EARLY MATURING SWEET POTATO VARIETIES FOR THE HIGHLANDS OF PNG

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ABSTRACT

Following the drought of 1997, it became clear that rural people in PNG need early maturing crops, which would produce food sooner rather than later during the post drought period. This paper reports three trials on 30 varieties of sweet potato for earliness to mature. The first two trials were conducted between 2001 and 2002, and trial three was a follow-up of the top nine selected varieties from the previous trials. The trials were conducted in Aiyura, Eastern Highlands Province. The third trial was conducted in 2003. This activity was part of the World Bank funded Drought Response Project.

The trials were laid out as Split Plot Design with three blocks. In the first two trials, there were four harvests (4th, 5th, 6th and 7th month after planting), which served as main plots and 30 varieties as subplots. Those varieties that yielded at the fourth and fifth months were analysed for earliness. Of the 10 high yielding varieties in the two trials, six were common. Based on this, nine varieties that yielded over 4 tonnes per hectare were selected for earliness and recommended to farmers.

Following that, the third trial screened these nine top performing varieties to identify the earliest yielding varieties. The harvest dates were 3rd and 4th month after planting. Seven varieties (WHCK 007, SSYK 026, PRAP 469, PRAP 417, WHCK 005, SKK 010 and WBS 010) gave acceptable yields (4 – 7 tonnes per hectare) at three months and 10 - 14 tonnes / ha at four months and can therefore be recommended as very early maturing.

Keywords: *Early maturing, varieties, sweet potato, trials, split plot design.*

INTRODUCTION

The PNG Department of Agriculture & Livestock and the National Agricultural Research Institute (NARI) jointly proposed a project to improve PNG's ability to cope with future El Nino related weather fluctuations. This was a consequence of the severe drought, associated with frosts, experienced in Papua New Guinea in 1997 and 1998. Crop yields were reduced by as much as 80% in some areas, resulting in severe food shortages (AUSAid Report). Towards the end of 1997, 40% of the rural population (1.2 million) was starving (Allen & Bourke 2000).

When the rain did return, people planted early maturing vegetables such as bean, leafy vegetables, corn, sweet potato and other staples. However, sweet potato takes between four and nine months to mature, depending on altitude and variety. It meant people had to wait that long. It was a crucial point in time. People suffered from diahorrea due to lack of solid starch foods and there were reports of deaths. The objective of these three trials were to select early maturing varieties of sweet potato to recommend for cultivation during the post drought period so that farmers can secure their invaluable energy food as soon as possible after an event of drought, frost or other natural disasters.

MATERIALS AND METHODS

There were three trials conducted. The two earlier trials were laid out using the Split Plot Design with three blocks. Four harvest dates served as main plots and the varieties (30) as sub plots. The blocks were 75 m x 48 m each while each main plot measured 75 m x 12 m. The plant spacing was 0.5 m within rows and 1.0 m between rows. The gross plot measured 6 m x 4.5 m and a net plot of 4 m x 4.5 m. There were 36 plants in the net plot. The outer 1 m x 4.5 m on each side served as guard.

In the third trial, the same trial design was applied with four replicates. The two harvest dates (three [3] and four [4] months after planting) served as the main

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plots and the nine varieties as subplots. Plots consisted of six single row ridges four metres long and spaced at one metre apart. The actual size of the plot harvested was 4 m x 3 m with 24 plants. Plant spacing was same for all trials.

The first trial was planted in March 2001, second in January 2002 and third in April 2003 in Aiyura, EHP at 1,680 metres above sea level. In the first two trials, the four main treatments were harvesting times; very early maturing at four months after planting, early maturing at five months, maturing at six months and late maturity at seven months. The harvesting dates formed main blocks, with the varieties as sub plots. The same 30 varieties were used in both trials. In the third trial, there were two main treatments as harvesting times, very earliest maturing (3 months) and very early maturing (4 months). The first harvest was carried out on July 28th, 2003, after three months, and the second harvest on August 28th, 2003.

The data collected were the same for all three trials; immature tuber number per plant, immature tuber weight per plant, mature tuber weight per plant, marketable tuber number per plant, marketable tuber weight per plant, non-marketable tuber number per plant, non-marketable tuber yield per plant, total yield per plot and vigor assessment.

The two earlier trials assessed 18 varieties, which farmers had selected as being drought tolerant (Humphrey, *et al.* 2002) and 12 high yielding varieties from the Pacific Regional Agricultural Project (PRAP) selection (Guaf *et al.* 1998). Listed below are the varieties evaluated: Farmer SSYK 023, Farmer SGG 008, Farmer SSYK 018, Farmer WHCK 005, Farmer SGG 001, Farmer SGG 006, Farmer SSYK 019, Farmer WJW 001, Farmer EDK 003, Farmer SKK 010, Farmer WBS 010, Farmer WMK 008, Farmer WJW 002, Farmer SSYK 002, Farmer WHCK 007, Farmer WJW 003, Farmer SSYK 026, Farmer SKK 009, PRAP 469, PRAP 91, PRAP 559, PRAP 714, PRAP 1443, PRAP 123, PRAP 107, PRAP 2, PRAP 219, PRAP SUGAR, PRAP 1170 and PRAP GOIFE.

The third trial assessed nine top performing varieties identified from the two earlier trials; they were WHCK 007, WHCK 005, WBS 010, SKK 010, PRAP 123, PRAP 714, PRAP 469, PRAP 559 and SSYK 026.

The trials were manually weeded using spades during the growing period. No fertilisers or chemicals was applied in all the trials.

RESULTS

The results of the first two trials are presented in Tables 1, 2 and 3 below and results of trial 3 are presented on Table 4 under the combined results.

First Sweet Potato Early Maturing Variety Trial Planted in Aiyura

Yield at four months was low for all varieties, though nine varieties yielded 4 tonnes per hectare or more (Table 1). At five months, seven varieties yielded 8 t/ha or more.

Second Sweet Potato Early Maturing Variety Trial Planted in Aiyura

At four months, 12 varieties yielded over 4 tonnes per hectare (Table 2). Eight of these varieties also yielded over 4 tonnes at four months in the first Trial. At five months, 14 varieties yielded more than 10 t/ha. Eleven varieties had mean yields of 8 t/ha or more (Table 2).

COMBINED TRIAL RESULTS

Based on harvest at four months of Trials 1 and 2, nine varieties were selected as early maturing. They yielded between 4 and 8 tonnes per hectare (Table 3).

Trial 3 assessed nine selected varieties from the two earlier trials, to identify earliest varieties that can mature as early as three to four months after planting with acceptable yield.

The fourth column in table 4 gives an indication of possible yields if farmers chose to harvest their crop between three and four months. Overall, the available data shows seven superior varieties.

DISCUSSION

The objective of these trials is to select early maturing varieties of sweet potato to recommend for cultivation during the post drought period; so that farmers can secure this important energy food sooner rather than later.

Yield at four months was low for all varieties in trial 1, though nine varieties yielded 4 tonnes per hectare or more and could be considered as early maturing. At five months, seven varieties yielded 8 t/ha or more

(Table 1). Four of these were among the nine, which yielded best at the first harvest. If mean yields from the first two harvests are considered, six varieties yielded over 6 t/ha.

For the purpose of selecting for early maturity, total yield of varieties when harvested at four and five months is important (Table 1). Yields were low in two of the three blocks in Trial 1 due to waterlogged conditions and death of some plants. Therefore there were significant differences between varieties in the number of plants harvested. The high CV reflects this. Despite that, one variety (714) produced the highest yield at five months.

Similarly in trial 2, selection for early maturity was done for harvests at the fourth and fifth months and analysed separately (Table 2).

If the top 10 varieties in Trial 1 and Trial 2 are compared, six varieties are common to both lists, suggesting that they consistently produce good

Table 1. **Total Yield (t/ha) of 30 Varieties of Sweet Potato after harvesting at 4 and 5 Months in Trial One**

Variety	4 Months	5 Months	Mean
PRAP 714	4.20	20.36	12.28
PRAP 123	6.84	13.70	10.27
WHCK 007	4.18	14.26	9.22
PRAP 91	3.68	12.96	8.32
PRAP 469	8.34	7.96	8.15
WBS 010	6.39	8.41	7.40
GOIFE	0.51	10.58	5.55
SSYK 022	3.20	7.68	5.44
WHCK 005	2.07	8.19	5.13
PRAP 559	6.19	4.02	5.11
PRAP 1170	5.09	4.90	5.00
SKK 009	3.93	5.57	4.75
SSYK 026	5.05	3.40	4.22
SKK 010	4.95	3.37	4.16
SGG 008	2.70	5.52	4.11
WJW 003	2.09	5.81	3.95
WJW 002	3.48	4.36	3.92
PRAP 219	3.52	3.78	3.65
WMK 008	2.86	4.35	3.61
EDK 010	1.21	5.71	3.46
SSYK 019	0.80	5.09	2.95
PRAP 2	1.42	4.21	2.81
WJW 001	0.85	4.17	2.51
SGG 006	1.51	3.46	2.49
SSYK 018	2.64	2.28	2.46
PRAP SUGAR	1.60	2.64	2.12
PRAP 1443	1.62	2.38	2.00
SSYK 023	0.47	2.26	1.36
PRAP 107	0.69	1.29	0.99
SGG 001	0.13	0.49	0.31
Mean	**3.07**	**6.11**	
LSD (P<0.05) CV (%)	7.7 17.2	8 80	

Table 2. **Total Yield (t/ha) of 30 sweet potato varieties after harvesting at 4 and 5 Months in Trial 2.**

Variety	4 Months	5 Months	Average
WHCK 005	8.59	16.04	12.32
WBS 010	6.99	16.93	11.96
PRAP 714	5.51	18.03	11.77
WHCK 007	7.34	14.92	11.13
SSYK 026	7.79	13.74	10.77
PRAP 469	5.62	15.68	10.65
SKK 010	6.44	13.71	10.08
SGG 006	4.08	14.06	9.07
PRAP 219	3.15	14.74	8.95
PRAP 559	4.82	12.65	8.74
PRAP 123	4.61	11.56	8.09
SKK 009	3.41	12.10	7.76
WJW 003	3.19	12.16	7.68
SSYK 019	4.23	9.92	7.08
PRAP 2	4.33	9.27	6.80
Goife	1.92	11.60	6.76
PRAP 1170	3.89	9.27	6.58
WJW 002	1.60	10.01	5.81
PRAP 91	3.22	8.36	5.79
EDK 010 (003)	2.99	7.54	5.27
SSYK 022	2.70	8.57	5.64
WMK 008	3.66	6.85	5.26
PRAP 1443	2.50	6.36	4.43
WJW 001	1.76	6.56	4.16
SSYK 023	2.48	5.75	4.12
PRAP 107	2.55	4.95	3.75
SSYK 018	2.47	4.68	3.58
PRAP Sugar	2.00	3.93	2.97
SGG 008	0.48	4.10	2.29
SGG 001	0.30	3.89	2.10
Mean	**3.82**	**11.04**	
LSD (P<0.05)	2.51	NS	
CV (%)	40	80	

yields when harvested early. These six are included in Table 3, which consists of high yielding and early maturing varieties at four months after planting.

Based on the results, all nine varieties on Table 3 and 4 are recommended as giving reasonable yield (more than 4 tonnes per hectare) at four months. Given that yield in traditional PNG gardens is between 5-20 tonnes per hectare (Bourke 1985), the yields of these varieties at 4 months are acceptable.

It should be noted that five of the nine varieties are also tolerant to drought conditions. It means farmers can add these varieties to their collection to be grown for long- term drought preparedness and for enhancing post drought recovery.

Further more, the results of Trial 3 confirmed earlier selections for early maturing sweet potato varieties and drought tolerance (Bang *et al.* 2002). The varieties found to be high yielding continue to out-

Table 3. **Total yield (t/ha) of common Early Maturing Sweet Potato Varieties at 4 months from Trials 1 and 2.**

Variety	Trial 1	Trial 2	Mean	Remarks
PRAP 469	8.34	5.62	6.98	Also drought tolerant
WBS 010	6.39	6.99	6.69	Also drought tolerant
SSYK 026	5.05	7.79	6.42	Popular in Simbu
WHCK 007	4.18	7.34	5.77	Very early Maturing
PRAP 123	6.84	4.61	5.73	
SKK 010	4.95	6.44	5.70	Also drought tolerant
PRAP 559	6.19	4.82	5.51	
PRAP 714	4.20	5.51	4.86	Also drought tolerant.
WHCK 005	2.07	8.59	5.33	Also drought tolerant

Table 4. **Total Weight of Edible Sweet Potato Tubers in tonnes per hectare (t/ha) and yield ratios at 3 and 4 months harvests from date of planting in trial 3.**

Sweet Potato Variety	Yields (t/ha)			Average Yields
	Three Months	Four Months	Ratios 3:4	
PRAP 559	2.83 a	7.96 a	0.36 abc	5.39 a
PRAP 123	2.85 a	8.96 a	0.33 ab	5.90 ab
PRAP 714	3.87 a	10.83 a	0.35 abc	7.35 abc
WHCK 007	3.96 a	13.80 a	0.28 a	8.88 bcd
SSYK 026	4.04 a	10.45 a	0.40 abcd	7.24 abc
PRAP 469	4.33 ab	13.92 a	0.32 ab	9.13 cd
WHCK 005	6.41 bc	13.56 a	0.46 bcd	9.99 cd
SKK 010	6.75 c	13.79 a	0.51 cd	10.27 cd
WBS 010	7.46 c	14.01 a	0.57 d	10.74 d
LSD (5%)	2.08	Ns		3.15
C.V. (%)	30.2	28.2	29.6	26.0

perform the others. Five varieties (WBS 010, SKK 010, WHCK 005, PRAP 469 and WHCK 007) produced tubers in excess of 13 tonnes/ha during the fourth month harvest. The highest yielding variety WBS 010 was particularly recommended for its ability to tolerate drought and early maturing characteristics.

It can be recommended for farmers to not only cultivate the top seven selected early maturing sweet potato varieties (WHCK 007, SSYK 026, PRAP 469, PRAP 417, WHCK 005, SKK 010 and WBS 010) post drought, but add these permanently into their gardening system as a strategy for long–term preparedness. All three trials at Aiyura have shown that acceptable yields can be obtained at three and four months, though tubers will continue to bulk up after this. They will be able to provide edible and good tuber sizes sooner than most varieties.

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