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# SEEDLING EMERGENCE AND GROWTH OF SOME ACCESSIONS OF AFRICAN WALNUT(*Plukenetia conophora )* IN DIFFERENENT GROWING MEDIA

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**Abstract**
In this study, nursery experiments were conducted to evaluate the effects of planting media on seedling emergence and seedling growth among some accessions of *Plukenetia conophora* (Mull. Arg.) with the aim of determining the most appropriate method of obtaining optimum and uniform germination of seeds of this species. Seeds of eight accessions of *Plukenetia conophora* were collected from five States in Nigeria and were in three different growing media. Results show that planting media significantly affected seedling emergence and seedling growth of *Plukenetia conophora.* Accession AC4 recorded the highest emergence percentage and quicker seedling growth and was significantly ($P<0.001$) different when compared with the other accessions, while AC8 recorded the least emergence percentage 90.0%). Sawdust recorded the highest effect on emergence and seedling growth and was significantly ($P<0.001$) different from other planting media, while topsoil recorded the least effect on emergence and seedling growth of *P.conophora*. Sawdust produced superior plant growth in terms of plant height, collar girth and leaf number.

**Keywords: Growing media, seedling emergence, accessions, seedling growth**

## Introduction

*Plukenetia conophora* [(African Walnut) (Müll. Arg.) Hutch. and Dalziel)] belong to the family *Euphorbiaceae* (GRIN, 2010) and is a perennial climber found in the moist forest zones of sub-Sahara Africa (Oke, 1995). It is cultivated principally for its nuts that are cooked and consumed as snacks, along with boiled corn (Oke, *ibid*). *Plukenetia conophora* is found in Nigeria and Cameroon (Dalziel, 1937) The plant is known as *ukpa* (Ibo), *asala* (Yoruba) and *Kaso* (Cameroon). Its habitat is usually under large trees. The fruits are greenish with four round seeds in each fruit. The testa of the seed is hard and the cotyledons white in colour. The fruits are edible and the plant is medicinal and used for various purposes. It is a climbing shrub 10-20ft long (Oke, 1995). Propagation is by seeds that remain viable for more than 2-3 years after harvesting. If kept in a cool and dry condition. The seed germinates within 7- 13 days in a good soil and does not need pruning to maintain a straight, unbranched trunk. The vine is found in the moist forest zones of tropical Africa between $4^{0}15'$ and 80N of the equator (Okafor, 1983). This wild fruit is grown in the traditional farming system of the lowland humid regions. It can tolerate any type of soil, provided it is well drained with moderate moisture-retention capabilities. In Nigeria, the conophor plant flowers between November and early January and fruits between February and September (Oluwole and Okusanya, 1993). The nut is harvested between the months of May and August. The plant normally flowers between 1.5 to 2 years after planting. Studies have shown inadequate information on effects of media on germination and early growth of the tree species for development of growth model and other silvicultural requirements (Adewusi and Lapido, 2000; Otegbeye, 2004; Takayama *et al.*, 2005). Egharevba *et al.* (2005) noted that type of nursery media significantly affected seedling growth but had no significant effect on germination of Africa walnut. Agbo and Baiyeri (2011) also showed that nursery media significantly affected the germination of African walnut (*Plukenetia conophora)* and its growth and development. However, there is a growing concern as to what can be done to develop a silvicultural technique for the regeneration of *Plukenetia conophora*. Hence the objective of this study was to determine the effect of different growth media on seedling growth and emergence of *Plukenetia conophora.*

## Materials and Methods

### *Germplasm collection*

Eight accessions of *Plukenetia conophora* was collected across five States in Nigeria within the range of longitude and latitude as shown in Table 1.

**Table 1: Accessions list showing place of Collection, State, longitude and latitude**

| Accessions | Place of collection | State | Longitude | Latitude |
|---|---|---|---|---|
| AC1 | Nsukka | Enugu | 6º52N | 7º24′E |
| AC2 | Kogi | Kogi | 7.5ºN | 6.7ºE |
| AC3 | Ugwuana | Imo | 5º7′N | 5º22′E |
| AC4 | Orlu | Imo | 5º7′N | 7º6′E |
| AC5 | Ngwa | Abia | 5º25′ E | 6º14 N |
| AC6 | Okpala | Imo | 5º3′N | 5º22′E |
| AC7 | Benin | Edo | 6º14′N | 8º0′E |
| AC8 | Umuahia | Abia | 7º32′E | 7º32′E |

***Emergency and seedling growth in different growing media***

Seeds of the eight accessions of *Plukenetia conophora* collected were sown in three different growth media in other to study the effect of media on seedling emergence and seedling growth. The experiment was carried out as a 3 x 8 factorial in a completely randomized design (CRD) with three replications. Factor A was media type, while factor B was the *Plukenetia conophora* accessions. The media used for the study were top soil and poultry manure in the ratio 2:1, Rice husk and poultry manure in the ratio 2:1, Saw dust and poultry manure in the ratio 2:1.

***Data collection***

Data were collected on monthly bases from 1 to 5 months, while the 5month data that is the cumulative was used for the study, on number of leaves, plant height (cm), collar diameter (cm), seedling fresh weight (g) seedling dry weight (g), number of roots and root length (cm), while data on seedling emergency was done on weekly bases.

***Data Analysis***

Data collected were subjected to analysis of variance (ANOVA), using the GenStat Discovery Edition 3 (GenStat, 2007) and mean separation was done using LSD at 5% probability level.

**Results and Discussion**

The analysis of variance in Table 1 showed that the mean squares for accession, media and the accession x media interaction were highly significant for collar diameter, fresh leaf weight and seedling length ($P<0.001$). The mean squares for accession were significant for seedling length, dry leaf weight, fresh stem weight and number of roots ($P<0.001$). Media were significant ($P< 0.01$) for seedling length, dry leaf weight, fresh stem weight and number of roots and accession x media interaction were significant ($P<0.05$) for seedling length, dry leaf weight, fresh stem weight and number of roots.

***Seedling Emergence***

Significant variation was observed among the accessions of *Plukenetia conophora* at the different periods. Emergence percentage of most of the accessions was at the peak at 2WAP and 3WAP, while it reduced drastically at 4WAP. Among the accessions, AC4 in sawdust based medium exhibited high emergence percentage (66.7%) at 2WAP and 3WAP (Table 2). Emergence percentage was highest in sawdust relative to the other media (rice husk and top soil), while AC5, AC6, and AC7 in all the growing media recorded no seedling emergency at 4WAP**.** Generally, saw dust had better emergence percentage than other media at the sampled periods, while top soil had the lowest emergence percentage.

***Collar diameter of Plukenetia conophora accessions as influenced by different growing media***

Analysis of variance in Table 3 showed that media, accessions and the interaction between media and accessions were significant ($P<0.05$). AC2 in sawdust based had highest collar diameter (5.78), while AC7 sown in topsoil based medium had the lowest collar diameter (0.33). Sawdust had highest collar diameter when compared to other growing media.

***Fresh and dry leaf weight (g) of seedlings of Plukenetia conophora as influenced by different growing media***

The Analysis of variance (Table 4) showed that the accession, media and the accession x media interaction were significant for fresh and dry leaf weight.($P<0.05$). AC6 in sawdust based media had the highest fresh leaf weight (65.4g), while AC7 topsoil based medium had the least fresh leaf weight (0.2g). The dry leaf weight followed the same pattern as fresh leaf weight. AC6 had highest dry leaf weight (33.0g), while the least dry weight (0.2g) was observed in AC7 topsoil based medium.

***Fresh and dry stem weight (g) of seedlings of Plukenetia conophora accessions as influenced by different planting media***

The Analysis of variance (Table 5) showed that accession, media and the accession x media interaction were significant for fresh and dry stem weight ($P<0.05$). AC2 and AC3 had significantly higher fresh weight, while the seedling grown in sawdust had significantly higher stem fresh weight. AC6 in sawdust based medium was observed to have higher fresh stem weight (77.6g), while AC7 in topsoil had the lowest (1.7g). The dry stem weight followed the same pattern as stem fresh weight.

***Seedling length of some accessions of Plukenetia conophora as influenced by different planting media***

Analysis of variance (Table 6) showed that media, accessions and the interaction between media and accession were significant ($P<0.05$). AC4 in sawdust based medium had highest seedling length (1012cm),

while AC5 in topsoil based medium had the least seedling length (12cm). Sawdust had highest seedling length when compared to other growing media.

***Number of roots of Plukenetia conophora accessions as influenced by different planting media***

Analysis of variance (Table 7) showed that media, accessions and the interaction between media and accession were significant ($P<0.05$). AC2 in rice husk based medium had highest number of roots/ plant (55.7) among the accessions, while AC5 in topsoil based medium had the least number of roots /plant (1.7 ).

Media sawdust and poultry manure at 2:1 ratio had better plant growth in terms of plant height, collar girth and leaf number. The significantly higher seedling emergence percentage of *Plukenetia conophora* seedling in sawdust could be attributed to greater porosity when compared to the other media; consequent upon the greater space for air and water which are the basic conditions for seedling emergence. The observed poor drainage of moisture in the polyethene bag, which often led to water logging in the polyethene bag must have led to seed decay and seedling growth. The significant difference in the performance of the *Plukenetia conophora* seedlings planted in the sawdust relative to the other media may stem from the fact that water logging that is prevalent in topsoil media and low rate of mineralization of rice husk due to its high carbon, nitrogen ratio, may have negatively impacted seedling growth (Gill *et al*., 1986). Waterlogged soils are known to be poor in soil oxygen due to poor aeration, leading to poor root respiration. Also, poor mineralization of organic material will always lead to poor plant nutrient.

**Conclusion**

Results from the present study showed that sawdust is a good growing media for the cultivation of Plukenetia *conophora* and thus recommended for the farmers to use. Based on its availability and low cost, farmer should adopt it as a low cost technology. The accession AC4 planted on Saw dust recorded the highest effect on emergence and seedling growth on *Plukenetia conophora*.

**Table 2: Analysis of variance table showing mean squares for all the traits**

| Sources of variation | Degrees of freedom | Mean squares | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seedling emergence (%) | Collar diameter | Fresh leaf weight (g) | Dry leaf weight (g) | Fresh stem weight | Dry stem weight | Seedling length | Number of roots |
| Rep | 2 | 538.9 | 1.514 | 132..5 | 32.67 | 228.3 | 60.90 | 58046 | 855.8 |
| Accession | 7 | 1434.1*** | 9.276*** | 1420.7*** | 232.57*** | 1319.7*** | 458.64*** | 300046*** | 1408.2*** |
| Media | 2 | 3372.2** | 9.276*** | 2838.3*** | 1761.19** | 9171.4*** | 2099.99** | 714391*** | 2193.6** |
| AccXMedia | 14 | 648.4* | 45.665*** | 983.5*** | 272.51* | 1081.7** | 237.09* | 153835*** | 406.1* |
| Error | 46 | 283.8 | 10.888 | 206.8 | 272.51 | 393.9 | 98.98 | 44988 | 157.9 |
| Total | 71 | | | | | | | | |

**Table 2: Seedling Emergency percentage of *Plukenetia conophora* accessions as influenced by different growing media**

| Accessions | 2WAP Media | | | | 3WAP Media | | | | 4WAp Media | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sawdust | Rice husk | Topsoil | Mean | Sawdust | Rice husk | Topsoil | Mean | Sawdust | Rice husk | Topsoil | Mean |
| AC1 | 60.0 | 53.3 | 40.0 | **51.1** | 33.3 | 40.0 | 26.7 | **33.3** | 6.7 | 0.0 | 6.7 | **4.4** |
| AC2 | 33.3 | 26.7 | 53.3 | **37.8** | 60.0 | 26.7 | 33.3 | **40.0** | 0.0 | 33.3 | 6.7 | **13.3** |
| AC3 | 26.7 | 20.0 | 40.0 | **28.9** | 33.3 | 33.3 | 26.7 | **31.1** | 20.0 | 13.3 | 13.3 | **15.6** |
| AC4 | 66.7 | 33.3 | 13.3 | **37.8** | 20.0 | 46.7 | 13.3 | **22.2** | 6.7 | 13.3 | 0.0 | **6.7** |
| AC5 | 40.0 | 33.3 | 6.7 | **26.7** | 33.3 | 20.0 | 0.0 | **17.8** | 0.0 | 0.0 | 0.0 | **0.0** |
| AC6 | 53.3 | 13.3 | 6.7 | **24.4** | 26.7 | 6.7 | 0.0 | **11.1** | 0.0 | 0.0 | 0.0 | **0.0** |
| AC7 | 46.7 | 13.3 | 6.7 | **22.2** | 33.3 | 6.7 | 0.0 | **13.3** | 0.0 | 0.0 | 0.0 | **0.0** |
| AC8 | 20.0 | 0.0 | 6.7 | **8.9** | 20.0 | 0.0 | 0.0 | **8.9** | 26.7 | 26.7 | 0.0 | **0.0** |
| **Mean** | **43.3** | **24.2** | **21.7** | | **32.5** | **22.5** | **12.5** | | **7.5** | **10.8** | **3.3** | |
| LSD 0.005 accession | | | | 15.99*** | | | | 17.87* | | | | 15.19* |
| LSD 0.005 media | | | | 9.79** | | | | 10.95* | | | | 9.30ns |
| LSD 0.005 accession x media | | | | 27.69* | | | | 30.97ns | | | | 26.31ns |

***ns = not significant, * = P<0.05, ** = P<0.01, *** = P <0.001***

**Table 3: Collar diameter of some accession of *Plukenetia conophora* as influenced by different growing media**

| Media | Collar diameter | | | |
|---|---|---|---|---|
| **Accessions** | **Sawdust** | **Ricehusk** | **Topsoil** | **Mean** |
| AC1 | 5.40 | 5.27 | 4.23 | **4.17** |
| AC2 | 5.78 | 6.37 | 4.77 | **5.02** |
| AC3 | 5.73 | 4.10 | 4.93 | **4.36** |
| AC4 | 5.50 | 6.73 | 1.49 | **4.69** |
| AC5 | 4.83 | 5.10 | 0.60 | **3.66** |
| AC6 | 5.40 | 1.23 | 0.50 | **2.68** |
| AC7 | 5.77 | 2.33 | 0.33 | **2.68** |
| AC8 | 4.40 | 1.43 | 0.70 | **2.24** |
| Mean | **5.35** | **4.07** | **2.19** | |
| LSD 0.005 accession | 1.27*** | | | |
| LSD 0.005 media | 0.78*** | | | |
| LSD 0.005 accession x media | 2.19*** | | | |

***ns = not significant , * = P<0.05, ** = P<0.01, *** = P <0.001***

**Table 4: Fresh and dry leaf weight (g) of seedlings of *Plukenetia conophora* as influenced by different planting media**

| | Fresh leaf weight (g) | | | | Dry leaf weight(g) | | | |
|---|---|---|---|---|---|---|---|---|
| **Accessions** | **Sawdust** | **Rice husk** | **Topsoil** | **Mean** | **Sawdust** | **Rice husk** | **Topsoil** | **Mean** |
| AC1 | 24.4 | 30.8 | 44.1 | **33.1** | 6.2 | 9.1 | 20.7 | **12.0** |
| AC2 | 43.9 | 51.6 | 63.8 | **53.1** | 27.6 | 30.5 | 18.4 | **25.5** |
| AC3 | 40.0 | 41.6 | 48.1 | **43.2** | 18.2 | 26.8 | 13.6 | **19.5** |
| AC4 | 44.1 | 50.7 | 5.0 | **33.3** | 25.5 | 14.2 | 0.8 | **13.5** |
| AC5 | 46.0 | 20.3 | 2.0 | **22.3** | 21.0 | 9.0 | 0.3 | **10.1** |
| AC6 | 65.4 | 13.7 | 2.4 | **27.2** | 33.0 | 4.2 | 0.8 | **12.7** |
| AC7 | 32.4 | 11.1 | 1.3 | **14.9** | 28.3 | 6.0 | 0.2 | **11.3** |
| AC8 | 51.2 | 12.6 | 6.2 | **23.3** | 29.7 | 4.6 | 2.9 | **12.4** |
| **Mean** | **43.4** | **29.0** | **21.5** | | **23.7** | **13.1** | **7.3** | |
| LSD 0.05 media | | | | 8.36*** | | | | 4.98*** |
| LSD 0.05 accession | | | | 13.64*** | | | | 8.13* |
| LSD0.05 media x accession | | | | 23.63*** | | | | 14.09** |

***ns = not significant , * = P<0.05, ** = P<0.01, *** = P <0.001***

**Table 5: Fresh and dry stem weight (g) of seedlings of *Plukenetia conophora* accessions as influenced by different planting media**

| | Fresh stem weight (g) | | | | Dry stem weight(g) | | | |
|---|---|---|---|---|---|---|---|---|
| **Accessions** | **Sawdust** | **Rice husk** | **Topsoil** | **Mean** | **Sawdust** | **Rice husk** | **Topsoil** | **Mean** |
| AC1 | 30.0 | 41.2 | 42.9 | **38.0** | 15.8 | 15.5 | 21.1 | **17.5** |
| AC2 | 59.5 | 62.3 | 51.3 | **57.7** | 28.7 | 39.6 | 25.2 | **31.2** |
| AC3 | 55.4 | 50.8 | 47.7 | **51.3** | 28.4 | 26.4 | 24.2 | **26.3** |
| AC4 | 66.8 | 56.5 | 4.3 | **42.5** | 30.1 | 17.3 | 1.4 | **16.3** |
| AC5 | 61.7 | 20.8 | 2.6 | **28.4** | 28.0 | 9.2 | 1.2 | **12.8** |
| AC6 | 77.6 | 14.8 | 2.2 | **31.5** | 34.9 | 7.3 | 1.0 | **14.4** |
| AC7 | 49.9 | 20.8 | 1.7 | **24.1** | 27.0 | 7.8 | 0.7 | **11.9** |
| AC8 | 67.6 | 7.9 | 6.2 | **27.2** | 31.5 | 2.6 | 2.8 | **12.3** |
| **Mean** | **58.6** | **34.4** | **19.9** | | **28.1** | **15.7** | **9.7** | |
| LSD 0.05 media | 11.5*** | | | | 5.78*** | | | |
| LSD 0.05 accession | 18.83*** | | | | 9.44*** | | | |
| LSD0.05 media x accession | 32.62*** | | | | 16.35* | | | |

***ns = not significant , * = P<0.05, ** = P<0.01, *** = P <0.001***

**Table 6: Seedling length of some accessions of *Plukenetia conophora* as influenced by different planting media**

| **Accessions** | **Sawdust** | **Rice husk** | **Topsoil** | **Mean** |
|---|---|---|---|---|
| AC1 | 337 | 534 | 576 | **482** |
| AC2 | 524 | 754 | 654 | **664** |
| AC3 | 571 | 756 | 666 | **696** |
| AC4 | 1012 | 792 | 285 | **696** |
| AC5 | 667 | 556 | 12 | **411** |
| AC6 | 742 | 262 | 16 | **340** |
| AC7 | 712 | 246 | 49 | **336** |
| AC8 | 428 | 141 | 16 | **195** |
| **Mean** | **624** | **505** | **284** | |
| LSD 0.05 media | 123.2*** | | | |
| LSD 0.05 accession | 201.3*** | | | |
| LSD0.05 media x accession | 348.6*** | | | |

***ns = not significant, * = P<0.05, ** = P<0.01, *** = P <0.0001***

**Table 7: Number of roots of *Plukenetia conophora* seedling as influenced by different planting media**

| Accessions | Sawdust | Rice husk | Topsoil | Mean |
|---|---|---|---|---|
| AC1 | 36.7 | 39.3 | 40.0 | **38.7** |
| AC2 | 43.3 | 55.7 | 39.3 | **46.1** |
| AC3 | 41.0 | 35.0 | 39.3 | **39.2** |
| AC4 | 27.0 | 40.0 | 41.7 | **23.9** |
| AC5 | 49.0 | 23.0 | 1.7 | **24.7** |
| AC6 | 43.9 | 16.7 | 5.0 | **20.8** |
| AC7 | 37.3 | 20.0 | 4.7 | **20.8** |
| AC8 | 13.0 | 6.7 | 17.0 | **8.1** |
| **Mean** | **36.3** | **29.5** | **29.2** | |
| LSD 0.05 media | 7.30*** | | | |
| LSD 0.05 accession | 11.93*** | | | |
| LSD0.05 media x accession | 20.66* | | | |

***ns = not significant, * = P<0.05, ** = P<0.01 , *** = P <0.001***

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