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PROCEEDINGS

Crop Improvement in Eastern and Southern Africa

Research Objectives and On-Farm Testing

**A regional workshop held in
Nairobi, Kenya, 20-22 July 1983**



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Crop Improvement in Eastern and Southern Africa: Research Objectives and On-Farm Testing

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Editor: Roger A. Kirkby

RÉSUMÉ

Un atelier a réuni un petit groupe représentatif de scientifiques travaillant à des programmes d'amélioration des cultures alimentaires en Afrique orientale et australe, pour discuter de la planification, de la conduite et de l'élaboration de ces programmes. Le débat a porté surtout sur les aspects méthodologiques, communs à la majorité des cultures réalisées par les petits fermiers et les plus susceptibles de permettre l'utilisation des résultats de la recherche.

On s'intéresse donc ici aux cultures locales et aux pratiques culturelles, à l'organisation de l'aide institutionnelle pour améliorer les cultures, aux objectifs particuliers des programmes et au mode d'établissement de ces objectifs, enfin aux méthodes d'évaluation employées pour formuler une nouvelle recommandation sur les travaux de vulgarisation. On résume aussi la séance de discussion qui a porté sur l'organisation des programmes d'amélioration des cultures, l'établissement des objectifs techniques, l'application des critères de sélection, la méthodologie pour les essais tous terrains et sur les fermes et, enfin, l'orientation de la recherche.

RESUMEN

Este seminario reunió un pequeño grupo representativo de científicos que trabajan en programas de mejoramiento de cultivos alimenticios en África oriental y meridional con el ánimo de discutir la planificación, la ejecución y el desarrollo de tales programas. El énfasis de la discusión recayó en aquellos aspectos metodológicos, comunes a la mayoría de los cultivos sembrados por los pequeños agricultores, que tienen la probabilidad de influir más en que los resultados de la investigación sean utilizados por el agricultor.

Entre estos trabajos se encuentran breves recuentos de las variedades locales y las prácticas de cultivo empleadas actualmente, la organización institucional para el fitomejoramiento, los objetivos específicos de los programas y su sistema de establecimiento, así como los procedimientos de evaluación empleados para llegar a las nuevas recomendaciones para los trabajos de extensión. También se incluye en este volumen un resumen de la sesión de discusión sobre la organización de los programas de fitomejoramiento, la fijación de los objetivos técnicos y la aplicación de los criterios de selección y la metodología para las pruebas tanto en fincas como en localización múltiple. Varios temas de política fueron identificados.

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ROOTS AND TUBERS

ROOT-CROPS PROGRAM, ZANZIBAR

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Cassava is grown throughout Zanzibar and Pemba on well-drained, sandy red soils. On both islands, these soils support mainly tree crops (cloves on Pemba and cloves, coconuts, and fruit trees on Zanzibar). On the more fertile soils, bananas and cocoyams are grown. Cassava is cultivated on poor, light soils, frequently under mature coconuts or where the tree cover is less dense. The coral soils on the eastern half of both islands support cassava in areas of deeper soils. Where the soil depth is sufficient, cassava is grown on ridges approximately 1 m apart. Ridging is used to prevent waterlogging during the extensive rains from March to May (Masika) and November to December (Vuli). It is also practiced as a soil conservation measure, aids deep root development, and facilitates root removal at harvest. The interplant spacing is generally 1 m (10 000 plants/ha). The main planting season is after the Masika rains, with a secondary planting season during the Vuli rains. These planting times, however, are not restrictive as Zanzibar does not suffer from a prolonged dry season. Cassava is planted when moisture becomes adequate.

Cassava is most frequently intercropped with sweet potatoes, although other short-term crops such as maize, groundnuts, and tomatoes are also used as an intercrop. On Zanzibar, according to the 1982 report on the implementation of agricultural work (Ministry of Agriculture, unpublished data), 18 409 ha were planted with cassava and 6448 ha with sweet potatoes, producing a yield of 6.3 and 6.8 t/ha respectively. The average size of a cassava farm is 0.4 ha (Carpenter 1980).

There are about 20 local varieties of cassava grown on Zanzibar. Most are considered "sweet" tasting and are classified according to their time to harvest: short term (6-9 months) and long term (12-18 months). Delays in harvesting cassava roots result in excess thickening and an increased fibre content, thus spoiling the root quality. The cassava is frequently tested by farmers in the fields where it is judged to be bitter or sweet. The tubers are commonly eaten boiled in coconut milk. About 30-40% of the cassava yield (generally the bitter types) is split, dried in the sun, and ground into flour. Some cassava, after being split and dried, is fermented for 12-24 hours and then boiled and mixed with coconut milk to form a very common Zanzibar dish called "makopa." The cassava leaves (kisambu) are cut once or twice during the plant's growing season and are eaten as a vegetable throughout the island. The people of Zanzibar believe that one or two

cuttings of kisambu help root development, but frequent cutting is avoided as it stunts growth and reduces yield. At one time, cassava was used as cattle feed but due to population increases and the low yield characteristics of local varieties almost all cassava is now grown for human consumption. Much cassava is sold in the town of Zanzibar, where urban tastes determine which varieties are brought to market.

The cassava program is jointly funded by the Government of Tanzania and the International Development Research Centre (IDRC) of Canada. Officially the project began in 1976 for a period of 3 years. At that time, CA\$54 000 was donated by the sponsors as an operational and capital budget, while the Zanzibar Ministry of Agriculture provided land for project work and salaries for the workers. Since the initiation of the program in 1976, Dr. Allan Carpenter of the Food and Agriculture Organization of the United Nations (FAO) has assisted in the development of the program. At present, the program staff includes two agronomists, one field officer, and several field assistants. Most of the field assistants have certificates in general agriculture and some have attended short courses in specialized fields at the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria.

PROGRAM OBJECTIVES

The broad objectives are: (1) to screen, under local conditions, root crop germ plasm imported from IITA to identify high yielding and disease and pest resistant varieties; (2) to institute a multiplication program of promising varieties; and (3) to assist in the diploma and degree training of Tanzanians in agriculture abroad.

Most local varieties, although sweet tasting, are low yielding and are highly susceptible to cassava mosaic disease (CMD) and to infestation of green mites (GM) (*Mononychellus tanajoa*). As mentioned earlier, the population increase has placed a heavy demand on cassava production and, thus, the emphasis on selecting for high yielding and disease and pest resistant varieties. However, as most cassava is eaten fresh (i.e., not dried and made into gari or similar flour products), its palatability is also an important criteria. The project has not started a plant-breeding program as IITA provides adequate improved germ plasm.

In the area of agronomic adaptation, the project is selecting varieties for: (1) shade tolerance -- cassava in Zanzibar is planted under mature coconuts due to competition for land with several other crops such as bananas, cloves, and citrus fruits (cassava production is reduced by heaving shading); (2) intercropping -- vertical, high-branching varieties as opposed to low, horizontal-branching varieties are better suited for intercropping with regard to shading and accessibility to the intercrop; and (3) weed suppression -- in areas where cassava is grown as a sole crop or at some distance from the home, frequent weeding is unlikely; thus, weed suppression would be a factor affecting yield increases as well as facilitating harvesting.

At present, the program has undertaken: (1) intercropping trials, e.g., cassava and groundnuts, cassava and upland rice, cassava and sweet potatoes; (2) shade tolerance trials under immature and mature coconuts; (3) cassava varietal trials involving IITA varieties

and local varieties and trials involving IITA sweet potato varieties and local varieties; (4) multilocal trials testing IITA varieties under different soil conditions on the islands; (5) trials to determine the opportune time to plant a particular variety, with reference to yield and disease and pest resistance; and (6) multiplication plots of selected IITA varieties.

EVALUATION METHODS

Multilocal trials are usually established on research stations, as the project has access to these lands. The initial selection of the site and planting and harvesting are performed under supervision and by workers from the main experiment station (Kizimbani). Land preparation and maintenance of the plots (e.g., weeding) are undertaken by project workers. The trials are checked as frequently as possible and scoring for CMD and GM resistance is performed by project field assistants.

Cassava cuttings are distributed free of charge to farmers throughout Zanzibar. The farmers are advised as to basic planting practices, i.e., ridging and spacing. They generally receive 10-20 stakes as the project's major limiting factor is the multiplication rate of varieties for distribution. The project has little control over whether or not the cuttings are planted with an intercrop and the frequency of weeding. The project attempts to do a follow-up study on each farmer within 4 months of the distribution of the cuttings.

The varieties' resistance to GM and CMD is evaluated using standard scoring scales from IITA. Counts are made as to the number of plants infected with GM or CMD. Yield is determined on a fresh-weight basis at maturity. Root characteristics such as skin colour, neck length, and shape are also evaluated using IITA guidelines. The tubers undergo two palatability tests; raw in the field and after boiling until soft. Workers involved in the harvest evaluate the cassava varieties for palatability.

In the Zanzibar market, 1 kg of tubers sells for TZSh10. The average cassava production is 4-6 t/ha, thus giving a gross return of TZSh40 000 (US\$3333). The expected yield with the IITA improved varieties is 20-30 t/ha; hence, a return of TZSh200 000 (US\$16 666), an increase of TZSh160 000 (US\$13 333).

The program has had some difficulty in obtaining accurate data from experimental sites other than Kizimbani. Soil test results are not available for any of the land under cassava trials. The farmer's small average plot size precludes accurate yield data (i.e., 10-20 plants of cassava per farm) and in the usual case the inaccessibility of the on-farm cassava trials prevents frequent follow-up studies by the project. Also, many of the varieties distributed by IITA are highly suitable for the production of gari (flour) but not simply through other methods of preparation used in Zanzibar such as boiling.

SUMMARY OF METHODOLOGICAL ISSUES

The objectives of the project have not changed over the past years although at present emphasis is being placed on distribution of

the IITA cuttings to farmers. The project also prefers to work directly with the farmers rather than through an intermediary. This ensures that the farmers actually receive the cuttings. A rapid multiplication hut is being built to aid in the quick multiplication of IITA varieties for distribution. The project continues to assist Tanzanians in agricultural training, which is an important aspect of the program.

The most interesting features of the program are the high root-yielding ability of the introduced varieties and their suitability for "kisambu." Some farmers actually steal the leaf cuttings to test them in their own fields. The high potential of the IITA varieties to produce good "kisambu" forces the project to post guards at field trials at Kizimbani to prevent the cutting of the leaves.

Carpenter, A.J. 1980. Economics of research and development of root and tuber crops in Zanzibar, Tanzania. In Root Crops in Eastern Africa: Proceedings of a Workshop held in Kigali, Rwanda, 23-27 November 1980. International Development Research Centre, Ottawa, Ontario, Canada, IDRC-177e, 75-77.

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