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Effect of Tillage and Staking on the production of fluted Pumpkin

C.G Okeke[1], S.I. Oluka[1] and O. Oduma[2*]
[1]*Department of Agricultural and Bio-resources Engineering, Faculty of Engineering, Enugu State University of Science and Technology, Enugu,Nigeria*
[2]*Department of Agricultural and Bio-resources Engineering, College of Engineering and Engineering Technology, Michael Okpara University of Agriculture, Umudike, Nigeria*

ABSTRACT: *A field experiment was conducted using fluted pumpkin (telfairia occidentals) to determine the effect of 3 different tillage (zero, mound and flat) and 3 different staking (zero, individual and pyramid) on a sandy clay loam soil of the humid tropics at faculty research farm Esut, Enugu Southeastern Nigeria between June and December, 2008. The treatment consists of 3 levels of tillage and3 levels of staking as mentioned above. The experiment was a 3 x 3 factorial laid out in randomized complete block design (RCBD) with four replications and nine treatments. The results obtained revealed significant different of p 0.05 among some of the ç. treatments. The highest number of vine length and number of flower per plant of 196.16 and 36 were obtained from zero tillage / individual staking while the least were recorded for flat tillage/individual staking of 115.19 and zero tillage/pyramidal staking of 3 respectively. Average leaf yield ranged from 277.7 to 852.5 (g) were obtained. Based on their performance, treatment 5 (mound tillage/individual staking and treatment), 6(mound tillage/pyramidal staking) have the highest leaf yield.*

Keyword: *Fluted pumpkin, flat tillage, staking, mound, zero tillage*

I. INTRODUCTION

Fluted pumpkin, (terlfairia occidentals) is the most popular leafy vegetable crop belonging to the family (Cucurbitaccae) and the genus telfairai. It originated in East and West Africa. It is widely grown and consumed in Nigeria especially in Igbo land. It is also grown and consumed in mid-western area (Edo and Delta States) and to an appreciable degree in the south western states (Ondo, Ekiti Lagos, Ogun, Oyo) of Nigeria (Okoli and Mgbeogu, 1982). The crop is called ugu by the Igbos while Yorubas call it Ugwu. In Ghana, it is called Krobonko or oroko, it is called kobon in Cameroon but in Sierra Leone it is referred to as pondoko or gonugbe. It is a pot-herb (Akobundu1987), cultivated mainly for its succulent young leaves and shoots, which are used as vegetables.

Fluted pumpkin is a high climbing perennial plant with partial drought tolerance and perenting root system (Tindall, 1986). It is commonly cultivated as an annual crop because the leaves and young shoots dry at the end of growing season but as the starting of the rainy season, new shoots regenerate along the main branches, especially in female plant. The female plants can survive for about 4 years when their main stem must have reached a diameter of up to 10cm and its lianeous branches could be over 30cm long when found high up in trees. The male plants have short time of surviving than the female plants. Female plants withstand dry conditions better than the male plants. The male plants drop their leaves about 3 weeks earlier than the female plants.Fluted pumpkin has 3 to 5 lobes deeply divided leaves. The plants are dioeciously with protandrous flowering that is male and female flowers. The male flowers open before the female ones, and they open in the evening or at night and often shade their pollen soon afterwards. Female flowers open in the evening, but open wider from mid-morning until early afternoon. Male plants are borne in clusters while female plants are borne singly (Greensill, 1968). The male plants flower about 1-5 months from sowing while female flowers need extra 3 weeks before the first flowers is open.

Fluted pumpkin is a cross pollinated crop, but pollination by hand is more successful (Akoroda et al, 1989). The fruits mature about 9 – 10 weeks after pod setting. The fruits are green in colour, 60cm long in height and 30cm in diameter. When the crop is growing for it seeds, they produce about 3000-5000 fruits.

Seeds fail to germinate when they are kept dry (Thanpson, and Kelly, 1957). The seed quality is best when seeds inside the fruits are between 9 -12 weeks old. When seeds are left inside the fruit for too long, they

start germinating inside the pod (Schipper, 2000). The pods have bright yellow fibrous flesh and contain 50 — 100 which look like the colanut seed, and over 2.5cm in diameter (Asoegwu, 1987, Lrvine, 1969). The colour of the seed ranges from yellow to brown to dark — red.

Fluted pumpkin can be cultivated on a zero tilled land, tilled land and on mounds. Akoroda (1988) observed that telfairia occidentals are a common homestead garden crop in southern Nigeria,mostly cultivated by woman. In home gardens, they are grown close to fence or to a tree, wall, and structures on which the shoots are allowed to climb (Okoli and Mgbeogu, 1982). It can be allowed to creep on the ground or staked (Akoroda, 1988, Nihort, 1986). They grow on a wide range of soil including poor, sandy soils but perform better on sandy loam soils with internal drainage and are characterized as ultisols (Asiegwu;1985). They require a high temperature of above 25°C during the growing period and fairly low humidity. Fluted pumpkin is tolerant to slightly acidic soils (Stevels, 1999).

Tillage and staking are the 2 major cultural practices that are usually carried out in the production of the crop. Not much have been done on this crop, its literature is very scanty. There is the need to carry out more research work on the crop (telfairia occidentals). The objective ofthis work is to determine the effect of tillage and staking on the growth and yield of fluted pumpkin.

II. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out a the faculty research farm of Enugu State University of Science and Technology Enugu. The area is located within latitude 06° 25N and longitude 0.7°15E south west of derived agro ecological zone of Nigeria and on the soil classified as ultisols.

The research was carried outto determine the effect of tillage and stating on the performance of telfairiaoccidentalis (fluted pumpkin) in the agro ecological zone during 2008 cropping season.

2.2 Source of Material

The planting material (pod /fruit of telfairiaoccidentalis) that was use for the experiment was gotten from IITA Ibadan.

2.3 Soil Analysis

Soil sampling and analysis was carried out. Soil samples were collected from different parts of experimental site, to a depth of 0-20cm using soil auger and were bulked to produce a composite sample. The soil analysis was done to determine the soil naïve nutrient level and other soil properties. Soil properties analyzed for includes; clay, site, find sand, sand, pH value, organic matter %, exchangeable based(meg/bOg), CEC, Base salt, Exchangeable Acidity.

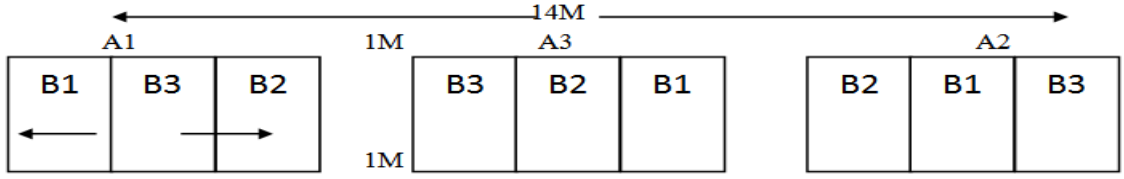
2.4 Field Method

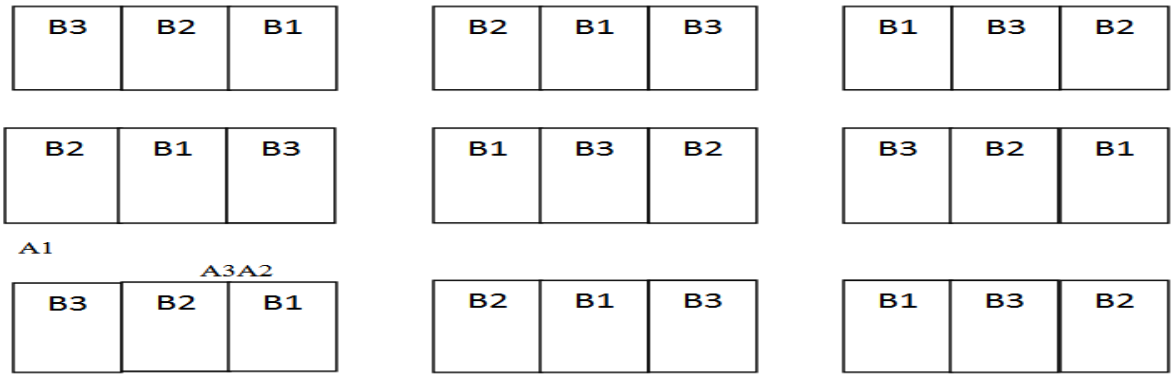
The experimental site was cleared on the 27th day of May 2008 with the use of cutlass and hoe. After which, the plots were mapped out using measuring tape, pegs and ropes, to get a total land area of 161m2 (11.5m x 14m). The land area was divided into 12 plots. Each plot was divided into 3 sub-plot with total sub-plots of thirty six (36) which was used for the experiment.

The twelve (12) main plots were demarcated from each other with pegs and ropes and was spaced 1m x 1m square. Plots were cultivated on the 3rdday of June 2008, using 3 different methods of tillage via; zero mound and flat tillage. The fruit was plot open using matched and the seeds were extracted. The bright yellow fibrous pulps around the seeds were gently squeezed off the seeds. The seeds were later dried under the shade for two days before planting. They were planted on the 4th day of June 2008 at the rate of one seed per hole. Three seeds were planted in each subplot, nine (9) seeds per main plot and 27 seeds per block. According to the field layout model, 108 seeds / plants were planted in the project plot. The planting was done by opening the soil to a depth of 6cm and inserting the seeds after which the openings were covered with topsoil. Some of the vines were staked on the 16th day of June 2008 and some were left unstakedbased on the type of treatment.

2.5 Experiment Design

The experimental field layout was a 3 x 3 factorial in randomized complete block design (RCBD) with nine(9) treatments and four (4) replications.





A1 = Zero Tillage B1 =Zero Staking
A2 = flat tillage B2 = individual staking
A3 = mound tillage B3 = pyramidal staking
9 treatments and 4 replications
Treatment 1 = zero tillage / unstaked; Treatment 2 = zero tillage / individual staked
Treatment 3 = zero tillage / pyramidal staked, Treatment 4 = mound tillage / unstaked
Treatment 5 mound tillage / individual staked, Treatment 6 = mound tillage / pyramidal staked, Treatment 7 = flat tillage / unstaked, Treatment 8 = flat tillage / individual staked, Treatment 9 = flat tillage / pyramidal staked

2.6 Cultural Practices

Adequate field maintenance was carried out to ensure that the crops perform well. Weeding was carried out twice in the field using traditional hoe. Poultrymanure was applied into the soil before the crops were planted. The fertilizer used was NPK 15:15:15. It was applied 23rd of June 2008 at equal rate of 0.0003267kg to each crop. Staking of vines was done on16th June 2008 with 3 different staking via: zero, individual and pyramidal staking.

2.7 Data Collection

The following agronomic data were collected:

i. Days to seed emergence:This was determined by counting the number of days it takes the plants to germinate. The plants did not germinate the same day. The germination started on 13th day of June 2008 that is 2 weeks after planting.

ii.Percentage emergence (%): This was determined visually by counting the total number of seedlings that emerged in each sub-plot after 2 weeks, over the total number of seeds planted on the sub-plot and the value expressed in percentage.

iii.Vine length (cm): This was measured as the distance from the baseof the plant to the tip of the vine. Vine length of 2plants! sub-plot were measured with a meter rule andthe mean taken. The measurement was made at 4weeks stage, 6 weeks, 8 weeks, 10 weeks and 12weeks.

iv. Leaf area index (LAI): This was determined by measuring the length and weight of the leaves with a meter rule. Two leaves per plant were measured. The result was calculated using the following formular:

$$LAI = \frac{\text{no of leaves x area of leaf x no of plant pr sub-plot}}{\text{Area covered (size of sub-plot)}} \quad (1)$$

v. Number of leave per plant: This was determined by counting the total number of leaves each plant produced.

vi. Number flower per plant: This was determined by counting the total number of flower produced by a plant.

vii. Number of aborted flowers:This was determined by counting the number of aborted flowers in each plant that produces flowers.

viii.Leaf yield per plant (g): This was obtained by weighing the leaf yield of telfairia per plant using a weighting balance and the mean taken.

2.8 Statistical Analysis

The analysis of variance (ANOVA) was carried out according to the procedure outlined by Steel and Torrie (1980), for a factorial experiment in randomized complete block design (RCBD), and separation of treatment means for significant effects was done using the least significant different (LSD) techniques.

III. RESULTS AND DISCUSSION

3.1 Results

The results of this research work are presented in Table 1-7

Table I: Soil Physico-chemical Properties of the Experimental Site

Properties	Contents
Particle size %	
Clay	29
Silt	21
Fine sand	28
Sand	22
pH value	4.1
H_2o	3.0
Kel	1.34
Organic matter %	
Carbon	
Organic matter	2.32
Total nitrogen	0.098
Exchangeable base ($cmol^1kg$)	2.6
Ca24	
Mg	2.6
K	0.18
Na	0.07
Cee	30.8
Exchangeable acidity	Trance
A1	
H	
	6.7
	5.60

Table II: Treatment Means of the Percentage Germination at Four (4) Weeks after Planting (WAP)

Treatment	% germination at 4 WAP
Zero tillage/unstaked	100
Zero tillage/individual staking	100
Zero tillage/pyramidal staking	100
Mound tillage / unstaked	100
Mound tillage / individual staking	100
Mount tillage / pyramidal staking	91.68
Flat tillage/individual staking	91;68
Flat tillage/pyramidal staking	100
Flat tillage/pyramidal staking	91.69
F-LSD (0.05)	Ns

Table III: Treatment Means of the Vine Length (Cm) at Four (4) and Six (6) Weeks after Planting (WAP)

Tr Treatment	Vine length at 4 WAP 6 WAP	
Zero tillage/unstaked	79.34	137.88
Zero tillage/individual staking	89.48	196.16
Zero tillage/pyramidal staking	89.32	158.06
Mound tillage / unstaked	90.03	173.58
Mound tillage / individual staking	89.74	152.39
Mount tillage / pyramidal staking	90.70	178.73
Flat tillage/individual staking	70.16	158.81
Flat tillage/pyramidal staking	71.45	115.19
Flat tillage/pyramidal staking	59.99	159.93
F-LSD (0.05)	33.21	ns

Table IV: Treatment Means of the Number of Leaves/Plant at Four (4) and Six (6) Weeks after Planting (WAP)

Treatment	Vine length at 4 WAP 6 WAP	
Zero tillage / unstaked	42	137
Zero tillage / individual staking	28	168
Zero tillage / pyramidal staking	43	134
Mound tillage / unstaked	37	157
Mound tillage / individual staking	33	100
Mound tillage / pyramidal staking	32	146
Flat tillage / unstaked	28	87
Flat tillage / individual staking	34	117
Flat tillage / pyramidal staking	24	112
F-LSD (0.05)	13.61	ns

Table V: Treatment Means of the Number of Flower Bud/Plant at Ten (10) and Twelve (12) Weeks after Planting (WAP)

Treatments	No of flower bud/plant at 10 WAP 12 WAP	
Zero tillage / unstaked	162	62
Zero tillage / individual staking	0	66
Zero tillage / pyramidal staking	15	109
Mound tillage / unstaked	0	60
Mound tillage / individual staking	99	100
Mound tillage / pyramidal staking	70	98
Flat tillage / unstaked	47	164
Flat tillage / individual staking	0	0
Flat tillage / pyramidal staking	0	0
F-LSD (0.05)	52.20	71.68

Table VI: Treatment means of the number of flower /plant, no. of aborted flower/plant and leaf yield/plant at twelve (1.2) weeks after planting (WAP**)**

Treatments No of F/plant, no of a.fl. leaf yield/plant (g) 12 WAP			
Zero tillage / unstaked	13	8	277.7
Zero tillage / individual staking	4	1	677.5
Zero tillage / pyramidal staking	3	3	477.5
Mound tillage / unstaked	30	0	658.75
Mound tillage / individual staking	36	16	852.5
Mound tillage / pyramidal staking	12	4	765
Flat tillage / unstaked	8	3	580
Flat tillage / individual staking	0	0	655
Flat tillage / pyramidal staking	0	0	622.5
F-LSD (0.05)	14.49	5.470	215.85

Table VII: Treatment Means of the Leaf Area Index (Lai) at Four (4), Six (6) and Eight (WAP) (8) Weeks after Planting

Treatments LAI at 4 WAP LAI at 6 WAP LAI at 8 WAP			
Zero tillage I unstaked	1.31	1.19	2.04
Zero tillage / individual staking	1.86	1.45	2.03
Zero tillage / pyramidal staking	1.45	1.43	1.98
Mound tillage / unstaked	1.53	1.79	1.79
Mound tillage / individual staking	1.82	1.57	2.35
Mound tillage I pyramidal staking	1.26	1.84	2.35
Flat tillage / unstaked	1.97	1.72	1.59
Flat tillage / individual staking	1.28	1.64	1.69
Flat tillage / pyramidal staking	1.80	2.44	2.15
F-LSD (0.05)	Ns	0.69	0.61

3.2 Discussion

3.2.1 Soil Characteristics of the Experimental Site

The soil analysis result shown in Table 1, indicates the chemical and physical properties at the experimental site. The soil was found to be acidic, pH 4.1 and 3.0 using H20 and KCL, as extractants respectively. It was found to contain 29% clay and 2% sand respectively.

The soil was clay in nature and low in organic matter content. But because of the lower content of organic matter of the soil, it was amended with NPK fertilizer. The result showed that application of urea increased shoot dry matter in telfairia. This is in line with Tsuna and Fujise (1984) and Stino (1953) when they reported that nitrogen increased dry matter production of sweet potato by increasing the leaf expansion. Nitrogen is usually associated with the building up of leaf tissue while potassium is essentially for meristematic and photosynthetic activities-factors important for crop growth and yield (Tsunaand Fujise, 1984).

3.2.2 Effect of Tillage and Staking on the Germination Percentage (%) of Fluted Pumpkin

The result presented in table 2 shows that there was no significant difference (p = 0.05) among the treatments with respect to generation. All the treatments had 100% germination except for treatment six (mound tillage / pyramidal staking), treatment 7 (flat tillage / unstaked) and treatment 9 (fIat tillage / pyramidal staking) that had approximately 90% germination.

The percentage growth rate of the telfairaoccidentalis seeds planted on the flat tilled plots was lower than others. The tillage practices affect the physical properties of the soil like the temperature, soil moisture, texture and structure (Lal, 1987). In the case of soil temperature, in south western and south eastern region, the maximum soil temperature on ridged / mound and ploughed plots were higher than on unploughed and straw mulch treatment.

It should then be agreed that high soil temperature causes excessive evaporation from the soil and may trigger planted seed into secondary dormancy.

In term of soil moisture, soil tillage can influence the water content of the upper soil and there by influence seed germination and seedling emergence (Hall and Cannel, 1979).

Loose open soil loses water more readily than firm soil with only small void because of mass air movement in large voids. It tends to become drier also because of poor contact with moist soil below and slower upward movement of water into the loose soil.

The seeds planted in zero tilled soil also found it slightly difficult to germinate because the area where they were planted was later compacted. This compaction was due to the effect of rain falling on the untilled soil, which causes the compaction and sealing of the partially tilled planting holes made before planting the seeds. The seeds planted on the zero tillage have the highest germination percentage followed by mound.This may be due to the lowering of the soil temperature and conservation of moisture in the soil. The seeds planted on the flat tilled plots have gradual germination starting from the first 2 weeks after planting.

3.2.3 Effect of Tillage and Staking on the Vine Length (cm) of Fluted Pumpkin

The result on vine length at 4 WAP shows a significant difference (p = 0.05) among some of the treatments as shown in table 2. Treatment 6 (mound tillage/pyramidal staking) had the highest vine length of 90.70 cm, which was significantly different from treatment 9 (flat tillage / pyramidal staking) with vine length of 69.99 cm. However, there was no significant difference among the vine length at 6 WAP as shown in Table 5. Treatment. 2 (zero tillage / individual staking) had the highest vine length of 196.16cm, which was statistically the same with vine lengths of treatment 3, 4, 6, and 9 (mound tillage / pyramidal staking).

The vine length of telfairiaoccidnetalis planted on flat tilled plots at 4 WAP and 6 WAP was not as high as other forms of tillage used. The telfairia planted on zero tilled plots were competing in terms of growth rate with those on mound — tilled plots.

It can then be asserted that if there are enough plant nutrients in the soil and proper management measure taken, telfairia can be grown on soil with moderate bulk density without tilling the soil. The problems that can be encountered in cultivating telfairiawith zero tillage are the poor infiltration rate of the soil and also high rate of erosion and weeds. Mulching or covering the soil with organic materials can solve these problems. Infiltration rate of telfairia that are allowed to creep on the ground can be improved when the leaves have fully covered the ground. It also helps to control erosion.

3.2.4 Effect of Tillage and Staking on the Number of Leaves I Plant of Fluted Pumpkin

The number of leaves/plant of talfairia obtained at 4 WAP shows a significant difference (p = 0.05) among some of the treatment as shown in table 2. Treatment 3 (zero tillage / pyramidal staking) had the highest number of treatment 9 (that tillage / phraamidal staking) with number of leaves of 24.5. At 6 WAP, there was no significant effect among the treatments. Treatment 2 (zero tillage / individual staking) had the highest number of leaves of 168.75, which is significantly the same with treatment 3, 5 and 9.

This experiment revealed that talfairia production could be highly enhanced by staking. According to Trenbath, (1976) staking exposes the leaves for effective light reception, as light is one of the factors needed by leafy vegetables. Staked plants produce the highest number of leaves and the longest vine length. Oyenuga, (1986) had earlier recommended staking as the leaves of telairiaspp are palatable and nutritious and are very much cherished by goats, while Akoroda et al, (1990) supported staking because it facilitates harvesting of the

leaves and pods. Talfairiaoccidentalis is not the only crop that is staked. Staking is practiced on crops like yam (Philips, 1964, Onwueme, 1979), bean (Vignaspp) (Akobundu, 1987), cucumber (Kwarteng and Twoler, 1994) and tomato. In yam; staking has encouraged the yield in clayed soils (Aams, 2002) while it reduced the incidence of blossom end rot and fruit crack in tomato (Anyanwu et al, 1979). However, Amah (1997) conclude that staking increased the loss of yam production by 30 — 35%. The availability of staked for staking tendering / climbing vines are diminishing at an alarming rate as the result of factors of urbanization, road construction, industrialization, bush fire and harvesting for fuel wood.

3.2.5 Effect of Tillage and Staking on the Number of Flower Bud I Plant of Fluted Pumpkin

The result presented in Table 4 shows that there was a significant difference (p = 0.05) for number of flower bud / plant at both 10 and 12 WAP. At 4 WAP, treatment 1 (zero tillage / unstaked) had the highest number of flower bud/plant of 162, which was statistically different from treatment 3 (zero tillage / pyramidal staking) with number of flower bud / plant of 15.At 12 WAP, treatment 7 (mound tillage / unstaked) had the highest number of flower bud I plant while treatment 2 (zero tillage / individual staking) had the least with number of flower bud I plant of 66. At 10 WAP and 12 WAP there was no flower bud / plant formation at treatment 8 and 9. The highest number of flower buds was recorded at the unstaked plants.

3.2.6 Effect of Tillage and Staking on the Number of Flower I Plant of Fluted Pumpkin

The number of flower / plant formation as showed in Table 5 has a significant different (p= 0.05) among the treatments except treatment 4 (mound tillage /unstaked) at 12 WAP. Treatment 5 (mound tillage /individual staking) had the highest flower / plant of 36,which was statistically different from number of flower /plant among other treatment. Treatments 8 and 9 have
no flower formation.

3.2.7 Effect of Tillage and Staking on the Number of Aborted Flowers I Plant of Fluted Pumpkin

The number of aborted flowers/plant presented in Table 5 shows a significant treatment different (p =0.05) among all the treatments that produced flower.Treatment 5 (mound tillage / individual staking) had thehighest number of aborted flowers of 16 while treatment3 and 7 have the least.

3.2.8 Effect of Tillage and Staking on the Leaf Yield I Plant (G) of Fluted Pumpkin

The result obtained from the leaf yield of talfairia at 12 WAP shows a significant different (p = 0.05) among some of the treatments as showed in table 7. Telfairiaplants on mound —tilled soil have the higher leaf yield than those planted on zero and flat tilled plots. Treatment 5 (mound tillage / individual staking) has the highest leaf yield of 852.2. Individual staked plots have the highest leaf yield followed by pyramidal staked plots while the unstaked plots have the least. The staked plots have the higher leaf yield than the unstaked plots, this may due to the exposure of the vines which obtained more photosynthesis than the unstaked once.

3.2.9 Effect of Tillage and Staking on the Leaf Area Index (Lai) of Fluted Pumpkin

The measurement of leaf area index LAI of telfairia leaves started at 4 WAP. Result shows that at 4 WAP there was no significant difference but at 6 and 8 WAP, there is significant difference (p = 0.05) among some of the treatments. At 6 WAP, the leaf area index (LAI) measured of talfairia varied significantly among all the treatment except treatment 3 (zero tillage / pyramidal staking). Treatment 9 (that tillage / pyramidal staking) had the highest leaf area index of 2.44. Significant treatment difference were found in the leaf area index of telfairia leaves at 8 WAP among treatment 6 (mound tillage / pyramidal staking), 7 (fIat tillage/unstaked) and 8 G (flat tillage / individuals staking).

IV. CONCLUSION AND RECOMMENDATION

The results obtained in this research work provethat planting telfairiaoccidentalis on mound and stakedwhen the vines come up will give the highest vine length and leaf yield.

The complete breakdown of the result of the research showed that the vine length of talfairia planted on mound and staked is greater than those planted on flat titled and staked, greater than those planted on flat tilled and unstaked it is also greater than those planted on zero, staked and unstaked. Also the yield followed the same trend.

It is recommend that further research should be conducted on the effect of tillage and staking on the performance of talfairiaoccidentalis to ascertain whether panting telfairia on mound and staking will give better performance.Plantingof telfairiaoccidnetalis on mound followed by individual staking is the best for the performance of the crop.

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