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Effect Of Staking And Spacing On The Growth And Yield Of Fluted Pumpkin (*Telfairia Occcidentalis* Hook. F.) In Ibadan, Southwest, Nigeria

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Abstract: *Fluted pumpkin is one of the most widely cultivated leaf vegetables in Nigeria. The leaves are rich sources of protein, oil, vitamins and minerals. Hence, the need to carry out experiment on the spacing and type of staking required for the planting is very important. Randomized Complete Block Design (RCBD) was used for the experiment with four (4) treatments replicated four times. Parameters assessed included, Plant height, number of leaves, and stem girth. The result of analysis of variance (ANOVA) shows that there was significant different among the treatments in plant height, number of leaves and stem girth at 5% level of probability. The seedlings staked on bed with spacing of 0.5 m by l m (b2) had the highest mean value in respect of plant height, number of leaves, and stem girth as 150.79 cm, 96, and 2.21 mm respectively. This was followed by the un-staked seedlings on bed with spacing of 0.5 m by 0.5 m with mean value in plant height, number of leaves, and stem girth as 146.25cm, 88.25, and2.20mm respectively. The staked seedlings in bed with spacing of 1 m by l m had the lowest mean values of 126.25 cm, 65.50, and 2.09 mm for plant height, number of leaves, and stem girth respectively. Based on the results obtained from the experiment, it can therefore be recommended that fluted pumpkin (Telfairia Occidentalis) should be staked on bed with spacing of 0.5m by 1 m in order to obtain good yield.*

Keywords: *Telfairia Occidentalis*, Plant height, Number of leaves, Stem girth, Yield.

Introduction

Fluted pumpkin (*Telfairia occidentalis*) as a vegetable is important and grown in south eastern Nigeria mainly for human consumption. It belongs to the family Cucurbitaceae and it is a high climbing perennial crop with partial drought tolerance and penetrating root system [1]. This vegetable has 37.3% protein content on a dry weight basis [2]. The leaf has 29% protein, 18% fat, mineral and vitamin (20%) while seed contains 20.5, 45, 23, 2.2 and 4.8kg/100kg of protein, fat, carbohydrate, fibre and total ash respectively [3]. In addition, the oil in the seeds is useful for soap making and domestic cooking, also, fluted pumpkin had gained medicinal importance to be blood purifiers which enhanced good health among the poor resource farmers in the developing countries [4].
In spite of the nutritional, medicinal and industrial uses of fluted pumpkin (Telfaria occidentalis) in Nigeria, its optimum production has not been attained because the farmers cultivate the same piece of land continually without fertilizers application and this had led to serious decline in soil fertility [5]. The sole use of inorganic fertilizer is often not a viable option for soil fertility management as it may lead to yield gain in the short term but usually it is uneconomical to resource poor farmers does, not sustain good yields in the long terms and unfriendly to the environment [6]. The use of organic manure especially poultry manure increased number of nodules and yield in cowpea and also used as amendment of degraded soils [7]. It was also stated by [8] that poultry manure increased leaf nitrogen, phosphorus, potassium, calcium and, magnesium content in fluted pumpkin. [9] in their report noted that poultry manure resulted in higher number of root and shoot than NPK fertilizer treatments on tomato.

Telfaria. occidentalis has gained relevance in the south western part of Nigeria and is highly demanded for its consumption and medicinal purpose, yet, staking is not considered to be of standard. Due to this, the crop is left to creep on the ground with an assured problem of pest and disease infestation and splash of sand on the vegetable due to rainfall. It is staked by local farmers for yield and during experiment for ventilation, better exposure to sunlight and good yield. [1] recommended that staking of *Telfairia occidentalis* for enhanced marketable leaf yield is necessary. [10] suggested that the climbing species such as Telfairia occidentalis should be supported with bush sticks to enhance growth and development. [11] recommended raised platform staking method for increase pod yield, enhanced market value and higher estimated revenue for such climbing vegetables as cucumber and *Telfairia occidentalis.* [12] recommended staking of tomatoes and other fruit crops for higher yield and good quality fruits. [13] reported that staking increases fruit yield, reduces the proportion of unmarketable fruit, enhances the production of high quality fruits, prevents disease and fruit rot allows better aeration and exposes better exposure of the foliage to sunlight and photosynthetic activities. The objective of this study is to determine the effect of various spacing parameters on the harvestable yield of *Telfaria occidentalis* and the differences in growth and maturity between staked and unstaked *Telfairia occidentalis*. It is a very important

vegetable to mankind and has soon evolved to be one of the most important and consumed vegetable. The plant is a drought resistant plant, the young shoot and the leaves are the main ingredient in various Nigeria soup.

Hence, the need to carry out experiment on the spacing and type of staking required for the planting is a very important. The study is aimed at improving the farmer's income and reduce his expenses, these can only be achieved if only there is proper understanding of the type of spacing required by the plant and the staking procedure that can lead to an optimal productivity by the plant. It will also enable the farmer to easily adapt to the easy and best way of raising *Telfairia occidentalis* without incurring unnecessary cost in the course of production.

Materials and methods

The experiment was carried out within the premises of Federal College of Forestry, Jericho, Ibadan, Oyo State, Nigeria. The planting of the crops was carried out opposite nursery B of the college. The following materials were used for the project: *Telfairia occidentalis* seeds, hand trowel, gloves, field book, pen, polythene pot, sawdust, watering can, bamboo for staking, vernier caliper, ruler, hoe, cutlass, twine ropes. The seed of *Telfairia occidentalis* was purchased from dugbe market. Hand trowel, twine ropes, ruler and caliper were also purchased at the same market. Bamboo for staking were collected from the college premises.

The experimental field was cleared manually with the use of cutlass and hoe and the site used was 13 m by 7.2 m and eight seedlings beds of ugwu were made on it. Four beds of ugwu seedlings were staked with different spacing and the other remaining four beds with ugwu seedlings were not staked. The experimental design and treatment is a 2 x 4 factorial experiment arranged in randomized complete block design.

TREATMENT	SPACING
T_1 (STAKED)	S1(0.5 m by 0.5 m)
	S2 (0.5m by l m)
	S3 (1 m by 1 m)
	S4 (2 m by 1 m)
T2 (UNSTAKED).	S1 (0.5 m by 0.5 m)
	S2 (0.5 m by 1 m)
	S3(1 m by 1 m)
	S4 (2 m by 1 m)

Data collection started two weeks after the nursery stage of planting and continued weekly. The parameters assessed were:

- Plant height (cm): Each seedling height were measured using measuring rule calibrated in cm and were recorded.
- Number of leaves: The number of leaves were taken by counting the leaves.
- Stem diameter: The stem girth was taken by measuring the stem diameter with the aid of vernier caliper and was recorded

The data collected was subjected to Analysis of Variance (ANOVA) and the treatment means were separated using LSD at 5% level of probability.

Results and Discussion

Table 1: Soil physio-chemical properties of the experimental site

SAMPLE	SOIL
$_P$H	6.90
O.C %	1.96
O.M %	3.38
N %	0.17
P mg/Kg	31.4
Mn mgf Kg	56.5
Fe mg/Kg	5.7

Cu mg/Kg	11.4
Zn mg/Kg	26.3
Na Cmol/Kg	0.015
K Cmol/Kg	0.11
Mg Cmol/Kg	4.49
Ca Cmol/Kg	26.3
Sand %	74.5
Clay%	17
Silt %	8.5

Source: FRIN, 2021

Table 2: Mean number of leaves of *Telfairia occidentalis* as affected by Staked/unstaked and spacing.

		Number of Leaves per-Week							
Treatment	**Spacing**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Staked	0.5 m x 0.5 m	8.75^{bc}	22.25^{bc}	3.00^{d}	45.25^{d}	60.50^{e}	67.50^{d}	72.50^{e}	77.50^{e}
	0.5 m x l m	9.00^{bc}	22.75^{ab}	32.50^{c}	56.75^{a}	76.50^{a}	86.50^{a}	92.25^{a}	96.00^{a}
	1 m x l m	8.00^{c}	17.25^{de}	28.25^{c}	45.50^{d}	56.50^{f}	64.75^{e}	68.00^{f}	72.25^{f}
	1 m x 2 m	8.25^{a}	16.00^{a}	35.50^{b}	42.50^{e}	55.50^{f}	60.50^{f}	63.25^{g}	65.50^{g}
Unstaked	0.5 m x 0.5 m	11.25^{c}	24.00^{a}	39.50^{a}	50.75^{b}	67.75^{b}	74.25^{b}	81.25^{b}	88.26^{b}
	0.5 m x 1 m	9.50^{b}	21.25^{c}	36.50^{b}	47.25^{c}	63.75^{c}	71.25^{c}	78.25^{c}	83.00^{c}
	1 m x l m	9.25^{bc}	21.25^{c}	36.25^{b}	48.00^{c}	61.75^{d}	68.25^{d}	75.75^{d}	80.75^{d}
	1 m x 2 m	8.75^{bc}	18.50^{d}	30.75^{d}	44.75^{d}	60.75^{e}	71.25^{e}	71.25^{e}	77.00^{e}
LSD		1.29	1.48	1.27	1.26	1.54	1.54	1.32	2.07
Trt l		*	*	*	*	*	*	*	*
Trt 2		*	*	*	*	*	*	*	*
Trt l	Trt 2	NS	*	*	*	*	*	*	*

Source: Field Study 2017

It was evident from table 2, that seedlings staked on the bed with spacing of 0.5 m x 1 m had the highest leaf production with an average mean of 96 leaves at week 8. The trend in increase of leaves production was statistically noticed from week 4 to week 8.

Seedlings grown without staking with spacing of 0.5 m x 0.5 m performed best in leaf production between week 1 and week 3 while seedlings staked with spacing 0.5 m x 1 m recorded highest average mean of leaf production from week 4 to the 8th week of assessment. Significant difference was established among the treatment through the weeks of assessment. Interaction between spacing also showed significant effect on leaf production of ugwu seedling at 5% level of probability.

Table 3: Mean number of plant height of *Telfairia occidentalis* as affected by Staked/un- staked and spacing.

		Number of Height per Week							
Treatment	**Spacing**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Staked	0.5 m x 0.5 m	22.00^{e}	37.00^{c}	52.00^{e}	76.25^{c}	96.25^{d}	104.25^{d}	119.50^{d}	126.25^{d}
	0.5 m x l m	26.50^{a}	45.75^{a}	73.25^{k}	98.25^{a}	123.00^{c}	135.00^{b}	137.75^{a}	150.75^{a}
	1 m x l m	18.75^{d}	35.25^{d}	62.00^{b}	83.00^{b}	95.5^{d}	100.75^{d}	111.00^{e}	119.50^{e}
	1 m x 2 m	15.25^{e}	32.75^{e}	57.75^{d}	76.50^{c}	90.00^{e}	101.75^{d}	10.825^{ef}	116.00^{f}
Unstaked	0.5 m x 0.5 m	26.50^{a}	40.75^{b}	60.00^{bc}	83.00^{b}	111.25^{b}	122.5^{b}	133.25^{b}	146.25^{b}
	0.5 m x 1 m	24.50^{b}	37.50^{c}	58.00^{cd}	77.75^{C}	102.75^{c}	116.75^{c}	127.75^{c}	138.25^{c}
	1 m x l m	21.25^{d}	37.75^{c}	5150^{C}	72.75^{c}	97.50^{d}	113.25^{c}	126.25^{c}	136.50^{c}
	1 m x 2 m	17.50^{d}	30.75^{f}	46.25^{f}	63.25^{c}	83.25^{f}	90.50^{c}	104.75^{f}	121.00^{c}
LSD		1.79	1.62	2.09	1.99	2.84	5.49	4.29	3.17
Trt l		*	*	*	*	*	NS	*	*
Trt 2		*	*	*	*	*	*	*	*
Trt l	Trt2		*	*	*	*	*	*	*

Source: Field Study 2017

It was observed on table 3 that seedling of ugwu staked on the bed spacing of 0.5 m x l m performed best in height development from week 1 to 8. The average mean value at week 8 was 150.75 cm. The seedling staked at 0.5 m x l m performed best overall at week 8. This was followed by the seedlings staked with the bed spacing of 0.5 m x 0.5 m with the average mean value of 146.25 cm. Seedlings staked with bed spacing of l m x 2 m performed least in terms of height development with the average value of 116.00 cm and the result also revealed significant difference among the treatments. It was evident that the treatment are significantly different from one another throughout the weeks' assessment at 5% level of probability. The results obtained established that the interaction effect between staking and spacing is significant throughout the weeks' assessment.

Table 4: Mean number of stem girth of *Telfaria occidentalis* affected by Staking/unstaking and spacing.

Number of stem girth per week

Treatment	Spacing	1	2	3	4	5	6	7	8
Staked	0.5 m x 0.5 m	1.48^{a}	1.58^{ab}	1.93^{a}	2.00^{b}	2.05^{a}	2.07^{a}	2.17^{a}	2.20^{a}
	0.5 m x l m	1.58^{a}	1.68^{a}	2.00^{a}	2.18^{a}	2.25^{a}	2.16^{a}	2.19^{a}	2.21^{a}
	1 m x l m	1.55^{a}	1.53^{b}	1.95^{a}	1.98^{b}	2.00^{c}	2.07^{b}	2.11^{d}	2.17^{bc}
	1 m x 2 m	1.55^{a}	1.60^{ab}	1.80^{b}	1.80^{c}	1.86^{c}	1.92^{d}	2.00^{f}	2.09^{a}
Unstaked	0.5 m x 0.5 m	1.58^{a}	1.60^{ab}	1.61^{c}	1.73^{c}	1.91^{d}	1.97^{c}	2.14^{c}	2.20^{a}
	0.5 m x 1 m	1.55^{a}	1.63^{ab}	1.67^{c}	1.73^{c}	1.87^{c}	1.98^{c}	2.15^{bc}	2.21^{a}
	1 m x l m	1.50^{a}	1.61^{ab}	1.65^{c}	1.73^{c}	1.91^{d}	2.05^{b}	2.19^{a}	2.19^{ab}
	1 m x 2 m	1.53^{a}	1.63^{ab}	1.65^{c}	1.73^{c}	1.76^{f}	1.81^{c}	2.08^{c}	2.16^{c}
LSD		0.12	0.13	9.52	0.08	0.04	0.04	0.03	0.03
Trt l		Ns	Ns	*	*	*	*	*	*
Trt 2		Ns	Ns	*	*	*	*	*	*
Trt l	Trt 2	Ns	Ns	*	*	*	*	*	*

Source: Field Study, 2017.

As shown in table 4, it was discovered that seedlings of ugwu staked on bed spacing of 0.5 m x l m and the ones unstaked with a spacing of 0.5 m x 1 m performed best with an average mean of 2.21 mm, the trend increases as the weeks increase. It was also observed that seedlings of ugwu staked and unstaked on bed with spacing of 0.5 m x 1 m performed second best all through the weeks of assessment with an average mean of 2.20 mm at week 8. Significant differences were observed from week 2 to week 8 while week 1 showed no significant differences among the treatments. Interaction between spacing and staking were observed from week 3 to week 4 while week 1 and week 2 showed no significant interactions between spacing and staking of ugwu seedlings.

Conclusion

It was evident that the staked seedlings on the bed with spacing of 0.1m by 1m had the highest leaves production with an average mean of 96 leaves at week eight and trend increase of leaf production was noticed from week 4 to week 8, which is in accordance with the findings of [14],[15] and [16] who obtained highest yield at higher plant spacing. The yield parameters assessed were discovered to be higher on the staked plants than the unstaked plants on the ground. The result agreed with the findings of [17] who observed that the yield of super select cucumbers were higher for the trellised treatment than for the non-trellised treatment.

Based on the height development, it was observed that the staked seedlings on bed with spacing of 0.5 m by l m performed best in height development from week 1 to week 8 with an average mean of 150.7 cm. [18] concluded that staked cucumber produced fruits that double the quantity of the ones on the ground. This could be concluded on the fact that there is poor quality in the colour of the fruit, reduced length of fruit and development of yellow bellies on the fruits, which confirmed their spoilage.

Based on the stem girth, it was discovered that the seedlings of staked ugwu on bed with spacing 0.5 m by 1m and the unstaked with spacing of 0.5m by 1m as well performed best with an average mean of 2.21mm and the trend increases along the week. Results affirmed the earlier report of [19] that plant spacing is an important agronomic practice that enhances growth, vigor and the overall development of a crop. The results showed that staked *T. occidentalis* planted at 0.5 m x 1 m spacing had the highest mean number of leaves, stem height and girth as compared to other spacing used. This suggests that good planting distance should be used to obtain better yield in *T. occidentalis* production.

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