

EFFECT OF GROWTH MEDIA AND SEED EXTRACTION DAYS ON GERMINATION AND GROWTH CHARACTERS OF FLUTED PUMPKIN (*Telfairia occidentalis* Hook. F.)¹Kayode, A. P., ^{*2}Oyewusi, I. K., & ³Akeredolu, M. I.^{1, 2 & 3}Department of Agricultural Technology, Federal Polytechnic, Ado Ekiti

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ABSTRACT

A screen house study was conducted to investigate the effect of different growth media and length of days after seed extraction from fruit, on germination and growth characters of fluted pumpkin. The experiment was laid out in randomized complete block design (RCBD) with four replicates. Different growth media: Topsoil, Topsoil + Poultry manure in the ratio 2:1, and Sawdust ash were filled into well-labelled 48 perforated plastic buckets of 5-litre capacity. Fluted pumpkin seeds were sown on 0, 3, 6, and 9 days in the different growth media. Watering was done every other day till the end of the study. The seeds sown were observed daily for 30 days to obtain germination count. Germination percentage and germination speed index were evaluated. The experiment was terminated 40 days after planting. Leaf number, vine length, stems girth, and leaf area from five randomly selected plants was also determined. Seeds sown in sawdust ash were significantly faster (18.08 days) in emerging than those sown in topsoil (19.42 days). Also, seeds planted on day 0 after seed extraction from fruits gave a 74.48 % germination percentage and those planted on day 3 after seed extraction from fruits gave a 72.40 % germination percentage. They therefore competed favorably with each other. Sawdust ash growth medium produced a longer vine length (71.30 cm) than the other growth media. Conclusively, sawdust ash as a growth medium, favors timely germination and optimum seedling growth of *Telfairia occidentalis*. Also, seeds extracted from fruits may be air dried between 0-3 days only for optimum germination.

KEYWORDS: Fluted Pumpkin; Germination; Growth characters; Growth Media; Length of days**INTRODUCTION**

Fluted pumpkin (*Telfairia occidentalis* Hook. F.), a member of the Cucurbitaceous family is one of the commonly consumed leafy and seed vegetables in Nigeria (Akwukwaegbu et al., 2016). It originated in Southeast Nigeria and was distributed by Igbos who have been cultivating this crop since time immemorial (Adejuyitan & Otunola 2018). The leaves are of high nutritional, medicinal, and industrial value rich in protein, fat, minerals, and vitamins (Adejuyitan & Otunola (2018). The leaves may be used alone or cooked with okra, dika nuts, or egusi seeds (Obinaju & Asa, 2015). They are therefore good sources of energy that help prevent adverse effects of dietary

deficiencies (Ajayi & Oderinde 2017, Idris, (2011). The seeds on the other hand have high nutritive and calorific values which make them necessary in diets as a good source of proteins, edible oils, and fats (Kuku et al., 2014). This vegetable can be propagated only by seeds, but their availability for planting is a major problem and cannot satisfy the widespread interest in the cultivation of the plant. There is usually a high incidence of failed seed germination which amounts to poor seedling quantities that can subsequently grow to maturity. In addition, to the best of the researcher's knowledge, studies on germination improvement in fluted pumpkins as influenced by different growth media and length

of days after seed extraction from fruits are almost non-existent. Sowing at a proper time and in the right growth media may prevent physiological stress and germination failure that may inhibit early germination and plant vigour (Abiodun & Akindele, 2012). It is important to examine the right time to sow seeds of fluted pumpkin after extraction from fruits for proper development that will promote early growth and seed yield. There is therefore a need to assess the effects of different growth media and length of days after seed extraction from fruit on seedling germination and growth characters of fluted pumpkin.

MATERIALS AND METHOD

Site Description

Study Area

The experiment was conducted in the Screen house at the Teaching and Research Farm of the Department of Agricultural Technology of the Federal Polytechnic, Ado-Ekiti, (7.56 °N – 7.61°N and 5.27 °E - 5.31 °E) between January and March 2018. The ambient temperature fluctuated between 25 °C to 31 °C during the period of the experiment. Temperature ranges in the plant house were from 24.5 °C to 30.1 °C and from 24.7 °C to 32.4 °C for the minimum and maximum temperatures respectively.

Source of planting materials

Mature fruits of fluted pumpkin (*Telfairia occidentalis* Hook F.) were sourced from local farmers within Ekiti. Seeds were manually extracted from the fruits and bulked together for uniformity.

Seed moisture content determination

Five seeds were collected in four replicates from each sample treatment of the study. The seeds were weighed together to determine the initial weight (W_i), after which they were oven-dried at 130°C for two hours. Seeds were removed from the oven after two hours and placed in a desiccator

for 45 minutes. They were then re-weighed to determine the final weight (W_f). The percentage moisture content was calculated as:

$$\text{Moisture content (\%)} = \frac{W_2 - W_1}{W_2 - W_1} \times 100 \quad (1)$$

Planting procedures

The experiment was a 3 x 4 factorial combination of Three (3) growth media namely; Topsoil (TS), Topsoil + Poultry manure (TS + PM), and sawdust ash (SDA), and 4 lengths of days after seed extraction from fruit considered at 0, 3, 6 and 9 days making a total of 12 treatments replicated four times in randomized complete block design (RCBD) to give a total of 48 plastic buckets. Topsoil (TS), Topsoil + Poultry manure (TS + PM) in the ratio 2:1 and Sawdust ash (SDA) were filled into well-labelled 48 perforated plastic buckets of 5-litre capacity. The contents of the plastic buckets were watered sufficiently and allowed to stand for 24 hours to soak the materials and also for the excess water to drain out.

Fluted pumpkin seeds were planted on day 0, day 3, day 6, and day 9 in the different media at the rate of eight seeds per hole. Seeds were considered germinated when the cotyledons appeared above the ground level. Watering was done every other day till the end of the study. The seeds sown were visually observed daily for 30 days to obtain the germination count. The experiment was terminated 40 days after planting.

Treatment combinations are listed as follows:

Fluted pumpkin seeds at day 0 sown in TS. This served as the control.

Fluted pumpkin seeds at day 3 sown in TS

Fluted pumpkin seeds at day 6 sown in TS

Fluted pumpkin seeds at day 9 sown in TS

Fluted pumpkin seeds at day 0 sown in TS + PM

Fluted pumpkin seeds at day 3 sown in TS + PM

Fluted pumpkin seeds at day 6 sown in TS + PM

Fluted pumpkin seeds at day 9 sown in TS + PM
 Fluted pumpkin seeds at day 0 sown in SDA
 Fluted pumpkin seeds at day 3 sown in SDA
 Fluted pumpkin seeds at day 6 sown in SDA
 Fluted pumpkin seeds at day 9 sown in SDA

Data Collection and Analysis

Seed germinability was evaluated using germination percentage and germination speed index.

Seedling vigor was examined using the following parameters: leaf number, vine length, stem girth, and leaf area from five randomly selected plants. All data collected were subjected to analysis of variance (ANOVA) while treatment means were partitioned using Fisher's Least Significant Difference (LSD) at a 5 % level of probability.

RESULTS AND DISCUSSION

Table 1 shows the physico-chemical properties of the soil used for the experiment. The pH of the soil was 6.29. The organic carbon content analyzed was 3.59 g/kg. Nitrogen content was 0.40. The available Phosphorus (P) content in the soil was 40.24 mg/kg, potassium (K) was 0.41cmol/kg, Sodium (Na) was 0.26 cmol/kg, calcium (Ca) was 3.15cmol/kg and Magnesium (Mg) was 1.12 cmol/c. The result showed that the soil was sandy loam in texture with a high proportion of sand (79 %). This implied that basic cations such as Ca, K, Na, and Mg would be made available easily for plant uptakes texture determines the degree of retention or ease of leaching of basic cations (Wapa & Oyetola, 2014). The soil was slightly acidic in pH (6.29) with high organic carbon content. The chemical properties of sawdust ash used are presented in Table 2. The growth medium contained a high SiO₂ content (62.87) which may have enhanced the performance ability of fluted pumpkin sown in it. Silicon has a major impact on improving plant root resistance and enhancing faster growth (Arya et al., 2022). Table 3 showed a moderate

nutrient content in the chemical composition of the poultry manure used for the experiment. Total nitrogen was 7.37%; Available phosphorus, 12.90 mg/kg and Exchangeable K, 8.80 Cmol.kg⁻¹.

Analysis of Variance (ANOVA) showing the effects of different growth media and length of days (after seed extraction from fruit) on germination traits of Fluted pumpkin

Data presented in Table 4 showed that the different growth media (GM) used and the varying length of days after seed extraction from fruits (DAE) significantly influenced seed germination percentage (GPCT) and the speed of germination (GI) of seeds of *Telfairia occidentalis*. Effects of the different growth media and the varying length of days after seed extraction from fruits for germination percentage and germination index were highly significant at 0.01 and 0.05 probability levels. There was also a highly significant interaction between the different growth media and the varying length of days after seed extraction from fruits for the germination traits (GPCT and GI) of fluted pumpkin.

ANOVA showing the effects of different growth media and length of days (after seed extraction from fruit) on growth characters of fluted pumpkin

Planting fluted pumpkin seeds in different growth media and at different lengths of days (after seed extraction from fruit) highly contributed significantly to the number of leaves (AVLNo), vine length (AVVL), stem girth (AVSTGTH), and leaf area (AVLA) of the seedlings (Table 5). There was also a highly significant interaction between the different growth media and the varying length of days after seed extraction from fruits for these growth characteristics (AVLNo, AVVL, AVSTGTH, and AVLA) of *T. occidentalis*.

Mean separation for effect of different growth media on germination traits of *Telfairia occidentalis*

Data presented in Table 6 showed that out of the three growth media used, topsoil gave the highest germination percentage (69.14%) and its performance was not significantly different from that of sawdust ash (65.63%). The better performance observed with topsoil could be attributed to the availability of microorganisms that assisted in making the medium nutrient-rich enough to trigger germination. Although Agboola et al., (2018) revealed that sawdust can be used as an alternative growth medium, there may be a delay in the appearance of growth parameters due to in availability of microorganisms as compared to soil medium.

Notwithstanding, the performance of topsoil or sawdust was significantly better than that of topsoil + poultry manure (24.22%). Topsoil + Poultry manure gave the lowest germination percentage. The poor performance of topsoil + poultry manure could be a result of several factors such as high salinity, excess of ammonium ions, organic compounds, or any fatty acids with low molecular weight the poultry manure might carry as observed by Otal, & Ojezele, (2019). The mineral toxicity from long-term weathering of the poultry may also cause the radicle, which is directly in contact with the topsoil and poultry manure, to get burnt as they emerge.

The speed of germination in topsoil (19.42 days) or sawdust ash (18.08 days) was not significantly different, although, seeds sown in sawdust ash were significantly faster in emerging than those sown in topsoil. This agreed with the work of Adekiya et al., (2021) who noted that materials like sawdust, river sand, rice hull, and their mixture allow seeds to sprout without forming a crust that will deter the seed from early sprouting

(Ayoola et al., 2021). However, the speed of seed germination in both topsoil and sawdust growth media was significantly faster than in topsoil + poultry manure (23.43 days) medium.

Mean separation on effect of length of days after seed extraction from fruits on germination traits of *Telfairia occidentalis*

Seeds planted on day 0 (74.48%) of seed extraction from fruits and those planted on day 3 (72.40%) after seed extraction from fruits competed favorably with each other in terms of germination percentage in data presented in Table 7. Their performances were however better than the performances of seeds planted on day 6 (56.77%) and day 9 (8.33%) after seed extraction from fruits. Leaving seeds from 6 to 9 days gave a 15% drop in germination. The more the length of days after seed extraction, the less the germination. The germination percentage in seeds planted 9 days after extraction from fruits was the poorest. The speed of germination from emerged seedlings raised from seeds planted on the different days after seed extraction from fruits was not statistically different.

Mean separation on effect of different growth media on growth characteristics of *Telfairia occidentalis*

In Table 8, number of leaves (11.14), vine length (17.95cm), stem girth (0.48cm) and leaf area (5.41m³) reduced significantly in topsoil + poultry manure growth medium compared to the number of leaves, vine length, stem girth and leaf area in growth media of Topsoil (34.43, 59.32cm, 1.27cm and 20.69cm³ respectively) or sawdust ash (33.94, 71.30cm 1.28cm and 21.99cm³ respectively). Sawdust ash growth medium however produced a longer vine length than the other growth media in the study area. Results from this work are consistent with the findings of Awodun (2007) who investigated the effect of

sawdust ash on nutrient status, growth, and yield of cowpea (*Vigna unguiculata*) and reported that sawdust ash treatments applied to the soil at 8 t ha⁻¹ significantly increased soil and leaf N, P, K, Ca and Mg contents and number of pods, pod weight, number of branches, number of leaves and grain yield. In addition, the better performance of sawdust could be a result of the fact that it is much lighter in weight and provides high water-holding capacity, good aeration, and stimulates warmth which facilitates plant growth.

Mean Separation on effect of days after seed extraction from fruits on growth characteristics of *Telfairia occidentalis*

Data in Table 9 showed that the number of leaves significantly declined at the 9th day of planting (33.05) compared to 0, 3rd and 6th days. Vine length increased significantly by about 17-20% on the 3rd day. Days 0 and 6 did not differ in terms of vine length. Planting on the 3rd day after seed extraction from fruits was better than planting on day 0.

CONCLUSIONS AND RECOMMENDATIONS

It is evident from the study that sawdust is an effective growth medium for improving germination and seedling establishment of fluted pumpkin. Therefore, for optimum germination and seedling growth of *Telfairia occidentalis*, sawdust is recommended, since it is readily available in sawmills as a waste product with little or no commercial value.

In addition, seeds extracted between 0-3 days from fruits and air-dried give the best seedling germination of *Telfairia occidentalis*. Poultry manure, however, should be completely avoided at the germinating stage of fluted pumpkin. It may however be added after transplanting to the field at mid vegetative stage when plants are better disposed to withstand adverse conditions.

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Table 1: Physical and chemical properties of the soil at the experimental site

Properties	Values
Ph	6.95
Total N (%)	0.38
Available P (mg/kg)	16.1
Exchangeable cations (Cmol.kg ⁻¹)	
Ca ²⁺	5.4
Mg ²⁺	2.5
K ⁺	1.07
Na ²⁺	0.38
Organic Carbon (%)	1.8
Organic matter (%)	0.59
H ⁺	0.2
CEC	2.96
Particle size distribution	
Sand	82.3
Silt	10.5
Clay	7.2
Texture	Sandy loam
Bulk density (g/cm ³)	1.32

Table 2: Chemical properties of sawdust ash used for the experiment

Properties	Values
Alumina (Al ₂ O ₃)	9.85
Silica (SiO ₂)	62.87
Potassium (K ₂ O)	1.71
Calcium (CaO)	10.35
Magnesium Oxide (MgO)	4.18
Iron (Fe ₂ O ₃)	4.45
Sodium (Na ₂ O)	0.035

Table 3: Chemical properties of sawdust ash used for the Experiment

Properties	Values
Alumina (Al ₂ O ₃)	9.85
Silica (SiO ₂)	62.87
Potassium (K ₂ O)	1.71
Calcium (CaO)	10.35
Magnesium Oxide (MgO)	4.18
Iron (Fe ₂ O ₃)	4.45
Sodium (Na ₂ O)	0.035

Table 4: ANOVA on the effect of different growth media and length of days after seed extraction from fruits on germination traits of fluted pumpkin

SV	DF	GPCT (%)	GI (days)
Rep	3	904.41	17.33
GM	2	22775.07**	26.14**
DAE	3	19972.33**	207.87**
GM *			
DAE	6	1521.81**	12.19**
Error		256.1	5.6
Mean		52.99	19.9
CV		30.2	11.89
R ² (%)		85.27	68.53

** Indicates highly significant values at 0.01 level of probability. GM - growth Media. DAE - Days after Extraction of Seeds from Fruits. GPCT – Percentage germination count. GI - Germination index. CV - Coefficient of Variation. R2 = Proportion of Variance in the dependent variable.

Table 5: ANOVA on the effect of different growth media and length of days after seed extraction from fruits on growth characteristics of fluted pumpkin

SV	DF	AVLNo	AVVL (cm)	AVSTGTH (cm)	AVLA (cm ²)
Rep	3	281.73	587.72	0.11	140.64
GM	2	5669.13**	25072.82**	6.76**	2720.48**
DAE	3	4847.94**	17346.99**	7.59**	1915.41**
GM * DAE	6	415.39**	1483.33**	0.59**	200.69**
Error		74.24	373.02	0.10	24.56
Mean		26.50	49.52	1.01	16.02
CV		32.51	39.00	31.19	30.92
R ² (%)		85.78	82.43	85.90	88.70

** Indicates highly significant values at 0.01 level of probability. GM = Growth Media. DAE = Days After Extraction of Seeds from Fruit. AVLNo = Average leaf number. AVVL = Average vine length. AVSTGTH = Average stem girth. AVLA = Average leaf area. CV = Coefficient of Variation. R2 = Proportion of Variance in the dependent variable.

Table 6: Mean separation for effect of different growth media on germination traits of fluted pumpkin

GM	GPCT (%)	GI (days)
1 (Topsoil)	69.14	19.42
2 (Topsoil + Poultry Manure)	24.22	23.43
3 (Sawdust)	65.63	18.08
LSD _{0.05}	7.83	3.33

Each value is a mean of four replicates. GM - Growth media. GPCT- Percentage germination count. GI- Germination index. LSD_{0.05}-Least Significant Difference at 5% level of probability.

Table 7: Mean separation for the effect of days after seed extraction from fruits on germination traits of fluted pumpkin

DAE	GPCT (%)	GI (days)
1 (0 day)	74.48	20.72
2 (3 days)	72.40	19.59
3 (6 days)	56.77	18.64
4 (9 days)	8.33	21.24
LSD _{0.05}	9.04	3.36

Each value is a mean of four replicates. DAE = Days after Extraction of Seeds from Fruits. GPCT = Percentage germination count. GI = Germination index. LSD_{0.05} = Least Significant Difference at 5% level of probability.

Table 8: Mean separation for the effect of different growth media on growth characteristics of fluted pumpkin

GM	AVLNo	AVVL (cm)	AVSTGTH (cm)	AVLA (cm ²)
1 (Topsoil)	34.43	59.32	1.27	20.69
2 (Topsoil + Poultry Manure)	11.14	17.95	0.48	5.41
3 (Sawdust)	33.94	71.30	1.28	21.99
LSD _{0.05}	4.30	9.63	0.16	2.47

Each value is a mean of four replicates. GM = Germination media. AVLNo = Average leaf number. AVVL = Average vine length. AVSTGTH = Average stem girth. AVLA = Average leaf area. LSD_{0.05} = Least Significant Difference at 5% level of probability.

Table 9: Mean separation for effect of days after seed extraction from fruits on growth characteristics of fluted pumpkin

DAE	AVLNo	AVVL (cm)	AVSTGTH (cm)	AVLA (cm ²)
1 (0 day)	33.05	59.30	1.29	21.62
2 (3 days)	35.64	71.67	1.44	21.65
3 (6 days)	32.02	56.71	1.12	18.40
4 (9 days)	5.31	10.40	0.19	2.81
LSD _{0.05}	4.96	11.12	0.18	2.85

Each value is a mean of four replicates. DAE = Days After Extraction of Seeds from Fruits. AVLNo = Average leaf number. AVVL = Average vine length. AVSTGTH = Average stem girth. AVLA = Average leaf area. LSD_{0.05} = Least Significant Difference at 5% level of probability.