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Research Paper

Effect of seed weight on some agronomic parameters in fluted pumpkin (*Telfairia occidentalis* Hook. f.) grown in a coastal plain sands derived soil

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A field experiment laid out in randomized complete block design (RCBD), having three treatments and seven replications was conducted in the Eastern Farm of the Michael Okpara University of Agriculture, Umudike, to investigate the effect of seed size on some agronomic parameters in fluted pumpkin (*Telfairia occidentalis* Hook. f.). The three treatments were: Treatment 1 (T1) – Heavy seeds, Treatment 2 (T2) – Medium weight seeds, and Treatment 3 (T3) – Light weight seeds. The seven replications were made up of seven fluted pumpkin pods obtained from Umuahia. The three treatments were evaluated with respect to nine (9) agronomic parameters, namely: Days to seedling emergence, Establishment count, Number of leaves per plant, Number of branches per plant, Fresh vegetative yield, Stem girth, Leaf area, Shoot length, and, Number of pods per plant. Days to seedling emergence did not differ for heavy and medium seeds, but it was earlier for heavy and medium weight seeds than for light seeds ($p<0.01$). Plants raised from heavy and medium weight seeds recorded higher establishment counts than those raised from light seeds ($p<0.05$). Plants raised from heavy seeds had thicker stems than those raised from medium and light seeds ($p<0.05$). There was no significant difference between medium and light weight seed plants in respect of stem girth. There were no significant differences among the three treatments with respect to number of leaves per plant, number of branches per plant, fresh vegetative yield, leaf area, and number of pods per plant. It was concluded that fluted pumpkin farmers in Southeastern Nigeria need not be overly concerned as to seed size when sourcing seed for planting as the heavy, medium, and light weight seeds gave rise to plants that did not differ significantly from each other in respect of vegetative as well as reproductive yield parameters in the crop.

Keywords: Seed weight, fluted pumpkin, vegetative.

INTRODUCTION

Fluted pumpkin (*Telfairia occidentalis* Hook. f.), cultivated for its edible leaves and seeds, is a common homestead garden crop in Southeastern Nigeria. It is commonly intercropped with yams, maize, and cassava. Ladeji *et al*. (1995) evaluated the nutritive value of the leaves of fluted pumpkin and reported that they contain about 30.5g crude protein, 3.0 g crude lipid, and 8.3 g total ash, per 100 g of dry matter; the potassium, calcium, and iron contents of ash in their samples were 594, 144, 100, and 12 mg /100 g dry matter, respectively; they had a high level of tannic acid, but the levels of phytic acid and oxalate were within normal range; they had an excellent ratio of essential amino acids to total nitrogen, and methionine was found to be the limiting amino acid with a chemical score of 16. The seeds which contain 58% oil and 27% protein, with high methionine content, are eaten boiled, roasted, fermented, or processed into a high-protein soup seasoning or infant food (Longe *et al*., 1983;

Asiegbu, 1987; Messiaen, 1994; Akwaowo and Ndon, 2000; Giami *et al*., 2003). The high level of unsaturation of its oil renders it useful as a drying oil. This means that fluted pumpkin seed oil, apart from being edible, also has a high potential value in the paint and varnishes industries (Asiegbu, 1987; Esuoso and Lutz, 2000; Giami *et al*., 1999; Nkang *et al*., 2003). It is in high demand by suckling mothers because of its high lactating properties, and the leaves are used in traditional medicine in treating anaemia (Akubue *et al*., 1980; Akoroda, 1990; Schippers, 2000).

Fluted pumpkin root extract which contains toxic compounds including resins, alkaloids and saponins, is used to kill pests such as rats and mice, and is known to be lethal when consumed by humans, livestock, and fishes (Akubue, 1980; Ajibesin *et al*., 2002).

Hoy and Gamble (1987) and Sexton *et al.* (1999) observed that under field stresses such as low temperature, wet or crusted soil, small seeds of soybean and the common bean perform better than large seeds as seedlings from small seeds were less damaged than those from large seeds, while large seeds of winter wheat and mung bean have been reported to perform better in germination than small seeds in a field free from stress (Chastain *et al*., 1995; Amin, 1999).

Seedlings of spring wheat (Lafond and Baker, 1986) were reported to emerge faster from small seeds than from large seeds. In other studies, however, germination percentage of winter wheat (Mian and Nafziger, 1994), and seedling emergence of soybean (Tekrony *et al*., 1987), were observed to be unaffected by seed size.

Singh *et al.* (1972) expressed the view that large seeds of soybean had greater supply of stored energy to support early seedling growth and subsequently positively affected plant growth and development. Amin, (1999) observed that 50% of large – seeded mung bean cultivars matured earlier than small-seeded types.

Emergence, seedling vigour, subsequent plant growth, and final yield are all related to seed piece size in potato (*Solanum tuberosum*) in which larger seed piece results in higher total yield, but the benefit of larger-sized seed pieces diminishes as the weight of the pieces increases above approximately 70.87g, that is, 2.5 ounces (Iritani and Thomton, 1984). Small seed size has been associated with increased specific leaf nitrogen and greater rate of photosynthesis in wheat (Morgan *et al*., 1990). Larger seeds produce larger sprouts including larger sprout weight, head diameter, and stem diameter in bean (Black, 1956; Burris *et al*., 1971).

Knauft *et al.* (1990) investigated the effect of seed size and P fertilizer on P intake, leaf area index, root length density, dry matter production and yield performance of groundnut using four different seed sizes of groundnut, namely, large, medium, small, and bulk ungraded seeds and reported that leaf area index, total dry matter, root length density, phosphate uptake, yield and yield components, varied significantly due to variation of seed size and P fertilizer.

Schippers, (2000) reported that germination and establishment counts increase as seed size increases in fluted pumpkin. Anyim and Akoroda, (1983) reported that small seeds have a greater chance of producing female plants than large seeds in fluted pumpkin. Uyoh and Ikong, (2004) observed that seed weight has no effect on seedling emergence, leaf area and number of branches per plant. Willie and Okoronkwo, (2016) exploited the phenomenon of polyembryony to raise multiple seedlings through fragmenting seeds of fluted pumpkin and reported that number of days to seedling emergence increased, while establishment count, number of branches per plant, number of leaves per plant, stem girth, leaf area, and fresh vegetative yield, all decreased, as seed fragmentation increased (that is, as effective seed size was artificially being reduced).

Farmers in Southeastern Nigeria believe that bigger (which usually means, heavier) seeds of fluted pumpkin, if planted, germinate to give a crop with higher vegetative and pod yields compared to the lighter seeds. This makes them go for heavier seeds as planting materials, thus pushing the price of heavier seeds above that of lighter ones during the planting season. The general objective of this study was to investigate the validity of this belief of local farmers. More specifically, the study was carried out to compare the agronomic performance of plants raised from heavy weight, medium weight, and light weight seeds of fluted pumpkin, and to use the information derived thereby to draw conclusions expected to be useful to farmers.

MATERIALS AND METHODS

The study was conducted at the Eastern Farm of Michael Okpara University of Agriculture, Umudike, from late March to early November, 2007. Umudike is located at latitude 05° 29' N, longitude 07° 32' E, at an altitude of 122 m above sea level and has a mean annual rainfall of 2200 mm distributed over an eight-month period (March to November). The rainy season has bimodal peaks in July and September, with a short dry spell in August. Temperature range is 22 -33°C, while the day-length ranges between 11.68 hours in March and 12.57 hours in October (NRCRI, 2001). The pods used for the study were sourced from one farmer in Umudike, near Umuahia, Southeastern Nigeria.

The experiment was a randomized complete block (RCBD) with three treatments and seven replicates. The three treatments were i) Treatment 1 (T1) – Heavy seeds, ii) Treatment 2 (T2) – Medium weight seeds, and iii) Treatment 3 (T3) – Light weight seeds. The seven replications were made up of seven pods of fluted pumpkin sourced from Umuahia. Each pod was opened up and its seeds weighed by use of a balance. Using specified ranges, the seeds in each pod was divided into

three weight categories which constituted the three treatments. For each of the seven pods, seeds in the highest weight category formed Treatment 1, seeds in the medium weight category formed Treatment 2, and seeds in the lowest weight category formed Treatment 3. A total of 21 plots, each measuring (3 x 2) m were marked out in a site that had been cleared, ploughed, and harrowed. The three treatments were randomized in each of the seven replications. The experiment covered a total area of (10 x 29) m, implying a land area of 290 m^2 (0.029 ha).

The seeds were counted, weighed, and planted in a nursery in a green house. The seedlings were nursed in polythene bags. Seedlings were transplanted to the field one week after emergence. Each plot had six stands per treatment planted at a spacing of (1 x 1) m. This gave a total plant population of 6 x 21 = 126 plants for the experiment (=10,000 plants per hectare). The treatments were assigned randomly to the plots within the blocks. The plots were kept weed-free through manual weeding throughout the period of the experiment. Harvesting for leaves and tender portions of the shoots began 48 days after transplanting. Four harvests were carried out at three weekly intervals. This involved pruning of young tender shoot branches and leaves using a sharp knife to make a cut at the mid-point of the internodes between the last leaves from the stem apex considered mature enough for use as vegetative and the one considered over-mature. Data were taken and recorded in respect of nine (9) agronomic parameters, namely, i) Days to seedling emergence, ii) Establishment count, three (3) weeks after planting, iii) Number of leaves per plant, iv) Number of branches per plant, v) Fresh vegetative yield (Kg/plot), vi) Stem girth (mm), vii) Leaf area (cm^2), viii) Shoot length (cm), and, ix) Number of pods per plant. Before commencement of the experiment, a composite soil sample was collected from the experimental field at the depth of 0 – 20 cm, using a soil augur and taken to the laboratory for nutrient content analysis. The sample was air-dried, gently crushed with a wooden roller, and sieved with a 2mm sieve and subjected to some physical and chemical analysis. The analysis showed that the soil particle size was sandy loam in texture with a dominant sand fraction of 769.3 gkg^{-1} and low in fertility as reflected by the low content of organic matter (15.85 gkg^{-1}) and total nitrogen (0.63 gkg^{-1}). Soil pH (H_2O) was strongly acid with a value of 5.4. The available phosphorous (P) and potassium (K) had values of 5.35 $mgkg^{-1}$ and 0.17 $cmolkg^{-1}$, respectively. Other nutrient concentration of the soil showed that Ca and Mg had values of 3.40 $mgkg^{-1}$ and 1.80 $mgkg^{-1}$, respectively.

Statistical analysis

The data generated from the laboratory and field experiments were subjected to statistical analysis of variance (ANOVA) and significant means were separated using Fisher's protected least significant difference (LSD) at 5% level of probability.

RESULTS

The means for the treatments, the effects of which were being investigated, are presented in (Table 1). A summary of analysis of variance carried out is shown in (Table 2). The difference among the three treatments in respect of days to seedling emergence was highly significant ($p<0.01$). A significant difference was observed between heavy weight seeds and light weight seeds ($p<0.01$). Number of days to seedling emergence was highest in light weight seeds (11.193 days) compared to the heavy and medium weight seeds in which seedlings took only 8.381 and 8.761 days, respectively, to emerge. Heavy and medium weight seeds had the same establishment count (6.00 plants per plot), which was higher ($p<0.05$) than that of light weight seeds (5.571 plants per plot; $p<0.05$).

Plants raised from heavy weight seeds had thicker stems than those raised from medium and light weight seeds ($p<0.05$), but there was no significant difference between medium and light weight seeds in respect of this parameter. The heavy weight seeds germinated to produce individual plants that had larger stem girth (19.271 mm) than those raised from the medium (16.586 mm) and light (15.971 mm) weight seeds. The three

Table 1. Mean growth parameters of fluted pumpkin.

Treatment	DTE	EC	NOL	NOB	FVY	SG	LA	SL	NOP
Heavy seeds	8.38	6.000	191.657	22.114	1.94	19.271	214.949	435.186	1.238
Medium seeds	8.761	6.000	165.357	18.971	1.375	16.586	214.461	436.057	0.809
Light seeds	11.193	5.571	160.900	18.471	1.164	15.971	179.449	372.057	0.524
F-LSD ($p<0.05$)	1.774	0.360	ns	ns	ns	2.436	ns	ns	ns
F-LSD ($p<0.01$)	2.487	ns	ns	ns	ns	ns	ns	ns	ns

Legend: DTE: Days to seedling emergence; EC: Establishment count; NOL: Number of leaves per plant; NOB: Number of branches per plant; FVY: Fresh vegetative yield; SG: Stem girth; LA: Leaf area; SL: Shoot length; NOP: Number of pods.

Table 2. Summary of analysis of variance for growth parameters in fluted pumpkin.

Parameter	Variance	Variance Ratio (F)
Days to seedling emergence	16.28	7.029**
Establishment count	0.429	44.576*
Number of leaves per plant	1933.818	1.111^{ns}
Number of branches per plant	27.298	1.329^{ns}
Fresh vegetative yield	1.127	3.719^{ns}
Stem girth	21.561	4.925*
Leaf area	2900.785	0.168^{ns}
Shoot length	9428.97	1.416^{ns}
Number of pods per plant	0.905	3.803^{ns}

Legend: *Significant (p<0.05); **highly significant (<p0.01); ns: Not significant.

treatments did not differ from each other on number of leaves per plant, number of branches per plant, fresh vegetative yield, leaf area, shoot length, and number of pods per plant.

DISCUSSION

Even though plants raised from heavy and medium weight seeds emerged faster, had higher establishment count, and thicker stems than those raised from light weight seeds, there was no significant difference among the three treatments with respect to number of leaves per plant, number of branches per plant, fresh vegetative yield, leaf area, shoot length, and number of pods per plant. These observations are in tandem with the report of Willie and Okoronkwo, (2016) who exploited the phenomenon of polyembryony to raise multiple seedlings through fragmenting seeds of fluted pumpkin and reported that number of days to seedling emergence increased, while establishment count, number of branches per plant, number of leaves per plant, stem girth, leaf area, and fresh vegetative yield, all decreased, as seed fragmentation increased. Heavy and medium weight seeds germinated into seedlings that emerged earlier, and recorded higher establishment counts than light seeds. These results were obtained because, as pointed out by Singh *et al*. (1972) in respect of soybean, large seeds have greater supply of stored resources to support early seedling growth than medium and light weight seeds, and subsequently positively affected plant growth and development. Heavy seeds germinated and grew into plants that had thicker stems than those raised from medium and light seeds.

Conclusion

When the above findings are compared with the observation that plants raised from heavy, medium, and light seeds did not differ from each other in respect of shoot length, number of leaves per plant, fresh vegetative yield, leaf area, and number of pods per plant, all of which are the key components of economic yield in the crop, it is concluded that local farmers in Southeastern Nigeria need not be overly concerned as to seed size when sourcing fluted pumpkin seeds for planting, as the heavy, medium weight and light weight seeds give rise to plants that do not differ significantly from each other in respect of vegetative and pod yields, which constitute the key agronomic interests in growing the crop.

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