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SEEDLING EMERGENCE AND GROWTH OF SOME ACCESSIONS OF AFRICAN WALNUT(*Plukenetia conophora)* IN DIFFERENT 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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