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THE EFFECT OF REMOVAL OF THE INNER CORTEX OF SEED YAMS OF TWO YAM (*DIOSCOREA* SP.) CULTIVARS ON VINE GROWTH AND YIELD OF WARE YAMS

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ABSTRACT

The inner cortex of two yam cultivars – Obiaoturugo (*Dioscorea rotundata Poir*) and Um680 (*D.alata L.*) were extruded, leaving a 1cm wall with the periderm. The two sett types (hollow and intact) in both cultivars, gave similar fresh tuber yields. Growth attributes of the yam vines were also fairly similar. It is suggested that the 1cm outer layer of ware tubers, usually thrown away, can be re-cycled the following cropping season to raise ware tubers.

INTRODUCTION

One tonne of 25g yam (Dioscorea sp.) pieces called Minisetts (Okoli et al, 1982), when planted, equalled or out-yielded 2.5 tonnes of seed yams per hectare (Igwilo, 1988a). The efficiency of the minisett propagules compared to seed yam propagules was attributed to earlier foliation and higher net assimilation rates (NAR) of the minisett leaves during the early phase of plant growth (Igwilo, 1988b; Igwilo and Okoli, 1988). Progressive removal of the minisett ground tissue (cortex) leaving a layer 1cm thick with the periderm (called peelsetts) and planted at the rate of 1 tonne per hectare outyielded the Minisetts at the same seed rate (Igwilo, 1999).

The objective of this trial is to explore the possibility of producing ware yams from seed yams with the inner cortical tissues removed, in the continued endeavour to reduce the cost of planting material in yam production.

MATERIALS AND METHODS

Tubers of two yam cultivers– *Obiaoturugo* (*Dioscorea rotundata*) and Um680 (*D. alata L.*) were used; two sett types of each cultivar – intact and hollow – were also used. Thus there were two cultivars and two sett types and the four treatment combinations were replicated five times in a split-plot design with cultivars in the main plots and sett types in the sub-plots.

To prepare the tubers for planting, tubers weighing 350-400g were selected. Portions of the head and the tail of all the tubers were cut off. Each tuber was then weighed. To half of the tubers, a table knife was driven into each tuber from both ends several times 1cm from the periderm. The head of the knife was then used to extrude the inner cortical tissue. A pair of calipers was used to ascertain that the hollow tubers were uniformly thick. Each hollow sett was also weighed.

Each plot had 20 mounds, 1 meter apart (20m^2). Tubers from each plot were mixed with 15g furadan before planting. The experiment was planted on 11 May, 1998 and 22 April 1999. Twenty days after planting, a pre-emergence herbicide was applied to control early weed emergence. The herbicide used was primextra (Atrazino/metalachlor) at 2.5kg a.i/ha mixed with paraquat at 0.5kg a.i/ha (Unamma and Melifonwu, 1986).

At maximum foliation (117 DAP in 1998 and 143 DAP in 1999), single plant samples were taken per plot. Plant height, number of nodes and leaves and leaf size were recorded. In each plant sample, 50 leaves were subsampled and traced on 1cm – square paper and square counts were taken. From the average leaf size and number of leaves, leaf area index (LAI) was calculated. In 1999, in addition, total length of vines and branches were measured and total number of nodes counted in each sample. At vine senescence (235 DAP in 1998 and 215 DAP in 1999), fresh tubers were harvested and the remains of parent tubers collected and weighed.

RESULT

Sprout emergence and plant growth

In 1998 (29 DAP), *Um 680* sprouted faster than *Obiaoturugo* (P= 0.01). However within cultivars, there was no significant difference between sett types of *Obiaoturugo* while intact *Um 680* sprouted faster (P=0.05) than hollow setts (Table 1)

Table 1: Effect of yam cultivar and sett type on percentage sprout emergence with time

Variety	Sett type	29 DAP	40 DAP	50 DAP	81 DAP
Obiaoturugo	Hollow	12.5	81.3	87.5	93.8
	Intact	6.3	100.0	100.0	100.0
Um 680	Hollow	25.0	75.0	93.8	100.0
	Intact	55.0	100.0	100.0	100.0
$LSD_{(0.05)}$ between treatment means					
Variety		17.9	N.S	N.S	N.S
Sett type in each Variety		25.3	N.S	N.S	N.S
Variety x Sett type		35.8	N.S	N.S	N.S

Table 2: Effect of two sett types on number of leaves per plant of two yam cultivars in 1999

Cultivar	Sett type	No. of leaves/plant	Cultivar mean
Obiaoturugo	Hollow	373.5	
			364.8
	Intact	336.0	
Um 680	Hollow	915.0	
			964.9
	Intact	1013.5	
$LSD_{(0.05)}$ between treatment means			
Cultivar		59.1	
Sett type in each variety		83.5	
Cultivar x sett type		118.1	

In 1999, there was no effect of sett type in the number of days to sprout emergence. In 1998 number of shoots/stand was not affected by sett type. However, *Um 680* had an average of 2.4 shoots/stand and *Obiaoturugo* 1.6 (P = 0.01).

Plant height was similar between propagules of hollow and intact setts (hereafter called hollow and intact propagules). In 1999, in *Obiaoturugo*, intact propagules (453cm) were taller than hollow propagules (399cm) which was significant

(P=0.05) whereas in *Um 680* intact propagules (641cm) were similar to hollow propagules (609cm). In 1999, hollow and intact propagules had similar lengths of vines, averaging 16.94m/plant in *Obiaoturugo* and 54.39m/plant in *Um 680*. In 1999 also sett types were similar in the number of nodes in *Obiaoturugo* averaging 251.6nodes/stand but in *Um 680* intact propagules had 32.6% (P=0.01) more nodes than hollow propagules averaging 608.5 nodes/stand. Thus internode length of hollow and intact propagules were similar in the two cultivars being 6.95cm in Obiaoturugo and 8.96cm in *Um 680* (P= 0.01). In 1998, number of leaves/stand was similar between sett types in *Obiaoturugo* (332.3 leaves/stand) as well as in *Um 680* (409.8 leaves/stand). In 1999 in *Obiaoturugo*, there was no difference between sett types in the number of leaves whereas intact *Um 680* had 10.7% (P=0.05) more leaves than hollow propagules.

In 1998, average leaf size in *Obiaoturugo* (69.5cm^2) was similar to that of *Um 680* (62.7cm^2) and there was no sett type effect. In 1999, average leaf sizes were also similar, 31.6cm^2 in *Obiaoturugo* and 33.5cm^2 in Um 680. Consequently, in 1999, leaf area index (LAI) was similar between hollow and intact propagules of *Obiaoturugo* but intact propagules of *Um 680* had 23.6% (P =0.01) more LAI than hollow propagules (Table 3).

Table 3: Effect of two sett types on leaf are index (LAI) of two yam cultivars in 1999

Cultivar	Sett type	LAI	Cultivar mean
Obiaoturugo	Hollow	1.20	
			1.18
	Intact	1.15	
Um 680	Hollow	2.88	
			3.22
	Intact	3.56	

LSD$_{(0.05)}$ between treatment means	
Cultivar or sett type	0.21
Cultivar x sett type	0.43

Tuber yield and remains of parent tuber at harvest

In both years, there was no difference due to sett type in fresh tuber size and tuber yield (Table 4). *Um 680* out-yielded *Obiaoturugo* by two folds (P=0.01). Tuber yield was higher in 1998 (Table 4) than in 1999 by 6.3% (P=0.05). In 1998 in Obiaoturugo, almost all the reserves were mobilized from the two sett types by the propagules (Table 5) so that in the end, more of the intact setts than hollow setts were mobilized (a difference of 54.34g/sett, Table 5c). In *Um 680*, similar amounts were also mobilized (Table 5) leaving behind more of the intact sett than hollow sett (Table 5) at harvest. The trend in 1999 was similar to 1998 (Table 5). Bright sunshine hours from April to November in 1998 was 595.1 and 538.4 in 1999.

DISCUSSION

Intact tubers were heavier than hollow tubers at planting (Table 5) yet both intact and hollow propagules gave similar fresh tuber yields in both cultivars (Table 5). Again weight of the remains of the planted tubers at harvest (Table 5) showed that intact propagules mobilised more reserve assimilates from the parent sett than hollow propagules in both cultivars. This suggests that the hollow propagules attained tuber yields similar to intact propagules by enhanced leaf photosynthesis. It has been observed that larger amounts of seed reserves in yam tubers of *D. rotundata* tended to reduce leaf net assimilation rates (NAR) and to delay foliation (Igwilo, 1988b; Igwilo and Okoli, 1988). In *Um 680*, the hollow and intact propagules mobilized similar accounts of assimilates from the parent seed yam (Table 5). This may be because seedlings of *D. alata* develop true leaves within the first 2-3 nodes irrespective of sett size. It has been observed that in *Obiaoturugo*, minisetts (25g) propagules develop true leaves earlier than seed yam (250g) propagules (Igwilo and Okoli, 1988). Indeed hollow seed yams started sprouting before intact seed yams in *Obiaoturugo* though it was not significant (Table 1). Other measurements of growth were similar between the two sett types in *Obiaoturugo* in both years. In *Um 680*, they were similar or inconsistent between years (Table 2 and 3).

Table 4: Effect of two sett types on the tuber yield of two yam cultivars in 1998 and 1999

a) Effect on tuber size (kg)

Cultivar	Sett type	1998	1999	Cultivar mean
Obiaoturugo	Hollow	1.14	1.02	1.08
	Intact	1.15	1.12	1.14
Um 680	Hollow	2.25	2.24	2.24
	Intact	2.24	2.19	2.22
Year mean		1.70	1.64	1.67

$LSD_{(0.05)}$ between treatment means

	1998	1999
Cultivar	0.52	0.42
Sett type	NS	NS
Between years	0.56	

Effect on tuber yield (t/ha)

Cultivar	Sett type	1998	1999	Cultivar mean
Obiaoturugo	Hollow	11.23	10.21	10.72
	Intact	11.48	11.15	11.32
Um 680	Hollow	22.45	21.22	21.84
	Intact	23.34	21.85	22.28
Year mean		17.13	16.11	16.54

LSD$_{(0.05)}$ between treatment means	1998		1999
Cultivar	5.17		4.08
Sett type	NS		NS
Between years		0.63	

Table 5: Parent sett remains at harvest (in grams)

Variety	Sett type	1998 mean sett weight at planting	1998 mean sett weight at harvest	1998 wt. of sett mobilized by propagules	1999 mean sett weight at planting	1999 wt. of sett weight at harvest	1999 wt. of sett mobilized by propagules
Obiaoturugo	Hollow	189.1	0.007	189.0	209.9	14.1	195.8
	Intact	243.4	0.03	243.3	303.9	13.9	290.0
Um 680	Hollow	210.6	81.6	129.0	200.1	40.6	159.4
	Intact	290.0	156.5	133.4	291.3	121.9	169.4

In intact *Um 680*, 41-54% of the weight of parent seed yam remained at harvest. This shows that a substantial amount of seed reserve material was left after *Um 680* propagules were established. *Um 680* parent seed yams even at harvest have undeveloped sprouts. This suggests that the parent sett could be extracted after the propagules are established and replanted, as has been observed with the rhizomes of ginger (Zingiber *officinale*) by Okwuowulu (1989).

In 1999, the LAI of *Um 680* was higher in intact propagules than in hollow propagules, yet the tuber yields were similar (Tables 3 and 4). This supports the earlier view that the hollow propagules had higher photosynthetic rates than intact propagules.

The biggest constraints in ware yam production has been identified as insufficient and high cost of planting material – seed yams or split ware tubers (Hahn *et al*, 1987; Onwueme, 1978; Oyolu, 1978). Thus this experiment has suggested that peels of appropriate weight from ware tubers can be used to raise ware yams. This practice will add to seed yams to make planting material more readily available to farmers and reduce production costs.

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