

# EVALUATION OF INTRODUCED SWEET POTATO CULTIVARS AT AIYURA IN THE EASTERN HIGHLANDS OF PAPUA NEW GUINEA.

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## ABSTRACT

Seven selections of sweet potato were introduced into Papua New Guinea from IITA in Nigeria and Louisiana State University in the USA after intermediate quarantine in the United Kingdom. They were introduced as 12 separate accessions. Evaluation has been conducted at four locations in PNG including Aiyura. This paper reports on a preliminary unreplicated evaluation at Aiyura and two formal trials which include the selections from IITA and the USA and three high yielding PNG releases. Consistent results were obtained between the 5 trials. Two IITA selections (TIS 2525 and TIS 2534) outyielded the best of the PNG cultivar, Merikan. These two releases and other IITA selections were of acceptable flavour to local tasters. The USA selections were generally unacceptable in flavour to local tasters.

**Keywords:** Aiyura, meristem culturing, electron microscopy, local material, eating quality.

## INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) remains by far the most important food crop in Papua New Guinea (PNG). Much of the on-going programme of research into PNG food crops has been directed towards the collection and evaluations of thousands of cultivars grown in this country, in order to select high yielding, good quality varieties suitable for subsistence and commercial growers. Although selection and breeding of sweet potato is in progress in other countries, the Department of Agriculture and Livestock (DAL) has been very cautious about making introductions from overseas because of the difficulty of ensuring that the vegetative planting material is completely free from diseases or pests that might damage or even devastate our most important food crop. However, in the mid-1970s, there was a small introduction programme for the purpose of preliminary assessment of whether selected overseas varieties were superior to local varieties. If the introductions proved greatly superior, there would be a strong case for an expanded introduction programme. If the introductions proved similar or inferior to local material it would be better, for the present, to concentrate on local material, thus avoiding the quarantine risks involved with introductions.

Through the kindness of the Glasshouse Crops Research Institute in United Kingdom, the International Institute of Tropical Agriculture (IITA) in Nigeria and the Department of Horticulture of Louisiana State University (LSU) in the United States, seven promising selections were screened and freed from disease in the United Kingdom (UK) and thereafter introduced to PNG. The screening involved meristem culturing, electron microscopy and grafting on to indicator plants. These tests indicated that much of the original material carried some sub-microscopic particles and only material completely free from suspicion was sent to PNG, where it was subjected to post-entry quarantine prior to release for field planting.

Because several meristem cultures were established in the UK and there was variable survival of cuttings sent to PNG, each of the original varieties was represented by one to three introductions (distinguished by different NG numbers). These were planted to separate entries in the trials described in this paper. The United States material comprised the commercial varieties Centennial, selection L9-190, subsequently named Jasper, and L9-163. Information about the four IITA selections provided by IITA in 1976, is shown in Table 1.

After their release from post-entry quarantine in PNG, a preliminary unreplicated evaluation was conducted at Aiyura by B. Siki. This was followed by two formal experiments conducted by the author to assess yield, eating quality and pest and disease incidence. These

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two experiments are reported here. Aiyura is situated at a latitude of 6° 19' South and a longitude of 146° East with an altitude ranging from 1600 to 1850 metres above sea level. The mean annual rainfall is 2200 mm. Both the experiments were conducted at an altitude of 1630 m. Trial 1 was located on a dark brown clay loam soil and Trial 2 on black loam. Similar tests have been completed or are in progress at the Lowlands Agricultural Experiment Station near Rabaul and Laloki Horticulture Research Station outside Port Moresby, both in the lowlands. Very poor yields were obtained when the introduced cultivars were tried at Tambul at an altitude of 2320 m above sea level in the Western Highlands Province.

## MATERIALS AND METHODS

A randomized block design was used with six replications of 15 lines in plots 12 m x 3 m. In each plot there were two rows of twelve mounds each measuring 1.5 m x 1.0 m. There was a guard row around the perimeter of the trials, but none between plots.

The ground was mechanically cultivated and mounds hand-made with spades. Four plants each spaced about 40 cm apart were planted on each mound. This planting arrangement gave a plant density of 27,000 plants per hectare. Weeding was done when it was found necessary. There was no fertilizer application

or pest and disease control.

The trial included the different accessions of four cultivars from Nigeria (See Table 1), three from USA and three local cultivars. The local cultivars were Milne Bay (from coastal PNG), Serenta (PNG highlands) and Merikan (thought to be an earlier introduction from America but now widely grown in the PNG highlands) (A.J. Kimber, pers. comm.). Serenta and Merikan are high yielding releases from Aiyura (Akus 1982). At harvest the tubers (storage roots) were graded into marketable and stockfeed yields. Marketable tubers were those that weighed more than 100 grams and considered acceptable for human consumption while stockfeed were those less than 100 grams and considered suitable only for animal feeding. Sweetness and strength (soft or firm when cooked) are two important factors which determine acceptance or rejection of a cultivar and so tests were conducted to assess these characteristics. Usually most people prefer sweet and firm cultivars. Tuber samples of each cultivar were given to different people to cook, eat and comment on sweetness, strength and acceptability. Scores for each characteristic were given for each sample, as detailed in Table 2b.

Analysis of variance was carried out for the total tuber yield for each trial. The total rainfall during the growing periods and dates of planting and harvesting are given in Table 2a.

Table 1. Information on the four IITA selections.

Cultivar	TIS 1499	TIS 1487	TIS 2534	TIS 2525
Total tuberyield (t/ha)	30-35	25-30	35-40	30-40
Sweet potato weevil resistance	Medium to high	Mild	High	Mild
Virussusceptibility	Medium to high	Average	Very resistant	Resistant
Tuber shape	Fair to poor	Good: oblong and smooth	Good: very smooth	Good: smooth
Storability	Fair to medium	Fair	Medium	Average

Source: A.K. Howland, IITA, Nigeria (pers. comm., 1976)

## RESULTS

Results of the preliminary evaluation are given in Table 3. Results of Trials 1 and 2 are summarized in Table 4. Table 5 gives the mean yields of the IITA, USA and PNG cultivars. Records of acceptability tests are given in Table 2.

## DISCUSSION

Accessions from the IITA release TIS 2525 were the best tuber yielders in both trials with mean yields of 51.3 t/ha and 48.9 t/ha for the two accessions. The mean tuber yields calculated over trials one and two showed the two Nigerian cultivars, TIS 2525 and TIS

**Table 2a. Total rainfall during the growing periods and planting and harvesting dates.**

Trial	Rainfall during growing period (mm)	Planting date	Harvesting date	Growing period (days)
1	1523	10 <sup>th</sup> Oct. 79	8 <sup>th</sup> Dec. 80	270
2	1508	25 <sup>th</sup> Nov. 80	12 <sup>th</sup> Mar. 81	254

**Table 2b. Scores of sweetness, strength and acceptability of introduced and local cultivars.**

Cultivar and accession	Sweetness	Strength	Acceptability
Merikan	2.8	3.7	3.5
Serenta	3.0	2.8	3.3
Milne Bay	2.8	2.2	2.7
TIS 2534 (NG 7570)	2.5	2.0	2.5
TIS 2525 (NG 7575)	2.5	2.0	2.3
L9-190 (NG 7473)	2.2	2.3	2.2
TIS 1487 (NG 7571)	1.8	2.8	2.1
TIS 2525 (NG 7477)	2.0	3.0	2.0
TIS 1499 (NG 7479)	2.0	2.0	2.0
L9-190 (NG 7574)	2.3	1.8	2.0
TIS 1487 (NG 7475)	2.0	2.8	1.8
L9-163 (NG 7474)	1.9	1.7	1.7
L9-163 (NG 7472)	1.8	1.2	1.2
Centennial (NG 7572)	2.6	1.6	1.2
L9-163 (NG 7573)	1.7	1.7	1.0

*Score scale*

Score	Sweetness	Strength	Acceptability
1	Not sweet	Very soft	Poor
2	Sweet	Soft	Fair
3	Quite sweet	Strong	Good
4	Very sweet	Very strong	Very good

**Table 3. Results of preliminary evaluation of the introduced cultivars at Aiyura.**

Cultivar	Total tuber yield (t/ha)
TIS 1499 (NG 7479)	74.0
TIS 2534 (NG 7570)	58.7
TIS 2525 (NG 7575)	56.0
TIS 2525 (NG 7477)	55.1
TIS 1487 (NG 7571)	47.1
Centennial (NG 7572)	44.9
Meristem 22915 (NG 7474)	43.1
L9-163 (NG 7573)	33.3
L9-190 (NG 7473)	33.2
L9-190 (NG 7574)	30.7
L9-163 (NG 7472)	28.5
TIS 1487 (NG 7475)	18.7

Source: B. Siki (pers.comm., 1978)

2534 to be superior to Merikan which slightly outyielded another Nigerian cultivar TIS 1487. Milne Bay and TIS 1499 followed Merikan with equal performances. Two American cultivars, Centennial and L9-163 outyielded Serenta which was followed by L9-190 with a yield of 22.3 t/ha (Table 4).

In Trial 1, introduced cultivars on average were higher yielding than the PNG material. IITA cultivars with a mean tuber yield of 43.1 t/ha were higher yielding than American and PNG cultivars. In Trial 2, mean yields of introduced and PNG cultivars were very similar although again IITA cultivars were higher yielding than those from USA and PNG. Average yields of the three cultivars groups over two trials were quite consistent. Quality assessments showed the three PNG cultivars were superior to introduced material (Table 2).

The ranking and yield levels of the various accessions and cultivars were similar in Trials 1 and 2. There was also good agreement between results obtained in the

**Table 4. Total and mean tuber yields of Trials 1 and 2 (t/ha).**

Cultivar and accession	Total tuber yield Trial 1	Total tuber yield Trial 2	Mean yield Trials 1 and 2	Mean cultivar yield
TIS 2525 (NG 7477)	48.8	53.7	51.3	50.1
TIS 2525 (NG 7575)	51.1	46.6	48.9	
TIS 2534 (NG 7570)	45.3	52.2	48.8	48.8
Merikan	40.9	42.6	41.8	41.8
TIS 1487 (NG 7571)	44.2	38.4	41.3	37.9
TIS 1487 (NG 7475)	37.2	31.8	34.6	
TIS 1499 (NG 7479)	31.6	39.1	35.4	35.4
Milne Bay	36.1	34.6	35.4	35.4
Centennial (NG 7572)	34.2	35.0	34.6	34.6
L9-163 (NG 7472)	34.9	32.8	33.9	
L9-163 (NG 7474)	33.0	26.1	29.6	30.3
L9-163 (NG 7573)	28.7	26.1	27.4	
Serenta	15.5	33.1	24.3	24.3
L9-190 (NG 7574)	22.5	25.8	24.2	22.2
L9-190 (NG 7473)	17.7	22.9	20.3	
Level of significance	0.01	0.01		
Least significant difference ( $p = 0.05$ )	8.2	8.6		

**Table 5. Mean tuber yield of IITA, USA and PNG cultivars (t/ha).**

Trial	IITA cult.	USA cult.	Introduced cult.	PNG cult.
1	41.6	27.6	35.8	30.0
2	42.6	28.5	35.9	36.0

*cult.* = cultivars

two formal trials and in the preliminary screening. Yield performance and quality assessments of different accessions of the same cultivars were generally similar.

Observations made for known pests and diseases (in the highlands) showed sweet potato weevil (*Cylas formicarius*) to be present in propagation material but this was not seen again in the experiment blocks. The loss due to taro beetle (*Papuana* spp.) was slight. Sweet potato leaf scab (*Elsinoe batatas*) was present. Rats caused some slight tuber damage.

## CONCLUSION

Most IITA selections were very high yielding and some have good eating quality. Some of the United States selections were higher yielding than Serenta, but both Milne Bay and Merikan proved superior to them. A mean tuber yield of 28 t/ha by USA cultivars is considered a good experimental yield but quality assessments indicated that they were unacceptable to PNG tastes. IITA cultivars TIS 2525 and TIS 2534 from Nigeria proved to be higher yielding than Merikan, the best PNG material, but further tests are required before their release to the farming community. Further introduction of material from IITA in Nigeria is warranted.

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## REFERENCE

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