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Full Length Research Paper

The Influence of seed treatments and growing media on seedling growth and development of African walnut, *Plukenetia conophorum*

Rachael K. Egharevba[1*], Matilda I. Ikhatua[2] and C. Kalu[2]

[1] Department of Crop Science, Faculty of Agriculture, University of Benin, Benin- City, Nigeria.
[2]Department of Forestry and Wildlife, Faculty of Agriculture, University of Benin. Benin-City, Nigeria.

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A nursery trial was conducted to investigate the effects of seed treatments and soil type growing media on the germination and growth of *Plukenetia conophorum*. The factors considered included seed treatments with hot water at 90°C, warm water at 60°C, overnight soaking in cold water and scarification. Soil type media were humus+manure and topsoil+manure at a 2:1 ratio. The results showed that the types of nursery media used were significant only on seedling growth but not on germination. However, the seed treatments have significant effects on germination and growth of the crop. Topsoil produced superior plant growth in terms of plant height, collar girth and leaf number. Scarification and overnight soaking in cold water produced best quality seedlings.

Key words: *Plukenetia conophorum*, seed treatment, growing media, top soil, humus, under-exploited fruit.

INTRODUCTION

Plukenetia conophorum has been described as a semi-wild plant found naturally in the wild and may be extensively encountered in rural dwellings and in farmlands where they are protected (Okigbo, 1977). Oduwaiye (1991) also confirmed that it is commonly found in the rainforest region of Nigeria where the edible seeds are extensively eaten throughout the southern states of the country. These are available in June-September when other fruits are scarce, and people cherished eating the succulent seeds.

As documented by Irvine (1990) the plant which is a perennial is also a climber requiring support of woody sticks to climb, grow and survive. The plant start flowering between 1.5 to 2 years after planting. The importance of *Plukenetia* as an indigenous fruit climber is enormous as it is a multi-purpose crop. In West Africa, especially in Nigeria and Sierra-leone, the fruits provide income to the rural people thereby improving their economy. As investigated by Okafor (1991) and Udeala et al. (1984), the fruits yield 47.72% crude protein and 50% fats and oils (conophor oil) which are of domestic and industrial importance for soap making, vanish and paints. Investigations by Okafor and Okorie (1990) revealed that the the macerated leaves and roots are used for medicinal preparations for asthma and hypertension traditionally. The plants also provide a microclimate within the forest as its branches spread on the canopy level of forest trees.

The existence of this useful under-exploited, forest fruit plant has been threatened by large scale deforestation. As a wild indigenous species, increase in production and availability will be only possible when suitable production practices for future exploitation of its potentials are obtained through domestication. *Plukenetia* show some degrees of dormancy, which makes it difficult to achieve adequate germination, necessitating the need for use of seed treatments. Several methods of seed treatments have been advocated for hastening germination and breaking seed dormancy. In this report, we used mechanical scarification, soaking seeds in cold or hot

*Corresponding author. E-mail: ranoiteg@yahoo.com.

Table 1. Effect of different seed treatment and growing media on seed germination of *P. conophora*.

WAP	Humus					Topsoil				
	SC	OS	HW	CO	WW	SC	OS	HW	CO	WW
3	0	2	0	0	0	0	0	0	0	0
4	2	10	4	0	2	0	6	3	0	2
5	6	4	4	0	4	2	6	6	2	2
6	4	0	3	2	4	6	6	4	4	4
7	2	3	4	1	2	5	4	4	1	3
8	1	2	3	1	1	4	2	2	1	2
9	1	1	2	0	1	2	1	1	0	1

WAP, weeks after planting; WW, warm water; SC, scarification; OS, overnight soaking; HW, hot water; and CO, control.

water as well as soil type to study the germination and growth of *P. conophorum*.

MATERIALS AND METHODS

Seed source

Mature seeds of *P. conophora* were procured from Ore and Otuo Constain forest reserve area of Ondo State, situated on Latitude 6.45°N, and 4.53°E North of the equator.
It was a field trial conducted at the University of Benin, Faculty of agriculture research and teaching farm, Benin City, Edo State, Nigeria. The climatic condition is that of tropical lowland rainforest vegetation and the pattern of rainfall is bimodal with long and sometimes short period of uncertain rainfall and an annual mean of about 2300 mm. The mean temperature is about 25.1°C.

Experimental design

The trial was therefore a 2 x 5 factoral design fitted into a randomized complete block design. Soil was air dried and thoroughly sieved through a 10 mm screen to remove stones and debris. Then 300 medium sized polythene pots of 14 cm diameter and 1.6 litre were filled with 1.2 kg of soil and left under gmelina trees in the shade to settle. Two growing media of 2:1 of topsoil/farm yard manure and humus/farm yard manure were used.

Sixty seeds (for each treatment) were placed in 500 ml beakers containing enough solution to immerse the seeds and these were. The treatments consists of hot water (HW) at 90°C for 5 min, warm water (WW) 60°C for 5 min, overnight soaking (OS) in cold water for 24 h, scarification (SC) by use of wooden mallet to crack outer seed coat and later soaked in cold water and the untreated control seeds (CO). Each growing medium was allocated to 15 polythene pots and replicated three times.

The seeds were then planted in the assigned growing media and maintained for 6 weeks after which growth parameters of plant height, number of leaves, and plant girth were recorded weekly for 11 weeks, since *Plukenetia* is a fast growing woody vine. Cultural operations carried out included erection of an overhead shade, watering every 2 days and weeding. The data obtained were analyzed statistically according to the method described by Akindele (1996) and significant differences among means were evaluated using Duncan multiple range test (Wahua, 1985).

RESULTS AND DISCUSSION

Seed germination

In both soil media, scarified seeds germinated first at 3 weeks after planting (WAP; Table 1). However, statistical analysis indicates no significant difference between the soil types. The early germination of scarified seeds over other treatments is probably due to water and gases entering the embryo early through the cracks and causing a series of enzymatic breakdown resulted in the transformation of the embryo into a seedling early enough than other seed treatments (Odunfa 1989). The overnight soaking in cold water ranked second .Overnight soaking allowed the seeds to imbibe water easily as a result of which the seed coats were softened thus allowing enzymatic activities to take place resulting in early seed germination.

The warm water treatment was third in the germination trial which is an indication that *P. conophorum* will germinate better at a temperate of about 60°C. The seeds treated with hot water at 90°C produced the lowest number of seedlings after 6 weeks of observation (Table 1). In alligator pepper, increase in temperature also inhibits embryo growth (Mugasha and Msanga, 1987). The seeds in the control treatment had about the same results as in warm water treatment. It is an indication that without any seed treatment that seeds of *P. conophrum* will germinate but at a much later period after planting.

Seedling growth

The plant height, collar girth, leaf number and dry matter content of the seedlings were measured (Table 2). It was also observed that seedlings in humus soil grew taller at the beginning than those in top soil, but this trend was reversed later. The overnight soaking in cold water (OS)

Table 2. Average plant height (cm) of *P. conophorum* of pretreated seeds in topsoil and humus.

WAP	Humus					Topsoil				
	SC	OS	HW	CO	WW	SC	OS	HW	CO	WW
6	8.95	15.76	10.5	06	6.4	9.0	11.0	10.9	4.5	8.1
7	13.16	25.45	13.0	10.0	12.5	16.0	13.0	15.5	8.5	13.0
8	17.00	30.00	27.0	13.5	13.2	21.2	25.4	23.0	11.0	25.4
9	22.00	26.00	36.0	16.0	16.4	35.0	31.6	36.25	16.4	31.6
10	24.14	23.00	30.4	17.0	19.8	31.4	43.2	50.5	32.0	28.0

WAP, weeks after planting; WW, warm water; SC, scarification; OS, overnight soaking; HW, hot water; and CO, control.

Table 3. Average collar girth (cm) of *P. conophorum* pretreated seeds in topsoil and humus growing media.

WAP	Humus					Topsoil				
	WW	SC	OS	HW	CO	WW	SC	OS	HW	CO
6	1.10	1.30	1.20	0.5	1.09	1.0	1.05	0.98	0.90	0.84
7	1.13	1.34	1.31	0.9	1.30	1.19	1.20	1.18	1.24	1.18
8	1.22	1.36	1.36	1.05	1.34	1.36	1.38	1.39	1.30	1.26
9	1.30	1.40	1.38	1.05	1.35	1.44	1.45	1.48	1.42	1,30
10	1.40	1.48	1.42	1.28	1.37	1.51	1.48	1.67	1.46	1.42

A total of 10 plants /replicate were tested in this case.
WAP, weeks after planting; WW, warm water; SC, scarification; OS, overnight soaking; HW, hot water; and CO, control.

Table 4. Number of leaves of *P. conophorum* pretreated seeds in topsoil and humus growing media.

WAP	Humus					Topsoil				
	WW	SC	OS	HW	CO	WW	SC	OS	HW	CO
6	4	5	5	2	3	4	5	5	3	3
7	6	8	8	4	4	8	9	8	5	4
8	9	13	12	9	6	11	15	13	8	6
9	12	15	14	10	9	14	18	15	10	9
10	14	19	18	12	9	16	22	19	12	14

WAP, weeks after planting; WW, warm water; SC, scarification; OS, overnight soaking; HW, hot water; and CO, control.

Table 5. Number of leaves of seedling of *Plukenetia conophora* in two growing media during the test period.

Soil type	Treatment				
	1	2	3	4	5
Humus	46.69	60.03*	40.02*	33,35	6.67
Top soil	33.37	53.36	34,16	31.62	20.01

*Significant at P = 0.05% level of probability.
1, Warm water; 2, scarification; 3, overnight soaking; 4, hot water treatment; and 5, control.

and scarification (SC) produced the tallest plants within 8 weeks to 10 weeks after planting in both growth media. Hot water treated seeds had lowest seedling height in both soil media. By the 9 – 10th week of the investigation, it was clearly observed that the top soil medium performed better than the hums soil.

Collar girth or diameter was measured from the 6th to 10th week after planting (Table 3). The OS, SC and WW treated seeds produced the largest collar girth seedlings throughout the sampling periods. This is as a reflection of the increase in plant height of the pre-germinated growing seedlings. There was no significant difference

on the effect of soil type on the collar girth/diameter within 6-10th weeks after planting.

P. conophorum usually produces large number of leaves and so provides a good microclimate. Leaf number was more in overnight soaking and scarified treated seeds than in other treatments in both growing media (Table 4). However, the topsoil/manure growing media produced more leaf number than those of humus/manure media (Table 5).

Conclusion

From the results of this investigation, one can easily suggest to *P. conophorum* growers that amended topsoil is a good medium for growth. Nurserymen usually, and conservatively too, soak their seeds overnight before planting as a means of removing any seed inhibitor. The overnight soaking or scarification (mere opening of one end of the seed) is effective in *P. conophorum* germination.

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