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Full Length Research Paper

The effects of seedbed types on yam-minisetts yield: A case study of Ushongo local government area of Benue state of Nigeria

IJOYAH, M.O.[1], ABA , J.[2] and UGANNYAN, S.[2]

[1]College of Agronomy and [2]F.S. Idachaba Library, University of Agriculture, Makurdi, Benue State, Nigeria.

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The effects of seedbed types on yields of yam-minisetts were studied in field trials at the University of Agriculture, Makurdi Research farm in 2002 and 2004 cropping seasons. The results indicated that the raised flattened top beds improved yam minisett emergence count by 22%, establishment by 23%, total tuber number by 24%, and yield of minisetts by 21% over the ridge system. Generally, higher number of ware yam (401 – 3000 g) were obtained from ridges. On technical grounds, the raised, flattened top bed was superior to the ridge system and had increased yam yield. The result of this study was shared with farmers in Ushongo Local Government Area of Benue State of Nigeria. It was discovered that the farmers were more responsive within the community using the various methods of information dissemination. This could be due to frequent personal contacts with the researchers as a channel of communication. It was also discovered that the improved technique satisfied the Information needs of the farmers. Thus, the result of this study has led to an innovation.

Key words: White guinea yam, *Dioscorea rotundata*, minisetts, seedbed types.

INTRODUCTION

Yams are Nigeria's leading crops both in terms of land under cultivation and preferred major staple food crops contributing immensely to rural and regional economies (Agboola, 1979). The Southern-Guinea savanna zone of Nigeria is a major yam producing area. The yams are the most important food crops in the zone (Onwueme, 1978). Recent studies in the zone have shown a high potential and suitability of the use of *Discorea rotundata* as minisetts in rapid seed yam multiplication (Kalu and Erhabor, 1992; Kalu and Ortese, 1993). Although, the minisett technique has been developed for the rapid production of seed yams, farmers prefer its use for the simultaneous production of seed and ware yams. From preliminary studies, Kalu (1986) showed that a larger proportion of ware yams could be produced from 2-metre ridges than from narrower ones. This, the author claimed, had the disadvantage of decreasing plant population density by more than 45%. An alternative production system involving only a modified seedbed, while maintaining the recommended plant population density of 40,000 ha-1 was considered necessary.

Igwilo and Ene (1982) in their study on the yield effect of planting minisetts on ridges, mounds and flats in the rain forest zone, concluded that there were no significant yield differences between the different seedbed preparations. Since different ecological zones have different environmental patterns, such effects would be expected to differ from zone to zone. The objective of this study was therefore to determine the effects of seedbed types (ridges and raised flattened top beds) on the yields of yam (*D. rotundata*) minisetts with a view to evolving an additional technological package that would enable yam growers to produce both marketable ware yams and seed yams simultaneously rather than from minisetts in quantity.

MATERIALS AND METHODS

The experiment was conducted during the two wet seasons of 2002 and 2004 at the research farm of the University of Agriculture

*Corresponding author. E-mailjaneaba2002@yahoo.com.

Table 1. Meteorological information for Makurdi during the two years of study (2002,2004).

Year of study	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Average monthly rainfall (mm)											
2002	0(0)+0.1(1)	1.7(1)	109.2(4)	135.4(8)	135.4(8)	241.0(11)	204.8(16)	287.3(16)	243.3(18)	98.7(9)	0(0)	0(0)
2004	0(0)	0(0)	1.5(1)	212.5(7)	99.1(11)	161.5(9)	83.4(9)	156.2(12)	317.2(18)	213.3(17)	0(0)	0(0)
2002	Average monthly temperature (^{o}0)											
Max	36.6	37.6	37.1	35.3	32.8	31.5	30.3	30.0	29.8	31.5	24.2	35.5
Min	18.5	28.1	25.9	25.3	24.1	23.4	22.6	23.0	22.8	22.4	13.5	16.2
2004												
Max	35.7	36.3	37.1	33.5	32.0	30.9	30.7	30.5	31.4	22.4	33.4	34.2
Min	20.5	18.7	26.0	22.9	23.6	23.0	22.7	23.1	21.2	23.3	18.6	17.1
	Average relative humidity (%)											
2002	46.8	51.6	56.4	64.2	72.4	77.6	77.2	79.8	79.6	73.6	54.2	48.6
2004	43.4	24.2	47.2	69.4	74.8	77.8	76.8	77.4	77.8	77.8	75.	46.4

+ Value in parenthesis indicate number of rain days.
Source: Air – force Base Meteorological Station, Makurdi, Nigeria.

in Makurdi, Nigeria to evaluate the effects of seedbed types on yields of White Guinea yam (minisetts). The result was administered to farmers in Ushongo Local Government Area of Benue State in Nigeria. The area is one of the major yam producing sectors of the state. At the demonstration exercise about 200 farmers were present. Of these, 120 were male farmers while 80 were female farmers. These farmers were stratified into two groups, namely, those who adopted improved techniques and those who used traditional technologies. Data were collected through the use of structured interview to obtain relevant data on such variables as household characteristics, resource allocation and farming system.

A randomized complete block design with three replications was used. The cultivar of white guinea yam (*D. rotundata*) Dan-onicha, local cultivar of white yam is grown extensively on a greater acreage. It is high yielding and when used as minisetts, gives a high number of seed yams (IITA, 1983). The field was ploughed, harrowed and then divided into two main treatment plots each measuring 10 x 10 m. Treatments were represented by planting on ridges and on raised, flattened top beds. The first treatment plot consisted of 10 rows of ridges 1 m apart, while the second treatment plot also consisted of 10 rows of raised flattened top beds 1 m apart. The ridge and raised, flattened top bed construction were done manually using the native hoe.

Intact tubers weighing about ±400 g apparently free from bruises and rot were selected from the previous years harvest and stored from January – May of each year of trial in single layers in an enclosed well-ventilated shed. Minisetts weighing ±25 g were cut from the ware yam tuber (±400 g). The yam-minisetts cut for planting were treated with Apron plus chemical (100 minisetts to 20 g of Apron plus) to prevent fungal attack and minisetts rot and cured for 24 h. Minisetts were planted about 6 cm deep and at 25 cm interval in single rows on ridges and on raised, flattened top beds to give a plant population density of 400 stands per treatment plot equivalent to (40,000 stands per hectare). The seedbed types were both adequately mulched with locally available dry grass after planting. In each year (2002, 2004), planting was done in mid – May (a time of the year when rains were unsteady). Emergence and establishment counts were recorded daily from 30 days after planting (DAP) until no new sprouts were observed. The data for days to 50% emergence and establishment was also recorded. The presence of two expanded leaves on a vine was used as an indication of stand establishment (Kalu and Erhabor, 1992). The leaf area of established minisett stands was measured at 60 days intervals starting from 60 to 180 days after planting. The plots were manually weeded four times using the native hoe at 4-week intervals from the date of planting. The recommended rate of fertilizer for yams; 50 kg N/ha, 20 kg P/ha and 40 kg K/ha (Ekpete, 1976) was applied. The fertilizer was applied twice at 8 and 16 weeks after planting. The number and weight of harvested tubers classified as seed yams (less than 400 g) or ware yams (401 – 3000 g) were taken and recorded. The yield of yam-minisetts per plot was obtained. The yam plots were harvested manually in December each year of study.

Analysis of variance was carried out on each of the observations recorded for each year of study, followed by combined analysis over the two years. The Least significant difference (LSD) test was used for detecting differences between means.

RESULTS AND DISCUSSION

Meteorological information

The meteorological information of the area of study is presented in Table 1. Rainfall was observed to be regular from the months of May to October for the two years of study with a corresponding high relative humidity. The month of September had the highest number of rain days. It was observed that rainfall was moderate during the growing period with a little bit of drought in the month of July, 2004. The intensity of rain increased as the season progressed for both years of study. With the first few rains early in the season and the heavy rains later in the season, the soil remained appreciably moist for a long time.

Emergence count

The effect of seedbed types on yam minisett emergence count is shown in Table 2. The result shows that the bed system improved emergence count by 22% over planting

Table 2. EFFECTS of seedbed types on yam – minisett emergence count, days to 50% – minisett emergence, establishment count and days to 50% yam – minisett establishment.

Seedbed Types	Emergence count (No)	Days to 50% yam – minisett Emergence) (No)	Establishment count (No)	Days to 50% yam – minisett Establishment (No)
Ridge	20.5	63.2	19.1	69.9
Bed	25.0	56.1	23.5	62.4
LSD0.05	4.30	Ns	3.3	ns

Source: Field survey 2004.

Table 3. Mean leaf area index (LAI) of established stands of minisetts on ridges and on beds at the specified days after planting.

Days after planting	Ridge	Bed	Significance
60	0.11	0.23	ns
120	2.99	4.09	*
180	0.37	0.76	*

Source:Field survey 2004.

on ridges. This might be attributed to the fact that the bed system could have provided more favourable conditions for better moisture retention.

Days to 50% yam-minisett emergence

The seedbed types did not significantly affect days to 50% emergence. This, perhaps, could be due to the fact that rainfall during the period was moderate and well distributed while the seedbed types were adequately moist for good emergence.

Establishment count

The bed system improved establishment count by 23% over planting on ridges. The significant improvement of minisetts from raised flattened top beds might also be linked to the fact that the bed system has provided more favourable conditions for better moisture retention.

Days to 50% establishment

The seedbed types did not significantly affect days to attain 50% yam-minisett establishment. The same reasons explained for days to 50% emergence could also be linked to days to attain 50% establishment.

Leaf area index of yam-minisett at 60, 120 and 180 DAP

The seedbed types did not significantly affect leaf area index at 60 days after planting (DAP). At 120 and 180 DAP, the bed system significantly gave a larger leaf area compared to those from ridges (Table 3). This could be due to the fact that the raised, flattened top bed system might have had its applied nutrients securely in place for the yam root uptake without experiencing any soil nutrient wash which was more pronounced on ridges. At 120 days after planting, the yam-minisetts were in the tuberization phase thereby justifying a larger leaf area recorded.

Frequency of twining

Frequency of twining was not affected by the seedbed types. The rainfall was moderate, well distributed and seedbeds had sufficient supply of moisture.

Weight classes of yam tuber

Higher percentage of seed yams (50 to 400 g) were recorded on the ridge system while higher percentage of ware yam tubers (401 to 3000 g) were recorded on the raised flattened top beds (Table 5). The seedbed types differed only in the structure. It is therefore to be inferred that the difference in the quantity of harvested tubers classifying as seed or ware yams could be attributed to the difference in the seedbed structure. The basis for classifying harvested tubers weighing 50 to 100 g was that an earlier report (Kalu, 1989) showed that tubers within that weight range when planted produced heavy tubers weighing 800 to 2300 g (0.8 to 2.3 kg) at harvest.

Yield of yam-minisetts

The raised, flattened top beds improve yield of minisetts by 21% over the ridge system. This could be linked with the reason stated earlier that the nutrients applied were securely in place on raised flat beds and did not experience any soil wash or leaching. The roots could have appropriately absorbed the nutrients thereby enhancing the weight of tubers.

Total tuber number

The bed system improved total tuber number by 24% compared to ridges. This could be attributed to the seedbed structure and its ability to retain moisture and

Table 4. Effects of seedbed types on frequency of trimming, total tuber number and yield of yam – ministetts

Seedbed Types	Frequency of trimming	Total tuber number (No)	Yield of yam minisetts
Ridge	1.31	20.2	1.30
Bed	1.33	25.0	1.57
LSD0.05	ns	4.55	0.26

Source: Field survey 2004.

Table 5. NUMBER (x100) of harvested ha-1 classifying as seed or wareyams from two seedbed types.

Weight classs of tubers	2002		2004		Mean	
	Ridge	Fair	Ridge	Fair	Ridge	Fair
Seed Yams						
50 -100grams	32	16	42	21	37	18.5
101 - 200grams	65	32	35	48	50	40
201 – 400grams	164	52	151	49	157.5	50.5
Total seed yams	261	100	228	118	244.5	109
Ware Yams						
401 – 600grams	53	92	69	64	61	78
601-800 grams	7	39	27	70	17	54.5
801 – 1000grams	1	56	2	45	1.5	50.5
1000 – 3000grams	1	80	1	109	1	94.5
Total Ware Yams	62	267	99	288	80.5	277.5
Total tuber number	323	367	327	406	325	386.5
Significance	*		*		*	

+ Value in parenthesis indicate percentage contribution from seed or ware yams to total tuber number.
* Significant differences (P = 0.05) between ridge and bed and gross weight classes.

Table 6. Levels of information dissemination.

Methods of Information	Area of Disssemination	Level of Dissemination (%)		
		2002	2003	2004
FFV	Within Community 1	80%	75%	77.5%
	" L.G.A (2) *	15	10	12.5
	Outside L.G.A (3)	5	15	10
		100	100	100
FFD	(1) +	70	80	75
	(2)	25	15	20
	(3)	5	5	5
		100	100	100
FS	(1)	70	85	77.5
	(2)	30	10	20
	(3)	--	5	2.5
		100	100	100

* Within the Local Government Area
+ Area of Information Dissemination

nutrient. The raised flattened top beds not only provided simple depth of loose, fertile soil for tuber and root penetration, but are less readily washed away by rain during the course of the season compared to ridges. Onwueme (1975) pointed out that the major difficulty often encountered in ridge planting, is the gradual wash down of the ridge tops during the rains thereby decreasing the height of ridges, exposing tubers and influencing total tuber number.

Table 7. Information needs of the respondents.

Types of information Needs	Frequency	Percentage
Improved tools and equipment	42	70.00
Hybrid seeds/New seed varieties	38	68.33
Fertilizer	35	58.33
Pesticides/herbicides	33	55.00
Storagefacilities	32	53.33
Market price product	30	50.00

Source: Field survey 2004.

Table 8. Food Contents and Oil Characteristics in Pepper as affected by Phosphorus and Poultry Dropping Levels.

Treatment Phosphorus kg (p/ha)	6	1	2	3	4	5
	Iodine Value mg/100g	Protein	Carbohydrate	Fats and Oil	Saponification Value mg/100g	Acid Value mg/100g
0	19.06^{ab}	9.25^{e}	12.96^{d}	9.86^{bc}	900.61^{f}	5.08^{a}
25	19.82^{a}	12.05^{d}	28.25^{c}	10.20^{b}	105.62^{e}	4.22^{ab}
50	19.99^{a}	14.30^{c}	30.25^{ab}	10.32^{b}	110.63^{d}	4.20^{ab}
75	20.01^{a}	16.22^{b}	29.65^{ab}	12.46^{a}	115.72^{c}	3.65^{c}
100	20.05^{a}	20.32^{a}	31.24^{a}	14.36^{a}	118.96^{b}	3.60^{c}
125	20.10^{a}	20.35^{a}	31.28^{a}	14.38^{a}	120.66^{a}	3.15^{cd}
LSD (0.05) S.E.	0.643	1.051	1.342	0.65	11.62	0.034
Each data is a Mean of 4 replicates. Means followed by different alphabet are significantly different at P=0.05 using DMRT.						
Poultry droppings (Kg/ha)						
0	18.65^{d}	9.30^{d}	11.95^{d}	9.30^{e}	101.25^{e}	4.25^{a}
100	20.89^{c}	14.95^{e}	32.65^{c}	11.85^{d}	110.60^{d}	3.60^{b}
200	22.25^{b}	17.62^{ab}	36.38^{b}	13.36^{c}	115.60^{c}	3.40^{b}
300	22.25^{b}	18.70^{b}	40.56^{a}	16.85^{b}	120.62^{b}	3.22^{b}
400	23.01^{a}	23.05^{a}	40.42^{a}	17.93^{a}	125.62^{a}	2.65^{c}
500	23.05^{a}	23.20^{a}	40.96^{a}	17.90^{a}	125.80^{a}	2.62^{c}
LDS (0.05) S.E.	0.564	1.002	1.211	0.52	10.162	0.022
Each data is a Mean of 4 replicates. Means followed by different alphabet(s) with a parameter are significantly different at 5% level using DMRT.						

Information dissemination to the farmers

We used the following methods to disseminate information to the farmers: farmer to farmer visits (FFV), farmers field days (FFD), and farmers seminar (FS). As shown in Table 6, through the use of these methods of information dissemination, the farmers within the community were more responsive to researchers. This could be due to frequent personal contact with the researchers as channel of communication. It was also discovered that the improved techniques satisfied the information needs of the farmers. Furthermore, this seems to have influence the rate and level of adoption of the farmers. It was also discovered that the exchange of ideas persuaded the farmers to accept the new technique and ensures quick feedback between the respondents and the researchers. However, it was observed that the contact with farmers within and outside the Local Government Area under study did not appear to have much influence on the technique adoption by the farmers.

Information needs of the farmers

The information needs of the farmers are multifarious as there are new and complex problems and challenages that confront the farmers daily. According to Gregorio and Sison (1989), there are many differences in agricultural information needs within a country and among countries. The information needs of the Nigerian farmers mainly revolve around pest hazards, weed control, moisture insufficiency, soil fertility, farm credit, and labour shortage. Ozowa (1995) grouped these problems into five headings; agricultural inputs, extension education, agricultural technology, agricultural credits and marketing. Table 7 shows the responses of the respondents.

The table reveals that 70% of the respondents have acquired improved tool equipment while 68.33% now use hybrid seeds/new seed varieties. 58% of the farmers use fertilizer, 55% use pesticides/herbicides and 53.33% use storage facilities. 50% acknowledged that market price for products has appreciated.

CONCLUSIONS

Result from this study suggests that the ridge system can be embarked upon if the farmer's preference is to obtain more of seed yam than ware yams, while the raised flattened top can also be used if the farmer's preference is to obtain more of edible ware yam than seed yams. However, the raised flattened top bed was superior to the ridge in producing both seed and ware yams. It was discovered that the improved technique was adopted in 50% of yam fields while local technique was adopted in the remaining 50%. A combination of fear of risk and illiteracy seemed to constitute a hindrance to the adoption of innovations in seedbed types. It was also discovered that the new technique was an improvement on existing crop and therefore was not too complex for the adopters. The innovation is compatible with existing practices and profitable. The improved method raised the yield by 100% over the existing method.

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