Influence of decreasing minisett weight and intra-row spacing on the coated ginger cv Taffin-giwa

P A OKWUOWULU
National Root Crops Research Institute
Umudike, Umuahia, Imo State, Nigeria

ABSTRACT

The influence of varying minisett weights, intra-row spacing, sites and weather on yield of the ginger cv. Taffin giwa is discussed. Yield of fresh ginger at increasing minisett weights has the same effects as decreasing intra-row spacing, both factors inversely related to seed harvest multiplication ratio. Off-shoots (seed pieces = 3g) are potential setts. Using reduced minisetts stimulates complete harnessing of food reserve in mother setts during crop growth. The level of sunshine and heat radiation during crop growth and drastic/erratic changes in ambient soil temperature in the tuberous stem deposition zone cause significant (≤ 30%) yield losses.

Key words: ginger, Taffin-giwa, minisetts, seed harvest multiplication.

Introduction

Large scale cultivation of ginger in Nigeria dates back to 1927 (Arene *et al* 1987). There are two commercial cultivars, Yatsun-biri and Taffin-giwa. Taffin-giwa is the choice for direct culinary use, condiments, and confections in the home; being cherished for richness in mild flavours. In transverse section, the tuberous stem has attractive golden-yellow colour. The yield is high (0.93kg/plant) and only moderately (26%) susceptible to bacterial wilt (Indrasenan *et al* 1982). The production at the moment is constrained by a lack of technique of rapid seed multiplication at farmers level. This paper presents the findings of a study in this direction.

Setts are obtained by splitting larger knobs into desirable smaller setts; a process often resulting in off-shoots and wastages of these undersized setts, < 5g. It was desirable to test adaptability of the small setts as seed ginger. The mother sett in ginger may be recovered in fully plantable condition at crop maturity. The relative quantity recoverable at low sett weights is small suggesting that use of small setts could be explored to maximise the use of the mother setts. As yield increases with sett weights but is inversely related to seed harvest multiplication ratio (SHMR), there is need to explore other methods of attaining higher yields and SHMR as well.

Materials and methods

The study was conducted in sandy loam (1988) and sandy clay loam (1989) soils in Umudike (05°29'N; 07°33'E; 122m altitude) and Bori (04°41'N; 07°21'E; 4m altitude).

Choice of test sett weights

A preliminary study using sett weights of 5,4,3,2 and 1g in 1986 and 1987 revealed low establishments due to shrinking and desiccation of setts smaller than 3g. The smallest sett weight in this study was, therefore, 3g.

Field investigation

Seed pieces of 9, 7, 5 and 3g, obtained from larger knobs such that setts below 9g fitted as 7g, and so on till 3g setts, constituted the main treatments and were spread on the floor of the prep-room for 24h, considered adequate to enable cut surfaces to heal-up through suberization de novo. They were sown at 20, 15, and 10cm within rows, 20cm apart in grooves 5cm deep. The study was laid in randomised complete blocks replicated 3 times on plots 2m x 2.4m; the sowing done in late April when the rainfall had become regular. Commercial ginger fertilizer, NPK 15:15:15 at the rate of 700kg ha^{-1}, was broadcast after sowing. Each plot was then mulched to a thickness of about 5cm with wilted guinea grass (*Panicum maximum*) shoots in Umudike or saw dust (more readily available) in Bori. Establishment counts were taken after weeding at 8 weeks and the crop, weeded again at the 13th week, was harvested at maturity at 9 months from sowing. During the harvesting, a deliberate attempt was made to recover the un-decomposed parent setts to confirm whether lowering the sett weights (< 5g) would enable parent setts to become fully mobilized at early stages of crop growth. Weather data were obtained and used to explain some of the differences in relative yield of tuberous stem.

Results and discussion

Plant factor (sett weight) response was scored. Significant (P = 0.05) difference in percentage establishment, similar in both years, occurred due to varying sett weights and between sites as shown in Table 1, confirming an earlier study (Okwuowulu and Ujoh 1987). Higher losses were sustained due to desiccation of smaller setts. Further work is concerned with ascertaining the optimum edaphic environment (e.g. through irrigation) for achieving higher sprout and establishment counts of smaller setts.

Table 1. Percentage establishments: Influence of varying minisett weights in 1989.

Sett weights	Bori	Umudike
(g)	% establishment	
9	80.80	66.13
7	74.47	59.13
5	67.13	54.13
3	63.80	44.93
S.E.	1.60	1.02

The quantity of mother setts recoverable at crop was of interest, being found to be negligible at the lowest (3g) setts and minimal enough to reject continued effort in the recovering process at 5g setts. This aspect of the study revealed that use of small setts was a method of fully mobilizing the parent setts during crop development and growth.

Table 2 summarizes the fresh ginger yield. The trend was also similar in both years of study in both locations. A significant (P = 0.05) yield increase obtained by increasing minisett weights has the same affect as decreasing intra-row spacing. The corresponding higher yield at close density was seen as due to between plant competition enabling each plant to express larger defence mechanism in sink accumulation activity. This occurred at

Table 2: Yield response of fresh ginger (t/ha) to varying minisett weights in both years of study.

	Sett weights (g)							
	Bori 9	7	5	3	Umudike 9	7	5	3
1988 Intra row spacing (cm)								
20	27.67	23.1	23.4	18.6	16.4	18.5	11.8	11.3
15	21.0	24.0	14.47	14.9	13.4	11.8	10.1	10.5
10	19.4	17.33	13.33	15.47	11.3	11.3	9.6	10.5
S.E.		1.998				0.87		
1989 Intra row spacing (cm)								
20	20.67	14.43	12.63	10.73	9.43	8.43	5.47	3.53
15	14.27	13.43	10.67	8.7	6.43	7.40	4.43	3.40
10	14.67	12.07	8.6	9.47	6.33	6.90	3.37	2.53
S.E.		1.47				0.79		

all sett weights. Similarly, increasing yield at larger setts occurred because the sink capacity was still within the range of desirable sett weights to attract and accept more assimilates in each specific environments. Further more, there was probably the inert potential (loosely called vigor) in seedling at below maximum yield potential. The trend was similar and in agreement with earlier work (Sivan 1979. Whiley 1981, Okwuowulu 1988), for varying intra-row spacing and use of large sett weights in ginger.

However, the SHMR (Table 3) was inversely related to increasing sett weights and decreasing intra-row spacing. Therefore the minisetts confer advantage for rapid multiplication. The total mobilization of food reserve of the planted setts at considerably low setts enabled more yield per unit of such seedling. As the sett weights increased the mechanism triggering on the total mobilization of stored food in mother setts decreased as the current photosynthates was in excess of the seedling plant requirement. The mother tubers therefore remained fresh to be harvested in plantable condition later on.

Table 3. Influence of sett weight and intra row spacing on Seed Harvest Multiplication Rate (SHMR).

Spacing	Sett weights (g)							
1988	Bori				Umudike			
Intra rows (cm)	9	7	5	3	9	7	5	3
10	6	7	9	13	4	5	5	7
15	7	10	9	15	4	4	5	8
20	9	10	11	21	5	5	6	10
1989 Intra rows (cm)								
10	5	4	5	7	2	2	2	2
15	5	6	6	9	3	3	3	2
20	7	7	7	13	3	3	4	3

The limit of the smallness of the setts to obtain total utilization of all food reserve to contribute to attaining potential yield of the growing crop has not been determined but may be governed by the limit of desiccation occurrence for example, which will permit successful sowing of small setts. Earlier observation on this was reported by Okwuowulu and Ujoh (1987) in preliminary studies on optimum setts in seed ginger production. The fresh tuber yield obtained at the 3g seed pieces in the present study confirms that off-shoots ($\leq$ 5g setts) are potential setts in ginger. The significance is adaptability to specific environments and reduction in seed-rate.

The relative yield differences in the two years and between sites were attributed to variation in the weather elements. Generally, the rainfall and temperature were not as markedly different but the sunshine (h) and the level of heat radiation distribution varied and caused growth setback during sprouting and establishment in 1989. More yields were obtained in 1988, resulting from more evenly distributed sunshine (measured with sunshine recorder) which was warm but copious then. Furthermore, the ambient temperature at the soil depth/zone (0-5 or 5-10 cm depth) bearing the tuberous-stem (Table 4) varied drastically, becoming erratic during 1989 crop harvest and hence caused significant yield losses (Table 2). Leverington (1975) had reported that ginger is susceptible to weather changes causing variation in yield from year to year. The dry-heat-wave during the 1990 crop harvest also might have contributed to yield loss from tuber desiccation and shrinkage. More work is being done to minimise losses in the field crop production.

Table 4. Certain weather elements during crop harvest in Umudike; not maintained in Bori.

Crop	Harvest	Temperature						Relative humidity %	
		Air		Soil					
Year	Month	Min.	Max.	5cm		10cm			
				0900	1500	0900	1500	0900	1500
1988	Nov.	23	32	31.2	38.0	29.1	35.2	78	61
	Dec.	21	31	28.8	36.0	29.5	33.2	71	51
1989	Jan.	17	32	27.4	36.9	26.0	33.1	32	22
	Feb.	21	34	30.5	40.2	28.9	36.0	48	37
	March	22	33	31.2	37.8	29.1	33.6	72	54
	Nov.	23	32	31.6	38.3	29.2	34.3	79	63
	Dec.	21	32	30.0	37.9	28.2	34.9	70	49
1990	Jan.	23	33	31.1	38.7	29.6	35.7	75	51
	Feb.	22	34	31.4	41.9	29.6	37.4	67	37
	March	24	36	34.9	43.6	32.3	40.0	63	36

Acknowledgments

Appreciation is expressed to Director, NRCRI, (National Root Crops Research Institute), Umudike, and the Head Community Development Project, SPDC, Port Harcourt for gift of materials used in this study; Mr. A.O. Ubbor for meteorological data and Mrs. G.N. Nwuche for typing this manuscript.

References

Anonymous 1989 Annual Report of National Root Crops Research Institute, Federal Ministry of Science and Technology, Umudike, Nigeria.

Arene O B, Orkwor G C & Okwuowulu P A 1987 Ginger Research in Nigeria. Trop. Root Crops: Root Crops and the African food Crisis. Proceedings of Inter. Soc. for Trop. Root Crops - African Branch, Owerri, Nigeria. IDRC, Otawa, Ont. 89-93.

Indrasenan G, Vasantha Kumar K, James Mathew & Mamman M K 1982 Reaction of different types of ginger to bacterial wilt caused by *Pseudomonas solnaccearum* (Smith) Smith. Agric. Res. J. Kerala 20: 73-75.

Leverington R E 1975 Ginger technology. AIFST Convention paper on Food Technology in Australia pp. 509.

Okwuowulu P A & Ujoh I A 1987 Determination of optimum sett size and spacing for seed ginger production. Ann. Report of Nat. Root Crops Res. Inst., Umudike pp. 134-135.

Okwuowulu P A 1988 Effect of seed ginger weight on the flowering and rhizome yield of field grown edible ginger (*Zingiber officinale* Rosc.) in Nigeria. Trop. Sci. 28: 171-176.

Sivan P 1979 Growth, spacing, time of lifting and production of early harvest ginger in Fiji. Fiji Agric. J (1980) 42: 49-50

Whiley A W 1981 Effect of plant density on time of first harvest maturity, knob size and yield in two cultivars of ginger (*Zingiber officinale* Rosc) grown in south east Queensland. Trop. Agric. (Trinidad) 58: 245-251