STUDIES ON THE OPTIMUM MINISETT SIZES FOR RAPID MULTIPLICATION OF RIZGA *(Plectranthus esculentus)*, HAUSA POTATO *(Solenosterum rotundifolius)* AND TUMERIC *(Curcuma longa)* IN NIGERIA.

EKE-OKORO, O.N., A.O. OLOJEDE and C. NWADILI

National Root Crops Research Institute, Umudike, P.M.B. 7006, Umuahia, Nigeria.
Email: ekeokorono@yahoo.com.

ABSTRACT

The effects of four minisett weights (3, 4, 5 and 6 g) on the performance of four minor root and tuber crops (White Rizga, Black rizga, Hausa potato and Turmeric) were studied in 2003/2004 cropping seasons in Umudike, Nigeria. The number of days to 50% seedling emergence, total number of fresh tubers, fresh tuber yields, marketable and unmarketable fresh tuber yields and dry matter were dependent on the weight of minisetts. Optimum minisett weight of 5 g sustained the highest number of fresh tubers, fresh tuber yields, and marketable and unmarketable fresh tuber yields irrespective of crop variety. For rapid multiplication of minor root and tuber crops (Rizga, Hausa potato and Turmeric) an optimum minisett weight of 5g is recommended.

Key words: minisett sizes , rapid multiplication, Rizga, Potato, Tumeric

INTRODUCTION

In Nigeria, about 16 different root and tuber crops exist. They are classified as major (Cassava, Yam, Cocoyam, Sweet Potato, Ginger) and minor (Rizga, Turmeric, Sugar/garden beet, Hausa potato, Tigernut, Carrot, Radish, Turnip, African yam bean, Mexican yam bean and Jerusalem antichoke) root and tuber crops. The major root and tuber crops contribute 15.1% of total calories and 8.0% of total protein in the daily diet of average Nigerian (Olayide, 1979 and Allenman and Coertze, 1979).

Minor root and tuber crops are small shrubs (crops) mostly grown by the traditional farmers in the Middle Belt and Northern agro-ecological zones of Nigeria. Recently Scientists have began to grow them in Southeastern Nigeria for obtaining more knowledge of the crop husbandry. Generally, minor root and tuber crops such as Rizga or Livingstone potato (Plectranthus esculentus) and Turmeric (Curcuma longa) are consumed as snacks and food adjuvants. Rizga and Hausa potato are eaten fresh, boiled or roasted and eaten in combination with cereals. Turmeric serves as spice and colouring agent in Rice, Guinea corn and Maize (Olojede et al, 2002).

Minor root and tuber crops like the major root and tuber crops have low multiplication ratio (IITA 1990 and Eke-Okoro et al 2005) as when compared with cereals such as Rice and Maize. Therefore, the greatest constraint to increased production of minor root and tuber crops is the scarcity or high cost of the seeds used for production. The scarcity of the seeds of these crops militates against their availability for research and production (Olojede et al; 2004). Yam and cocoyam have low multiplication ratios but the use of minisett technique in multiplying yam and cocoyam has reduced the problem of insufficient seed yams and cocoyams for planting (NRCRI, 1975). The use of 25g sett in rapid multiplication of yam has popularize yam production (NRCRI,

1975) There is no literature on the minisett size or weight for rapid multiplication of Rizga, Hausa potato and Turmeric, as these crops have been neglected for so long. The traditional growing of rizga, hausa potato and turmeric is by using a whole tuber of more than 50g. Therefore, there is need for rapid multiplication of the seeds through the popular minisett technique (IITA, 1990 and Eke-Okoro et al 2005). The objective of this study was to determine the optimum minisett sizes necessary for massive production of seed Rizga, Hausa potato and Turmeric, so as to support recent research attention on minor root and tuber crops in Nigeria.

MATERIALS AND METHODS

Two varieties of Rizga (black and white skinned), Hausa potato and Turmeric were splitted into four minisett sizes of (3,4,5, and 6g) using sharp kitchen knives. Minisett sizes of the tubers were obtained by varying the length of the tubers. The cut setts of the various sizes were grown in polyethylene bags of 25 x 17x 17 cm^3 dimension. The polyethylene bags were filled with natural top soils mixed with poultry manure. The soils in the polyethylene bags were saturated with water at 100% field capacity. The polyethylene bags were placed in an open experimental field of the National Root Crops Research Institute, Umudike, in 2003/2004 seasons.. The minisetts were planted into the polyethylene bags at a depth of 5cm and covered with soil. Planting of the minisett was done in mid May 2003 and 2004 respectively. Water was applied two times a week to the mini-tubers in the polyethylene bags. The experiment was laid out in a randomized complete block design using a 4 x 4 factorial arrangement with three replications. The crops were harvested at 4 months after planting. The following data were collected: Days to 50% seedling emergence, total number of tubers, length of tubers, fresh yield of tubers, marketable (20 – 50g) and unmarketable tubers (<10g) and dry matter. Dry matter was obtained after drying a specified fresh weight of respective tubers in an oven maintained at 80°C. Percent emergence was computed using the formula given by Hartman and Kester (1964):

$$\% \text{ emergence} = \frac{\text{Total number of emerged seedlings}}{\text{Total number of seeds}} \times 100$$

Data were combined and analyzed with Genstat Computer Package (2003) and means were separated at 5% level of probability.

RESULTS AND DISCUSSION

The number of days to seedling emergence was assessed and the result is shown in Table 1. The effects of crop variety and weight of minisett on 50% seedling emergence were significant. Minisett weight of 5g of respective crops took the lowest number of days to emerge (17.7 days) above which there was non-significant difference in seedling emergence. Minisett weight of 3g took the longest period to 50% seedling emergence (23.2 days) than every other weight. Turmeric was least to reach 50% seedling emergence (24.2 days). The interaction of crop variety – white rizga X minisett weight of either 4 or 5g took the lowest number of days to 50% seedling emergence while crop variety – Turmeric X minisett weight of 3g took the highest number of days to 50% seedling emergence.

The total number of fresh tubers harvested was assessed and the result is shown in Table 2 below. Minisett weight and crop variety significantly influenced the total

number of fresh tubers generated. Minisett weight of 5g gave the highest number of tubers (15.8) irrespective of crop variety. The lowest number of tubers was accounted by minisett weight of 3g (10.8).

Table 1: Number of days to 50% seedling emergence as affected by crop variety and weight of minisett

	Weight of minisett (g)				
	3	4	5	6	Mean
White Rizga	22.3	12.0	12.3	28.3	18.7
Black Rizga	18.7	15.0	24.7	19.0	19.4
Hausa Potato	18.7	16.0	16.0	16.0	16.7
Turmeric	33	31.5	17.7	14.5	24.2
Mean	23.2	17.7	19.5	19.4	-

LSD (0.05) for comparing crop variety means = 2.6
" " " " weight of minisett means = 2.6
" " " " crop variety x minisett weight means = 10.4

Table 2: Total number of tubers as affected by crop variety and weight of minisett.

	Weight of minisett (g)				
Crop Variety	3	4	5	6	Mean
White Rizga	4.7	3.3	12.0	8.5	7.1
Black Rizga	7.0	5.3	4.3	8.7	6.3
Hausa Potato	9.7	22.0	24.0	21.3	19.3
Turmeric	21.7	13.7	23.0	16.7	18.8
Mean	10.8	11.1	15.8	13.8	-

LSD (0.05) for comparing crop variety means = 3.8
" " " " weight of minisett means = 3.8
" " " " crop variety x weight means = 9.4

Above the minisett weight of 5g, the number of fresh tuber reduced across all the crop varieties. Hausa potato sustained the highest number of tubers (19.3) which was not significantly different from the number of tubers obtained by Turmeric (18.8). The interaction of minisett weight of 5g and Hausa potato gave the highest number of tubers (24.0), but this was not significantly different from the interaction of 5g for Turmeric. The interaction of white risga and minisett weight of 3g gave the lowest number of fresh roots (4.7).

The length of tubers as influenced by treatments is shown in Table 3. Crop variety significantly affected the length of fresh tubers harvested. White rizga gave the longest length of tubers (7.3 cm) while Hausa potato gave the shortest length of tubers (4.0). Minisett weight did not significantly influence the length of fresh tubers. The interaction of minisett weight of 5g and white

rizga gave the longest length of fresh tubers (9.7 cm) while the interaction of minisett weight of 3g and Hausa potato gave the lowest length of tubers (3.0 cm).

The yields of the varieties and minisett weights are shown in Table 4. Minisett weight and crop variety significantly influenced the associated yields. Minisett weight of 5g gave the highest fresh tuber yield (202.5 g) while minisett weight of 3g gave the lowest fresh tuber yield (81.6g).

Table 3. Length of tubers (cm) as affected by crop variety and weight of minisett

	Minisett weight (g)				
Crop Variety	**3**	**4**	**5**	**6**	**Mean**
White Rizga	4.3	12	9.7	3.0	7.3
Black Rizga	8.7	3	4.0	7.3	5.8
Hausa Potato	3.0	6.3	3.3	3.3	4.0
Turmeric	8.3	3.0	4.7	7.7	5.9
Mean	6.1	6.1	5.4	5.3	-

LSD (0.05) for comparing crop variety means = 1.7
" " " " minisett weight = N.S.
" " " " crop variety x weight means = 4.4
NS = Non significant

Table 4: Fresh tuber yield (g) as affected by crops variety and weight of minisett

	Minisett weight (g)				
Crop Variety	**3**	**4**	**5**	**6**	**Mean**
White Rizga	103	270	170.0	140	170.8
Black Rizga	100.0	106.0	83.3	113.3	100.6
Hausa Potato	76.6	196.7	260	280	203.4
Turmeric	46.7	146.7	296.7	260.0	187.5
Mean	81.6	179.9	202.5	198.3	-

LSD (0.05) for comparing crop variety means = 28.6
" " " " minisett weight means = 28.6
" " " " crop variety x weight means = 40.7

Hausa potato sustained the highest fresh tuber yield (203.4 g) while Black rizga gave the lowest fresh tuber yield (100.8 g). The interaction of minisett weight of 5g and turmeric obtained the highest fresh tuber yield (296.7 g) while the association of minisett weight of 3g and Hausa potato gave the lowest fresh tuber yield (76.7g). The fresh weight of marketable (20 – 50g) and unmarketable (< 10g) yields associated with treatments are shown in Tables 5 and 6. Minisett weight of 5g gave the highest marketable and unmarketable fresh tuber yields. (177.5 and 25.0g). Minisett weight of

3g gave the lowest marketable and unmarketable fresh tuber yields (96.0 and 8.7g). Hausa potato gained the highest marketable fresh tuber yield but lower unmarketable fresh tuber yields. However, the highest unmarketable fresh tuber yields obtained was by turmeric. The interaction of minisett weight 3g and turmeric gave the lowest market and unmarketable fresh tuber yields.

The dry matter production assessed is presented in Table 7. The trend of dry matter accumulation in the tubers as influenced by minisett weight did not differ significantly across the minisett weights. However, crop variety significantly influenced dry matter production. Black rizga and Hausa potato significantly sustained the highest dry matter produced (28.8 and 28.7g) while white rizga and turmeric obtained the lowest dry matter produced (14.3 and 15.3g) respectively.

Table 5: Weight (g) of marketable tubers as affected by crop variety and weight of minisett

	Minisett weight (g)				
Crop Variety	**3**	**4**	**5**	**6**	**Mean**
White Rizga	100.0	83.3	156.7	93.3	108.3
Black Rizga	183.3	101.0	73.3	110.0	116.9
Hausa Potato	70.0	170.0	226.7	260.0	181.7
Turmeric	38.7	126.7	253.3	230.3	162.2
Mean	96.0	128.3	177.5	173.4	-

LSD (0.05) for comparing crop variety means = 24.5
" " " " minisett weight means = 24.5
" " " " crop variety x weight means = 82.6

Table 6. Weight (g) of unmarketable tubers as affected by crop variety and weight of minisett.

	Minisett weight (g)				
Crop Variety	**3**	**4**	**5**	**6**	**Mean**
White Rizga	3.3	6.7	13.3	0.0	7.8
Black Rizga	16.7	16.7	10.0	3.3	11.7
Hausa Potato	6.7	26.7	33.3	20.0	21.7
Turmeric	8.0	20.0	43.3	29.7	25.3
Mean	8.7	17.5	25.0	13.5	-

LSD (0.05) for comparing crop variety means = 6.4
" " " " minisett weight means = 6.4
" " " " crop variety x weight means = 11.6

Table 7: Dry matter (%) as affected by crop variety and weight of minisett

	Minisett weight (g)				
Crop Variety	**3**	**4**	**5**	**6**	**Mean**
White Risga	13.8	13.3	18.4	15.7	15.3
Black Risga	26.4	51.2	16.0	21.5	28.8
Hausa Potato	37.0	22.7	36.5	18.5	28.7
Turmeric	4.5	8.2	18.0	26.3	14.3
Mean	20.4	23.9	22.2	20.5	-

LSD (0.05) for comparing crop variety means = 6.5
" " " " minisett weight means = NS
" " " " crop variety x weight means = 13.7

The performance of various minisett weights of crop varieties (White rizga, Black rizga, Hausa potato and Turmeric) for use in rapid multiplication were evaluated in 2003/2004 cropping seasons. Irrespective of crop varieties minisett weight of 5g significantly accelerated seedling emergence, total number of fresh tubers, length of fresh tubers, fresh tuber yield, fresh weight, marketable and unmarketable tuber yields. Above minisett weight of 5g all the parameters evaluated decreased. The weights of root and tuber crops have been shown to influence their productivity. Eke-Okoro et al (2001) showed that for maximum and stable yield in cassava production a stake weight of 88g could be used. Lower minisett weights did not significantly improve the assessed crop performance parameters. This could be attributed to little food reserve associated with their weights. Okeke (1994) associated differential performance of cassava stake weights to differences in food reserve of the stakes. Interactions of minisett weight of 5g and any of the crop varieties (Rizga, Turmeric, and Hausa potato) sustained upward performance of these crop varieties.

The differential performance of the various crop varieties in terms of number of days to 50% emergence, total number of fresh tubers, length of fresh tubers, fresh tuber yields and dry matter could be attributed to differences in crop varieties used. Olojede et al (2004) associated differential yield of minor root and tuber crops to their genetic differences.

In conclusion, for rapid multiplication of minor root crops (Rizga, Hausa potato and Turmeric) an optimum minisett weight of 5g is suggested.

REFERENCES

Allenman J., and Coertze, A.F. (1979). Indigenous Root Crops. A3. Solenostemon. Pretoria, South Africa.: Vegetable and Ornamental Plant Institute.

Eke-Okoro, O.N., O.U. Okereke, J.E. Okeke (2001). Effect of stake sizes on some growth indices and yield of three cassava cultivars. Journal of Agricultural Science (Cambridge): 113: 419-426.

Eke-Okoro, O.N., C.C. Chinaka, B.C. Okezie and K.I. Nwosu. (2006). Root and tuber crops seed multiplication. A training manual. 30pp.

Eke-Okoro, O.N., E.C. Ekwe and K.I. Nwosu (2005). Cassava stem and root production. A practical manual. Atlas publication Umuahia. 53 pp.

GENSTAT, (2003). GENSTAT 5.0. Release 4.23DE, Discovery Edition I, Lawes Agricultural Trust, Rothamsted Experimental Station.

Hartman, E.T and Kester, D.E. (1964). Principles of plant propagation. Prentice –Hall Inc. U.S.A. 3 – 15.

IITA (1990). Cassava in Tropical Africa. A reference manual. Chayce Publication Services, United Kingdom. 175 pp.

NRCRI (1975) Guide to rapid multiplication of yam tubers. Advisory Bulletin No. 2. 1-10

Okeke, J.E. (1998). Productivity and yield stability in cassava as affected by stake weight. Journal of Agricultural Science. Cambridge 122: 49 – 55.

Olojede, A.O., C.C. Nwokocha, O.N. Eke-Okoro and J.K.U. Emehute (2004). Varietal response of Livingstone potato NPK fertilizer application at Umudike National Root Crops Research Institute, Annual Report 2004. 86 – 88.

Olayide S.O. (1979). Food production in Nigeria. University of Ibadan Printing Press, Ibadan, Nigeria. 370 pp.

Olojede, A.O., O.N. Eke-Okoro, T. Daylop, D.M. Lenka and M.C. Igbokwe. (2002). Determination of optimum population for Livingstone potato production under Umudike and Jos conditions.

National Root Crops Research Institute, Annual Report (2002). 126 – 128.