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The Influence of Minisett Size on the Profitability of Yam Production in Edo State, Nigeria

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Abstract: This study compared the influence of different minisett sizes (ranging from 25g to 50g) on the profit realizable from yam production in the Forest and Forest-Savanna transition zones of Edo State, with the main objective of determining the optimum level of returns with respect to the minisett sizes. The randomized complete block design involving six minisett sizes (25, 30, 35, 40, 45 and 50g) in four replicates was employed in examining the output from the two zones covered in this study. The result of the analysis indicated that the total production cost per hectare increased with increasing sett size, ranging from $1822.43 for the 25g sett to $2942.43.00 for the 50g sett respectively for the two zones. The economic returns also increased with increasing minisett size for the two zones, with the highest gross margin and net returns of $12909.57 and $12622.78 respectively from the 50g sett size recorded in the Forest-Savanna zone. In the Forest zone, a gross margin of $12648.70 and net returns of $12361.91 were obtained from the 50g sett size. Optimum returns from the different minisett sizes however, differed in both zones, based on the viability indices of returns per dollar invested which amounted to $4.75 under the minisett size of 40g and $5.43 under minisett size of 30g at the Forest and Forest-Savanna transition zones, respectively.

Key words: Forest, Forest-Savanna transition, minisett, seed yam, profitability, technical efficiency.

INTRODUCTION

Yam (*Dioscorea species*) is a preferred staple food crop appreciated for its taste and cultural role throughout coastal Africa [1] with Sub-Saharan Africa currently producing about 90% of the world's total yam output [2]. Many farmers in the Southern parts of Nigeria (particularly Edo State) are however, finding it extremely difficult to cultivate this very important crop which has been found to attract far higher price than other root and tuber crops. Shortage of planting materials ranks high among the factors causing serious limitations to the yam production in this region [3, 4]. The emergence of yam minisett technique for massive seed yam production is a unique breakthrough in yam research which has helped in stemming the bottleneck of high cost of planting materials. Much work has been done in the past on minisett technology [5-8]. The adoption rate of these technologies by resource-poor smallholder farmers, responsible for producing over 90% of agricultural output in this region [9, 10] has been rather low. A more recent study by Ijoyah *et al.*,[11] on the effect of seed bed types on yam minisetts yield indicated an adoption rate of 50% with the remaining 50% sticking to the traditional methods. Fasasi and Fasina [12] however, harped on the need to encourage farmers to use more of minisett technique instead of the current practice of using the very expensive and relatively scarce seed yams. The rural farmer is highly rational [8], often basing his production decisions on basic economic principles of profit maximization based on the equi-marginal principles of resource allocation. Consequently, no matter how technically efficient a given technology may be, the farmer may not adapt until, it is proven to be economically plausible.

The objective of this study was therefore to provide an economic analysis of the performance of different sizes of yam minisetts in both the Forest and Forest-Savanna transition ecological zones of Edo State, in order to provide empirical evidence for the most cost-effective yam minisett size suitable for farmers in the respective zones. This would not only help in strengthening the economic base of these farmers by optimizing their returns, it would also encourage them to increase their yield ha^{-1} thereby boosting the productivity of yam and ensuring its continuous availability for its dietary and cultural needs.

MATERIALS AND METHODS

This trial was conducted at Irrua (Forest-Savanna transition zone) and Evboneka (Forest zone). The physiochemical properties of composite samples of topsoil (0-30cm depth) collected with an auger from

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Table 1: Soil physical and chemical properties of the experimental sites before cropping with yams during 2004 cropping season.

	Experimental sites	
Soil properties	Evboneka	Irrua
pH (H_2O)	5.70	4.8
Organic carbon (%)	1.62	0.79
Total nitrogen (%)	0.18	0.07
Available phosphorus ($mgkg^{-1}$)	7.30	3.85
Exchangeable cations		
- Calcium ($cmolkg^{-1}$)	7.80	0.7
- Magnesium ($cmolkg^{-1}$)	0.60	0.6
- Potassium ($cmolkg^{-1}$)	0.40	0.15
Clay (%)	11.00	31
Silt (%)	11.00	22
Sand (%)	78.00	47
Textural class	Loam sand	Sandy loam

Keys: Evboneka - Forest zone
Irrua 1 - Forest-Savanna zone

each of the two sites are presented in Table 1. The design for the trial was randomised complete block design with six treatments namely 25g, 30g, 35g, 40g, 45g and 50g and four blocks. A ridge represents a plot 10m in length and spaced 1m from neighbouring ridges.

The land was cleared of the existing vegetation and ridges constructed. Ridges were 10m long and 1m apart. The yam tubers previously, stored in a traditional yam barn for over five months after harvest, were washed clean of dirt in tap-water and cut into the six sett sizes with a clean knife.

The cut surfaces were treated in aqueous suspension composed of wood ash, Demasan and Aldrex T (a fungicide/insecticide) at a rate of 24g Demosan, two sachets of Aldrex T and about 250ml of wood ash in $4dm^{-3}$ of water. The setts were soaked in this suspension for 2 - 3 minutes. After pre-planting treatments, all setts were spread out under shade for a day to dry.

Planting out was done following curing with 3g of Furadan applied in the planting hole per stand and the 21st and 22nd of May, 2004 at Evboneka and Irrua, respectively. The minisetts were planted at 25cm x 100cm spacing, giving a planting density of 40,000 pph while the large sett (macrosetts) were spaced at 100cm x 100cm, giving a planting density of 10,000 (plants per hectare) pph.

The plots were maintained weed free as they were weeded manually when necessary. The minisett plants were staked singly to avoid bias. NPK fertilizer was applied at the rate of 200kg per hectare through basal application.

The yam tubers were harvested at 28 WAP after the extensive drying up of most leaves. After harvest, data were collected on tuber yield (t) per hectare as estimated using the Ogbu and Okereke [13] formula.

Data collected were analyzed with GENSTAT programme, version 8.1 using analysis of variance and significant differences among treatment means were separated using the LSD procedure.

To determine the optimum tuber yield in the trials, the gross margin, return per dollar invested, the net return and the benefit-cost ratio were used [14]. All the expenses and revenue were calculated per hectare.

RESULTS AND DISCUSSION

The output ha^{-1}, revenue and total production cost increased with increasing sett size across the two zones (Table 2). It ranged from the lowest of 9.3t ha^{-1}, \$8086.96 and \$1822.43 for the sett size of 25g in the Forest zone to the highest of 17.80t ha^{-1}, \$15478.26 and \$2942.43 for the sett size of 50g in the Forest-Savanna transition zone for output, revenue and total production cost respectively (Table 2). Output and revenue were higher in the Forest-Savanna transition zone for the six different sett sizes in this study.

The gross margins and net returns also increased with increasing sett size across the zones, though the net returns of \$12394.61 recorded for the sett size of 45g at the Forest-Savanna transition zone was marginally lower than the \$12413.39 recorded for 40g sett size (Table 2). The return per dollar invested and benefit-cost ratio, which serves as economic indices for evaluating the profitability and viability of an enterprise, however, followed a different trend, with both attaining a peak of \$4.75 (return per dollar invested) and 4.20 (benefit-cost ratio) and \$5.53 (return for dollar invested) and 5.43 (benefit-cost ratio) under the sett sizes of 30 and 40g, at the Forest and Forest-Savanna transition zones, respectively before declining with increasing sett size (Table 2).

The major inference that could be deduced from this analysis is that white Guinea yam production is highly profitable in both zones with increasing yield and revenue from the use of bigger sett sizes. However, the average yam farmer has been shown to be highly rational [8] and would therefore not spend all or most of his scarce resources on the purchase of planting materials alone. The economic indices of viability and profitability show that the farmer would obtain optimum returns from the use of yam minisett sizes of 40g and 30g at the Forest and Forest-Savanna transitional zones, respectively.

This result compares with the findings of Kalu and Erhabor [8] and Ijoyah *et al.* [14] who recorded increasing yield and net returns with increasing yam minisett size. It however, differs from the findings of Chikoye *et al.* [15] who reported average tuber yield of between 4.7t ha^{-1} and 7.1t ha^{-1} and comparatively lower crop value of between \$1345.57 to \$2043.22. This disparity in yield and returns could be a function of varietal qualities, as far higher yield have been recorded by other researchers. Studies by Nlerum [16] acknowledged the potential profitability of yam minisett technology but reported very low adoption rate of

Table 2: Profitability analysis of the influence of minisett size on the performance of *D. rotundata cv "Obiaoturugo"*

Site	Item	Sett size (g) 25	30	35	40	45	50
Evboneka (Forest)	Output (t ha^{-1})	9.30	11.60	12.90	14.60	15.00	17.50
	Revenue (869.57t^{-1}$)	8086.96	10036.96	11217.39	12695.65	13043.48	15304.35
	Total variable cost ($)	1629.57	1817.39	2005.22	2193.04	2380.87	2568.70
	Total fixed cost ($)	192.87	211.65	233.61	249.22	268.00	286.78
	Total cost ($)	1822.43	2029.04	2235.65	2442.26	2648.87	2942.43
	Gross margin ($)	6457.39	8269.57	9212.17	10502.61	10662.61	12648.70
	Return / $invested	3.54	4.55	4.59	4.75	4.48	4.92
	Net return ($)	6264.52	8057.91	8.894.78	10253.39	10394.61	12361.91
	Benefit-cost ratio	3.44	3.97	3.98	4.20	3.92	4.19
Irrua (Forest- Savanna transition)	Output (t ha^{-1})	11.60	15.00	16.30	16.70	17.30	17.80
	Revenue ($869.57 t^{-1})	10086.96	13043.48	14173.91	14521.74	15043.48	15478.26
	Total variable cost ($)	1629.57	1817.59	2005.22	2193.04	2380.87	2568.20
	Total fixed cost ($)	192.87	211.65	233.61	249.22	268.00	286.78
	Total cost ($)	1822.43	2029.04	2235.65	2442.26	2648.87	2942.43
	Gross margin ($)	8457.39	11226.09	12168.70	12328.70	12662.61	12909.57
	Return/$invested	4.64	5.53	5.44	5.05	4.78	4.39
	Net return ($)	8264.52	11014.91	11938.26	12413.39	12394.61	12622.78
	Benefit-cost ratio	4.53	5.43	5.34	5.08	4.68	4.29

18.9%. It was therefore recommended that farmers be assisted to adopt through the supply of necessary inputs which among other things include minisett dust.

It has been shown in this study that yam farmers in Edo State would maximize their earnings by cultivating minisett sizes of 40g and 30g at the Forest and Forest-Savanna transition zones, respectively. They would however need to be assisted with the necessary inputs and extension education to enable them actualize this aim. The result would help in strengthening of the farmers' economic base, increased food security and assured availability of white Guinea yam even for export to other regions where demand is high.

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