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ROOT CROPS IN EASTERN AFRICA

Proceedings of a workshop held in Kigali, Rwanda, 23-27 November 1980

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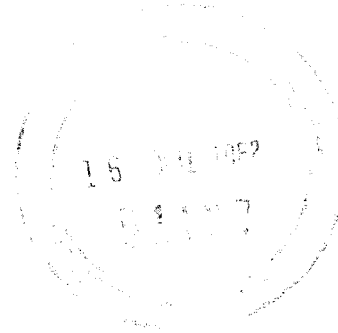

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Résumé

Cette brochure traite principalement des deux tubercules alimentaires les plus importants en Afrique orientale, soit le manioc et la patate douce. Quelques communications portent sur la pomme de terre, l'igname, le taro et l'« enset » dont la consommation est considérable dans plusieurs pays de la région. Le rendement de ces cultures est limité par de nombreux facteurs. Aussi, la recherche effectuée dans le cadre de programmes agronomiques nationaux et internationaux est-elle orientée vers la correction de cette situation en Afrique. Les difficultés rencontrées en cours de travaux et les progrès réalisés sont décrits par des représentants et des consultants de l'Institut international d'agriculture tropicale d'Ibadan (Nigéria) et d'autres pays tel que le Cameroun, le Kenya, l'Ouganda, le Malawi, le Zimbabwe, l'Éthiopie, le Burundi, le Zaïre et le Swaziland.

Resumen

Esta publicación se enfoca en la mandioca y el camote — los cultivos de tuberosas más importantes del Africa oriental. Los trabajos tratan también del *Solanum tuberosum*, *Dioscorea* spp., *Colocasia* sp., *Xanthosoma* sp., y *Enset* sp., que son todos cultivos importantes a los países de esta región. La producción de cada uno es restringida por serios constreñimientos, y el alivio de éstos es el objetivo de varias investigaciones llevadas a cabo por los programas agrícolas nacionales e internacionales en el Africa. El progreso hacia y los problemas encontrados en llegar a este fin son delineados por especialistas representando al Instituto Internacional de Agricultura Tropical en Ibadan, Nigeria, y a los países de Camerún, Kenia, Uganda, Malawi, Zimbabwe, Etiopia, Burundi, Zaire, y Swazilandia.

Contents

Agronomic research on cassava cultivation in Rwanda

J. Mulindangabo[1]

Cassava was introduced into Rwanda in the 1930s and quickly became a staple food for the people. Research on the crop in the country has been under way since the 1940s but received new impetus in 1975. It is now a focus of the Institut des sciences agronomiques du Rwanda (ISAR), which is cooperating with the International Institute of Tropical Agriculture (IITA) in an attempt to reduce the production constraints. ISAR has adopted a 6-year selection procedure, based on IITA standards, for its long-term research program and, on the short term, is involved in assessing the local varieties in its collection so that it can provide assistance to rural farmers.

Le manioc, introduit au Rwanda dans les années 1930, est rapidement devenu une denrée alimentaire de base. Les recherches sur la production se font depuis les années 1940 mais elles ont reçu un nouvel élan en 1975. Elles sont l'une des préoccupations principales de l'ISAR, l'Institut des sciences agronomiques du Rwanda, qui coopère avec l'IITA, l'Institut international pour l'agriculture tropicale, pour tenter de réduire les facteurs limitants de la production. L'ISAR a adopté un programme de sélection de six ans inspiré des normes de l'IITA à titre de projet à long terme, et évalue à court terme les variétés locales de sa collection pour aider les exploitants agricoles.

Cassava (*Manihot esculenta*) was introduced into Rwanda in 1936 by Belgian agronomists to enable the country's inhabitants to survive the famine raging at the time. Since then, it has played an increasingly important role as a staple food for the people. It is drought tolerant, grows well in poor soils, and gives high yields in areas that are marginal for other crops. It can be grown practically everywhere in Rwanda below 1800 m, although the highest yields are obtained at elevations between 1300 m and 1600 m.

The country can be divided into four major regions, according to cassava-production potential:

- Extremely high-yield region: Bugesera and Imbo;
- High-yield region: Mayaga, eastern plateau, and the eastern savanna;
- Moderate-yield region: Impara, central plateau, and the granitic ridge; and
- Poor-yield or no-yield region: shores of Lake Kivu, volcanic soils, the Zaire–Nile divide, and the Buberuka region. In this region, cassava is being replaced by potatoes, which are better adapted to the prevailing conditions.

Past research

The first cassava trials in the country were carried out at the Institut des sciences agronomiques du Rwanda (ISAR), Rubona, with cuttings from Venezuela, Uganda, Kenya, Indonesia, Zaire, etc. They provided valuable background on the factors affecting cassava adaptation, and they served as the basis for chemical analyses, yield trials, and selection.

Researchers tested several varieties to ascertain the relative concentrations of hydrocyanic acid in the roots, classifying them as:

- Bitter, very toxic, containing from 0.01872% to 0.02246% HCN, e.g., Eala Amer 07;
- Semi-sweet, moderately toxic, containing

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from 0.01123% to 0.01591% HCN, e.g., Ikiela, Sao Pedro-Preto, Creolinha; and

- Sweet, slightly toxic, containing from 0.00561% to 0.01029% HCN, e.g., Kenya 08.

The findings indicate that certain types of cassava considered sweet in their area of origin are toxic in Rubona or moderately toxic and vice versa. For example, Amer (6 months) is bitter in Mulungu but sweet in Karama-Maza. Thus, the degree of toxicity of a variety appears to be considerably influenced by environmental conditions.

Chemical analyses have shown that cassava roots are an incomplete food, high in carbohydrates but deficient in amino acids. The leaves have not been analyzed in Rwanda because they are not yet widely used as a food.

Yield trials of cassava varieties have been carried out at Rubona since 1940. Two trials were done from 1940 to 1944, the aim being to catalogue the varieties according to fresh root, peeled root, and starch production. The variety Eala Amer 07 produced the best average yields: fresh roots, 20.4 t/ha; peeled roots, 16.7 t/ha; and starch, 4.2 t/ha. Other varieties that were also shown to be of value were: Ntolili, Sao Pedro-Preto, Creolinha, Ikiela Pacarae, Kenya 08, and Kenya 03.

Later, work on cassava at Rubona was limited to maintenance of the eight acceptable varieties in the collection and to multiplication and distribution work on the elite variety Eala 07. The intercropping of cassava with legumes, especially groundnuts, was determined to be a good practice.

Since 1975, cassava has held the attention of researchers at ISAR because of the problems hindering its production, such as: the loss of the Eala 07 multiplication fields after elephants went on the rampage at Karama in 1975; a severe attack of cassava mosaic disease; and the appearance of the green mite and bacterial blight.

The loss of the multiplication fields at Karama, which had been supplying rural farmers with improved planting material, was a considerable setback, forcing a halt to distribution while Rubona staff reestablished production. Cuttings were collected from farmers, especially those in the Icyanya and Nkanga regions where the distribution of cassava had previously been intensive, and about 20 varieties from INERA (Zaire) were added to the collection.

In November 1975, a hectare of Eala amer 07 was planted at Karama. Unfortunately, when the cuttings took root, most showed signs of mosaic disease and had to be removed from the field and burned. The remainder were monitored weekly for the presence of mosaic symptoms. By October 1976, only about 15% of the plants were left.

The cuttings taken from this material were planted (1.5 ha) in November 1976 and were screened for disease during the following year. About 50% of the plants remained healthy, providing enough planting material in November 1977 for 5 ha. Still, some of the plants (about 1%) showed symptoms of mosaic disease. These were immediately eliminated and replaced. Thus, by 1978, the ISAR station at Karama was once again able to launch its cassava-distribution program to rural areas, and by 1980 it had distributed 560 000 cuttings of Eala Amer 07.

Follow-up has shown that fewer than 10% of the plants show symptoms of mosaic disease and that it is possible to reduce this figure if farmers weed out diseased plants.

Mosaic is the main disease affecting cassava in Rwanda; its control depends on careful selection of planting material. Farmers and extension workers alike should ensure that cuttings for new plantations are from healthy stalks.

Future prospects

Cassava production in Rwanda is constrained primarily by diseases and pests such as mosaic, bacterial blight, cercosporiosis, and the cassava green mite, which has become very damaging in recent years, especially in the dry season. As a first step in dealing with these problems, ISAR has outlined a two-part, cassava-research program.

Short-term research

The purpose of the short-term research within the program is to determine the morphological and agronomic characteristics of the varieties in the collection. At present, the collection includes 55 varieties, and others will be added gradually. The results of this work are expected to be used in assisting individual farmers to choose the most suitable variety for them.

Activities began 2 years ago at Karama and Rubona and have involved the setting up of a yield-testing program for the different vari-

eties. Harvesting is being done after 12, 18, and 24 months. At harvest, observations on incidence of disease, morphology, and agronomic characteristics will be recorded, with IITA standards being applied for shape, length, circumference, colour of peel, etc.

Long-term research

The selection process is long term and is used to obtain resistant varieties, which are vital in the search for an effective solution to disease and pest problems, and it needs to be based on a collection with wide genetic variability, produced through techniques of rapid multiplication. Thus, at present, ISAR staff are expanding their collections, three series of cassava seed beds already having been built at Karama from IITA seeds and from seeds harvested from local material. Three hundred and thirty-five cuttings are being evaluated. The purpose of the long-term research work is to obtain varieties that yield well, mature early, resist attack by diseases and pests of economic importance, and adapt readily to different cassava-producing regions.

The procedures follow a 6-year schedule. In the 1st year, seeds (60 000–100 000) are acquired from IITA and from local varieties and are planted in the Karama seed beds; sorted for resistance to mosaic, bacterial blight, cassava green mite, and other diseases of economic importance; taste-tested for level of HCN contents; and studied in terms of root structure and characteristics (shape, length, circumference, and colour of peel).

In the 2nd year, cuttings at Karama are evaluated, researchers choosing the best 2000–3000 cuttings from the best families, verifying the seed-bed evaluation for disease resistance and root characteristics, determining dry matter (expressed as a percentage), measuring yields, assessing damage from insect attack, and noting morphological and agronomic characteristics.

The 3rd year is devoted to preliminary yield trials, at Karama, of the best 100 cuttings from which about 50 are chosen for advanced yield trials the next year at three different locations (Karama, Rubona, Mayaga) and in mixed-cropping systems with beans and groundnuts.

During the 5th year, uniform yield trials are conducted with the best 25 cultivars at five different locations (Karama, Rubona, Gisaka, Mayaga, and Mutura), the results being compared with those from advanced yield tests. The last year is spent on rapid multiplication and distribution of the best 2–5 varieties.

This method of research, based on IITA standards, combines the best families with a selection of the best subjects within the best families. We at ISAR hope that, by carrying out this research with the cooperation of IITA and with other national programs, we can devise solutions to cassava-production difficulties.