN headquarters in these areas. Most of these farmers believe that cassava allow a rapid growth of pork. The high pork demand among the Chinese UN peacekeepers excited farmers to produce high quantity of pork that rely on cassava as main source of energy. The existence of many foreign communities that are interested in pork consumption will keep increasing the demand for cassava and pork meat. Hence, developing and making available technologies that allow farmers to satisfy to the demand while meeting their domestic needs, appear to be relevant. In Kivu provinces, cattle production used to be the main sources of animal proteins. However, because of the persistent outside and imposed wars, cattle production can no longer still meet population needs and wants. Hence, the existence of several small-scale entrepreneurs (around 4000), raising chicken in urban and peri -urban areas. Most of them use cassava as source of energy for their birds. The total daily demand is of 200 t per month. This demand is higher than the current production for the three provinces. In Orientale province, the high demand of cassava by artisanal plant, factories and breweries either for nutrition of their workers or the production of alcohol and beers, have increased the demand and price of cassava at the local market, creating some kind of food insecurity even at the level of producers who are in majority small scale farmers. There is many other UN companies interested in purchasing cassava products and distribute them in refugees camp where there are many cassava eaters. This is the case of World Food Program (WFP), FHI (Food for Hunger International), CICR and the World vision. At the regional level, cassava transaction between Uganda, Rwanda, Burundi, Zambia, is very important, throughout weekly common markets. Considering this high demand at domestic and regional markets, there is a need for scientific community to increase cassava productivity in order to enable farmers to ensuring their own food security and to supply sufficient quantity for outside demand (urban areas, mining areas, factories, companies, UN peace keepers. Industrials).



# Study on ex-ante adoption of improved yam varieties in Côte d'Ivoire

Toure M., Kouakou A.M., Zohouri G.P., Doumbia S., Yapi-Gnaore Et Akindes

ABSTRACT

Yam (*Dioscorea* spp) constitutes the first food crop of Cote d'lvoire in relation to the tonnage produced. An analysis of the literature of this culture shows that numerous constraints weaken the sustainable development of the crop. The objective of this study is to analyze the social, cultural and economic determinants of the adoption of new varieties of yam in peasant environment. The data were collected from a survey of 300 producers. The results show that the culinary attributes as well as the morphological and agronomic features of a tuber are the most important criteria for adoption. For the pounded yam, the sought-after attributes are the white color, a good springiness and the constancy of the dough. As for the boiled yam, it must be sweetened, crumbly, humid and of white color. In addition to these culinary attributes, the producers in their big majority prefer the high yielding varieties, giving more than one tuber per stand, resistant to the drought and precocious. The socio-economic variables capable to exercise a meaningful influence on the final decision of the producers are determined then by a statistical model. The probability of adoption of a new variety of yam is especially high when the producer has a long experience, has a school training, maintains regular contacts with the research and intension agents, is located in a region where the constraints are accentuated and has access to agricultural inputs.

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# Problems of providing yam in Abidjan and profitability of investments in yam wholesaling

Mahyao A., Zoungrana P., Zohouri G.P.

## ABSTRACT

In Cote d'lvoire, the main urban center of yam (*Dioscorea* spp) consumption is Abidjan. The high growth rate of the population increases the demand. Among the different varieties of yam commercialised in Abidjan, the precocious *Kponan* yam cultivated in the area of Bouna and Bondoukou, is the most appreciated (Nindjin & *al*, -1999) by consumers but the most expensive. The satisfaction of demand depends on the availability of supply, behaviour of people involved in the marketing channel and the financial capacities of wholesalers to supply the market in yam. The objective of the study is to analyse these different conditions. This study shows that wholesalers in the area of Bouna and Bondoukou, work with rural middlemen who take the primary collection and the forwarding to Abidjan. Another type of middlemen, working in Abidjan, intercedes with dealers during the commercial transaction. According to the period, commissions taken by these middlemen go from ten to twenty percent of the total marketing cost. Most often, farmers send yams to wholesalers in Abidjan. These producers pay the transport costs of the product, which is forty-three to fifty-seven percent of the total cost in Abidjan, the primary wholesalers receive large quantities of yams from the production's areas and commercialise them to the secondary wholesalers. One invested franc yielded 3.03 and 3.51 francs to the primary and secondary wholesalers respectively. The availability of *Dioscorea rotundata* all along the period of commercialization and the importance of the sales contributes significantly to the improvement of the wholesalers' profit. The profitability's rates of 203 and 251% show that wholesalers are able to have, more than twice the value of the amount invested in the year. Investments in yam's wholesaling in Abidjan are profitable. Working capital requirements is high but the high profitability guarantees repayments. Measures aiming to improve consumption of yam in Abidjan should take into account the reduction of transport costs and middlemen's activities, the access of wholesalers to loan. Farmers should make sales cooperative.

# The role of stakeholders in sweetpotato promotion in western Kenya

Susan A. Wasike and Tabitha Agwang

## ABSTRACT

Sweetpotato is one of the major crops grown by many households in Western Region of Kenya popularity lies in it having a comparative advantage as a food security crop over the other food crops in low potential drought-prone conditions typical of the region. With the current changes in the rainfall pattern and subsequent frequent failure of the conventional cash crops, sweetpotato has assumed commercial potential. It has generally moved away from the traditional crop, which was consumed after boiling or roasting, to processing into chips for composite nutritional flours and ingredient in baked products. Various institutions and organisations in western region of Kenya are involved in the various promotional activities of this important crop. These institutions and organisations have different technical skills and knowledge, and approaches that others could count on as they undertake the promotional of this crop. The most crucial fact is that they have no linkages between them and have continued to provide overlapping or at times similar interventions. This state of affair does not allow improvement on interventions / approaches and sharing of lessons learnt. The result is the inability to produce critical volumes to ensure food security and achieve commercialization. To change this scenario, a stakeholder's forum was deemed necessary to bring together all involved institutions to share expertise, experiences and lessons learnt, and chart the way forward for sweetpotato promotion. This paper presents an analysis of activities of the various stakeholders in sweetpotato promotion. The identified promotional gaps are also outlined and joint action areas undertaken by the various institutions including major achievements discussed.

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

R. Maliki, F. Amadji and I. Adje

## ABSTRACT

A study on the evaluation of the economic profitability of the systems improved for yam production was led in the savanna area of Benin in the degraded and less degraded zones with an aim of promoting a better natural resource management. The testing design was conducted in farmers' field and comprises 6 treatments: Preceding *Aechynomene histrix* on plot of *Gliricidia sepium* (G+Ae), Preceding groundnut on plot of *Gliricidia* (G+Ar); The preceding *Aeschynomene* (Ae), Preceding groundnut (Ar), Old cleared fallow (T); slash and burn (J) in the natural fallow. The shrub of *Gliricidia* was used for organic fertilisation and yam tutorizing. A density of the shrubs of *Gliricidia* of 625 seedlings per hectare was recommended in consequence of the constraints of management and competition between shrubs and crop arisen by the experimentative producers with a relatively high shrubs density (3333 plants of *Gliricidia* $ha^{-1}$). The results of the study revealed that among the systems tested the preceding *Aeschynomene* one yam and rotation *Aeschynomene* -yam on plot of *Gliricidia sepium* had interesting results on the degraded or less degraded soils compared to other systems. The system *Gliricidia sepium* with low density of shrubs in a rotation of culture with *Aeschynomene* allows a production of 22,3 t $ha^{-1}$ fresh matter (MF) of yam Gangni (*Dioscorea rotundata*] against 25,6 t $ha^{-1}$ of MF in the system of slash and burn. It induces a benefit Net of 880.000 FCFA against 750.000 FCFA $ha^{-1}$ on conventional system of slash and burn (either a rate of increase in 15%) with a workload of 175 H-J $ha^{-1}$ against 206 H-J $ha^{-1}$ or a reduction of working time of 15% on the conventional system. The *Aeschynomene* preceding on yam allows a production of 24 t $ha^{-1}$ (MF) of yam Gangni *(Dioscorea rotundata*) against 25, 6 t $ha^{-1}$ MF in the system of slash and burn. It induces a benefit Net of 995.000 FCFA against 750.000 FCFA $ha^{-1}$ on the system of slash and burn (either a rate of increase in 25%) with a workload of 128 H-J $ha^{-1}$ against 206 H-J $ha^{-1}$or a reduction of working time of 27%.

# Profitability of investments in yam's wholesaling in Côte D'ivoire: the case of wholesalers in Abidjan, Bouaké and Korhogo

Mahyao A. Toure M., Doumbia S., Kouame C.N., Zohouri P., Zoungrana P.

## ABSTRACT

In Cote d'lvoire, the urban market provision in yam is essentially assured by wholesalers. The guarantee of a regular provision depends not only on the availability of supply, but also of the financial capacity of the wholesalers to buy important quantities of yams for markets. Our objective was to analyze profitability of investments in yam's wholesaling in Abidjan, Bouake and Korhogo. Five financial ratios have been used: the ratio of exploitation or ratio of efficiency, the output of the sales, the profit by every invested franc, the profitability rate and the profit actualized. The study shows that the wholesaler of Bouake has the choice between the sale or the transfer of the yams toward Abidjan. The second option drags supplementary expenses. The ratios of efficiency of the wholesalers of Korhogo and Abidjan are more or less steady during the year, whereas in Bouake, this ratio varies according to the place of sale and the period of the year. The output of the sales of the wholesalers of Korhogo and Abidjan is constant and elevated on all year round, whereas it is necessary for the wholesaler of Bouake, to export yams in Abidjan to increase profit. Every franc invested gets a profit of 2.76 and 2,38 francs for the wholesaler in Abidjan and Korhogo, respectively. When the wholesaler of Bouake sells yams in Bouake, every franc invested get a profit of 1, 02 francs for every franc invested. When he exports yams to Abidjan, this profit is 1.44 francs. The survey revealed that investments in yam's wholesaling are more profitable in Abidjan and Korhogo that in Bouake.

# Understanding the traditional cassava commodity market in Nigeria: a preliminary analysis

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

## ABSTRACT

The traditional cassava commodity market can broadly be categorised into two namely a demand and a supply market. By definition the major cassava demand markets are all the urban centres were there is, in relative terms, very limited cultivation of cassava. The supply markets are the major cassava producing zones with excess output for sale beyond the production zones. Similarly, the traditional cassava based products can be classified into two namely; dry products and wet products. The important dry cassava products in Nigeria include gari, fermented cassava flour (lafun/elubo), cassava chunks or strips and abacha. Wet cassava products include cassava fresh tuber, edible cassava starch, wet fufu paste and/or prepared fufu. The objective of this paper is to provide information on the spatial movement of traditional cassava products in Nigeria. The survey that led to this paper was divided into two phases. The first phase begins with an inventory of rural source markets of traditional cassava products to Nigeria's major urban centres. The second phase of the study locates all the supply (source) markets for traditional cassava products and provides a geo positioning of these markets. Other information collected during the survey include relative volumes of commodities by source markets, prices per unit, transport costs to urban markets, and distances of supply markets to urban markets. This paper reports results from the first phase of the survey.

# Sweetpotato for food security and poverty reduction

Muchui MN, Gitonga LN, Njuguna LW, Kiuru PN, Ndungu BW and Kibaki JM

## 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 organisations (CBOs). This initiative was initiated at KARI-Thika in 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 sweetpotato. Mukangu Bio-banana self help group located in Muranga district in Central Kenya requested and was facilitated for this technology. Through this intervention the group was able to commercialise sweetpotato production and enhance food security through improved production and diversified utilisation. Other benefits included conservation of natural resources through inclusion of the sweetpotato in the crop rotation programme in the farms. This paper discusses benefits and impact of sweetpotato before and after ATIRI intervention

# Analyse du fonctionnement du marché semencier de I'igname en République du Bénin

Jonas C.Hinvi

## ABSTRACT

L'igname (*Dioscorea* spp.) est une des principales sources alimentaires des populations de 1'Afrique Occidentale et Centrale. Avec sa production moyenne annuelle de 1, 3 million de tonnes. le Benin occupe le quatrième rang mondial derrière Ie Nigeria, la Côte d'Ivoire et le Ghana. La production du matériel de plantation saint en quantité suffisante y est la principale contrainte à la production de l'igname. Cette contrainte peut être contournée par 1'utilisation de la technique de minifragments financièrement plus rentable que les méthodes traditionnelles de production de semenceaux d'igname. La prolificité de la technique de minifragment requiert une organisation de la filière semencière et une meilleure connaissance du marché semencier de I'igname. A partir d'un échantillon de 139 Chefs d'exploitation agricoles (dont 8 femmes) choisis au hasard dans les grandes zones de production de I'igname, la présente étude, d analysé le fonctionnement du marché semencier de I'igname et examiné les facteurs determinant la mise en marché des semenceaux. Trois périodes d'activité caractérisent le marché actuel la periode de faible activité (septembre-novembre) où Ie prix moven du semenceau est de 44 F/kg, la periode de reprise du marché (novembre-janvier) avec un prix moyen de 51,7 F/kg et la période d'intenses activités du marché (janvier-mai) avec un prix moyen de 98,6 F/kg. Avec le modèle Tobit, l'étude a montré que le prix. le nombre de buttes. le lieu de vente, 1'expérience agricole, l'âge, le moyen de transport, la durée de stockage et le mode de vente sont les facteurs qui influencent la mise en marché des semenceaux en période de faible activité du marché. La période de reprise du marché quant à elle est influencée par le prix. le lieu de vente et le mode de vente tandis que la mise en marché des semenceaux en période d'intenses activités du marché est uniquement déterminée par Ie prix des semenceaux. Les valeurs de loglikelihood sont de - 74,609; - 125,508 - 170,768 respectivement pour les modèles de la période de faible activité, de reprise du marché et d'intenses activités du marché de semenceaux. Ces résultats sont importants pour tout promoteur de production et de commercialisation de semenceaux d'igname car ils indiquent les périodes de vente de ses produits pour mieux profiter des opportunités du marché.

# Analyse économique de la production de pomme de terre dans l'extréme nord Bénin

Baco M.N., Dossou R, Amadou L.

## ABSTRACT

Face aux grandes menaces que constituent la pratique d'une agriculture mono-culturale, Ie Bénin opte de plus en plus à travers ses projets de développement à diversifier son agriculture. Pour cela, toutes les possibilités de production doivent être identifiées, valorisées et optimisées. Dans ce cadre, nous avons entrepris des recherches sur la pomme de terre, dans 1'Alibori, zone reconnue favorable pour cette culture au Bénin. Cette étude a permis de tester dix varietés et de retenir les meilleures variétés adaptées à 1'ecologie de 1'Alibori. Ces variétés sont Rosanna, Pamina, Sahel, Stemster, et Lola. D'autres part, les variétés citées donnent des rendements économiquement rentables. Le potentiel productit est advantage accru lorsque les pommes sont produites sur billon plutôt que dans les casiers qui constituent la pratique paysanne. L'application de 1'engrais 450Kg $ha^{-1}$ de NPKSB, + 50 kg $ha^{-1}$ d'urée et 80 kg $ha^{-1}$ de K2S04 sur les parcelles permet aussi d'augmenter très sensiblement les rendements. Les charges relatives aux semences représentent à elles seules 70% du total des coûts. Néanmoins la production de la pomme de terre est rentable dans 1'Alibori, car elle permet aux producteurs de dégager une marge brute moyenne de 800 000f à 900 000Fcfa/ ha largement supérieur au revenu tiré de la culture du coton qui est la principale culture de rente du pays.

# Role of gender in potato bacterial wilt management in the central highlands of Kenya

J.M. Ndubi, Muriithi, L.M, V.W. Wafula and S. Amboga

## ABSTRACT

Potato is a staple food and cash crop after maize and beans in the central highlands of Kenya. Despite the many problems associated with the potato crop production and storage male and female farmers continue growing the crop due to its importance and demand. Bacteria wilt (BW) is a disastrous disease to potato production resulting in reduced yield and quality and quantity. A survey was conducted to determine effect of cropping history, indigenous and improved technical knowledge, agronomic and/or cultural practices and gender issues on BW incidence, spread and severity Seventeen farmers' groups were interviewed from three age group categories: young (below 40 years), middle (40- 59) and elderly (over 60 years). Potato is an old crop in Meru and Embu districts. It is a staple food and cash crop after maize and beans. Despite the many problems associated with potato crop production and storage, farmers continue growing the crop due to its importance and demand. Asante and Tigoni are newly released varieties, 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 e.g. improved management; high yielding variety but they do not have resources to acquire the inputs. Agricultural Extension Officers provide link between farmers and researchers by facilitating the flow of information from research to farmer and vice versa. Potato diseases, e.g. bacterial wilt, late blight and leaf roll virus have continued to be a major threat in potato production and expansion. Indigenous methods of managing BW by uprooting infected plants, selecting clean seeds from known source and avoidance of infected fields are among the few alternatives still popular among the farmers because they are cheap, affordable and familiar to them. On gender issues, both female and male participate equally in seed variety selection. Spraying is an activity done by males only. Males also mainly do plot selection because they are the heads in most households. Female does most of the planting and weeding assisted by girls and boys when they are not in school.

## Technology Transfer

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# The role of the national agricultural extension system in cassava sub-sector development in Nigeria

E. Okoro, A. Dixon, C. Ezedinma, M. Akoroda, J. Lemchi, and F. Ogbe

ABSTRACT

The dramatic increase in cassava production in Nigeria has been attributed to increase in human population density and urban development. However, the increased use of improved cassava varieties especially the TMS 30572 has not been sufficiently explained. This paper traces the historical role of the national agricultural extension system in the dissemination of improved cassava varieties in Nigeria. The IFAD funded Cassava Multiplication project used the extensive spread of the agricultural development programmes to extend improved cassava varieties in Nigeria in the late eighties and early nineties. However, this approach was to narrow concentrating on the production side issue alone. This apparently led to a surplus in the commodity and a decline in producer prices at the farm level. The Root and Tuber Expansion program also funded by IFAD again followed with a view to add value in cassava. In addition, the Integrated Cassava Project of the IITA was initiated to build a firewall against the virulent form of the cassava mosaic disease advancing from east Africa. Both projects, which are complementary, include activities in post harvest and market development. Again the national agricultural extension system is used to implement both projects in Nigeria.

# Sensory evaluation and consumer acceptability of white and orange fleshed sweetpotato in Tanzania

Tomlins, K.I., Ndunguru, G.T., Kimboka, P., Neema, J., Ngendello, T., Rwiza, E., Amour, E., and Ramadhani, B.

## ABSTRACT

The consumer acceptability of orange and white-fleshed sweetpotato cultivars was compared for 100 school children (5 to 18 years) and 60 mothers with pre-school children. All were acceptable but three were variations. The orange-fleshed Resisto received the highest scores for acceptability followed by the Orange-fleshed Karote, then the white fleshed Polista and lastly the white fleshed Sinia B. This trend for acceptability was similar for all of the groups interviewed. The most acceptable cultivars (orange fleshed) were associated with the sensory descriptors watery, pumpkin flavour and orange colour. There were three variations in acceptability for sweetpotato within the population of school children and mothers. The largest group gave high scores to both orange and white-fleshed cultivars suggesting that this group like all forms of sweetpotato. The next largest was more discriminating and gave higher scores for the orange-fleshed cultivars compared to white fleshed ones. The third group gave lower scores to the orange-fleshed cultivar Karote. Interviews with the school children suggested a strategy for promoting orange-fleshed sweetpotato. Half of the school children were already eating orange-fleshed sweetpotato and said they had received information before. This implies that previous promotions were having a positive impact on eating behaviour. However, less than a third of the children mentioned that sweetpotato was their favourite meal; the competing meals were ugali (stiff maize porridge) and rice. Considering pathways for promoting the benefits of growing and eating orange fleshed sweetpotato. The pathways that they wished to receive information in the future differed from how they have previously received it. While parents were still rated as important sources of information, extension workers, radio and school teachers were considered more important and ought to be considered as promotion pathways

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# Study on the impact of dissemination of the varieties of cassava and orange-fleshed sweetpotato in Mozambique. A case study: District of Chokwè-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 organisations, carried out activities of multiplication and distribution of considerable amounts of cassava and orange-fleshed sweetpotato (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 Zambezia 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 it is high as, on average, each primary beneficiary offered the material to, at least, three 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), "rale, cooked and roasted cassava, as well as beverages. About 1/4 of these producers process cassava according to improved technologies introduced under the project.

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# Adoption of improved cassava varieties in western Kenya

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

## ABSTRACT

KARI-Kakamega in partnership with other development organisations 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 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 was 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 neighbours. 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 labour during cassava production. The decline in cassava acreage was attributed to inadequate or lack of planting materials. Farmers 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 neighours. The utilisation of cassava stems as firewood 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, labour, years of growing cassava, source of variety and utilisation was not significant and did not influenced 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 on 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 farmers' confidence in food security. The MOA and NGOs 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 DAOs 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 sensitize the farmers on the importance of men participation in other cassava activities other than land preparation for increased production.

## Biotechnology

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# Simple sequence repeat diversity of local cassava varieties from Tanzania, Nigeria, Ghana, Uganda, Sierra Leone: Lessons from genetic diversity and differentiation of a

# vegetatively propagated crop in a secondary centre of diversity

M. Fregene, A. Kullaya, C. Suarez; L. Montes, C. Azurdia, B. Raji, A. Dixon, E. Okai, E. Kizito, U. Gullberg, W. Castelblanco, J. Gutierrez, C. Buitrago

## ABSTRACT

Cassava genetic resources held by farmers have been demonstrated by highly successful breeding program at the International Center for Tropical Agriculture (CIAT) and the International Institute for Tropical Agriculture (I1TA) to represent a critical resource for the future productivity and stability of production of cassava. It is therefore imperative to catalogue, classify and conserve genetic diversity of cassava as a first step towards its exploitation. The systematic study with molecular markers of cassava local varieties, particularly in sub-Saharan Africa, has been the principal objective of the cassava molecular diversity network (MOLCAS), with funding from the International Program in the Chemical Sciences (IPlCs), University of Uppsala. So far SSR diversity assessment of collections made in Tanzania, Nigeria, Ghana, Uganda, Sierra Leone and comparison with collections from Colombia, Brazil and Gutemala year have been carried out. Results of SSR characterization of more than 1000 African local varieties and more than 500 Neotropical ones reveal broadly a high genetic diversity in all country collections analyzed and low genetic differentiation with the exception of a group of accessions fromGuatemala and all others. Nonetheless, African and Neo-tropical accessions were roughly divided into 2 broad clusters, and a clear sub structure of genetic diversity was observed for accessions from almost all African countries. An earlier sub-structure found in the Brazilian collection was shown to be according to taste but the basis of structuring found in African countries was not by taste and this is the objective of further research. The high genetic differentiation between some accessions from Guatemala and the rest reveals that cassava might have two independent centers of domestication, South America and Central America as has been shown for other crops including common bean and pepper. The two groups of accessions might also represent heterotic pools and is also the subject of ongoing work. The primary mode of disseminating the research results from MOLCAS country study is via the network's website, http://www.ciat.cgiar/molcas. The network has also published findings of its first country study in the journal Theoretical and Applied Genetics. Two other papers describing other country studies, Giiatt'mala and Uganda have been submitted for publication.

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# Towards the establishment of a yam EST database for understanding plant genome evolution. Gene discovery and germplasm characterization

H.D. Mignouna, M.M. Abang, R. Geeta and R. Asiedu

## ABSTRACT

Progress in breeding yams (*Dioscorea* spp.) for increased yield, adaptability to marginal environments, improved tuber quality, and pest and disease resistance has been constrained by biological constraints such as dioecy, poor to non-flowering, polyploidy, vegetative propagation, long growth cycle, a heterozygous genetic background and poor knowledge of the organisation of crop diversity. The early testing of progenies from hybridization is complicated by yam's slow multiplication rate and a juvenile phase during which it is unreliable to use conventional screens for some economic traits. Molecular markers that are linked to genes controlling these important traits would be useful in selection at an early stage of the plant's growth, thereby enhancing the speed and efficiency of selection. RAPD and AFLP markers have been used to investigate phylogenetic relationships and genetic diversity in wild and domesticated species, and to develop genetic linkage maps for tagging specific traits in the D. *alata* and D. *rotundata* genomes. However, for effective gene discovery and marker-assisted breeding, it is important to develop more user-friendly and efficient markers such as EST-SSRs and SNPs. Apart from its applications in yam improvement, an EST database would enable the filling of large gaps in information on plant genome evolution and gene expression derived from grass and eudicot model systems. This is because yam occupies a critical, intermediate phylogenetic position straddling the eudicots, which contains model species such as *Arabidopsis* and tomato on the one hand, and the grasses, which contain model species such as rice and maize on the other. It thus holds the promise of yielding important clues to the extent to which biological generalizations could be made based on model species. Here, we document research efforts towards the establishment of a yam EST database, highlight the challenges ahead, and discuss the implications of the database for yam germplasm enhancement and for gaining new insights into plant genome evolution.

*Pages 113-114*

# Conservation et valorisation de l'agrodiversité au nord Bénin: l'example de l'igname et du maïs

Nasser Mohamed BACO

## ABSTRACT

La biodiversité agricole, et plus particulièrement !es rcssources génétiques pour l'alimentation et 1'agriculture, constitue Ie réservoir d'où l'humanité puise son alimentation (Biowatch, 2()00). 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 vitales pour ralimentation, 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 société reste dépendante de ragriculture 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 l'érosion de la biodiversité à tel point que 1'Organisation Mondiale pour 1'Alimentation et 1'Agriculture (FAO) demanda dès 1965 à de nombreux experts d'analyser les causes et les dangers de I'erosion génétique. Parmi les principales causes soulignées dans la Stratégic Mondiale de la Biodiversité (WR I, UICN, PNUE, 1992), on peut citer:

- Les systèmes économiques et politiques ne prenant pas en compte l'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 ressources naturelles

En Afrique sub- saharienne, on note une croissance démographique galopante associée aux problemes 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 l'erosion de I'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 Ie libre echange. Le risque d'une appropriation par des intérêts privês 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 àdiverses 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 africames où plus de 75% de la population vit avec moins de 2 dollars par jour (Banque Mondiale, 1999). II convient également de promouvoir une gestion durable dé I'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 present etude contribuera à determiner la place et le role de la conservation et de la valorization de l'agrodiversité dans un monde de libre échange, à montrer l'impact de cette conservation sur la sécurité alimentaire des ménages ruraux pauvres.



# Molecular marker-assisted and farmer participatory improvement of cassava

# germplasm for farmer/market preferred traits in Tanzania

A. Kullaya, K. Mtunda, E. Masumba, H. Kulembeka, M. Freguson , J. Marin, C. Ospina, E. Berrera, A. Jarvis, N. Morante, H. Cebellos, Tohme J.M. Fregene

## ABSTRACT

Tanzania is the fourth largest producer of cassava in Africa with average yields of about 8 t $ha^{-1}$ (FAO, 2001). This is well below the continent's average of 10 t $ha^{-1}$ and the average yield of 14 t $ha^{-1}$ of Africa's (and the world's) largest producer, Nigeria. The low yield is caused by many factors including susceptibility of commonly grown varieties to major diseases and pests such as cassava mosaic diseases (CMD) and the cassava brown streak disease (CBSD). Cassava varieties grown by small farmers in Tanzania has however been shown to be very diverse and could be the basis of a successful breeding project. A farmer participatory, molecular marker-assisted, decentralized, breeding scheme was proposed as a means to speed up the process of improving local cassava germplasm for resistance to pests and diseases in Tanzania. The scheme was recently approved for fundoing by the Rockefeller foundation. The proposed breeding project will take farmer preffered germplasm by agro-ecology and cross them to improved introductions thata have resistance to Cassava Mosaic Disease (CMD), Cassava Green Mite (CGM), and Cassava Bacterial Blight (CBB). Given the fairly large number of perants that will be used, molecular markers associated with pest and disease resistance will be employed to reduce, in a logical manner, the number of progeny to a manageable number. The progeny selected by MAS will be evaluated in a single season in the corresponding agro-ecology and then evaluated over two cycles in collaboration with end-users (rural communities and cassava processors). The project will be carried out in a total of six years divided into 2 three-year phases. A principal objective of the project is the development of capacity for participatory plant breeding and market-assisted breeding. The project began in November last year with the collection of local varieties in three regions of the country namely: the Southeastern coastal region of Mtwara and Lindi; the central eastern coastal region of Tanga and around Dar es salam, and around the Lake region (Mwanza). The local varieties were established and evaluated with morphological markers as well as molecular markers. They will be evaluated for agronomic traits at harvest March next year, in collaboration with farmers. Based upon the above information, selections will be made, at least 10 best parents per region, will be selected for genetic crosses to improved introductions. Simultaneously, more than 400 improved introductions, selected with molecular markers for resistance to CMD and CGM were shipped from Colombia to Tanzania as *in vitro* plants, in collaboration with ARI Mikocheni and the post-entry quarantine authorities from TPRI, Arusha. The plants were hardened in the green house and then transferred to the field after molecular diagnostics to ensure that they were free frog skin disease (FSD). Thirty of the best

genotypes will be selected in March for genetic mapping of resistance to the cassava brown streak disease (CBSD), being carried out by the cassava breeder from ARI-Ukiriguru.

*Page 114-115*

# Molecular marker-assisted breeding for resistance to the cassava mosaic disease in Latin America cassava gene pools

J. Marin, C. Ospina, E. Barrera, L. Santos, D. Moretta, Y. Moreno, H. Ceballos, M. Fregene

## ABSTRACT

Molecular marker-assisted selection (MAS) for CMD resistance at CIAT is both a pre-emptive measure, should in case the disease is accidentally introduced in Latin America, and an effort to contribute the broad genetic variation of CIAT's elite germplasm to Africa. MAS for CMD resistance has been made possible by the discovery of several SSR and SCAR markers associated with the single dominant gene CMD2. The MAS scheme currently used at CIAT involves crossing CMD reisistance donor parents, obtained from IITA, to CIAT's elite cassava parents (by agro-ecology) and germination of the resulting seeds as embryo axes followed by multiplication and molecular analysis, using leaf tissue from *in vitro* plants, with the SCAR marker RME1 and the SSR marker NS158, both closely linked to *CMD2*. Establishment as embryo axes is necessary to fulfill pyhto-sanitary conditions for the shipment of these germplasm to partners. Genotypes that carry the resistant allele are shipped to collaborators in Africa and India and also sent to the green house for hardening and transfer to the regular breeding scheme. Molecular analysis is by a rapid DMA miniprep isolation method using 96 well plates followed by PCR and eletrophoresis. An excel file format was developed for the

collation and storage of the marker and other relevant information such as pedigree, phenotypic evaluation, number of plants available and where. This year, a total of 2315 seeds were harvested from more than 2000 controlled crosses between CMD resistant parents and elite parents of the 5 cassava gene pools by agro-ecology or backcross derivatives of *M. esculenta* sub spp *flabellifolia* resistant to the green mite. More than 1,500 genotypes have been processed by the MAS scheme described above. The cassava MAS lab currently has two persons and together they can process 192 genotypes in 2 days or 480 genotypes per week or over 24,000 samples in a year, molecular marker analysis alone. Work in ongoing to improve this by doing the grinding and DNA isolation in 96-well plates. Current costs of a single SSR marker data point analysis for cassava at CIAT is US$0.30, processing 24,000 samples in a year requires a budget of US$7,200. The bottleneck remains the tissue culture establishment step. We are also working on elimination of the DNA isolation step via the use of PCR amplification directly on leaf squashes on FTA cards.

## Crop Utilisation

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# Effect of feeding cassava silage on milk yield of diary cattle: the case of Malawi

V. Sandifolo, N.M. Mahungu, A. Mhone, F. Gondwe and J. Buitrago

ABSTRACT

Lack of protein and energy sources is the major constraint to the dairy industry in Malawi. The major source of carbohydrates to dairy animals is maize, while protein is often supplied by soy bean and animal based products imported from neighboring countries of Zambia, Zimbabwe and South Africa. Stiff competition arises between

human beings and animals for maize as source of energy and legumes as source of protein during critical times of the year. This necessitates exploring alternative feeds for animals that would reduce the competition between animals and human beings. An experiment whose objectives were to determine the acceptability of cassava silage by dairy animals, determine the effect of feeding cassava root and leaf silage on the health of the animal and milk yield was conducted at Katete Farm in the 2002/03 season and Chitedze Research Station in the 2003/2004 season. Six animals were used of which 3 were fed from cassava silage (80% leaves and 20% roots) and the other 3 were controls fed on grass and maize silage with protein supplement from soy bean cake. Results indicated that the animals accepted the cassava silage readily and that body conditions/health of the animals improved. The animals feeding on cassava silage produced an average of 13 litres/animal/day as compared to those led on maize silage with protein supplement from soy bean cake which had a mean production of 61itres/animal/day. Results also indicated that butterfat content of the milk was improved by the cassava silage from 3.2% to 3.6%. Economic analyses of feeding cassava on dairy animals indicated that every Kwacha invested in cassava silage brought a return of K49.20 in milk as opposed to investment in maize/grass silage which brought a return of K14.00 only. Smallholder dairy farmers have started adopting use of cassava silage after attending demonstrations on the technology. There seems high potential for improving the dairy industry by using cassava silage in Malawi.

*Pages 115-116*

# Appropriate mechanical efforts to promote sweetpotato utilisation in Malawi: A case study with Kenya variety

Hendrex W. Kazembe

ABSTRACT
Kenya is one of the Sweetpotato (*Ipomea batatas*) varieties widely grown in Malawi for cash and as a snack. However, its popularity and reliability is being limited by its short shelf-life (3-7 days) which eventually affect its utilisation. Current storage means do not seem promising and thus farmers are still experiencing the problem. Potato chips were suggested as an alternative product by most farmers. However, the size reduction for quick drying of the chips proved a problem. As such an experiment was carried out to determine an optimum size reduction of Kenya chips for quick drying using mechanized compared to hand chipping means. Thereafter a consumer feedback assessment and product storage test was carried out. The results showed that mechanical chipping was superior to the hand means, with drying rate of 98g (m.c) per hour compared to 34g (mc) per hour on wet basis. This therefore, meant that machine chips dried faster and stored longer than hand ones. This was attribute to the smaller and the more uniform the chips size, the better the drying characteristics in this case ninety five percent of the sweetpotato farmers expressed strong demand for the alternate technology.



# The orange fleshed sweetpotato: Opportunities for strengthening agriculture, nutrition and gender linkages at policy and programme levels.

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

# 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.

# Utilization of sorghum silage and sweetpotato vines in milk production by small-scale dairy farmers in the dry highlands of Kenya

G.B. Ashiono, J.O. Ouda, J.K. Kitilit and K.R.G. Irungu

## ABSTRACT

Marginal areas in Kenya continue to be heavily resettled by small-scale farmers commonly practicing dairy farming. Feed shortage in these areas is a major limitation to dairy productivity especially during the dry seasons. The current work evaluated the nutritive value of sorghum silage (SS) and sweetpotato vines (SPV) as feeds for dairy production in the dry highlands. On- station work involved performance trial of diary cattle fed on varying proportions of SS and SPV while on-farm work involved demonstration and popularization of sorghum and SPV utilisation technology. Grain and dry matter (DM) yields ranged from 4-7 and 17 - 29 t $Ha^{-1}$ respectively. The DM, crude protein, (CP) neutral detergent fibre (NDF) and acid detergent lignin (ADL) contents of SS ranged from 267.3 - 350.7, 50.0 - 70.6, 60.8 - 640.8 and 55.0 - 67.3 g $kg^{-1}$ respectively. The corresponding values of SPV were l29.5 -190.4, 83.4 -179.1, 300.9 - 383.5 and 61.5- 68.0 g $kg^{-1}$. The sorghums differed organic matter degraded (OMDeg) in the rumen, which ranged from 520 to 678 g $kg^{-1}$ in 24 h and 706 to 805 g $kg^{-1}$ in 72 h. Daily milk yield ranged from 3.441 $d^{-1}$ 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 ratooned sorghum and fed as green chop besides SS especially during the dry season. Improvement and sustenance of milk production was observed from farmers, showing that sorghum and SPV utilisation technology has great potential of enhancing dairy production.

# Nutritional value and cyanogenic content of cassava silage for dairy cows

Albert Mhone, Vito Sandifolo, Mazganga Phiri, Christopher Moyo, Sella Jumbo, Nzola-Meso Mahungu, James Abaka-Whyte

ABSTRACT
Studies conducted in Malawi indicated that cassava could play a vital role in the feeding systems of diary 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 per kg for animal feeds. The crude protein, ADF and NDF values were high enough so that protein concentrates in the diets of low yielding (<10 kg per day) and medium yielding (10-15 kg per day) cows can be eliminated.

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# The potential use of cassava in animal feeds industry: A case study of Kenya, Uganda and Madagascar

James B.A. Whyte, James M. Mbwika and A.O. Makokha

ABSTRACT
Most feed millers in Kenya, Uganda and Madagascar use cereals based carbohydrates as sources of  and is suitable and cheaper source of energy its use in animal feeds formulation in the region is highly limited. The use of  cassava in animal feeds is

exemplified by the huge amounts of cassava pellets exported by Thailand into European Market. FAO estimates that 25% of cassava produced in 1992-94 worldwide went into animal feeds. The use of cassava in animal feeds grew by 200% in Europe, 200% in Asia, and by 70% in Latin America between 1961 and 1995 and only by 1.3% in Africa. According to 1FAD/FAO 6% of total cassava production in Africa is used for livestock feeding mainly as supplements for livestock reared in extensive traditional systems. The use of cassava in the animal feeds industry in Kenya, Uganda and Madagascar is largely undocumented, although estimates indicate that 3% (74,000MT of fresh weight equivalent) of cassava produced in Madagascar goes into animal feeds manufacture. Such data is not available in the case of Kenya and Uganda. However, recent survey conducted by EARRNET established that 29.2% of the households interviewed in Kenya and 44.4% interviewed in Madagascar were using cassava as animal feed. In terms of potential, Kenya has a potential to use 500,000 MT of fresh weight equivalent, Uganda 48,000 MT and Madagascar 350,000MT. A number of studies have shown estimates of substitution level for cassava in the animal feeds as follows: 100% in dairy, 44% for beef fattening, 10% for broilers and up to 60% for pigs. Studies conducted elsewhere also indicate that cassava based feeds can lead to a cost reduction of between 1.2 and 14% for poultry (layers and broilers), 4.5% and 19.2% for pigs and 7.4 and 21.5% for dairy cattle. In terms of performance, milk yields of 11.1 kgs for cassava-based feed's as opposed to 11.3kgs per day for corn-based feeds have been observed. Reduction in cost of feeds is considered important in order to achieve reduced cost of dairy products, eggs and meat. This will make these products from the three countries more competitive. This paper examines the possible future use of cassava as raw material for animal feeds formulation by looking into the following areas: the size of the animal feeds market in the three countries, the potential amount of cassava that can be used in the animal feeds industry and the economics of the competitiveness of cassava based feeds compared to maize based feeds. The paper also looks at other factors that could limit the use of cassava in the animal feeds industry.

# Competitiveness and standardization of cassava for the livestock industry in sub-Saharan Africa

Olumide O. Tewe

ABSTRACT

Cassava usage for livestock feed in sub-Saharan Africa averages 6% of total production on the continent.High cost of processing and transportation limit inclusion of cassava in cost- effective livestock feed formulations. Farm-gate processed cassava products include peeled cassava chips, whole root dried chips, cassava grits, cassava seviate, cassava pellets, dried cassava peels and leaves. These must be processed to meet criteria recommended for energy and protein-rich ingredients in livestock feeds. Nutritional studies on incorporation of these in cost-effective rations for poultry, pigs, sheep and goat show satisfactory biological and economic performance. Promotion of these cassava-based rations among rural farming communities in Nigeria also reveal satisfactory performance and economic indices for poultry and sheep fed on these rations. Farm-gate processed, high quality cassava products can compete favourably with corn-based rations for livestock feeding in sub-Saharan Africa.

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# Policy initiatives for private sector involvement in the development of tropical

# root and tuber crops: the case for potatoes in Kenya

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

## ABSTRACT

Potato is the second most important food crop in Kenya after maize but for the crop to contribute significantly to the Government's overall goal of economic growth, wealth and employment creation, food security, improvement of farm incomes and poverty alleviation, the production has to be transformed from subsistence to a commercial and profitable business enterprise. Furthermore, the creation of the legal and regulatory policy frameworks that are fair to farmers, producers, processors, and marketers, besides the availability of an efficient agricultural research and extension systems, is key to encouragement of the required public-private sector partnerships. With over 70 pieces of legislation (Acts of Parliament), however, none addresses the issue of agribusiness development in potatoes. Indeed unfavorable policy environment has led to stagnation in the commercial development or growth of the food crops in general. In order to streamline the production, marketing and processing of potatoes, the Ministry of Agriculture began consultations with stakeholders in 2003 in order to come up with appropriate policy guidelines. Stakeholders' workshops, internal meetings, formation of a growers association, and surveys to gather views from farmers were facilitated by the Horticultural Division of the Ministry in collaboration with the GTZ-Private Sector Development in Agriculture Project. The Ministry found that although the potato is an important food security crop, the production and marketing has been faced with serious problems that include: lack of proper policy guidelines, inadequate seed supply, poor quality control and marketing systems, among others. A draft government policy paper on potato was thereafter produced following the consultations with stakeholders. Strategies outlined in the policy include: varietal development and other applied research; seed R&D, research-extension linkages, farmer empowerment, packaging and marketing, post-harvest storage, processing and new product development; quality assurance (seed and ware potatoes), agronomy, and crop protection. Implementation of the policy will address the many constraints hampering growth and productivity of the potato industry. One of the critical ingredients for success will be higher public investment in the industry as a whole following publication of a Gazette notice by the Ministry to make the policy effective. Lessons learnt can be utilized to formulate appropriate policy guidelines for other root and tuber crops.

# Targeting different end uses of cassava: genotypic variations for cyanogenic potential and pasting profiles

B. Maziya-Dixon and A.G.O. Dixon

## ABSTRACT

Cassava flour has potential multiple applications in the food industry. Product quality is influenced, however, by starch structure and pasting properties. The use of cassava flour is primarily determined by the physicochemical properties. Pasting properties influence the quality of food processing materials and industrial products and are often determined to evaluate the performance of starches practically. Crop quality is influenced by both varieties and environmental factors. To develop cassava varieties for targeted industrial uses, it is necessary to evaluate the varietal and environmental variations. This study aimed to determine the cyanogenic potential and pasting properties of cassava flour. A total of 381 were grown in a replicated field trial at the IITA research farm at Ibadan, Nigeria in 2000 and 2001 and harvested after 12 months after planting. From each replicated trial, four plants and three storage roots of different size per plant per genotype were randomly selected for cyanogenic potential analysis. The cyanogenic potential of storage roots was measured by an automated enzyme hydrolysis method using an Auto analyzer. For pasting properties, random samples of four storage roots of each genotype were peeled, shredded, and dried in an oven at 60°C for 72 hours. Samples were ground to pass through a 1 mm sieve and stored at 4°C until analysis. A Rapid Visco Analyzer (RVA) was used to determine pasting properties. Parameters assessed were peak viscosity, setback viscosity, final viscosity, and pasting; temperature and time. There were differences in root cyanogenic potential, ranging from 2.3 to 52.9 mg $HCN_{eq}$/l00g and a mean of 10.4 mg $HCN_{eq}$/l00g, and 3.4 to 70.2 mg $HCN_{eq}$/100g and a mean of 18.8 mg $HCN_{eq}$/100g in 2001 and 2002 respectively. The pasting properties exhibited wide ranges of variation among the studied genotypes. Pasting temperature ranged from 74.9 to 76.8°C and hot paste viscosity from 68.8 to 88,0 RVU and final viscosity from 94.5 to 130.7 RVU. The observed differences for pasting properties indicate that cassava genotype can be targeted for use in different food products and industries.

# Vitamin A for Africa (VITAA) partnership: Progress and challenges

R. Kapinga, P. Anderson, S. Tumwegamiire, B. Lemaga, F. Opio and D. Zhang

## ABSTRACT

Partnerships or alliances on the food-based solutions to nutrient deficiency have taken root in Africa. Among them is The Vitamin A for Africa Partnership (VITAA). In 2001 an international group of 70 agriculturists, health experts, and nutritionists launched what is believed to be the first crop-based initiative to attack Vitamin A deficiency in Sub-Saharan Africa. Working under the VITAA umbrella, 40 partner agencies from the health, nutrition and agricultural sectors agreed to collaborate in a coordinated effort to extend the impact of the new orange-fleshed sweetpotato (OFSP) in seven partner countries: Ethiopia, Kenya, South Africa, Tanzania, Uganda., Mozambique and Ghana. Close linkages are also maintained with partner institutions in other countries through two root crops regional networks: PRAPACE and SARRNET. VITAA initiative is coordinated by the International Potato Center (CIP) and it includes the collaborative work of government ministries, non-governmental organisations, international organisations, local groups, universities and more. VITAA is promoting a simple change-consumption of OFSP instead of traditional African white ones—to make a difference in the lives of millions of children and mothers, the people most at risk from vitamin A deficiency. Its principal objective is to promote wide-scale production and use of OFSP. The fact that OFSP varieties are liked by the consumers more so ranked high by children, implies that they can be easily adopted among the farming communities in Africa. Ex-ante impact study estimates that up to 50 million children in the region could benefit significantly from the new OFSP varieties. Project activities include: impact assessment, participatory testing of varieties for adaptation and acceptability, community-based multiplication of planting materials, nutrition education, post-harvest processing for market and for home consumption, promotion through social marketing, monitoring of impact on nutrition and health, and capacity building. Implementation strategies concentrate on women because of their central role in the production and marketing of sweetpotato and other food crops used in the family diet. Activities are currently on-track with the key stakeholders to identify interventions with the highest potential pay-off. This report summarizes the progress made to-date under each by participating partners and lessons learnt.

# Promotion of cassava based instant baby phala and the effect of the mixture to the under weight children

K.L. Salipira, I.R.M. Benesi, P. Chikopa and N.M. Mahungu

ABSTRACT

Malnutrition is very common in Malawi especially among the under five children. This is attributed to poor feeding and hunger, as most families cannot afford the wheat based cereal and other food supplements. Maize porridge that children are sometimes fed on is not nutritious by itself as it is low in protein, vitamins and minerals that are vital for child growth. An investigation into the use of cassava-based *phala* as an alternative solution to the problem was conducted using subjects from Chitedze Clinic. The results have shown that there is positive response to cassava-based *phala*, as children gained weight faster than the maize porridge. The report discusses the findings.

# Promotion of improved sweetpotato processing and diversification use of value added products for smallholder farmers in Tanzania

John Msemo, K. Mtunda, M. Kilima, R. Kapinga

## ABSTRACT

Sweetpotato (*Ipomea batatas* L), are at present grown in more than 100 countries of the world and most producers are in countries where poorest people live. In Tanzania the crop is grown all over the country and it plays an important role in household food security of many Tanzanian farmers. Studies involving Sweetpotato farmers, processors and private entrepreneurs were carried out in order to promote and commercialize sweetpotato. The processing technology and processed products were tested in three villages in the eastern zone of Tanzania. Processed products containing mashed Sweetpotato and wheat flour at a ratio of 1:4 mashed Sweetpotato: Wheat Flour, 1:3 Mashed Sweetpotato: Wheat Hour and 2:5 were prepared and tested with the consumers in order to identify products that will be eaten with satisfaction. Sensory evaluation attributes namely appearance/colour, taste/mouth feel, texture and general acceptability were given scoring ranking from 2.67 and 4.80 in hedonic scale (0 -5). Processing machine tested included the manual slicer and motorized slicer. Farmers indicated that the equipment suited to their needs and they can afford manual slicer. Results on overall general acceptability showed that sweetpotato based products at a ratio of 20 - 40% are accepted by consumers by using difference attributes {88.4%} and therefore can substitute wheat flour in making buns {maandazi}. Cost benefit analysis of improved processing was also carried out and results showed that sweetpotato based products increase profit by 20% and 45% per kilogram an indication that sweetpotato based products can be a source of income. In collaboration with other stakeholders efforts are now being made to incorporate orange-fleshed sweetpotato in supplementary/weaning foods.

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# The role of intellectual property rights in root and tuber crops research

Muthoka S.

ABSTRACT

Being creation arising from human mind (intellect). Intellectual Property (IP) is an important tool for research and trade and thus is exploited for development. For centuries millions of IP Rights have been granted throughout the world under various IP laws of various countries but for similar reasons: to encourage the creator to disclose his creation to the public and thereby promote the progress of science and the useful arts. The science and useful arts facilitate research, not only in Root and Tuber crops, but also in all other fields of technology. They also avail technological and marketing systems that are vital for the development of Root and Tuber crops in particular and the agriculture sector on one hand and national growth in general. This presentation is to introduce intellectual property rights and the role they play in research, technological and a socio-economic development of a country with respect to agriculture and particularly Root and Tuber Crops.

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# Regeneration and agro-bacterium-mediated transformation of Kenyan sweetpotato for resistance to sweetpotato feathery mottle virus

Njagi I.W., Gichuki S.T., Irungu, J., Machuka J. and Muluvi G.M.

## ABSTRACT

Sweetpotato virus disease (SPVD) is the most damaging disease of sweetpotato in Africa. On susceptible varieties yield loss caused by SPVD can be as high as 80%. Sweetpotato feathery molte virus (SPFMV) is the major cause of SPVD. Conventional breeding methods have had limited success in the control of SPVD. Therefore there is need for a biotechnological appraoch to creating virus resistance in sweetpotato. In this study a Kenyan sweetpotato variety, KSP36 was subjected to somatic regeneration experiments and to an *Agrobacterium*-mediated transformation. The effect of some plant growth regulators and two selective agents were tested. In transformation experiments, a coat protein gene of SPFMV was introduced into leaf and stem explants. Transient GUS histochemical analysis was used as a control test in the transformation process and the transformed explants were regenerated by the method of somatic embryogenesis. For selection of transformed explants paramomycin was found to be effective at 25mg/L while kanamycin was effective at 20mg/l. The lower concentrations of 2, 4-dichlorophenoxyacetic acid (2, 4-D) concentrations proved better in regeneration as opposed to the higher 2, 4-D concentrations Zeatin/IAA (indole acetic acid) combination was more effective at embryo production as opposed to kinetin/2, 4-D combination. Out of the 18 regenerants tested by PCR, 11 plants tested positive for the coat protein gene. This protocol can be recommended for other sweetpotato varieties.

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# Molecular characterization of Sweetpotato Transformed with sweetpotato Feathery Mottle Virus coat protein gene

Wanja R.W., Gichuki S.T., Gitonga N.M., Wanjala,B., and J. Machuka

ABSTRACT

Sweetpotato {*Ipomoea batatas* (L.) Lam) is a major crop that ranks seventh among food crops in annualproduction in the world. The most serious disease of the crop is russet crack disease, caused by sweetpotato feathery mottle virus (SPFMV). Yield loss caused by the virus can be as high as 80%. Efficient methods to control the virus are not available and conventional breeding programs to render genetic resistance has had very limited success. Breeding for resistance through genetic engineering offers an alternative solution for the control of SPFMV. Kenya Agricultural Research Institute (KARI) and Monsanto Company, USA have transformed sweetpotato with the SPFMV coat protein gene to confer resistance to SPFMV in the sweetpotato. Stable expression of the foreign genes was achieved using an *Agrobacterium tumefaciens* mediated system. Confirmation of transgene expression has been done using Kanamycin painting and β- glucuronidase (GUS) assays as well as Polymerase Chain Reaction and Southern Blotting.



# Analysis of sweetpotato passport data using Geographical Information Systems (GIS) and characterisation with morphological and molecular markers

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

ABSTRACT
Morphological and molecular characterization was done for a total of 595 sweetpotato varieties randomly collected from western. Eastern and Central Kenya. Using descriptors developed by the International Plant Genetic Resources Institute (IPGRI) and the International Potato Center (CIP), differences between varieties in vine, leaf, and storage root characters were recorded. A total of 24 descriptors were selected for analysis. Discriminate analysis and clustering procedures were used to analyze similarities between varieties based on the morphological data. The passport data of all the 595 accessions was analyzed using DIVA-GIS program. Five ISSR markers have been used to generate molecular profiles for 22 sweetpotato varieties. Relationships between varieties have been analyzed by dendrograms using UPGMA clustering procedure and multidimensional scaling. The comparison between morphological and molecular analysis is discussed.



# Participatory evaluation of sweetpotato varieties in central and eastern Kenya using the farmer field school approach

Gathaara, V.N., Gichuki, T.S., Ngugi J.N., Ngigi, G.K. Priscillia, K. and Kihurani, A.W

ABSTRACT
Sweetpotato (*Ipomea batatas* L) is a crop with high food value and is one of the world's highest yielding crops. In Kenya, the crop can be grown under a wide range of climatic conditions and its contribution to food security and nutrition cannot be overlooked. The crop's potential production levels have not been achieved in the past due to lack of

attention by agricultural researchers leading to loss of its germplasm. The crop has also been lacking a market-oriented development such as technologies towards value addition. However, more emphasis is now being given to the crop to enhance its contribution to the National food security and poverty eradication. The McKnight sweetpotato project is using the FFS approach in the introduction and evaluation of the various varieties alongside the orange-fleshed type. From this evaluation, it is expected that the farmers will be able to select and adopt the most superior varieties. To date a total of six FFS have been established in Central and Eastern Kenya with a membership of about 120 men and women farmers. KARI researchers and extension officers in the Ministry of Agricultural (MOA) are doing facilitation of the FFS. Farmers are fully in charge of running the FFS. The FFS members have so far gained the necessary knowledge and skills in sweetpotato production and value addition. The approaches being used in the FFSs include Participatory Technology Demonstrations (PTDs), Agro-ecosystems Analysis (AESA) and practical product development. All th PTD plots are performing well and the crop is at the harvesting stage. In regard to value addition, a total of 17 sweetpotato products have been developed. Observations made so far have shown that FFS is an effective approach to technology evaluation and transfer.