

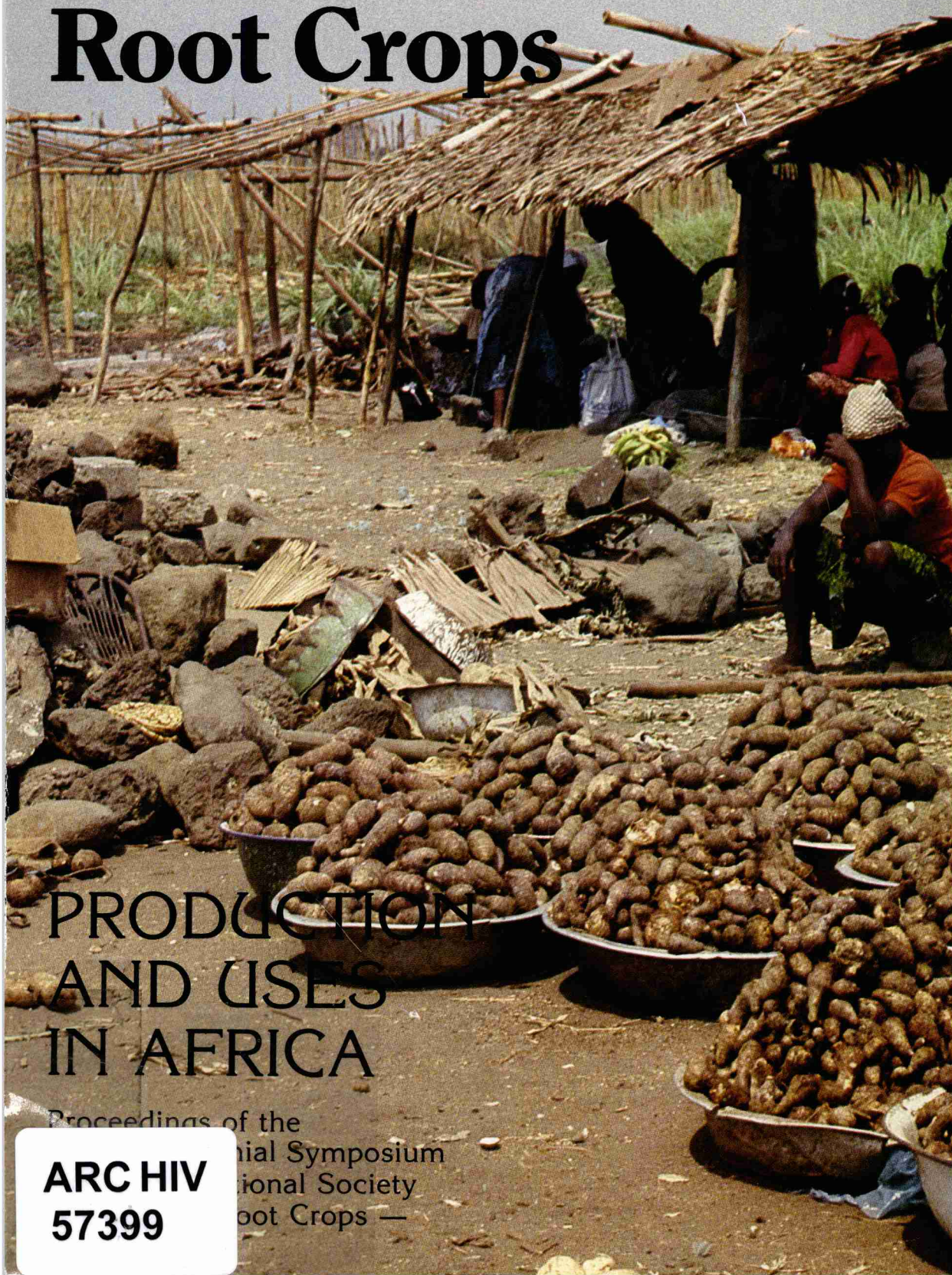
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Tropical Root Crops

PRODUCTION AND USES IN AFRICA

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The International Society for Tropical Root Crops — Africa Branch was created in 1978 to stimulate research, production, and utilization of root and tuber crops in Africa and the adjacent islands. The activities include encouragement of training and extension, organization of workshops and symposia, exchange of genetic materials, and facilitation of contacts between personnel working with root and tuber crops. The Society's headquarters are at the International Institute of Tropical Agriculture in Ibadan, Nigeria, but its executive council comprises eminent root and tuber researchers from national programs throughout the continent.

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Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa, Canada

Terry, E.R.
Doku, E.V.
Arene, O.B.
Mahungu, N.M.

International Society for Tropical Root Crops, Africa Branch, Ibadan NG

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ABSTRACT

A mixture of original research, updates on procedures, literature reviews, and survey reports, this document resulted from the second symposium of the International Society for Tropical Root Crops — Africa Branch, with 77 participants from 16 countries. The focus was cassava, yams, cocoyams, and sweet potatoes, from the perspectives of breeders, agronomists, soil specialists, plant pathologists, entomologists, nutritionists, food technologists, etc. Learning from past successes and failures, many of the researchers directed their efforts toward problems obstructing progress in reaching improved production and use of root crops and attempted to view, realistically, the context in which their results would be applied.

RÉSUMÉ

Résultats de recherches récentes, mises à jour sur les méthodes de recherche, revues de publications et rapports de sondages sont contenus dans ce document issu du Deuxième symposium de la Société internationale pour les plantes-racines tropicales — Direction Afrique, qui a réuni 77 participants de 16 pays. Des communications sur le manioc, le taro, le yam et la patate douce ont été présentées par des phytosélectionneurs, des agronomes, des pédologues, des phytopathologistes, des entomologistes et des spécialistes de la nutrition et des aliments, entre autres. Tirant leçon de leurs succès et de leurs échecs, beaucoup de ces chercheurs ont dirigé leurs efforts vers la solution des problèmes qui entravent l'augmentation de la production et de la consommation des plantes-racines et ont tenté de considérer d'un œil réaliste le contexte qui sera celui de l'application de leurs recherches.

RESUMEN

Una mezcla de investigaciones originales, actualizaciones de procedimientos, reseñas de literatura e informes de encuestas, este documento es el resultado del segundo simposio de la Sociedad Internacional de Raíces Tropicales, Filial Africana, que contó con 77 participantes de 16 países. El simposio se centró en la yuca, el ñame, el cocoñame y las batatas, desde la perspectiva de los fitomejoradores, los agrónomos, los especialistas en suelos, los patólogos vegetales, los entomólogos, los nutricionistas, los tecnólogos alimenticios, etc. A partir de los éxitos y fracasos anteriores, muchos de los investigadores encaminaron sus esfuerzos hacia los problemas que obstaculizan el avance para lograr una producción y un uso mejorados de las raíces y trataron de obtener una visión realista del contexto en que los resultados pueden ser aplicados.

TROPICAL ROOT CROPS: **PRODUCTION AND USES IN AFRICA**

EDITORS: E.R. TERRY, E.V. DOKU, O.B. ARENE, AND N.M. MAHUNGU

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CASSAVA SCREENING IN RWANDA

J. MULINDANGABO¹

In Rwanda, work to improve cassava was begun in earnest in 1979 following serious damage from diseases and pests, especially cassava mosaic, bacterial blight, and the cassava green mite. The purpose of this paper is to describe progress in research by the Institut des sciences agronomiques du Rwanda (ISAR) in conjunction with the International Institute of Tropical Agriculture (IITA) to obtain and screen breeding material for resistance to disease and the green mite. The future prospects of cassava research in Rwanda are also discussed.

In 1978, ISAR outlined a screening program to find productive, disease-resistant varieties of cassava. It has now begun advanced yield trials, and final results are expected in another year and a half. Initial findings are promising.

OBJECTIVES

The aim of cassava screening in Rwanda is to obtain varieties that are:

- High yielders in terms of quantity and quality per unit area and time;
- Resistant to disease and insects that have an economic impact, with efforts being concentrated on cassava mosaic, bacterial blight, and acariasis;
- Low in hydrocyanic acid;
- Adapted to different environments in the cassava-growing areas of Rwanda, nutritious, and likely to be accepted by consumers.

IITA's procedures (Hahn 1982) were adopted for cassava screening in ISAR but were adapted to the agroecological conditions found in Rwanda.

RESULTS

Since 1979, five series of seed beds were prepared, representing 42 794 seeds, of which 18 000 came from exotic varieties (IITA) and 24 794 from local families.

Natural infection by cassava mosaic caused little damage, and *Cercospora* had no economic impact, as it attacked only the lower leaves. Bacterial blight was not observed. None of the plants were spared infestation by the cassava green mite, although some of the clones exhibited tolerance, which was exploited in later screening. The root characteristics of each plant were recorded at harvest.

Clonal evaluation trials were conducted to check and substantiate nursery findings and to try to assess the material for yield. Four series of evaluation trials have already been conducted with roughly 300 clones planted in rows with 4–6 stakes/clone, depending on the availability of planting material.

Observations were regularly recorded; the findings were that:

- 8–10 clones developed mosaic, with the borders consisting of heavily infected plants to facilitate natural infection. The vector, *Bemisia tabaci*, seems to play a very minor role in transmitting the disease under the conditions existing at Karama.
- All the clones were attacked by *Cercospora henningsi*, but the upper leaves were spared. *Cercospora caribbaea* was less severe in its attack.
- The number-one enemy was the green mite, to which all the clones were susceptible, especially during the dry season. Consideration was given to importing plant material in the form of tissues from resistant varieties that have been identified by IITA.

Clones with yields greater than 20 t/ha were selected for a screening trial (Table 1) on the basis of response to diseases and pests and root

¹ Institut des sciences agronomiques du Rwanda (ISAR), Karama, Kigali, Rwanda.

Table 1. Results of clonal evaluation trials, 1980–82.

	1980	1981	1982
Planted	335	386	324
Infected with			
Mosaic	41	5	3
<i>Cercospora</i>	260	210	105
Acariasis	335	366	324
Eliminated	232	322	260

Table 2. Yields for the 10 best clones in the screening trial, 10 months after planting.

Variety	Fresh root yields (t/ha)	% of control yield	Origin
Kibombwe/1	31.3	210	Local
30572-1977/12	30.0	201	IITA
Eala 07/4	29.6	199	Local
AYT Bulk 1977/12	28.3	190	IITA
Ikiela/2	28.2	189	Local
IYT Bulk 1977/11	27.8	187	IITA
AYT Bulk 1977/11	27.1	182	IITA
PYT Bulk 1977/69	27.0	181	IITA
PYT Bulk 1977/29	26.5	178	IITA
IYT Bulk 1977/18	25.2	169	IITA
Eala 07 (control)	14.9	100	Average for 35 plots

characteristics. Screening tests were to compare varieties from the clonal evaluation with a local variety (control). Two screening trials have already been conducted at Karama, and a third is under way. Only the first, set up in 1981, has been completely analyzed. It included 103 clones from the 1980 clonal evaluation. The control Eala 07 included four clones.

During the trial, the harvest was staggered. The first harvest, at 10 months, allowed ISAR staff to detect early, productive species, and the later harvests ensured productive species with longer growing cycles were detected.

Findings showed clonal tolerance to mosaic, susceptibility to *Cercospora*-induced diseases and acariasis, and a wide genetic range in resistance to drought and attack by the cassava green mite.

At the first harvest, 44 clones were selected and planted in advanced yield trials at Karama, Rubona, Mututu, and Mutara. The yield for these clones was equal to or greater than 20 t/ha (Table 2). The second harvest took place exactly 15 months after planting. The 44 clones selected

during the first harvest for the advanced yield trials continued to produce satisfactorily.

Root characteristics were far more interesting in the second than in the first harvest, and there was a substantial increase in yields (Table 3). In fact:

- Some yields had doubled; for example, the control — a late variety — increased from 14.9 t/ha at 10 months to 36.8 t/ha at 15 months; and
 - Varieties Eala 07/4, Ikiela/2, PYT Bulk 1977/69 were among the 10 best in both harvests.
- In the third harvest after 20 months (Table 4):
- The variety PYT Bulk 1977/31 doubled its 15-month (35.9 t/ha) yield; i.e., it produced 70.9 t/ha;
 - Eala 07/4 and Ikiela/2 produced the same yields after 10 months as after 15 or 20 months;
 - The local varieties produced higher yields after 20 months than did the exotic families, once again demonstrating that local varieties are late in maturing.
 - In the control Eala 07, there was little difference between 15-month and 20-month yields; and
 - Although 20-month yields were higher than 15-month yields, the increases did not offset the additional time that the crop occupied the land. The 15-month crop seems the best suited to conditions in Rwanda.

The 44 varieties selected after the first harvest were further tested in advanced yield trials at Karama, Rubona, Mututu, and Mutara. Five local varieties served as controls, bringing the

Table 3. Yields for the 10 best clones in the screening trial, 15 months after planting.

Variety	Fresh root yields (t/ha)	% of control yield	Origin
Kiryumukwe/1	59.3	161	Local
Ikiela/2	56.7	154	Local
PYT Bulk 1977/19	56.6	153	IITA
Eala 07/4	54.7	148	Local
PYT Bulk 1977/18	48.1	130	IITA
30001/9	47.3	128	IITA
PYT Bulk 1977/69	44.1	119	IITA
30595 Bulk 1977/10	40.5	110	IITA
30572 Bulk 1977/2	37.7	102	IITA
PYT Bulk 1977/31	35.9	97	IITA
Eala 07 (control)	36.8	100	Average for 35 plots

Table 4. Yields for the 10 best clones in the screening trial, 20 months after planting.

Variety	Fresh root yields (t/ha)	% of control yield	Origin
PYT 1977/31	70.9	172	IITA
Eala 07/4	68.7	167	Local
Kibombwe/14	64.7	157	Local
Ruharwe/3	57.4	140	Local
Ikiela/2	57.3	139	Local
Kiryumukwe/1	52.6	128	Local
Kiryumukwe/3	50.7	123	Local
PYT Bulk 1977/20	48.9	119	IITA
30395 Bulk 1977/9	48.2	117	IITA
IYT Bulk 1976/3	47.6	116	IITA
Eala 07 (control)	41.0	100	Average for 35 plots

total number of varieties included in the trials to 49.

The trials were conducted jointly with the Service des semences sélectionnées of the Mutara Office de valorisation agricole et pastorale du Mutara. In the four sites, each variety was planted in rows with 8 plants/row in a Fischer block design with four replications. Planting took place in October–November 1981. The varieties showed good growth except at Rubona where the land set aside for the trial was poor. In general, phytosanitary conditions were satisfactory in the four trials, indicating that screening

had paid off. The crops were harvested in February and March 1983, i.e., after 15 months' growth (Table 5).

The variety Creolinha Java, which was introduced into Rwanda about 1930–32, stood out. Unfortunately, it tends to be fibrous and has not been accepted by the rural population. As it proved to be a good producer at all four sites, further work should be done on this variety.

A multiple mean comparison ($P < 0.05$) showed that Creolinha, Ntolili Seed 16, Kiryumukwe/3, Kibombwe/13, and Kiryumukwe/18 were significantly better than the other varieties; Kibombwe/13 was adapted to all four sites. Amer Eala 07, which currently has a wide distribution, proved to be a very promising variety. There are plans to improve it by crossing it with new varieties to shorten the growing cycle and introduce disease resistance. The differences attributable to environment were highly significant. The most favourable environmental conditions were found at Mututu and Mutara and the least at Rubona.

For a comparative varietal trial conducted at Karama, Rubona, and Mutara, 10 sweet varieties — Mulundi, Maguruyinkware, IYT Bulk 1977/11, PYT Bulk 1977/29, PYT Bulk 1977/66, Kiryumukwe/21, Kibombwe/13, Kiryumukwe/3, IYT Bulk 1977/17, and Kibombwe/14 — and 10 bitter varieties — Eala 07, Creolinha, Ntolili Seed 16, PYT Bulk 1977/69, PYT Bulk 1977/19, Kiryumukwe/18, 30395 1977/11, Maguruyinkware/1, Eala 07/4, Amer 6 months Seed 2/3 —

Table 5. Mean yields (t/ha) of 20 varieties in advanced yield trials.

Variety	Karama	Rubona	Mutara	Mututu	Mean
Creolinha	38.8	16.8	82.4	52.5	47.6
Ntolili seed 16	37.0	16.2	46.5	57.2	39.2
Kiryumukwe/3	26.7	17.7	62.0	45.9	38.1
Kibombwe/13	24.2	22.1	63.9	37.8	37.0
Kiryumukwe/18	24.5	19.4	60.4	33.8	34.5
IYT 1977/7	24.9	13.4	52.4	40.0	33.4
Kibombwe/14	29.6	16.6	61.5	24.1	32.9
Eala 07	37.8	19.3	39.9	34.4	32.9
Mulundi	20.6	15.9	39.8	54.7	32.7
IYT Bulk 1977/11	23.2	19.8	44.7	40.6	32.1
Ikiela/1	31.7	8.9	39.6	42.2	30.6
Kibombwe/1	25.0	22.8	23.8	48.1	29.9
30572 1977/24	13.5	15.6	20.8	63.1	28.3
PYT Bulk 1977/69	31.4	11.1	42.9	25.9	27.8
Eala 07/4	24.3	12.9	38.4	31.6	26.8
Maguru	25.9	11.9	40.9	26.9	26.4
30395 1977/11	21.9	7.3	40.5	30.6	25.1
IYT Bulk 1976/6	12.3	8.2	19.2	59.4	24.8
Kiryumukwe/21	20.1	15.6	26.8	34.7	24.3
IYT Bulk 1976/9	15.9	6.2	27.8	46.9	24.2

were selected. The purpose of the trial was to screen the one or two best varieties for propagation and distribution in a rural environment.

FUTURE PROSPECTS AND CONCLUSIONS

As a result of the initial findings, research will concentrate on:

- Development of a hybrid-producing program designed to improve local varieties, i.e., Eala 07, Creolinha, Maguruyinkware, which have the advantage of being well adapted to Rwanda's ecological conditions but the drawback of being susceptible to diseases. Crossing the best varieties in the selection with local varieties should produce highly productive offspring that are both disease-resistant and adapted to the country's ecological conditions. This hybridization program is to begin in 1984.
- The best varieties from screening will be tested in a rural environment in the Bugesera and Gisaka-Migongo regions as part of a

joint study with the farming-system program. This program receives financial aid from the World Bank via the Bugesera-Gisaka-Migongo (BGM) project that has been operating in the region for close to 6 years. Scientific support is provided by IITA, which has supplied two scientists to work in the program. Variety tests in a rural environment will begin with the 1983-84 growing season.

- Trials on cultural methods (planting dates, mixed cassava cropping, mode and method of planting) will be conducted, and the Karama station is to pursue its work on the rapid propagation of the most promising cassava varieties.

I wish to thank Dr S.K. Hahn, the director of IITA's root-crop program, who visited the ISAR project on two occasions, advised judiciously, and offered encouragement. Thanks also go to all those who have helped in the program and without whom this work could not have been satisfactorily completed. Also, I am grateful to ISAR and IDRC for making it possible for me to attend this symposium.