OPTIMUM REPLANTING STAGE FOR TWO VARIETIES OF PIT-PIT (*SETARIA PALMIFOLIA*) IN THE HIGHLANDS OF PAPUA NEW GUINEA

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ABSTRACT

Two varieties of edible pit-pit were grown near Tari in the Southern Highlands Province. The crop was progressively harvested over 512 days with a total of five harvests. Yields over the whole trial were 5.0 and 3.9 tonnes of edible portion per hectare for the two varieties, Mbu and Banguma respectively.

A quadratic regression of cumulative edible portion per day on days after planting demonstrated that rate of growth declined approximately 350 days after planting for Mbu and 325 days for Banguma. The decline in both varieties was due to a lower individual stem weight and a higher percentage of waste (non-edible portion of total harvested) the longer the crop was in the ground.

It is estimated that an increase of 2.0 and 1.8 tonnes per hectare for Mbu and Banguma respectively could be attained by harvesting every 100 days and practicing 325 day replanting rather than leaving the crop in situ *for over 600 days.*

INTRODUCTION

Edible Pit-Pit (*Setaria palmifolia* (Koenig) Stapf.) or New Guinea asparagus is grown and eaten throughout the highlands of Papua New Guinea (Powell 1976). There are a number of different varieties in each area; sixteen in Mount Hagen (Powell *et al.* 1975), seven in Simbai (Rappaport 1968) and at least seven in Tari (Rose, unpublished data). Varieties are distinguished by the colour of the stem bases and leaf midribs. They also differ greatly in yields of edible portion, and Powell (1976) has reported a range of 8 to 49 tonnes of edible portion yield per hectare.

It is a perennial crop and the tillering of lateral shoots is accelerated by regular harvesting. Powell (1976) observed that the period of edible production was from four months to two years and Rappaport (1968) observed a period from six months to two years.

In the Tari area, mature single or double stems are planted at the edge of the ubiquitous sweet potato mounds on alluvial and volcanic ash soils between 1,500 and 1,800 m a.s.l.

The edible portion is the soft, white central stem just above and below the growing point (*Plate III*) that is exposed by the removing of the outer leaf sheaths from the stem. These stems can be eaten raw but are usually cooked in stone ovens with sweet potatoes. Their succulence undoubtably enhances the invariably dry-tasting sweet potatoes.

In a pilot trial during 1975, it was observed that a white stemmed variety called Mbu† and a red stemmed variety called Banguma out-yielded the other three varieties on trial. The aim of the present experiment was to record yields of these two varieties and to estimate the optimum stage to replant for maximum growth.

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† A local name. This variety is called Buka in the Hagen area. (Powell, pers. comm.).

METHODS

The trial was planted at Piwa Agricultural Station near Tari (1,620 m a.s.l.) on river alluvium which is re-worked volcanic ash (A. Wood, pers. comm.). The ground was well dug prior to marking out, having been fallow for a number of years. A randomised block design was used with two plots of 2.5 by 5.0 metres each per block and eight replicates. One metre wide drains were dug between blocks to a depth of 30 centimetres. Single stems, forty centimetres long, were planted at a slight angle to the vertical about eight centimetres deep at a spacing of fifty centimetres between plants and rows, i.e. 40,000 plants per hectare.

Initially, the leaves on the planted stems wilted and faded in colour but within a month, new, light green leaves were observed emerging from the central stem of the parent material. The blocks were weeded 65 days after planting and thereafter were left unattended except for harvesting. No fertiliser treatments were applied. No pest or disease damage was observed during the trial.

Table 1.—**Yield of edible portion (EP), mean stem weight and percentage waste for two varieties of pit-pit**

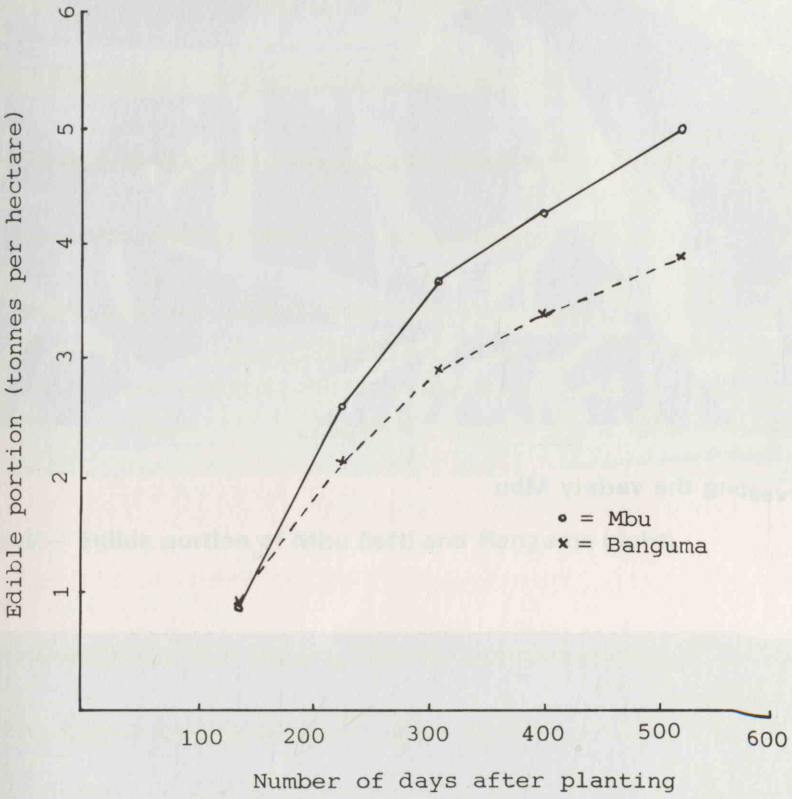
	VARIETY			
	Banguma	Mbu	(s.e.)	
Edible portion (t ha^{-1})	3.88	5.05	(± 0.436)	*
Weight of indiv. stems (g)	9.9	10.6	(± 0.29)	NS
Percentage waste	77.2	75.1	(0.47)	**

Levels of significance
NS = not significant
* = $0.01 \leq P < 0.05$
** = $0.001 \leq P < 0.01$

Table 2.—**Estimated yield of edible portion (EP) and expected difference with a 325-day planting cycle (tonnes per hectare)**

Days after planting	Harvest No.	Mbu	Banguma
125	1	1.11	1.05
225	2	1.21	0.95
325	3	1.14	0.80
Sub total harvests 1–3		3.46	2.8
425	4	0.90	0.60
525	5	0.51	0.35
625	6	0	0.05
Sub total harvests 4–6		1.41	1.0
Difference between harvests 1–3 and 4–6		2.05	1.8

Figure 1.—**Yield of cumulative edible portion for two varieties of pit-pit over five harvests (tonnes per hectare)**



Harvests were made 136, 222, 308, 339 and 512 days after planting. Two people harvested one block at a time and alternated harvesting each variety, thereby overcoming the bias of one operator harvesting the same variety in every block. The stems were broken off about two nodes below the growing point (*Plate I*); not all stems were harvested, only those suitable for eating. The top leaves were twisted off as is the local custom (*Plate II*) and the stems were counted and weighed. These were immediately stripped to edible portion and weighed (*Plate III*).

The total edible portion harvested, percentage waste and mean individual stem weight were calculated. The quadratic equation, $y = a_2x^2 + a_1x + a_0$ where x was the number of days after planting was used:

1. To estimate the cumulative edible portion per day (rate of crop growth) as the crop was harvested.

2. To estimate the yield effect of replanting after 325 days rather than leaving the crop for 625 days.

Estimates of yields of edible portion (kg ha^{-1}) at each harvest were interpolated using the following equations:

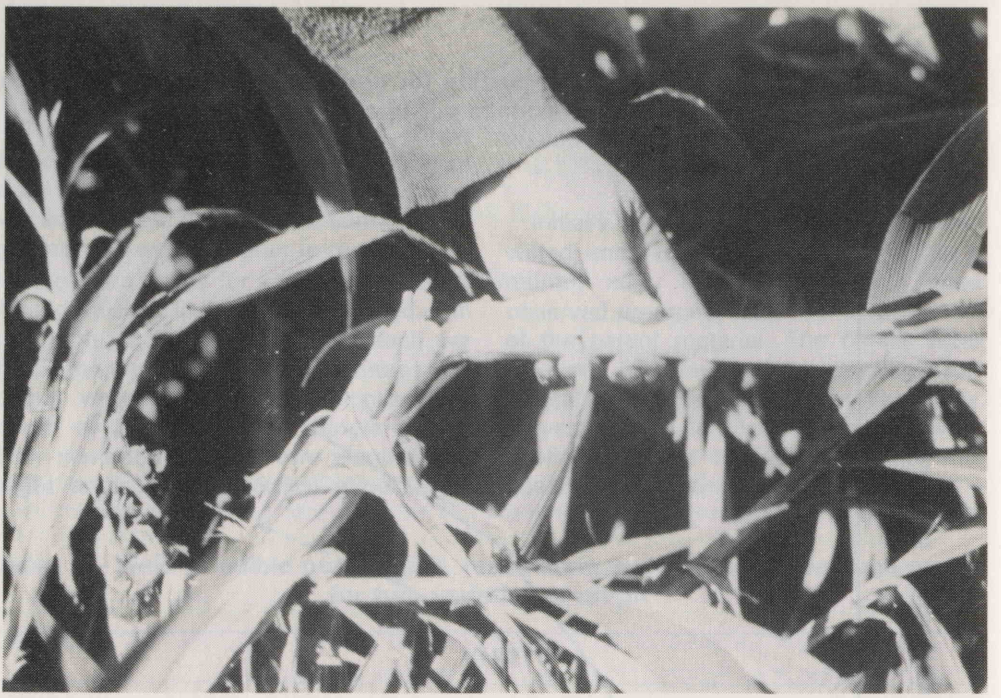


Plate I. — **Harvesting the variety Mbu**

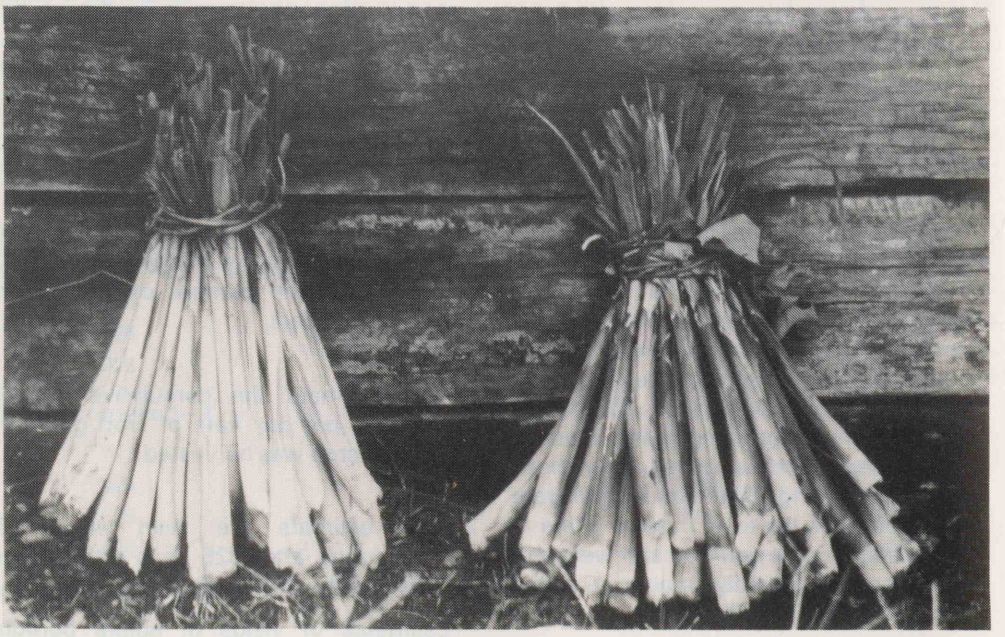


Plate II. — **Harvested portion of Mbu (left) and Banguma (right)**

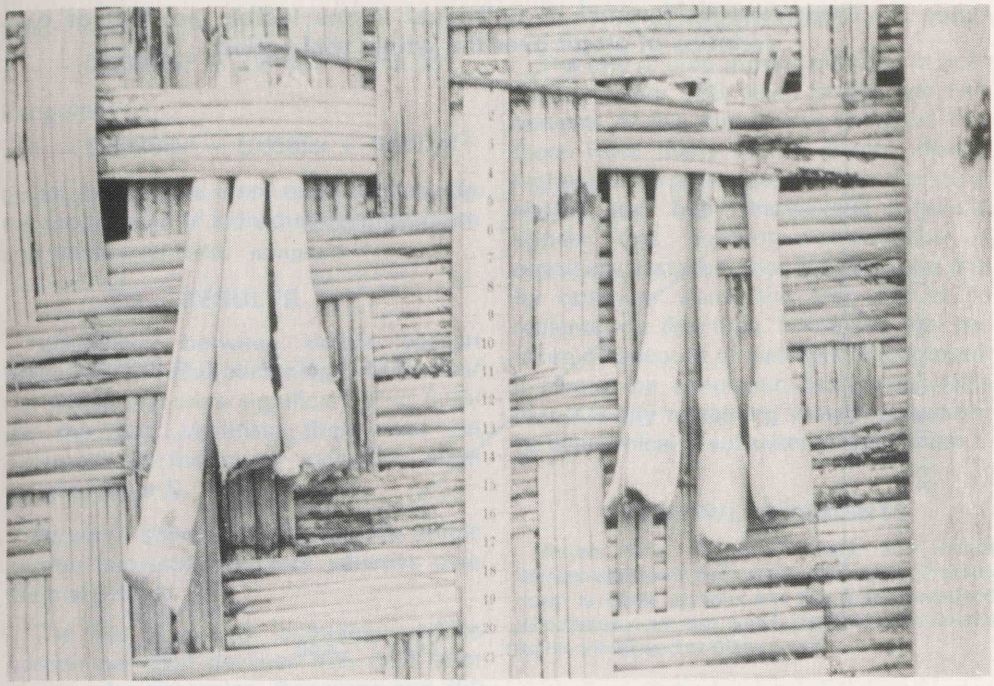


Plate III. — **Edible portion of Mbu (left) and Banguma (right)**

Figure 2. — **Cumulative yield per day (rate of crop growth) for two varieties of pit-pit (kg per ha)**

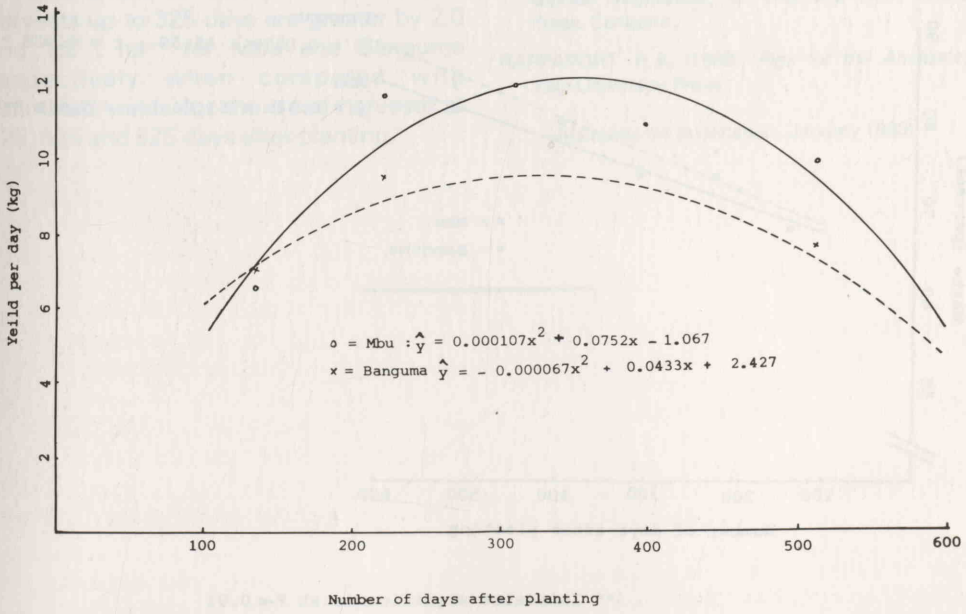
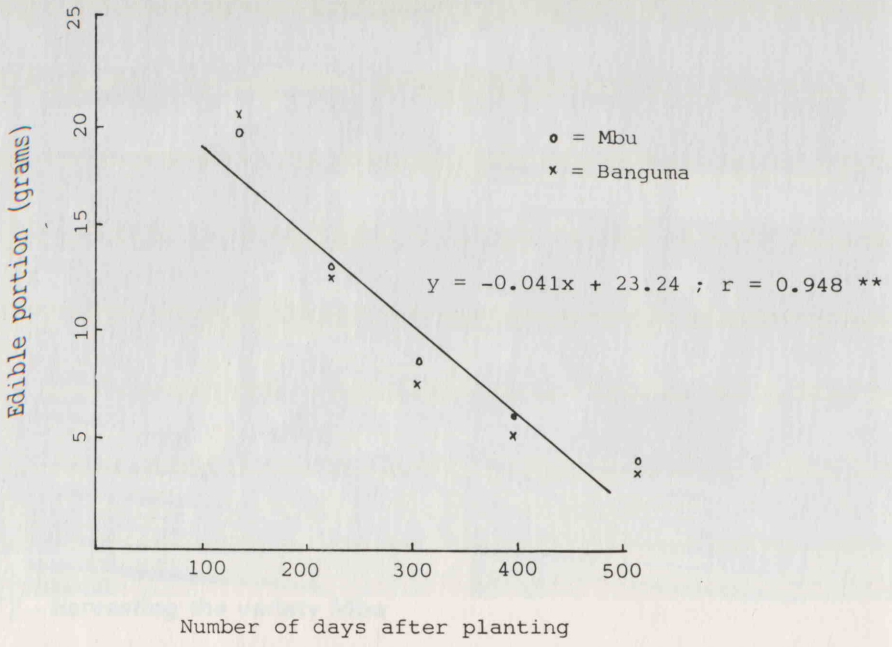
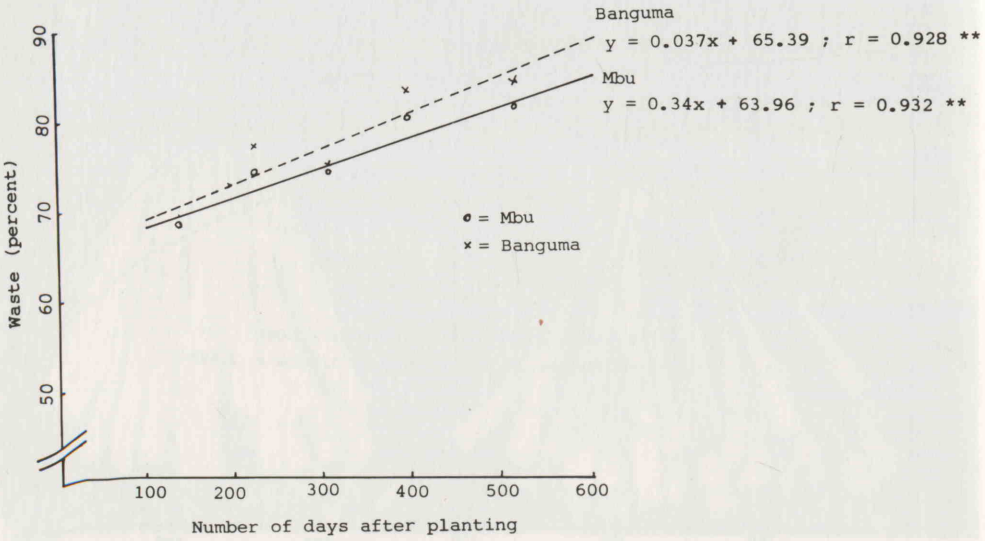


Figure 3.—**Mean weight (grams) of individual stems (edible portion) of two varieties of pit-pit over the whole trial period**



** Indicates significance at P <0.01

Figure 4.—**Waste (percent) over whole trial for two varieties of pit-pit**



** Indicates significance at P< 0.01

Mbu:

$$\hat{y} = -0.00818x^2 + 3.8158x + 762.06$$

Banguma:

$$\hat{y} = -0.00258x^2 - 0.0585x + 1095.68$$

Linear regressions were used to illustrate the progression of individual stem weights and waste over time.

RESULTS

Differences between edible portion harvested (EP) and percentage waste over the whole trial were significant ($P < 0.05$) for the two varieties; there was no difference in the mean individual stem weight (*Table 1*).

Figure 1 shows the cumulative edible portion harvested for both varieties over the trial period.

The rate of growth (cumulative edible portion per day) declines 325 days after planting for the variety Banguma and 350 days for Mbu (*Figure 2*). Banguma maintains its optimum vigour for longer than Mbu. The mean weight of individual stems decreases (*Figure 3*) and the percentage waste increases (*Figure 4*) the longer the crop is in the ground.

Table 2 shows that yields from three harvests up to 325 days are greater by 2.0 and 1.8 t ha^{-1} for Mbu and Banguma respectively when compared with estimated yields for the three harvests at 425, 525 and 625 days after planting.

DISCUSSION

The rate of crop growth declined in both varieties after 350 days. In the last two harvests of this trial it was observed that there were many lateral shoots tillering higher up the parent stems since the lower shoots had been harvested. It would appear that nutrient translocation is physically impaired after 350 days and that for optimum yields the crop should be replanted at this time. Since this trial has taken no account of yield per labour input, it cannot be concluded from area yields that 325-day replanting would necessarily be economical in subsistence agriculture.

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