

EFFECT OF PLANTING METHODS AND PIG DUNG RATES ON THE GROWTH AND YIELD OF YAM (*DIOSCOREA ROTUNDATA*) IN ISHIAGU, SOUTHEAST NIGERIA.

OGWULUMBA, S. I., ARIRI, F.C., OKON, N. D., AND UGOAMA, LD.

DEPARTMENT OF CROP PRODUCTION TECHNOLOGY, FEDERAL COLLEGE OF AGRICULTURE ISHIAGU, EBONYI STATE, NIGERIA.

EMAIL: SOLOOGWULU@GMAIL.COM

ABSTRACT

This experiment investigated the effect of planting methods and pig dung rates on the growth and yield of yam. 100 – 200 g yam mini-setts were used in the research work. The research was conducted at the research and teaching farm of Federal College of Agriculture Ishiagu Ebonyi State, during the 2020 and 2021 cropping seasons. The experimental design used was 2 x 4 factorial in randomized complete block design (RCBD). Treatments used were; Two planting methods (conventional mounds and Bags), pig dung at 5 t/ha, 10 t/ha, 15 t/ha and Control (without pig dung). Factor A was planting methods while factor B was pig dung rates. Data were collected on vine length and number of leaves, at one month after planting, number and weight of tubers at harvest. Data collected were analyzed using analysis of variance (ANOVA) and significant treatment means were separated using least significant difference (LSD) and all inferences were made at 5% level of probability. The results showed that the planting methods and pig dung rates as well as their interactions significantly ($P < 0.05$) affected the vine lengths of yam at one month after planting but did not produce any significant ($P > 0.05$) effects on the number of leaves and tubers produced by the crop. The treatments and their interactions significantly ($P < 0.05$) increased the weight of the crop at harvest. Results further showed that 15 t/ha of pig dung in bags performed better than other treatments statistically, hence, it is recommended to yam farmers in Ishiagu.

Key words: mounds, bags, pig dung rates, growth, yield

INTRODUCTION

White yam (*Dioscorea rotundata* Poir) is one of the important and widely consumed tubers in Nigeria, a leading producer country in the world (FAOSTAT, 2013). Of the 600 species of the genus *Dioscorea*, the most important edible species are *D. rotundata* (white yam), *D. alata* (water yam), *D. cayenensis* (yellow yam), *D. dumetorum* (bitter yam), *D. esculenta* (Chinese yam), and *D. bulbifera* (aerial yam). Among these, *D. rotundata* is the most preferred and cultivated, accounting for a large proportion of yam production in West Africa, a region which produces 93 % of the world's yam (FAO 2013).

The crop is typically propagated vegetatively using tubers through methods that are described as being notoriously slow and prone to diseases because of recycling of diseased planting material. Although recent developments in the search for rapid means of propagating yam have led to the use and promotion of vine cuttings as an alternative source of planting material (Maroya *et al.* 2014; Balogun *et al.* 2017), the use of tubers continues to be the only means of propagation for millions of small-scale farmers. It is rare

to find farmers who intentionally plant crops to produce only seed yam.

Traditionally, 'seed' yams or setts (tuber portions) are used for propagation. The yam tuber, which contains a deposit of starch, does not have dormant buds as found potato (*Solanum tuberosum*). However, at the end of dormancy a meristematic layer of cells beneath the skin of the tuber produces sprouts, usually from the head (proximal) region, indicating that the tuber is ready for planting. Most yam farmers use seed tubers saved from a previous crop for propagation. Seed yams represent up to 30% of the harvest, generating competition over the use of tubers as either food or planting material (Agbarevo, 2014). As an alternative, 200–500 g pieces from a large tuber (sett) can be used as planting material (Kohtaro and Ryo 2019). A mini sett method has also been developed that uses tuber pieces under 50 g for seed yam production in a process that is separate from food yam production (Aighewi *et al.* 2015).

Yam is a long period growing crop and needs a balanced supply of nutrients for higher tuber yield (Aighewi *et al.* 2015). This necessitates the need for soil fertility maintenance through external sources of nutrients for

crop production. And this can be effectively achieved through the application of organic fertilizers. The application of organic nutrient sources ensures a more balanced nutrition and less probability of negative effect on quality. Organic fertilizers (poultry and swine manures) are reservoir of nutrients like N, P, K and other macro and micro-nutrients for healthy growth of plants (Okoli and Nweke, 2015). Organic fertilizers can sustain cropping system through better nutrients recycling and improvement of soil physical attributes.

Enormous quantities of organic wastes such as swine wastes are available in Nigeria, where they pose disposal problems and environmental hazards including the high cost of their disposal. These wastes are in the same time effective sources of nutrient for tuber crops like yam through composting. This process recycles organic wastes into organic fertilizers and prevents the environmental nuisance their improper disposal could cause (Iseki and Matsumoto 2019).

The use of organic fertilizers as soil amendments to sustain adequate crop yields have been found effective for cereals (Law-Ogbomo and Osaigbovo, 2017). Resource poor farmers in Nigeria depend upon tuber crops especially cassava and yam as a dietary supplement and a major source of energy and nutritional requirement. Yam tuber yield within the Southeast is slow due to constraints such as low soil fertility status and poor cultural practices among other factors. The low soil fertility status is due to depletion of soil nutrients by leaching, erosion and loss of organic matter from most tropical soils. In Nigeria, farmers do practice tillage method for yam production, which places great pressure on limiting fallow land resources.

The objective of the study was to determine effect of land preparation methods and pig dung rates on the growth and yield of *Dioscorea rotundata*

MATERIALS AND METHODS

The experiment were carried out at the students' research and teaching farm of Federal College of Agriculture, Ishiagu, Ebonyi State during 2021 cropping season. The area is located within latitude 05° 56' N and longitude 07° 41' E. The mean annual rain fall and mean monthly temperature have been reported as 1350mm and 30° C respectively. The area lies within the derived savanna vegetation zone of South Eastern Nigeria, with grass and shrub tree combinations. There are two reported distinct seasons, the dry season which spans through November to March, at times extends to April and the rainy season which spans April to October with a short break normally in the month of August called August break (Nwite *et al.*, 2008).

Experimental Materials and Source

Ware yams (*Dioscorea rotundata*) were obtained from National Root Crops Research Institute (NRCRI) Umudike Nigeria.. The pig manure was obtained from

the piggery unit of Federal College of Agriculture Ishiagu, Ebonyi State, Nigeria.

Experimental Design

Two experiments were carried out in 2020 and 2021 planting seasons. 100 – 200 g yam setts were planted in conventional mounds, bags and the soils were amended with 5 t/ha, 10 t/ha, 15 t/ha pig dung with no treatment as control. These were laid out in a 2 X 4 factorial in randomized complete block design.

Each of the treatments was replicated three times. Mounds measuring 100 cm X 100 cm were prepared manually with hand hoe while bags measuring 60 cm x 60cm x 80 cm were used. Five mounds and bags separated 50 cm apart constituted a treatment in a replicate in both set ups, while the replicates were separated 1 m apart to form blocks.

Laboratory analysis

A composite soil sample (0 - 30 cm depth) was taken from the site using auger before treatment application to ascertain its physical and chemical properties, using standard laboratory procedures as outlined by Mylaravapus and Kennelley (2002). The organic fertilizers pig dung was also analyzed for its chemical composition.

Planting

Yam setts weighing 100 - 200 g were planted one sett per hole. The sett was placed at the centre of each hole about 25 - 30 cm deep and covered with soil. The various manure rates were randomly assigned to the mounds and bags in the field.

Weeding

Weeding was manually carried out using hoe and hand pulling, care being taken to protect the tender roots and it was done three times at 6, 12 and 18 weeks after sprouting.

Data Collection

Data were collected on the following; Vine length (cm), number of leaves at one month after planting by measuring with a meter rule from the base of the plant to the tip, number and weight (g) of tubers were counted and measured with digital weigh balance manufactured by Camry at harvest.

Statistical Analysis

Data collected were analyzed using analysis of variance (ANOVA) according to the procedure for factorial in randomized complete block design (RCBD) as described by Gomez and Gomez (1984). The treatment means were separated and compared using Fisher's least significant difference (F-LSD) at 5% probability levels.

RESULTS

Table 1 shows that the textural class of the soil in the experimental site was sandy loam. The soil and pig dung pH were slightly acidic. The results further revealed moderate contents of organic carbon, exchangeable

potassium, total N, available P, exchangeable calcium, magnesium and C: N ratio.

Table 1: Physico-chemical properties of experimental soil and pig dung

	Soil		Pig dung	
	2020	2021	2020	2021
Particle size (gKg⁻¹)				
Sand	810.00	814.00	Not determined	Not determined
Silt	64.98	53.76	Not determined	Not determined
Clay	114.24	98.53	Not determined	Not determined
Textural Class	Sandy loam	Sandy loam	Not determined	Not determined
Chemical Properties				
pH	5.35	5.98	6.43	6.57
Organic Carbon (g_Kg ⁻¹)	20.09	20.15	23.00	23.42
Total Nitrogen (g_Kg ⁻¹)	0.88	0.86	1.76	1.69
C:N ratio	22.74	21.33	11.03	13.25
Available Phosphorous (mg_Kg ⁻¹)	7.34	6.79	12.97	12.46
Calcium (Cmol_Kg ⁻¹)	0.76	0.75	3.89	3.86
Magnesium (Cmol_Kg ⁻¹)	0.13	0.11	0.42	0.47
Potassium (Cmol_Kg ⁻¹)	0.33	0.31	0.32	0.29
Sodium (Cmol_Kg ⁻¹)	0.73	0.57	0.23	0.19

Table 2 showed that the treatments significantly ($P < 0.05$) affected the vine length in the mounds and bags in both years. Crop treated with 15 t/ha produced the highest vine lengths across the planting methods and

years while the least vine lengths were observed in the control. Their interactions did not have any significant ($P > 0.05$) effects on the vine length of the yam at one month after planting.

Table 2: Effect of planting methods and pig dung manure rates on the vine length(cm) at one month after sprouting

Treatments	Planting Methods			
	Mound		Bags	
	2020	2021	2020	2021
Control	46.31	45.74	77.30	75.23
Pig dung 5t/ha	50.03	51.03	101.72	100.07
Pig dung 10 t/ha	63.71	65.45	112.32	117.34
Pig dung 15 t/ha	76.32	77.82	132.32	134.03
LSD (0.05)	5.72	5.34	4.31	4.63
LSD (0.05) for pig dung rates X planting methods interactions in 2020 = 3.46				
2021 = 3.58				

There were no significant ($P > 0.05$) effects by the treatments and their interactions on the number of leaves produced by the crop at one month after planting as shown in Table 3.

Table 3: Effect of planting methods and pig dung manure rates on number of leaves.

Treatments	Planting Methods			
	Mound		Bags	
	2020	2021	2020	2021
Control	5.33	5.37	10.11	10.03
Pig dung 5t/ha	5.93	5.87	12.32	11.89
Pig dung 10 t/ha	6.21	6.54	13.34	12.97
Pig dung 15 t/ha	7.31	8.02	14.12	14.02
LSD (0.05)	NS	NS	NS	NS
LSD (0.05) for pig dung rates X planting methods interactions in 2020 = NS				
2021 = NS				

The results in Table 4 showed that there was no significant ($P>0.05$) effect on the number of tubers at harvest by the treatments as well as their combinations.

Table 4: Effect of planting methods and pig dung manure rates on the number of tubers at harvest

Treatments	Planting Methods			
	Mound		Bags	
	2020	2021	2020	2021
Control	3.21	3.23	4.11	4.21
Pig dung 5t/ha	3.35	3.32	4.33	4.43
Pig dung 10 t/ha	3.43	3.38	4.45	4.77
Pig dung 15 t/ha	3.98	4.03	5.22	5.82
LSD (0.05)	NS	NS	NS	NS
LSD (0.05) for pig dung rates X planting methods interactions in 2020 = NS 2021 = NS				

The results in Table 5 showed that the treatments significantly ($P<0.05$) affected the weight of tubers at harvest. The interactions of planting methods and pig dung rates showed significant ($P<0.05$) effects on the weight of tubers at harvest.

Yam planted in bags gave the highest weights of 1181.11 g (1.181 kg) and 1101.23 g (1.101 kg) tuber at

harvest in 2020 and 2021 when compared with yam planted in mounds which gave 629.33 g (0.62933 kg) and 620.12 g (0.62012 kg) respectively in the two years when treated with 15 t/ha pig dung. The lowest yam weights were observed in tubers obtained from the control in both mounds and bags in the two years.

Table 5: Effect of planting methods and pig dung manure rates on the weight (g) of tuber at harvest

Treatments	Planting Methods			
	Mound		Bags	
	2020	2021	2020	2021
Control	157.42	159.43	172.41	175.45
Pig dung 5t/ha	196.09	201.22	334.24	330.34
Pig dung 10 t/ha	283.75	285.67	793.13	797.54
Pig dung 15 t/ha	629.23	620.12	1181.11	1101.23
LSD (0.05)	80.71	79.21	251.32	232.43
LSD (0.05) for pig dung rates X planting methods interactions in 2020 = 132.04 2021 = 124.31				

DISCUSSION

The organic fertilizers used in the study contained appreciable quantity of plant nutrient as evidenced by the laboratory. The pH of both the soil and pig dung are good for the thrive of tuber crops like yam. It was observed that yam planted in bags had significant improvement in yield when compared with yam planted on mound. This could be attributed to the conservation of nutrients in the bags which enabled the yam to assimilate more nutrients than those planted in conventional mounds where the nutrients would have been eroded beyond the reach of the yam roots. Pig dung manure on crops has been widely reported to increase dry matter production and improve soil fertility, microbiological activity, and water holding capacity as well as substitute for part of mineral fertilizer in the soil for uptake by plant roots. Similarly, Ikpe and Powel, (2002) pointed that the fertility of the soil could be sustained with the addition of pig dung manure as soil amendment. Singh (2015) as well pointed out that the

application of swine manure enhanced significantly the growth attributes of ginger through higher nutrient availability from manures.

The increase in vine length because of organic fertilizer application could be due to increased uptake of nutrients especially nitrogen even though it was statistically similar. Nitrogen is a constituent of protein and protoplasm. It aids in the vegetative development of plants. Addition of organic manure especially in high doses catalyses the vegetative development of plants.

10t/ha of pig dung also significantly improved the growth parameters of yam when compared with other manure rates. This could be linked to nutritional level of pig dung, it has high level of nitrogen, phosphorus and calcium. This make it more suitable for cultivation of yam. This is in line with Adebayo *et al.* (2011) found that organic amendment increased both the vegetative and dry matter yield of crops. Also Law-Ogbomo and Nwachokor (2010) reported that nutrient status of soil plays a unique and significant role in the quality and

yield crop performance. Okoli and Nweke, (2015) Organic fertilizers (swine manures) are reservoir of nutrients like N, P, K and other macro and micro-nutrients for healthy growth and yield root and tuber crops.

CONCLUSION/RECOMMENDATION

White yam is one of the important and widely consumed tubers in Nigeria. Thus, this study has shown that bags are good and recommended for the cultivation yam in the study area, also 15 t/ha of pig dung is good for cultivation of yam both in mounds and bags.

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