



## EVALUATION OF DIFFERENT TILLAGE PRACTICES ON GROWTH AND YIELD OF FLUTED PUMPKIN *TELFAIRIA OCCIDENTALIS* IN UYO, SOUTHEASTERN NIGERIA

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### ABSTRACT

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A study was conducted at University of Uyo Teaching and Research farm to evaluate the effect of different tillage practices on growth and yield of fluted pumpkin in an ultisol. The treatments were no till, flat, surface hoeing, raised bed, mounds and ridges. The parameters studied were establishment percentage, number of leaves per plant, vine length, leaf area, number of branches, and number of pods, length and circumference of pods as well as pod yield in tons per hectare. Data collected were subjected to analysis of variance and means were compared using least significant difference (LSD) at 5% probability level. There was no significant difference in the establishment count. However, significant differences occurred in all other parameters studied. Best results were obtained from the ridges and mounds over the other tillage practices. Ridges and mounds are therefore encouraged for increased production of fluted pumpkin.

**Contribution/ Originality:** This paper's primary contribution is finding that tillage practices have additional benefits in the growth and yield performance of crops particularly fluted pumpkin and farmers should till their soils before planting preferably using surface hoeing which is a less costly tillage method.

### 1. INTRODUCTION

Tillage is defined as the physical, chemical or biological manipulation of the soil to optimize conditions for seed germination, emergence and seedling establishment and has been used in some agro-ecologies to increase crop yield (Lal, 1977). Tillage therefore creates soil environment favourable for plant growth (Klute, 1982) and is also reported to have profound changes in soil fertility status and such changes may be manifested in good or poor performance of crops (Ohiri and Ezumah, 1990; Ojeniyi and Agboola, 1995; Aiyelari *et al.*, 2001). Since tillage practices loosen, granulate, crush or even compact soil particles, soil factors that influence plant growth such as bulk density, pore size distribution and the composition of the soil atmosphere may be affected (Ndaeyo, 2003). Consequently, appropriate tillage practice has been one of the agronomic measures adopted to ensure optimum soil moisture content and invariably optimum crop yield in some location and soil types (Opara-Nadi and Lal, 1987). Tillage becomes imperative after land clearing before crops are planted even though, various forms of tillage may also be carried out while the crop is growing on the field.

Tillage is often carried out for one or a combination of the following purposes including raised bed preparation, control of weeds and incorporation of organic matter into the soil, soil and water conservation as well as improvement of soil's physical condition (Ndaeyo, 2003). These could be possible through ploughing and harrowing where soils are collected into mounds, ridges and beds. Appropriate soil tillage is considered necessary for enhanced crop production since it creates a greater soil volume for seed germination and emergence, seedling establishment and root growth (Aiyelari *et al.*, 2001). Fluted pumpkin is an important vegetable in the south-south part of Nigeria where the edible leaves and succulent stems are used in preparing various delicacies and meals for human consumption while animal feeds are made from different components of the crop (Ojeniyi and Agboola, 1995). The sustained production of fluted pumpkin is hindered by many factors, of which is the tillage method applied in its cultivation. This study therefore was mounted to evaluate the different tillage practices commonly used by farmers in the locality and to recommend the suitable method for increased output of fluted pumpkin cultivation.

## **2. MATERIALS AND METHODS**

### **2.1. Experimental Site and Cropping History**

The present study was conducted at the University of Uyo Teaching and Research Farm in Uyo, Akwa Ibom State, Nigeria during the early cropping season of 2011. Uyo is located in the south-south part of Nigeria and is situated within the humid tropical rainforest zone. The mean annual rainfall ranges from 2680.8 – 2700.1mm with a mean monthly relative humidity of 79.8% while the mean monthly atmospheric temperature range is 26.88 – 27.00°C (Ndaeyo, 2003). The experimental site was under fallow for four years and had been previously cultivated with yam, maize, sweet potato, fluted pumpkin and egg-plant.

### **2.2. Experimental Design and Treatments**

The experiment was laid out in a randomized complete block design with three replicates. The treatments were six tillage methods: no till (control), flat, surface hoeing, raised beds, mounds and ridges. The experimental area measured 22m x 17m while each plot size separated by a space of 1m apart measured 3m x 3m.

### **2.3. Soil Sampling and Analysis**

Composite soil samples were collected randomly with soil auger at depths of 0 – 15 cm and 15 – 30 cm at ten different locations and taken to the Agronomy Laboratory of University of Uyo for physico-chemical analysis. The samples were dried at room temperature and crushed using mortar and pestle and sieved with a 2 mm impact mesh sieve. The following analysis were carried out on the soil samples; pH test, extraction of total exchangeable bases (Jackson, 1964) determination of total nitrogen and determination of available phosphorus using Bray P-1 method (Bray and Kurtz, 1945). Particle size analysis was done by hydrometer method (Bouyoucos, 1951) and textural triangle was used to determine soil texture.

### **2.4. Land Preparation and Planting**

The experimental site was manually cleared using machete and spade while the debris was packed using wheelbarrow. The plots were marked out using measuring tape, pegs and ropes. Thereafter, ridges, mounds and raised beds were made. Seeds of fluted pumpkin were purchased from Itam market, Akwa Ibom State, Nigeria and sundried for 2 days before planting one seed per hole using a spacing of 1m x 1m giving a population of 10,000 stands per hectare.

### **2.5. Fertilizer Application and Weed Control**

The fertilizer used was NPK (15:15:15) applied at three weeks after planting using the ring method. Manual weeding was done at 4, 6 and 9 weeks after planting using a hand weeding hoe. The commonly found weeds at the

experimental site were *Centrosema pubescens*, *Panicum maximum*, *Caladium bicolor*, *Axonopus compressus*, *Commelina benghalensis* and *Talinum triangulare*.

## 2.6. Data Collection and Analysis

Growth parameters such as establishment percentage, average vine length, average number of leaves and average number of branches were recorded at 2, 4, 6, 8 and 10 weeks after planting (WAP). The yield and yield components evaluated were number of pods, weight and length of pods and foliar yield. Data obtained were subjected to analysis of variance and means compared using LSD test at 5% probability level.

## 3. RESULTS AND DISCUSSION

### 3.1. Soil Physic-Chemical Properties of the Experimental Site

The experimental site had very low fertility with organic matter content of 2.7% and 1.3% at 0 – 15 cm and 15 – 30 cm depths, respectively (Table 1). The percentage of total nitrogen was 0.19% and 0.17% while the soil pH was 4.7 and the bulk density values for 0-15 cm and 15-30 cm depths were 1.4 and 1.5 g/cm<sup>3</sup> respectively. However, the available phosphorus was high with values of 109.7 mg/kg and 112.3 mg/kg for 0 - 15 cm and 15 - 30 cm depths, respectively. The result indicated low nutrient capacity with abysmal organic matter content. This may be due to the exhaustive use of the land for a prolonged period of time with little or no soil management and conservation practice.

### 3.2. Establishment Percentage and Vine Length of Fluted Pumpkin

There was a significant difference ( $P < 0.05$ ) amongst the tillage practices when establishment count was recorded ridges and mounds promoting an establishment of 100% (Table 2). Between flat, surface hoeing and raised bed, there was no significant difference recorded while the lowest establishment count of 78% was recorded in no till method. Vine length at different times after planting showed significant differences amongst the tillage practices. The vine length obtained from planting on ridges, mounds, raised bed and surface hoeing was significantly different from practice of planting on flat and no till (Table 2). This could be as a result of the high establishment percentage of *T. occidentalis* planted on raised soil formations.

### 3.3. Effect of Tillage Methods on Foliar Yield of Fluted Pumpkin

The foliar yield of fluted pumpkin as affected by the different tillage methods is shown in Table 3. Significant difference in foliar yield between the no till method and other tillage methods was observed. However, no significance was observed between ridge, mound, raised bed, surface hoeing and flat. This may probably be due to the ample root zone that encouraged vibrant growth in the tilled plots against the no till plots.

### 3.4. Effect of Tillage Practices on Yield and Yield Components of Fluted Pumpkin

The number of pods, length of pod, pod circumference and pod yield (t/ha) were significantly higher in the tilled plots compared with the no till plots (Table 4). The ridge and mound practices consistently produced the highest number of pods with the widest circumferences as well as higher pod yields.

## 4. DISCUSSION

Establishment count was significantly different between the tilled and no till methods and the lower emergence or sprouting under no tillage could be as a result of shallow planting depth that is consequent upon high soil bulk density (Osuji, 1984). The growth and yield parameters significant differences between the tilled and no till plots may be due to a combination of high soil temperature and low soil moisture regimes (Alem, 1993). The better yield and yield components obtained in tilled plots relative to no till could be due to higher bulk density as observed by

Aiyelari *et al.* (2001) and Ndaeyo (2003). The result of the study revealed that tillage practices had additional benefits in the growth and yield performance of crops particularly, fluted pumpkin. Therefore farmers should till their soils before planting while adopting the least cost method of tillage like the surface hoeing.

**Table-1.** Soil physicochemical properties of the experimental site

Properties	Soil depth	
	0 – 15 cm	15 – 30 cm
Total Nitrogen (%)	0.19	0.17
Organic matter (%)	2.70	1.30
Available phosphorus (mg/kg)	109.7	112.3
Potassium (meq 100g)	0.12	0.09
Calcium (mg 100g)	2.40	1.20
Magnesium (meq 100g)	2.40	2.70
Sodium (meq 100g)	0.08	0.09
Exchangeable acidity (meq 100g)	3.20	2.60
Bulk density (g/cm <sup>3</sup> )	1.40	1.50
pH	4.70	4.80
Sand (%)	87.8	85.8
Clay (%)	6.2	8.20
Silt (%)	6.0	6.0

**Table-2.** Establishment percentage and vine length (cm) of fluted pumpkin

Tillage practices	Establishment percentage	Vine length at different weeks after planting (WAP)				
		2	4	6	8	10
No till	78.00 <sup>b</sup>	18.33 <sup>c</sup>	28.61 <sup>b</sup>	43.61 <sup>d</sup>	63.75 <sup>d</sup>	81.33 <sup>c</sup>
Flat	95.00 <sup>a</sup>	21.85 <sup>b</sup>	38.61 <sup>a</sup>	68.33 <sup>c</sup>	103.71 <sup>c</sup>	131.31 <sup>b</sup>
Surface hoeing	95.00 <sup>a</sup>	29.33 <sup>a</sup>	38.75 <sup>a</sup>	69.40 <sup>bc</sup>	112.41 <sup>b</sup>	163.22 <sup>a</sup>
Raised be	98.00 <sup>a</sup>	30.41 <sup>a</sup>	40.40 <sup>a</sup>	73.41 <sup>b</sup>	116.31 <sup>b</sup>	163.43 <sup>a</sup>
Mounds	100.00 <sup>a</sup>	29.54 <sup>a</sup>	40.85 <sup>a</sup>	78.42 <sup>a</sup>	123.31 <sup>a</sup>	169.33 <sup>a</sup>
Ridges	100.00 <sup>a</sup>	32.31 <sup>a</sup>	41.31 <sup>a</sup>	77.33 <sup>a</sup>	121.69 <sup>a</sup>	166.43 <sup>a</sup>
LSD (P<0.05)	5.65	3.03	3.11	3.87	5.13	5.54

Means in the same column followed by different letters are significantly different (P<0.05)

**Table-3.** Effect of tillage methods on foliar yield (t/ha) of Fluted pumpkin

Tillage practices	Foliar yield at different weeks after planting				
	4	6	8	10	12
No till	1.80 <sup>b</sup>	2.15 <sup>b</sup>	2.60 <sup>b</sup>	3.11 <sup>b</sup>	3.18 <sup>b</sup>
Flat	4.35 <sup>a</sup>	6.35 <sup>a</sup>	6.53 <sup>a</sup>	6.88 <sup>ab</sup>	7.09 <sup>ab</sup>
Surface hoeing	5.03 <sup>a</sup>	6.42 <sup>a</sup>	7.10 <sup>a</sup>	7.22 <sup>a</sup>	7.38 <sup>a</sup>
Raised bed	5.11 <sup>a</sup>	6.55 <sup>a</sup>	7.18 <sup>a</sup>	7.35 <sup>a</sup>	7.83 <sup>a</sup>
Mounds	5.25 <sup>a</sup>	6.75 <sup>a</sup>	7.25 <sup>a</sup>	7.38 <sup>a</sup>	7.85 <sup>a</sup>
Ridges	5.26 <sup>a</sup>	6.82 <sup>a</sup>	7.29 <sup>a</sup>	7.43 <sup>a</sup>	7.86 <sup>a</sup>
LSD (P<0.05)	1.57	1.81	2.11	3.82	4.11

Means in the same column followed by different letters are significantly different (P<0.05)

**Table-4.** Effect of tillage practices on yield and yield components of fluted pumpkin

Tillage practices	Yield and yield components			
	Number of Pods/plant	Length of pod (cm)	Circumference of pod	Pod yield (t/ha)
No till	1.22 <sup>b</sup>	20.33 <sup>d</sup>	25.82 <sup>c</sup>	5.82 <sup>c</sup>
Flat	3.88 <sup>a</sup>	40.25 <sup>c</sup>	59.60 <sup>b</sup>	11.33 <sup>b</sup>
Surface hoeing	3.95 <sup>a</sup>	43.41 <sup>bc</sup>	63.05 <sup>ab</sup>	13.61 <sup>ab</sup>
Raised bed	3.83 <sup>a</sup>	48.25 <sup>b</sup>	63.42 <sup>ab</sup>	13.75 <sup>a</sup>
Mounds	4.25 <sup>a</sup>	48.68 <sup>b</sup>	68.51 <sup>a</sup>	15.05 <sup>a</sup>
Ridges	4.01 <sup>a</sup>	49.03 <sup>a</sup>	66.25 <sup>a</sup>	15.30 <sup>a</sup>
LSD (P<0.05)	1.51	5.21	5.77	2.35

Means in the same column followed by different letters are significantly different (P<0.05)

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