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SEED YAM PRODUCTION WITH MINITUBERS

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ABSTRACT

The performance of various sizes of minitubers of both *D. alata* (UM680) and *D. rotundata* (Obioturugo and Abi) were evaluated for size and yield of seed yams between 1998 and 2000. Minitubers are whole but small (30-100g) tubers that farmers could simply plant directly into their farms, as is the case for seed potatoes. *D. alata* minitubers performed better than *D. rotundata* minitubers. *D. rotundata* minitubers weighing 10-25g produced 90% seed yams (100-500g) while the 26-50g and 51-75g minitubers produced 36% and 68% seed yams (200-1000g) respectively. Seed yams weighing 200-1000g are preferred by most farmers. From this experiment, minitubers weighing 10-25g gave seed yam yield that compared in size with those from 25g cut minisetts. Only 20% of seed yams weighing 200-1000g were produced from 10-25g minitubers of D. rotundata while D. alata gave 36.64% seed yams from 10-25g minitubers. Minitubers of 51-100g are hereby recommended as these give over 60% seed yams of 200-1000g, which are preferred by most farmers.

INTRODUCTION

The greatest constraint to increased yam production in Nigeria is scarcity or high cost of seed yams, which constitutes 30-35% of the total production costs (Oyolu, 1978; Nweke et al., 1991; Ezeh, 1994). Yams and all vegetatively propagated plants, have low multiplication ratio (1:5) unlike cereals and legumes that have multiplication ratios of between 1:15 and 1:80 (Onwueme, 1978). That was why the National Root Crops Research Institute Umudike in 1981 developed the yam minisett techniques for mass production of seed yams (Okolie *et al.*, 1982). With this technique, a farmer could use 1 tonne of 25g yam minisetts to achieve what 2.5t/ha of seed yams (250g) would hardly produce (Igwilo, 1988). However, nearly two decades after this breakthrough, farmers feed back showed that adoption rate of the yam minisett technology was still below 30% (Ogbodu, 1995). The major reasons farmers gave for low adoption rate, among other reasons, are that the 25g yam setts are too small and that the technology was developed under sole cropping systems while most farmers in the yam belt practice intercropping. This was recently confirmed by a team of investigators sponsored by the National Agricultural Research Project (NARP) in 1998 (Anuebunwa, *et al.*, 1998). Their findings showed low farmer-adoption rate and that farmers preferred intercropping larger-sized yam setts than the recommended 25g minisetts. NARP asked NRCRI to modify the yam minisett technique so as to enhance farmer's adoption. The first stage of this modification process based on compatible intercrops of the yam minisetts has been completed (Ikeorgu et al., 1998).

From experiments conducted at NRCRI Umudike, minitubers (30-100g) were produced from 6-8g minisetts. (Ikeorgu and Nwokocha, 2000). However these scientists did not tell the farmer what seed yam size and yield to expect from the 30-100g minitubers, nor varietal responses to the minituber technique. This paper therefore evaluates the field performance of minitubers from two yam varieties (*D. rotundata* and *D. alata)* for variations in size and yield of seed

yams. The yield potential of minitubers could also be estimated from the varietal performances.

METHODOLOGY

The trials were carried out between 1998 and 2000 at the National Root Crops Research Institute Umudike Experimental Farm ($5^0$27'N; $7^0$32'E and 122m above sea level) and at the NRCRI Sub-station located at Otobi (Guinea savannah). Annual rainfall in Umudike ranges between 1900mm and 2200mm and that of Otobi sub-station is 1200mm-1500mm. Soils in these locations can be described as ultisols and are low in N and P.

Umudike Location

In 1998, three minituber size ranges (10-25g; 26-25g and 51-76g) were selected from two D. rotundata cultivars (Obioturugo and Abi) and one *D. alata* cultivar (UM680) yam cultivar from the previous year's harvests to form the treatments shown in Table 1. These were laid out in randomized complete block design and replicated three times . Plot size used in each case was 5m x 6m. Land was conventionally prepared by dis-ploughing and harrowing before 1m ridges were made. The minitubers were planted in this location on 20th May 1998. Minitubers weighing 10-25g and those weighing 26-50g were planted on the crest of the ridge and spaced 25cm apart, while those weighing 51.75g were spaced 50cm apart. This trial was repeated in 1999 with only one yam variety *(D. rotundata* cv. Obioturugo), but with four additional minituber size ranges (76-100g; 101-150g and 201-250g) to take care of all the minituber sizes harvested in 1999 (Table 2). Data was collected on sprout count at 3WAP and seed yam yield at harvest.

Otobi Location

The trial conducted at Umudike was repeated at Otobi sub-station in the Guinea savannah zone in 1999. Three minitubers size ranges (10-25g; 26-50g; and 51-75g) from two yam cultivars (Obioturugo and UM680) were evaluated for size and yield of seed yams. Land was prepared with a disc-plough and harrowed before 1m ridges were made. Layout of trial, stand geometry and planting pattern adopted were similar to that described for Umudike location, except that planting was carried out on 17th June 1999. The conventional 25g cut yam minisetts of Obioturugo and UM680 were included as a check in each of the locations. The treatment combinations are represented in Table 4.

Routine cultural practices

Compound fertilizer (NPK 20-10-10) at the rate of 400kg/ha was applied to each plot 8 weeks after planting (WAP). Weeding was carried out three times at 3+8+12 WAP and slashed at 16WAP. The yam vines were staked with split bamboos from 4 WAP, using the pyramid method recommended by NRCRI and staking 4-6 vines per stake depending on the minituber size. Seed yams from each plot were harvested in November beginning with Umudike location (first week) and then Otobi location (last week). The seed yams from each plot were graded in size ranges as follows: <100g; 100-200g; 200-500g; 500-1000g and <1000g. The percentage of harvested tubers per treatment was calculated and the total tuber yield expressed in t/ha.

Data analysis

Analysis of variance for RCB design was used to compare the treatments and their means were compared with Fisher's LSD.

FINDINGS AND DISCUSSION

Umudike Location

Seed yam yields from minitubers of three yam cultivars evaluated in a field trial in Umudike in 1998, are presented in Table 1. Mean of seed yam yields from D. alata (13.53t/ha) were significantly higher than those from D. rotundata (5.1t/ha). This had earlier been reported by Igwilo and Okoli (1988) under the conventional 25g minisetts method. There were no significant differences among mean seed yam yields from the three minituber sizes in *D. alata* but in *D. rotundata*, minitubers above 25g gave significantly higher seed yam yields than those below 25g. The 10-25g minitubers yielded seed yams that did not differ from those from 25g cut-minisetts except in *D. alata*. The poor performance of the 10-25g minitubers may be related to the poor establishment as observed for Obioturugo at 3 MAP in 1999 (Table 3). These results suggest that for *D. rotundata*, minitubers above 25g will be required to achieve economic seed yam yields

while for D. alata, even 10g minituber could give seed yam yields of over 12t/ha. From 10-25g minitubers of white yam, 20% of seed yam yield will be in the size range of 200-1000g, while 26-50g and 51-75g size ranges, would produce 36% and 68% of seed yams in the range of 200-1000g. Most farmers in this zone prefer seed yams of between 500-1000g as against 200-300g reported by Onwueme (1978). This implies that minituber sizes of 50-100g would satisfy most of their requirements. The use of minitubers 100-200g will produce 40-50% seed yams above 1000g, which is already a ware yam size.

Otobi Location

The seed yam yields from minitubers of Obioturugo and UM680 evaluated at Otobi in 1999, are presented in Table 4. In Umudike location, UM 680 minitubers gave significantly higher seed yam yields than Obioturugo minitubers, irrespective of minituber size. The lowest UM 680 minituber size gave the same seed yams as the highest minituber size. The 10-25g minitubers gave significantly higher seed yam yields than those from 25g cut-minisetts used as control, irrespective of cultivar. This confirms that *D alata* responds better to the minituber (and minisett) techniques than *D. rotundata* and gives about double the seed yam yield from equivalent minituber sizes in white yams. Seed yam yield from 10-25g *D. rotundata* in Otobi (3.25t/ha) was significantly lower than those from 26-75g (6.35 t/ha) but seed yam yield from 26-50 (6.46t/ha) did knot differ from those of 51-75 (6.23 t/ha).

This study has shown that with 10-25g minitubers of *D. rotundata*, a farmer will harvest only 20% seed yams in the range of 200-1000g. With minitubers of 26-50g, 42% of the seed yams harvested will be in the range of 200-1000, and 68% for 51-75g minitubers. With D. alata, 10-25g minitubers produce over 50% of seed yams of 200-1000g, showing that *D. alata* is more efficient for minituber production than *D. rotundata*.

SUMMARY AND CONCLUSIONS

The implications of these findings could be summarized as follows:

D. alata minitubers performed better than *D. rotundata* minitubers showing that there are varietal differences in seed yam production using the minituber technique. This w as also observed in the conventional yam minisett technique. Although we did not evaluate many *D. rotundata* cultivars as we did for 6 and 8g minisetts, there was some indication that cultivar differences in seed yam production using the minituber technique exists.

Except for *D. alata*, minitubers 10-25g would produce 20% seed yams in the 200-1000g range while the 26-50g and 51-75g minitubers would respectively produce a bout 40% and 70% seed yams in the 200-1000g range. This is the popular seed yam range that most of the farmers use.

Use of 10-25g minitubers gave seed yam yield that d id not differ from those from 25g cut-minisetts.

Based on this reported two-year investigation, the use of 26-75g minitubers could be recommended since they produce 40-70% of seed yam sizes (200-1000g) preferred by most yam farmers.

Table 1: Mean seed yam yield (t/ha) from various sizes of minitubers of three yam cultivates, evaluated for yield and graded sizes in Umudike in 1998.

Minituber sizes (grams)	Size range as % of mean yield					
	<100g	100-00g	200-00g	500-000g	>1000g	Meanyield (t/ha)
1 D.rotundata						
Obioturugo (10-25)	32.75	46.01	15.84	5.40	-	2.80
Obioturugo (26-50)	19.93	42.94	14.82	23.77	-	5.65
Obioturugo (51-76)	10.20	16.93	32.34	38.81	1.72	5.93
2. *D. rotundata*						
Abi (10-25)	20.54	60.71	18.75	-	-	3.36
Abi (26-50)	16.18	49.19	34.63	-	-	6.18

Abi (51-76)	8.69	27.25	30.99	34.73	-	6.68
3. *D. alata*						
UM 680 (10.25)	16.09	31.86	31.39	15.25	5.25	12.68
UM680(26-50)	14.65	39.67	24.03	13.26	8.32	15.15
UM680(51-76)	8.69	32.34	34.61	13.08	11.20	12.77
4. CHECKS						
Obioturugo 25g Minisett	41.18	53.78	5.04	-	-	22.38
Abi 25g Minisett	31.67	63.45	14.29	2.52	-	2.81
UM680 25g Minisett	38.43	59.22	2.35	-	-	5.10
$LSD_{(0.05)}$						3.02
						18.00

Table 2. Stand count 3 months after planting of various sizes of minitubers evaluated for seed yams in Umudike in 1999.

Size	Stand count at 4MAP (% of maximum)
1. Obioturugo (10-25g)	68.33
2. Obioturugo (26-50g)	81.00
3. Obioturugo (51-75g)	94.33
4. Obioturugo (76-100g)	91.33
5. Obioturugo (101-150g)	97.67
6. Obioturugo (151-200g)	96.67
7. Obioturugo (201-250g)	99.00
8. Obioturugo (Minisett (25gg) CHECK	64.67
$LSD_{(0.05)}$	8.54
CV	5.63

Table 3. Seed yam yield (t/ha) from various sizes of Obioturugo minituber evaluated for yields and sizes in Umudike in 1999

Minituber	% of seed yams in size ranged shown					
(grams)	below 100g	100-200g	200-500g	500-1000g	>1000g	Mean yield (t/ha)
1. 10-25	40.99	31.58	18.80	8.65	-	2.66
2. 26. 50	30.77	6.51	44.67	18.05	-	6.76
3. 51-75	10.27	-	37.05	49.412	3.27	6.72
4. 76-100	17.55	9.324	21.42	42.35	9.34	6.21
5. 101-150	15.09		16.85	28.88	39.10	8.89
6. 151-200	3.43	2.3	12.91	27.61	53.71	7.28
7. 201-150	3.57	10.60	13.38	20.22	52.23	10.09
8. Minisetts (25g) (Check)	38.67	40.44	-	-	-	1.59
LSD (0.05)						2.75

Table 4. Mean seed yam yield (t/ha) from various sizes of minitubers evaluated at Otobi sub-station in 1999

Minituber size	Size ranges as % of mean yield					
	<100g	100-200	200-500	500-1000	>1000	Mean yield (t/ha)
1. Obiotutugo (10-25)	30.46	36.92	22.15	10.15	-	3.25
2. Obioturugo (26. 50)	15.63	42.26	8.05	33.90	-	6.46
3. Obioturugo (51-75)	13.80	18.62	26.64	41.09	-	6.23
4. UM 680 (10-25)	12.98	24.21	24.96	29.78	8.07	12.02
5. UM 680 (26-50)	14.22	24.33	23.92	36.59	9.43	14.84
6. UM 680 (51-75)	9.90	16.06	21.69	36.79	15.59	12.83
7. Obioturugo Minisetts(25g)	11.10	31.00	54.39	3.51	-	1.71

[illegible]	12.88	14.75	27.12	45.25	5.90	
[illegible]						
$LSD_{0.05}$						3.90

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