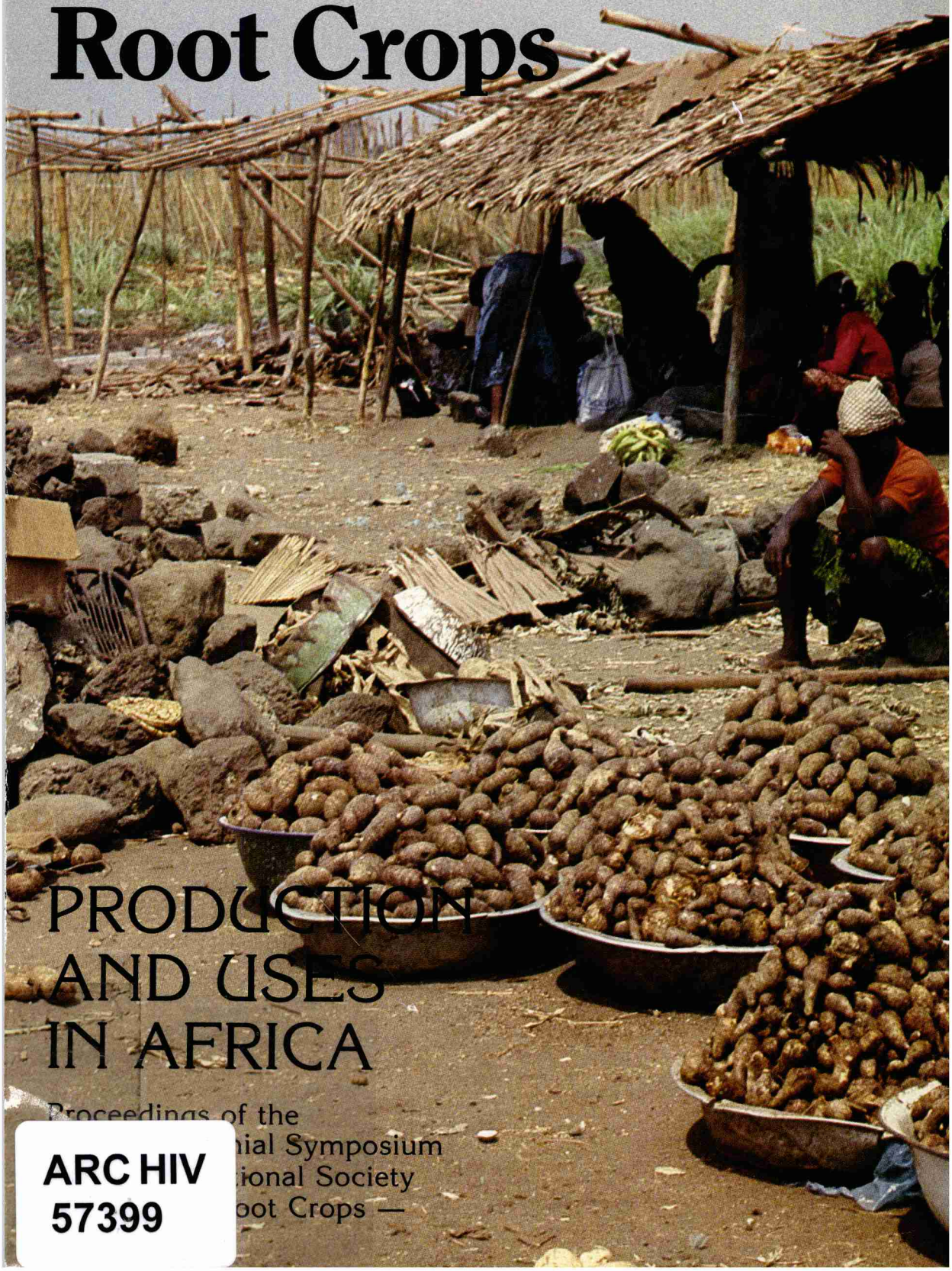
Tropical Root Crops



PRODUCTION AND USES IN AFRICA

Proceedings of the
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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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IDRC-221e

Tropical root crops: production and uses in Africa : Proceedings of the second Triennial Symposium of the International Society for Tropical Root Crops — Africa Branch held in Douala, Cameroon, 14–19 August 1983. Ottawa, Ont., IDRC, 1984. 231 p.: ill.

/Cassava/, /root crops/, /plant production/, /Africa/ — /genetic improvement/, /planting/, /plant diseases/, /pests of plants/, /intercropping/, /fertilizers/, /crop yield/, /sweet potatoes/, /plantains/, /agriproduct processing/, /nutritive value/, /food enrichment/, /feed/, /agricultural research/, /conference report/, /list of participants/.

UDC: 633.68 ISBN: 0-88936-409-5

Microfiche edition available.
Il existe également une édition française de cette publication.

TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA

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.

IDRC-221e

TROPICAL ROOT CROPS:
PRODUCTION AND USES IN AFRICA

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PROCEEDINGS OF THE SECOND TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS — AFRICA BRANCH HELD IN DOUALA, CAMEROON, 14 – 19 AUGUST 1983

CONTENTS

COMPORTMENT STUDIES WITH SWEET POTATOES IN THE HIGHLAND ZONE OF CAMEROON

S.N. LYONGA[1] AND J.A. AYUK-TAKEM[2]

Comportment and stability studies were conducted with sweet potatoes on sites ranging in altitude from 1176 m to 1500 m in the wet and dry seasons. Palatability and ambient-storage tests were also carried out with these cultivars. In the first trial involving 11 Cameroonian and 3 exotic varieties, Pa 8 was identified as being high-yielding in the wet season and Pa 4 was the highest yielding cultivar in the August–January planting. Variety Pa 11 had good palatability (6.9 out of a total score of 10.0) and ambient-storage (7.0 of 10.0) scores. In the second trial involving six sweet-potato cultivars, cultivar Tib 1 from the International Institute of Tropical Agriculture, Ibadan, was observed to be high-yielding in both the wet and the dry seasons, had a good taste score of 7.5/10.0, and had an average storage score of 5.5/10.0 at 45 days after harvest. Stability studies involving six cultivars grown from 1975 to 1978 were undertaken with Eberhart and Russell's (1966) regression method and Francis and Kannenberg's (1978) genotype-grouping technique. Variety Tib 1 was identified as being relatively stable in performance.

Sweet potatoes (*Ipomoea batatas*) are grown in most administrative provinces of Cameroon but are not a major staple crop. They are generally grown in association with other crops like cassava, maize, yams, beans, etc. In some localities such as in Bambili in Mezam Division of the North West Province, they are occasionally grown alone during the second season (August–January).

Annual production is low. In 1980–81, 2.96×10^5 t were produced, with a projected annual increase of about 9.2% (Cameroon, Government of 1976). The tubers and, in some parts of the country such as in the South Center Province, the young leaves are eaten.

Several varieties are grown in the country. The tubers range from round to cylindrical and are corrugated or smooth. The flesh colours include white, yellow, and red. The leaves also vary; some are serrated whereas others are ovate and pointed at the ends.

The objective of this study was to identify high-yielding and disease-tolerant varieties with good cooking qualities to be released for general cultivation in the highland areas where population pressure on the land is high (50–80 persons/km^2).

MATERIALS AND METHODS

The study was in two parts, namely:

- Collection and comportment study involving 14 different sweet-potato cultivars in three localities — Dschang (1500 m), Bambui Plain (1330 m), and Babungo (1176 m) — in the highland areas of Cameroon from 1968 to 1971; and
- Comparison of six sweet-potato varieties at Babungo from 1975 to 1978.

In both, the spacing was 1 m between ridges and 0.5 m between plants on the ridge (20 000 plants/ha). Plot size was 3 m × 12 m (3 ridges, 12 m long). All three ridges were used for data collection, and each plot received 54 kg of well-rotted farmyard manure (15 t/ha). Because of low temperatures at the three sites, tuber initiation was slow, and harvest was 5 months after planting (mid-March–mid-August — wet-season crops — and mid-August–mid-January — dry-season crops). Land preparation (mowing, plowing, harrowing, and ridging) was done with a Massey Ferguson 265 tractor.

The first part of the study was undertaken by Lyonga and Tardieu (1971) with 11 local and 3

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Table 1. Mean tuber yields (t/ha), palatability, and storage scores of 14 sweet-potato cultivars grown at three highland sites in Cameroon from 1968 to 1971.

	Mean yield (t/ha)		Score (maximum 10.0)[c]	
	Wet season[a]	Dry season[b]	Taste	Storage (45 days)
Pa 1	13.5	4.5	6.5	4.0
Pa 2	11.0	2.9	5.3	3.0
Pa 4	11.2	5.8	5.0	1.0
Pa 6	9.1	1.2	5.8	2.0
Pa 7	16.7	5.0	5.0	3.0
Pa 8	21.8	4.3	5.5	1.0
Pa 9	6.1	3.0	8.2	3.0
Pa 10	7.8	2.2	7.5	2.0
Pa 11	13.5	3.3	6.9	7.0
Pa 12	6.5	1.3	5.9	4.0
Pa 13	9.1	3.0	6.9	6.0
Yellow flesh	5.5	3.4	4.6	1.0
TN 53	13.8	1.9	5.9	1.0
TN 57	13.3	4.0	4.6	8.0
LSD (P = 0.05)	3.7	1.1	0.9	1.9

[a]Yields are for three seasons (1968, 1970, and 1971).
[b]Yields are for two seasons, namely 1968 and 1970.
[c]Scores are for 1971 only.

exotic sweet-potato cultivars. The cultivars tested were Pa 1 and Pa 2 ex Dschang in the Western Province; Pa 4 ex Mbanga in Littoral Province; Pa 6 ex Manjo in Littoral Province; Pa 7, Pa 8, Pa 9, and Pa 10 ex N'Kolbisson in the South Center Province; Pa 11 ex Ebolowa in the South Center Province; Pa 12 (serrated leaves) and Pa 13 (ovate leaves) ex Bambili in the North West Province; Yellow flesh ex USA; and Tai Nang (TN) 53 and TN 57 ex Taiwan.

The comportment studies were carried out in 1968 at Dschang in the Western Province in both the wet and dry seasons. A similar trial was carried out at Bambui Plain in 1970; the first crop was weeded twice before being harvested, and the second was weeded only once. At Babungo, the cultivars were tested only in the March–August season, 1971. Trials were replicated eight times.

For the Babungo trial in 1971, the tubers of each variety were also assessed by a taste panel. The tubers were prepared for tasting in three different ways — namely boiled, roasted, and fried in groundnut oil. Before each taste, the panel washed their mouths with soda water. All scores were based on a scale of 1–10, with 10 being the best.

At Babungo, tubers of all the varieties were stored at ambient temperature for 45 days, after which they were scored (1–10). Again, a score of 10 was the best, indicating that the variety stored well.

The second part of the study (comparing performance of six varieties at Babungo) was con-

Table 2. Mean tuber yields (t/ha) of six sweet-potato cultivars grown at Babungo from 1975 to 1978.

	Yield (t/ha)					
	Wet season				Dry season	
	1975	1976	1977	1978	1975	1976
Tib 1	56.3	49.5	27.1	28.2	48.9	15.8
Tib 2	49.3	29.2	16.1	24.0	30.5	11.5
TN 53	43.7	15.1	15.5	21.0	46.8	1.8
Pa 7	36.5	26.1	12.3	21.1	30.3	6.2
Pa 8	31.4	33.4	19.9	26.5	39.2	4.9
Pa 11	26.9	17.2	11.3	18.0	25.4	3.6
LSD (P = 0.05)	12.9	14.5	6.5	4.4	11.2	6.2

Table 3. Taste and ambient-storage scores of six sweet-potato cultivars grown in the wet season of 1978 at Babungo.

	Score (maximum 10.0)				
	Taste				Ambient storage for 45 days
	Boiled	Roasted	Fried	Mean	
Tib 1	7.3	8.5	6.8	7.5	5.5
Tib 2	4.3	5.2	6.0	5.2	4.3
TN 53	4.0	6.0	5.3	5.1	2.0
Pa 7	5.5	5.8	4.8	5.4	2.5
Pa 8	6.0	5.2	5.7	5.6	1.3
Pa 11	7.3	7.0	6.6	7.0	7.6
LSD (P = 0.05)	1.5	1.3	0.8	1.1	2.5

Table 4. Regression coefficient, residual mean square, and mean tuber yield (t/ha) of six sweet-potato cultivars grown at Babungo from 1975 to 1978 during the wet season.

Cultivar	Regression coefficient	Residual mean square	Mean tuber yield (t/ha)
Tib 1	0.98 ± 0.03	0.00	40.3
Tib 2	1.40 ± 0.52	26.80[a]	29.7
TN 53	1.17 ± 0.63	15.50[a]	23.8
Pa 7	1.00 ± 0.26	13.50[a]	24.0
Pa 8	0.47 ± 0.11	1.99	27.8
Pa 11	0.62 ± 0.15	5.00[a]	18.4

[a]Significant at the 1% probability level.

ducted in the Ndop Plain from 1975 to 1978. Two crops were planted in 1975 and 1976, but from 1977 to 1978 only one crop was planted in the main rainy season (mid-March–mid-August). Each plot was replicated four times.

The trials comprised Tib 1 and Tib 2 from IITA, Ibadan, Nigeria; TN 53 from Taiwan; Pa 7 and Pa 8 from N'Kolbisson, Yaounde; and Pa 11 from Ebolowa.

In the 1978 first-season trial, along with tuber yields, palatability and storage at ambient conditions were assessed.

Eberhart and Russell's (1966) regression method was applied to tuber yields for the 4 years during the main growing season (mid-March–mid-August) as a measure of stability of performance of each variety. Eberhart and Russell (1966) defined a stable variety as one with a high mean yield, unit regression coefficient, and deviations from regressions as small as possible.

The method of Francis and Kannenberg (1978) was also used to determine stable varieties; this is the genotype-grouping technique. It plots the mean yield of each variety against the coefficient of variability (CV) of its yields over environments. The method groups varieties into four classes, namely high and low mean yields with small and large variations. Varieties with high mean yields with small variations are considered stable, with high performance.

Results and Discussion

In wet-season trials, cultivar Pa 8 significantly ($P < 0.05$) outyielded the other cultivars, and Yellow flesh yields were consistently inferior to the others tested (Table 1).

During the dry-season trials, Pa 4 significantly ($P < 0.05$) outyielded all varieties except Pa 7. Variety Pa 8, which outyielded other varieties in the wet season, ranked fourth in the dry-season trials. The wet-season yields (11.4 t/ha) were significantly higher than those for the dry season (3.3 t/ha) (Table 1), and, in general, most sweet-potato growers plant in March, taking advantage of the higher yields possible. The yields of the August–January crop are low because the rains usually stop before 15 November. If weather conditions are drastic, the sweet-potato weevils (*Cylas formicaris*) damage the tubers and are responsible for further yield reductions.

Cultivar Pa 9 had the highest taste score (8.2) but also had a low storage score (3.0). At the same time, this variety had low tuber yields in both wet- and dry-season plantings. Variety Pa 11, although lower yielding than Pa 8, had good taste (6.9) and storage (7.0) scores. Pa 13 had good taste and storage scores (6.0) but produced low yields. Among the exotic varieties tested, TN 57 had an average taste score (4.6) and a high storage score (8.0).

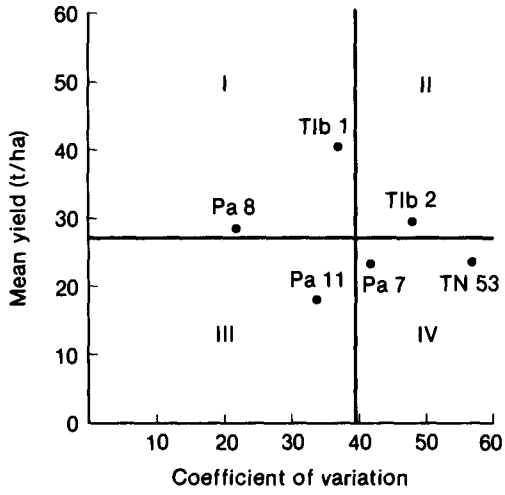

Fig. 1. *Mean tuber yields plotted against the coefficient of variation for six sweet-potato cultivars at Babungo: top left quadrant, high mean yield, small variation; top right, high mean yield, large variation; bottom left, low mean yield, small variation; and bottom right, low mean yield, large variation.*

During storage, soft and dry rot and sweet-potato weevils were observed, and their prevalence was high in cultivars that had a storage score of ≤ 3.0.

There was a lot of variation in tuber yields during the 4 years that the six sweet-potato cultivars were tested. Cultivar Tib 1 significantly ($P < 0.05$) outyielded (40.3 t/ha) all the tested cultivars except Tib 2 (29.7 t/ha) during the wet season. It also significantly ($P < 0.05$) outyielded Tib 2, Pa 7, Pa 8, and Pa 11 in the dry season (Table 2).

Cultivar Tib 1 had good taste (7.5/10.00) and fair storage qualities (5.5/10.0). Pa 11 had better storability (7.6/10.0) (Table 3), and this trait, perhaps, could be combined with the high-yield potential of Tib 1 through half-sib family selection.

Analysis of variance for yield stability revealed highly significant differences between varieties and between years. The differences between years reflected variations in rainfall and temperature but could not be attributed to soil type because the soil is fairly homogeneous (clay loam to silty-clay loam), with a pH of 6.0. The treatment $\times$ years interaction was also highly significant, indicating intervarietal differences in the pattern of response to yearly differences. Treatments with regression coefficients equal to unity (1) and residual mean square equal to zero (Table 4) were regarded as being stable. Thus, Tib 1 was the only cultivar considered stable, whereas, on the basis of Francis and Kannenberg's (1978) method (Fig. 1), cultivars Tib 1 and Pa 8 were both classified as stable.