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EFFECTS OF SIZE AND SPACING OF MINITUBERS ON YIELD OF THREE SELECTED YAM CULTIVARS IN THE HUMID TROPICS OF NIGERIA.

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ABSTRACT

Studies were conducted in 2000 and 2001 at Umudike Nigeria Umudike (5^0 27'N; 7^0 32'E) to determine the best spacing arrangement for growing minitubers for seed yam production. Three yam cultivars (*D.alata* cv UM 680) and *D.rotundata* (cv Abi and Obioturugo),3 intra-row spacings on 1m ridges (50cm, 75cm, 100cm) and three minituber sizes (50g, 75g 100g) were arranged in 3 x 3 x 3 split-split plot factorial arrangement of RCB design and replicated three times.

D.alata minitubers (6.91 t/ha) gave significantly (p=1%) higher seed yam tuber yield than the other two cultivars of *D.rotundata*,(2.08 t/ha for Abi and 1.99 t/ha for Obioturugo) irrespective of size of minituber or spacing used The results suggest that 50g minitubers should be spaced either 50cm apart on 1m ridges (4.63 t/ha) or 100cm apart (4.95 t/ha) while the 75g minitubers could be spaced at any of the three spacings evaluated (50cm=4.79 t/ha; 75cm=4.37 t/ha and 100cm=4.95 t/ha). Similarly, the 100g minitubers should be spaced at 75cm (4.95 t/ha) or at 50cm (4.74 t/ha).

INTRODUCTION

After over two decades, the yam minisett technology, developed by National Root Crops Research Institute Umudike as part of the solution to the perennial problem of scarcity and high cost of seed yams, has recorded below 40% adoption (Ogbodu, 1995; Anuebunwa et al., 1998). Some of the factors that hindered easy adoption of the yam minisett technology included the small sizes of, and the difficulty in obtaining the recommended 25g cut setts, the difficulties associated with the chemical treatment of the cut setts. According to Okoli *et al* (1982), in producing the minisetts, 2cm discs are cut from 250g healthy seed yams. Each 2 cm disc is further cut into 4 equal pieces called minisetts that are approximately 25g. The minisetts are then kept under shed to cure for about 24h before they are treated with yam minisett dust and planted. In addition the minisett technology was developed under monoculture while most farmers practice intercropping (Ikeorgu *et al.* 2000). There is therefore the need to develop an alternative to the yam minisett technique of seed yam production with relative ease of adoption. The possibility of developing small but whole tubers was considered. Small sized intact tubers so produced could be given to farmers to sow directly in their farms for seed yam production. Preliminary studies carried out in 1996 and 1997 at the National Root Crops Research Institute Umudike using a range of minisett sizes (4g-10g) showed that 6 and 8 gram minisetts were most promising for the production of 30-100g minitubers (Ikeorgu and Nwokocha, 2001). Minitubers are whole but small yam tubers that range in size from 10g to 150g which can be sown directly in the field for seed yam production. In this technology, the farmer does not have to cut 25g setts nor treat with minisett dust and the problem of non-uniform sprouting inherent in the yam minisett technique would be substantially minimised.

Various sizes of minitubers produced from 6g minisette were evaluated for seed yam size and yields (Ikeorgu and Igbokwe 2002) and 50g to 100g was suggested as the minituber size range that would give seed yam sizes of 200-1000g, the sizes most commonly used by farmers for ware yam production in the Yam Belt of Nigeria (Igwilo, 1988). However the report by Ikeorgu and Igbokwe (2002) did not say how the various sizes of minitubers should be spaced in the field for optimum seed yam yields but merely planted 50g and 75g minitubers at 50cm and 100g minitubers at 1m. This study was therefore carried out to determine the optimum spacing for each minituber size that would give highest seed yam yields. This would form an important component of a package for seed yam production by the minituber technique.

MATERIALS AND METHOD

This trial was carried out at the research farm of the National Root Crops Research Institute Umudike (5^0 27'N; 7^0 32'E) during the 2000 and 2001 growing seasons. Soil in this location is described as Oxic Paleudult with low N content and moderate to low in P and K .Minitubers of *D alata* (cv UM680) and *D.rotundata* (cv Abi and Obioturugo) previously produced from minisetts, were collected from the institute's yam barn and graded for 50g, 75g and 100g sizes.

Land was ploughed and harrowed before 1m ridges were made mechanically using a tractor. The plots were laid out in a 3^3split-split plot factorial arrangement of a randomised complete block design and was replicated three times. The yam cultivars were assigned the main plots while the minituber sizes were the sub-plots and the intra-row spacing constituted the sub-sub plots. The main plot size measured 12m x 5m and the sub-sub plot , 4m x 5m.

In 2000, planting was carried out on 4th June while in 2001 planting was done on 8th June. The 50g, 75g and 100g minitubers were each spaced 50cm, 75cm and 100cm apart on the ridge to give a plant population of 20,000, 13,330 and 10,000 plants/ha respectively. The plots were weeded at 3,8 and 12 weeks after planting (WAP) and compound fertilizer (NPK 20-10-10) at the rate of 400kg/ha was applied as side band to each plot at 12 WAP. The yams were staked with split Indian bamboos immediately after first weeding. The seed yams were harvested 5 months after planting. The fresh tuber yields/plot were recorded and were extrapolated to yield/ha for each year. Analysis of variance for split-split plot factorial arrangement of RCB design was used to assess treatment effects and means were compared by the Duncan's Multiple Range Test (DMRT) at 5% level (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The ANOVA tables for split-split plot factorial arrangement of RCB design of the trials conducted in 2000 and 2001 are shown in Tables 1 and 2.

Table 1 ANOVA for split-split plot factorial arrangement of RCB design involving 3 minituber sizes from Abi, UM680 and Obioturugo yam cultivars planted at 3 different spacings in 2000.

Sources of Variation	Degrees of freedom	Sum of squares	Mean squares	F value
Rep	2	83.175	41.587	10.08*
Cultivar	2	415.062	207.531	50.32**
Sett size	2	2.734	1.367	0.33 NS
Spacing	2	9.168	4.584	1.11 NS
Cultivar x sett size	4	7.708	1.927	0.47 NS
Cultivar x spacing	4	7.377	1.844	0.45 NS
Sett size x spacing	4	15.059	3.745	0.91NS
Cultivar x size x spacing	8	17.922	2.247	0.54 NS

** significant at 1%; * significant at 5%

The results of the two-year trials followed the same trend and showed that, of the three factors evaluated, only yam cultivar means showed significant (p=1%) differences. The results of combined two-year data are therefore presented (Table 3).

D.alata gave significantly (p=1%) higher fresh yam tuber yield (6.91 t/ha) than the other two cultivars of *D.rotundata*,(2.08 t/ha for Abi and 1.99 t/ha for Obioturugo) irrespective of size of minituber or spacing used (Tables 3 and 4).

Table 2 ANOVA for split-split plot factorial arrangement of RCB design involving 3 minituber sizes from Abi, UM680 and Obioturugo yam cultivars planted at 3 different spacings in 2001.

Sources of Variation	Degrees of freedom	Sum of squares	Mean Squares	F-value
Rep	2	12.359	6.179	3.47*
Cultivar	2	613.668	306.834	172.33**
Sett size	2	0.060	0.030	0.02NS
Spacing	2	0.605	0.303	0.17 NS
Cultivar x sett size	4	5.337	1.334	0.75 NS
Cultivar x spacing	4	2.591	0.648	0.36 NS
Sett size x spacing	4	8.033	2.008	1.13 NS
Cultivar x size x spacing 8	14.504	1.813	1.02 NS	

** significant at 1%; * significant at 5%

Table 3. Seed yam yield (t/ha) from various sizes of minitubers of three yam cultivars grown at three spacings in Umudike in 2000 and 2001 (combined).

Minituber		Seed yam yield (t/ha)			
Size (g)	Spacing (cm)	*D. alata* (UM 680)	*D. rotundata* Abi	Obioturugo	Size x Spacing Means
50	100 x 50	7.72	2.73	2.55	4.33
50	100 x 75	6.08	1.99	2.117	4.04
50	100 x 100	7.77	1.92	3.10	4.26
Variety x 50g Size Means		7.19	2.21	2.61	
75	100 x 50	8.27	2.08	2.47	4.27
75	100 x 75	7.58	1.92	2.30	3.93
75	100 x 100	7.83	3.14	2.65	4.54
Variety x 75g Size Means		7.89	2.38	2.17	
100	100 x 50	9.07	2.12		2.14
100	100 x 75	8.32	2.55		2.10
100	100 x 100	7.27	2.52		2.31
Variety x 100g Size Means	7.77	2.33	2.42		
Variety Means	6.91a	2.08b	1.99b		

Means with the same letter are not significantly different at5% level

Table 4. Mean yield of three different yam minituber sizes from three cultivars planted in Umudike in 2000 and 2001 (combined).

Yam Cultivar	Yam Minituber Sizes (g)			
	50g	75g	100g	Variety Means
UM 680	7.19	7.90	8.22	7.77a
Abi	2.30	2.38	2.39	2.36b
Obioturugo	2.61	2.47	2.19	2.42b
Size Means	4.03a	4.25a	4.26a	

Means with the same letter are not significantly different at 5% level.

This agreed with reports by Igwilo and Okoli (1988) and Ikeorgu and Igbokwe (2002) in their work with yam minisetts and minitubers, respectively. Water yam (*D.alata*) is about the most productive cultivar for seed yam production, (Igwilo and Okoli,1988). Minituber yields from the two cultivars of *D.rotundata* did not differ significantly from each other, confirming that the

D. alata species perform better than *D.rotundata* in minisett and minituber production. The poor performance of *D.rotundata* is purely a varietal response to this technology as was observed by Igbokwe *et al.* (1988) in their study with different yam minisett sizes of *D.alata* and *D.rotundata*.

Neither size of minituber planting material nor spacing (Tables 5 and 6) significantly affected seed yam yield. It was expected that the 100g setts would yield heavier seed yams than the 50g setts but this was not the case.

This result is contrary to the reports by several workers who showed that seed yam yields from yam minisetts increase as the sett size increases (Lyonga *et al.*; 1973; Onwueme, 1978; Igbokwe et al, 1988). However, these reports were from minisetts and not minitubers. Although the behaviour of minitubers need further study, it could be that the size differences were not large enough to have significant yield differences at the spacings used in this study. The implication of this result is that 50g minitubers could be planted at 1.0m x 0.50m, 1.0m x 0.75m or 1.0m x 1.0m without any significant yield differences. Similarly, both 75g and 100g minitubers could be planted using any of the three spacings with no significant seed yam yield differences.

Table 5. Mean yield of three different yam minituber cultivar from three cultivars planted at three different spacings in Umudike in 2000 and 2001 (combined)

Yam Cultivar	Yam Minituber Spacings (cm)			
	50	75	100	Variety means
UM 680	8.35	7.33	7.62	7.77a
Abi	2.31	2.16	2.61	2.36b
Obioturugo	2.39	2.19	2.69	2.42b
Spacing Means	4.35a	3.89a	4.31a	

Means with the same letter are not significantly different at 5% level

Table 6. Mean yield of three different yam minituber cultivar from three minituber sizes planted at three different spacings in Umudike in 2000 and 2001 (combined).

Yam Sett sizes (g)	Yam Minituber Spacings (cm)			
	50	75	100	Size means
50	4.34	3.41	4.35	4.03b
75	4.28	3.93	4.54	4.25b
100	4.44	4.32	4.03	4.26b
Spacing Means	4.35a	3.89a	4.31a	

Means with the same letter are not significantly different at 5% level

There were no significant variety x size, variety x spacing or variety x size x spacing interactions in either of the two years of this trial. Further research is however needed to test the results across locations and years as a measure of the stability of the technology in massive production of minitubers for seed yam production. Nevertheless this technique appears promising for farmers, seed production companies or persons wishing to go into seed yam production as a business venture.

REFERENCES

Anuebunwa, F.O., Ugwu, B. O., Iloka, A.W, Ikeorgu, J.E.G. and Udealor,A. (1998) Extent of adoption of improved yam minisett technology by farmers in the major yam growing areas of Nigeria. *A research report submitted to NARP Abuja by NRCRI Umudike. August 1998. 29pp.*

Gomez, K.A, and Gomez, A.A. (1984) Statistical procedures for agricultural research. John Wiley and Sons. New York.680pp.

Igwilo, N. (1988) Field performance of yams grown from minisetts and seed yams.1. Fresh tuber yields. *Niger Agric.* Jour. 23 (2):11-16.

Igwilo,N.H. and Okoli,O.O; (1988) Evaluation of yam cultivars for seed yam production, using the minisett technique.Firld crop Res. 19:81-89

Igbokwe,M.C; Okoli,O.O; Ene,L.S.O. and Obasi,M. (1988) Advances in the vegetative propagation of yams. The effect of size of minisetts and area of periderm from *D.alata* and *D.rotundata* on the yield of seed yams in the rain forst aone of Nigeria. *Niger. Agric. J. 23:144-152*

Ikeorgu, J.E.G.and Nwokocha, H.N; (2001) Development of the yam minituber technique for seed yam production. *Niger. Agric. J. 32*:97-108.

Ikeorgu, J.E.G. and Igboke, M.C. (2002) Seed yam production with minitubers. Niger.Agric.J. 33:46-52I

Ikeorgu, J.E.G; Nwokocha, H.N; and Ikwelle, M.C; (2000). Seed yam production through the minisett technique: recent modifications to enhance farmer adoption. *Proc. 12th International Symposium of ISTRC held in Tsukuba Japan. 10-16 September 2000. pp 373-375.*

Lyonga, S.N.;Fayemi,A.A. and Agbola,A.A. (1973) Agronomic studies on edible yams(Dioscorea spp)in the grassland Plateau of the United Republic of Cameroon. I. Collin A. Leaky (ed) pp 300-346. Proc. 3rd Symposium of ISTRC . Ibadan 2-8 Dec.1972.

Ogbodu, B. (1995) Report on extension activities in Enugu State of Nigeria in 1995. Paper presented at the 10th Ann Zonal Farming Systems Research and Extension Workshop. 4-8 Dec. 1995. Umudike. 10pp.

Okoli, O.O., Igbokwe, M.C., Ene, L.S.O. and Nwokoye, J.U.(1982). Multiplication of yam by minisett technique. Res. Bull.No.2. NRCRI Umudike. Nigeria. 12pp.

Onwueme, I.C. (1978) The Tropical Tuber Crops. New York, USA. John Wiley and Sons. 234p.