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Prevalence of Sexes and Yield Characteristics of Hormone Induced Fluted Pumpkin (*Telfairia occidentalis* Hook.F) in the Humid Tropics of Southern Nigeria

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Abstract: A study on the prevalence of sexes and yield characteristics of hormone induced Fluted pumpkin (*Telfairia occidentalis*) was carried out at the Teaching and Research Farm of the Rivers State University of Science and Technology, Port Harcourt. Induction of fluted pumpkin seeds with 0, 100, 200 and 300 parts/million (ppm) each of Gibberellic Acid (GA_3), Indole-3-Acetic Acid (IAA), Naphthalene Acetic Acids (NAA) and Ethrel (ET) was done before planting. The treatment with GA_3 300 ppm significantly reduced number of days before first male flower initiation to 94 Days After Planting (DAP) while increase in the number of days before first female flower initiation was 155 DAP with IAA300 ppm. Similarly, number of female and male flowers/vine were reduced but GA_3 200 gave the highest number of 57 male flowers/vine. Marketable vegetable yield decreased with higher levels of hormones at twelve weeks after planting. Consequently, low level of treatment at 100 ppm gave higher vegetable yields comparable to that of control. The highest yield of 2.2 kg/vine was obtained with Ethrel 100 ppm. Pod yield/vine significantly increased at above 100 ppm for all the treatments. The highest seed yield of 90 seeds/pod was obtained with IAA 300 ppm. Seed weight (kg/pod) generally decreased at 300 ppm but IAA 300 ppm had the highest seed yield of 1.13 kg/pod. The lowest but the best sex ratio (M/F) of 0.30:1 was obtained with IAA_3 300 ppm. Reduction in sex ratio resulted in favorable increase in the number female plants/plot of fluted pumpkin.

Keywords: Fluted pumpkin, hormone induced, pod yield characteristics, prevalence of sexes

INTRODUCTION

The production and utilization of fluted pumpkin as leafy vegetable is on the increase more than ever before in Southern Nigeria because of increased awareness of its nutritional and economic values. In a survey on the pattern of consumption of leafy vegetables in Nigeria Hart *et al*. (2005) gave the per capita consumption as 91-130 kg. This range was reported to be among the highest in Africa and *Telfairia occidentalis* was also listed among the Regionally Consumed Indigenous and Traditional Leafy Vegetables for West Africa, (Smith and Pablo, 2007).

The seeds of fluted pumpkin are also nutritious and rich in fat (50%) making it a potential raw material for the pharmaceuticals and soap industry (Okoli and Mgbeogu, 1983). Furthermore, the economic and nutritional benefits of blending fluted pumpkin seed into wheat flour for bread because of its nutritional value in a Nigeria economy has been revealed (Giami *et al*., 2003).

Presently, the seeds which are the only means of propagation present some problems, which include high cost and its scarcity at the time of planting and poor storability (Akoroda, 1990). It is a common knowledge that female plants have more luxuriant leaves and are more productive than the male plants, they also produce pods which bear seeds. The high productivity of the female plant makes it more preferred to the male by farmers particularly for seed production. It is however not yet possible to identify the sex of a seed before planting in order to ensure increased leaf, fruit and seed production.

The difficulty to differentiate between male and female plants before flower initiation in the crop also adds to the problems and limitations of fluted pumpkin production. Various attempts have been made to find an alternative method of propagation and preservation such as the use of vine cuttings and the *in-vitro* culture of embryos of fluted pumpkin (Nwonuala *et al*., 2007). Recently, Ogbonna (2009) studied portion and type effects on sex, growth and yield of fluted pumpkin and indicated no significant differences in sex ratio. In all these cases, the desired result of identifying the sexes in order to increase the production of fluted pumpkin per unit land area has not been attained.

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Experimental modification of sex expression of flowering plants has been earlier reported by Heslop-Harrision (1957). The work of Rudich *et al*. (1972) suggests that Ethylene participate in the endogenous regulation of sex expression by promoting femaleness in cucumber plant.

Later, Michael *et al.* (1977) indicated that exogenous Ethephon treatment on cucumber increased the female tendency in monoecious plants and decreased it in gynoecious ones. According to the study of Kshirsagar *et al*. (1995), plant growth regulators were confirmed to increase female flowers and yields in cucurbits.

Fluted pumpkin belongs to the same *Cucurbitaceae* family as cucumber; therefore, similarity in effects of exogenous plant hormone is anticipated. This research will therefore, provide useful scientific information on the effects of different plant hormones on the prevalence of sexes, vegetative and pod yield characteristics of fluted pumpkin thus paving the way towards the increase in productivity of the female plant with its attendant benefits.

MATERIALS AND METHODS

Field experiment was conducted at the Research and Teaching farm of the Rivers State University of Science and Technology, Port Harcourt. It is located at latitude 4.51°N and longitude 7.01°E and 18 m above sea level. The rain fall pattern is bimodal with peaks in June and September. The annual rain fall is variable and ranges between 2000 to 2484 mm/annum with an annual mean temperature of 25°C. Experimental materials are four plant growth hormones and the seeds of fluted pumpkin obtained within four major clusters of production in Rivers State of Southern Nigeria during the farming seasons of 2010 and 2011.

The treatments consist of seeds from matured pods induced by soaking them in prepared aqueous solution of the growth hormones: Indole-3-Acetic Acid (IAA), Naphthalene Acetic Acid (NAA), Gibberellic Acid (GA_3) and 2-Chloroethyl Phosphonic Acid (CEPA used in the commercial form as Ethrel) each at 0, 100, 200 and 300 parts/million (ppm) for 60 min, drained and sundried for another 60 min before planting.

The experimental design was a Randomised Complete Block (RCB) with 3 replicates. Seeds induced with hormones were planted at a rate of one seed per hole on the ridge and with a spacing of 1×1 m (10,000 plant/ha). Compound Fertilizer (N:P:K 15:15:20) was applied at the rate of 50 g/vine (500 kg/ha) by ring application on the ridge, 4 weeks after planting.

Data collated from the field were subjected to statistical analysis (descriptive and bivariate statistics), using the SPSS 15.0 Command Syntax Reference (2006) Evaluation version for windows.

RESULTS AND DISCUSSION

The mean time for first male flower initiation in Telfairia according to the results of this experiment occurred 116 days after planting and that of the female flowers took 124 days for the control plots. Female flowers usually take longer time than the males to occur. The results which are shown on Table 1, indicate that treatment with induced hormones, significantly reduced the number of days before first male flower initiation (94 DAP) with GA_3 300 ppm. Conversely, the same treatment significantly delayed the time before first female flower initiation by increasing the number of days before female flowers occurred. The longest delay in the number of days to first female flower initiation (155 DAP) was obtained with IAA300 ppm.

The response by the reduction in the number of days before the first male flower initiation is observed to be in agreement with the findings of Atsmon and Tabbak (1979) that GA_3 induces staminate flower formation in cucumber plant. The response however, is of reverse effect on the initiation of female flower by the extension to a minimum of 7 days beyond that of the control which occurred 124 DAP, when compared to GA_3 200 and IAA 300 ppm, female flowers were

Table 1: Effects of induced hormones on number of days to flower initiation, number of flowers/vine and sex ratio of Fluted pumpkin

			No of flowers/vine		
Hormone (ppm)	1^{ST} male FL(DAP)	1^{ST} female FL(DAP)	Male	Female	Sex ratio (M/F)
GA_3 100	119.00	147	21.63	12.71	1.85:1
GA_3 200	105.57	133	57.10	15.92	1:1
GA_3 300	93.69	136	32.28	19.13	0.42:1
ET 100	115.64	154	25.52	18.41	1.28:1
ET 200	116.57	136	23.40	15.42	1.43:1
ET 300	131.42	148	24.35	15.11	1.83:1
IAA 100	132.60	155	25.26	18.88	0.85:1
IAA 200	127.14	137	23.40	14.22	1.80:1
IAA 300	101.22	133	27.38	16.55	0.30:1
NAA 100	141.28	141	34.28	18.82	1.16:1
NAA 200	118.14	153	29.97	16.85	1.14:1
NAA 300	127.58	145	29.97	20.92	0.45:1
Control	116.29	124	39.33	23.07	1.28:1
S.E± (0.05)	3.68	2.63	2.62	0.79	0.13

*: Ethrel is abbreviated as ET, a trade name for 2 Chloroethyl Phosponic Acid (CEPA)

Table 2: Effect of induced hormones on marketable vegetable, pod and seed yield of fluted pumpkin

Hormone (ppm)	Vegetable yield (kg/vine) 12 WAP	Pod yield (kg/vine)	No of seed (pod)	Seed yield (kg/pod)
GA_3 100	1.45	2.29	48.08	0.39
GA_3 200	1.48	3.10	54.78	0.58
GA_3 300	1.28	2.70	77.50	0.61
ET 100	2.20	2.47	61.53	0.78
ET 200	1.13	4.50	52.52	0.95
ET 300	0.61	2.91	51.50	0.46
IAA 100	1.83	4.48	55.36	0.88
IAA 200	1.74	3.31	57.33	0.66
IAA 300	0.64	4.28	90.00	1.13
NAA 100	1.88	2.88	52.44	0.56
NAA 200	1.63	4.55	68.95	1.02
NAA 300	0.60	3.24	57.25	0.82
Control	1.96	2.96	55.56	0.68
S.E ± (0.05)	0.15	0.22	3.30	0.06

*: Ethrel is abbreviated as ET (trade name for 2 chloroethyl phosphonic acid); 12 WAP: 12 weeks after planting

produced 133 DAP. This result is in contrast to the response of cucumber when treated with similar concentrations of Ethrel and NAA which resulted in delay in appearance of first male flower and enhanced that of female flower (Kshiragar *et al*., 1995).

Generally, the number of male flowers was more than that of female flowers at all levels of treatment including the control. Hormone induction also significantly affected number of female and male flowers/vine.

Induction with GA_3 200 ppm produce 57 male flowers/vine which was the highest followed by the control. Except for GA_3 200 ppm, the number of male flowers/vine obtained with other treatments was less than that of the control. The least number of 16 male flowers was obtained with Ethrel 200 ppm while the control had 39 male flowers/vine. It is observed therefore, that the number of male flowers generally decreased as the days before male flower initiation was reduced by the hormone treatments. Similarly, for female flowers, there was also significant reduction in the number of female flowers/vine when the control plot had 23 female flowers as the highest number of flowers/vine. The least number of female flowers/vine (12.71) was obtained with GA_3 100 ppm. The number of female flowers however, increased with increase in the level of the hormones except with Ethrel 100 ppm.

Induced hormones also significantly affected the sex ratio of Fluted pumpkin. With GA_3 100 ppm the highest and sex ratio of 1.85:1 was obtained, while the control plot had a ratio of 1.28:1. The effect of Ethrel resulted in increased sex ratio with increase in the concentration of the hormone. Ethrel 300 ppm gave sex ratio of 1.83 which is not different from the highest ratio obtained with IAA200 and GA_3 100. Sex ratio decreased with increased levels of GA_3, NAA and IAA. The reduction in sex ratio indicates favorable increase in the femaleness of fluted pumpkin as a result of induced hormones. The lowest and the best sex ratio of 0.30:1 was obtained with IAA 300 ppm which was not significantly different from those of NAA and GA_3 at 300 ppm.

In Table 2, treatment effects indicate that increase in hormones levels significantly reduced the marketable vegetative yield of Telfairia at 12 weeks. Conversely, low level of 100 ppm gave higher vegetable yields comparable to that of control. The highest yield of 2.2 kg/vine was obtained with Ethrel 100 ppm. Control plot had the marketable vegetative yield of 1.9 kg/vine. The least vegetable yield of 0.6 kg/vine was obtained with NAA 300 ppm. At 300 ppm all the hormones except GA_3 did not significantly differ from each other in their effects on marketable yield at 12 weeks after planting.

On pod yield vine, the result indicate significant increased yield above 100 ppm for all the treatments. The highest pod yield of 4.5 kg/vine was recorded for NAA 200 ppm which is not significantly different from the yield of Ethrel 200, NAA 200 ppm and IAA 100 ppm. The lowest pod yield of 2.29 kg/vine was obtained with GA_3 100 ppm which was lower than that of control (2.96 kg/vine).

The number of seeds/pod also significantly increased with increase in level of treatment. The least number of 48 seeds/pod was however recorded with GA_3 100 ppm. The highest number of 90 seeds/pod was obtained with IAA 300 ppm, while control treatment had 55.56 seeds/pod.

The seed weight kg/pod decreased significantly at 300 ppm for GA_3, ET and NAA but was 1.13 kg/pod with IAA 300 ppm which was the highest while control treatment had 0.68 kg seed/pod. The least seed weight of 0.39 kg/pod was obtained with GA_3 100 ppm.

The seed weight/pod generally decreased significantly at 300 ppm but for IAA 300 ppm which had the highest seed yield of 1.13 kg/pod while control treatment had seed weight of 0.68 kg/pod. The least seed weight of 0.39 kg/pod was obtained with GA_3 100 ppm.

CONCLUSION

Induction with hormones influenced the vegetative and pod yield characteristics of Fluted pumpkin significantly. Though the pattern of response to the different hormones vary slightly, the trend however indicate similarity in the effects of GA_3, NAA and IAA on number of male and female flowers/vine; and sex ratio. With increased levels of treatment, the reduction in sex ratio indicates favorable increase in the femaleness of fluted pumpkin. The lowest and the best sex ratio of 0.30:1 were obtained with IAA 300 ppm which was not significantly different from those of NAA and GA_3 at 300 ppm. The effects of IAA, NAA and GA_3 were therefore similar on most of the characteristics of the plant, while that of ET differed more significantly from them.

It is important to highlight that in this experiment, low levels of 100 ppm gave higher vegetable yields comparable to that of control. The highest yield of 2.2 kg/vine was obtained with Ethrel 100 ppm.

The effects of induced hormones on pod yield indicate significant increased in pod yield/vine above 100 ppm for all the treatments.

The exogenous induction of plant hormones on the seeds and leaves of fluted pumpkin can be said with all certainty to influence vegetative yield and sex differentiation towards femaleness. The implication is that the benefits of female. Fluted pumpkin can be maximized through the exogenous induction of Hormones which influence the increase in femaleness and which is in no doubt directly related to increase in vegetable and pod yield.

It is recommended that for increase in marketable vegetable yield, low levels of hormone should be administered while the demand for increased pod and seed production should be with higher levels of hormones.

Furthermore, a correlation study of the various yield components of hormone treated Fluted pumpkin is necessary. This will further highlight the significant functional relationship between these effects and treatments towards greater production of female Fluted pumpkin.

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