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EFFECT OF EXTRACTION METHOD, SOIL MEDIA ON GERMINATION AND SEEDLING ESTABLISHMENT OF CHRYSOPHYLLUM ALBIDUM

Peace Nnadi[1] and D.I. Anyanwu[2]

[1]Department of Forestry, Rivers State University of Science & Technology, Port Harcourt, Nigeria
[2]Department of Plant Science & Biotechnology, University of Port Harcourt, Nigeria

ABSTRACT: *This research was aimed at using seed extraction methods, soil media and planting density to enhance seed germination and seedling growth of Chrysophyllum albidum commonly known as star apple. The experiment was conducted in two stages, mature, healthy ripe fruits were used and the seeds were extracted from the fruits. The experiment involves the extraction of uniform number of seeds of pulpled and depulped, planted into the various soil media. Result on planting density also showed that Depulped seeds/ seedlings at (p=0.05), recorded significant increase in germination percentage and seedling growth. The finding shows that when seeds are depulped, they enhance germination percentage and addition of poultry manure to the soil media encourages plant growth.*

KEYWORDS: Extraction Method, Soil Media, Germination, Seedling Establishment, Chrysophyllum Albidum

INTRODUCTION

Recent trends in West and Central Africa including Nigeria and Cameroon are showing greater attention on indigenous wild fruit trees. Early exotic fruit trees such as *Citrus spp, Cocos nucifera, Persea americana, Anacardium occidentale* etc have been widely studied and their plantations have been established. A major characteristic of the Nigerian compound farming system (home garden) is the use of selected indigenous multi-purpose tree species with different socio-economic values (Ekeke *et al.*, 1992), and the controversy about how fast we are losing these species is debated about our future, we have accelerated the rate of extinction of this indigenous species such as *Chrysophyllum albidum* far beyond the natural rate.

The most striking contribution of edible indigenous woody plants to the rural economy of the forest zone is the income they generate directly or indirectly (Okafor and Okoli, 1974). However, forest management cannot be solely concerned with timber production (Wicken,1994), inculcation of the indigenous species through Nigerian educational system will enhance the addition of *Chrysophyllum albidum* species into agro- forestry system, production and utilization.

Indigenous wild fruit trees species however are still volunteers on the farmer fields. . A survey shows that these indigenous wild fruits species have enormous nutritional, medicinal and socio-economic potentials (Kang, 1992). It is therefore pertinent that substantial research efforts are needed to exploit *Chrysophyllum albidum*. One of the indigenous wild fruit tree with enormous potential for plantation establishment is the African star apple.

Star apple which is locally known as udara among the Ibos and botanically called *Chrysophyllum albidum* (Linn) and commonly known as African star apple belongs to the

family Sapotaceae as described by (Keay,1964;Gbile, 1997) It is primarily a forest tree species and its natural occurrences have been reported in Nigeria, Uganda, Niger Republic, Cameroon and Cote D'Ivoire (Bada, 1997). The plant often grows to a height of 36.5m though it may be smaller and the stems are often branched and buttress at the base. It flowers in April – June and fruits ripe in January to February.

A mature star apple tree produces more than 10000 mature fruits in a fruiting season yet natural regeneration in forest from where they are found is very low leading to low density. The African star apple fruit is a large berry containing 4 to 5 seeds or sometimes fewer due to seed abortion (Keay, 1989). The plant has in recent time becomes a crop of commercial value in Nigeria. The fleshly pulp of the fruit is eaten especially as snack by young and old Adisa (2000).

The African star apple fruit has been found to have the highest content of ascorbic acid with 1000 to 3,330mg of ascorbic acid per 100gm of edible fruit or about 100 times that of oranges and 10 times that of guava or cashew (Asenjo, 1946). It is reported as an excellent source of vitamins, iron, flavours to diets, containing 8.75% protein, 17.1% fatty acid content, 29.6% carbohydrate and 42.1 moisture content; used as raw materials in some manufacturing industries . It is also used in jams and jellies production and the fruits also contain anacardic acid which is used industrially in protecting wood and also has beneficial effects on soil fertility through efficient nutrient recycling through its leaf litters (Okafor and Fernandes, 1987, Umelo, 1997) .It also protects the soil against erosion by serving as wind breaks, intercepting rainfall and reducing rainfall and rain splash. And that in Anambra and Imo State, the tree forms the focal point for a fertility rite in which young girls, childless wives celebrate a festivity- eating, singing and dancing for the sole purpose of praying to the god of birth. (Okolo, 1974).

In some parts of West Africa sub- region, it has been reported that this tree is held as a sacred tree of fertility and its fruits are of particular interest to pregnant women (Dalziel 1937). By way of utilization as food or refreshment, star apple fruit maybe considered nest to bush mango, African pears on which studies have been carried out on their market trends and their potentialities (Agbor,1994 and Ladipo et. al, 1994).though their post –harvest loss in fruit production has been reported (FAO, 1977).

The leaves in combination with natural honey are used in the treatment of dry coughs (Adewusi, 1997; Bada, 1997). When the same preparation is used as body massage, it activates the nerves for better sexual performance and becomes very useful in the treatment of frigidity in women and depressed libido in men.

Within the hard seed coat are the whitish cotyledons which are useful in the preparation of medicines for the treatment of loss or absence of menstrual cycle. Infertility due to presence of abdominalities within uterus and female tubes, abnormal pains in dysmenorrheal and infertility due to Oligopermia in males (Adewusi, 1997).

In some African countries, the sticky latex is used as birdline for catching birds, the seeds being sources of oil for soap making (Bada, 1997). The wood brownish white and soft is also used for household articles and tool handles. The seeds are arranged on strings and used in making jewelry as ankles in dancing.

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Statement of Problem

Till date not much work has been done in the domestication of this important economic tree. Chrysophyllum albidum could enhance the economic status of the resource poor farmers but Since they grow in the wild or semi-wild condition, they are going into extinction due to deforestation activities thus the need to enhance germination and seedling establishment of this economic tree.

This will improve production and utilization and also to increase the volume of seedlings which could be sold to the public.

Objectives

1. To compare the effect of pulping and depulping on the germination of *Chrysophyllum albidum*.
2. To determine the effect of different soil media on the seedling growth of *Chrysophyllum albidum*.

MATERIALS AND METHOD

Location

The experimental site was in the Screen House located in Rivers State University of Science and Technology, Port Harcourt.

Seed Collection

Healthy matured ripe fruits were bought from the market, and some were depulped and the seed extracted by removing the pulp around the seeds and some were not depulped, they were planted with the fleshly pulp around the seeds.

Soil Media

The different soil media used are:

Top soil + River Sand + Poultry Manure

Top soil + River sand + N_{15}. P_{15}. K_{15}

Top soil + River sand

Top soil alone

Top soil + N_{15}.P_{15}. K_{15}

Top soil + Poultry Manure

River Sand + Poultry manure

River sand + N_{15}. P_{15}. K_{15}

Experimental Soil

The Top Soil (0-5cm) used in this study was collected from an Agricultural land lying fallow(with no History of Pollution) in Rivers State university of Science and Technology , Nkpolu, Port Harcourt using a stainless steel hand auger in a randomized sampling quadrat design.

Top Soil (loamy soil) were collected and thoroughly mixed with the other soil media, it was then filled into a poly- bag well perforated at the base and side to ensure good drainage and better aeration of the soil.

Methods

Viability Test.

Water Floatation method: The viability test was done by a method known as water floatation method, whereby the seeds are soaked in a bucket filled with water, those that descend to the bottom of the bucket are termed viable while those that float to the surface of the water are not viable.

1. Ten seeds of the pulped and depulped were planted at the depth of 4cm differently in each of the soil media containing 1kg and 0.0308g of Poultry manure and NPK Respectively of the soil media mentioned above, which was replicated ten times in a poly-bag well perforated and was watered daily and germination count taken after five days.

Measurement Parameters

Germination percentage = $\frac{\text{Number of germinated seeds}}{\text{Total number of seeds planted}} \times 100$

Number of Germinated seeds = Number of germinated seeds planted per Replications.

Total Number of seeds Planted = Total number of seeds that germinated per each treatment.

Root Length: A meter rule was used to measure the root starting from the base of the stem to the end of the root system every two weeks.

Plant Height (cm)

A meter rule was used to measure the height starting from the plant base (soil surface) to the terminal bud of the plant every two weeks for six months.

Leaf Area

The method used was tracing method whereby the leaf was laid on a graphical paper and the leaf outlines was traced and this was done every two weeks (Cristofori et al. 2008)

Total Biomas:

This was done by oven drying the plants at constant temperature of 60^{o}C-80^{o}C until a constant weight is obtained.

Experimental Design

The experimental design is completely randomized design.

A C D A

D E B E

B C D C

D A D C

B C E A

Statistical Analysis

Data was analyzed using analysis of variance and mean separation with standard deviation (Wahua,1999).

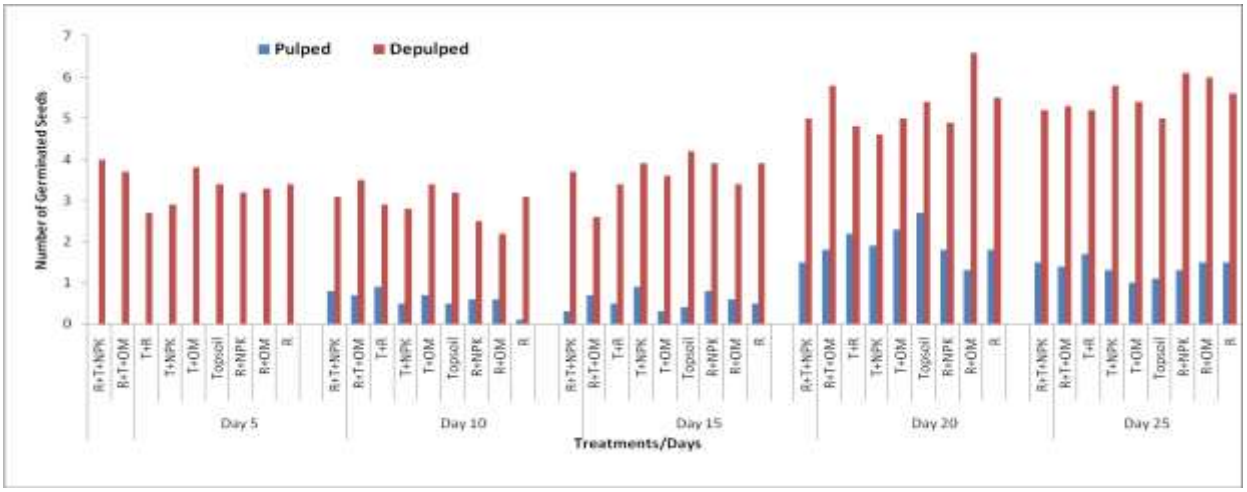
RESULTS AND DISCUSSION

Germination percentage

The result on the germination of *Chrysophyllum albidum* showed that depulped seeds were significantly different at P= 0.05 from pulped seeds by having the highest germination percentage on the first day of germination being 5th Day after planting while pulped seeds had zero germination on the 5th day.

It was also observed that on the 10th and 15th day after planting, depulped seeds still had the highest germination percentage than Pulped seeds .

Finally, on the 25th day after planting, depulped seeds had the highest germination percentage of 53% while pulped seeds had the lowest germination percentage of 14% as shown on the figure 4.1 below.



Effects of Seed Extraction Methods on Percentage germination of pulped and depulped seeds

Root Length(cm)

Depulped seedlings performed better than pulped seedlings by having a higher root length of 26.0cm while pulped seedlings had 10.0cm in River sand+ Top soil + Poultry Manure and the least was in River sand + N.P.K, depulped seedlings had 16.9cm while pulped had 11.8cm as shown on the table.

Effects of Seed Extraction Methods, Soil Media on the seedling Root Length of *Chrysophyllum albidum*.

Root Length. Mean + Standard Deviation

Week	Treatment	Pulped	Depulped
6	R + T + OM	5.98 ± 0.25	8.95 ± 0.23
	R + T + NPK	3.91±0.22	5.94±0.23
	T + OM	4.99±1.82	7.88±0.32
	T + R	1.98±0.23	4.90±0.23
	Top Soil	1.18 ± 0.14	3.99 ± 0.15
	R + OM	1.16 ± 0.15	3.97± 0.23
	R + NPK	1.23 ± 0.14	2.98 ± 0.19
12	R + T + OM	10.6 ± 0.50	15.9 ± 0.30
	R + T + NPK	9.0 ± 0.30	13.9 ± 0.26
	T + OM	6.94± 4.80	14.8 ± 0.23
	T + NPK	7.93 ± 0.24	12.9 ± 0.25
	T + R	6.95 ± 0.23	11.8 ±0.25
	Top Soil	6.01 ± 0.24	10.9 ± 0.30
	R + OM	5.9 ± 0.20	10.9± 0.25
	R+NPK	5.0 ± 0.18	9.9 ± 0.28
18	R + T + OM	15.1 ±0.21	18.0 ± 6.31
	R + T + NPK	12.9 ± 0.25	16.1 ±5.68
	T + OM	13.9± 0.27	17.3 ± 5.94
	T + NPK	11.9 ±035	15.3 ± 5.33
	T + R	10.9 ± 0.31	14.3 ± 5.03
	Top Soil	8.95 ± 0.25	13.3 ± 4.68
	R + OM	8.98 ± 0.29	13.2 ± 4.65
	R+NPK	7.76 ± 0.26	11.7 ± 4.12
24	R + T + OM	20.8 ± 0.28	26.0 ± 0.73
	R+T+ NPK	17.9 ± 0.24	22.9 ± 0.39
	T + OM	18.8± 0.28	25.7 ± 0.43
	T + NPK	16.9 ± 0.22	21.9 ±0.21
	T + R	15.9 ± 0.15	20.0±0.70
	Top Soil	13.9 ± 0.29	18.9 ± 0.29
	R + OM	13.9 ± 0.26	17.0±035
	R+NPK	11.8 ± 0.24	16.9 ±0.21

Plant Height (Cm)

The results on plant height showed that soil media had significant effect on the heights of the plants, it was observed that River sand+ Top soil + Poultry Manure had a higher plant height

of 27.8cm while pulped seedlings had 21.2cm. and the least was on River sand +NPK which had 19.1cm for depulped seedlings and 14.9cm for pulped seedlings as shown on the table

Effects of Seed Extraction Methods, Soil Media on seedling Plant Height of *Chrysophyllum albidum*.

Plant Height. Mean + Standard Deviation

Week	Treatment	Pulped	Depulped
6	R + T + OM	7.0 ± 0.26	10.0 ± 0.30
	R + T + NPK	4.9 ± 0.24	8.0 ± 0.25
	T + OM	5.4 ± 1.92	9.0 ± 0.26
	T+ NPK	4.0 ± 0.18	6.9 ± 0.25
	T+ R	3.0 ± 0.19	6.1 ± 0.20
	R + OM	2.0 ± 0.21	5.0 ± 0.18
	R+ NPK	1.63 +0.30	4.0 ± 0.25
	Top Soil	1.98 ± 0.21	4.98 ± 0.18
12	R+T÷ OM	10.8 ± 3.28	15.8 ± 0.22
	R+T+NPK	9.9 ± 0.32	12.5 ± 4.38
	T+OM	10.9 ± 0.26	14.8 ± 0.3 1
	T+NPK	8.9 ± 0.29	12.9 ± 0.26
	T+R	7.9 ± 0.28	12.0 ± 0.22
	Top Soil	6.9 ± 0.20	10.0 ± 0.30
	R + OM	6.9 ± 0.27	10.0 ± 0.3 1
	R+ NPK	6.1 ± 0.20	9.0 ± 0.26
18	R+T+ OM	16.9± 0.22	19.7 ± 6.91
	R + T + NPK	15.0 ± 0.21	17.9 ± 6.30
	T+ OM	15.9± 0.24	18.7 ± 6.58
	T+NPK	14.0± 0.25	17.1 ± 6.01
	T+R	12.9+ 0.29	15.3 ± 5.38
	Top Soil	11.0± 0.28	14.2 ± 5.00
	R + OM	11.0 ± 0.25	14.2 ± 4.99
	R+ NPK	8.9 ± 0.27	12.6 ± 4.43
24	R+T+ OM	21.2 + 0.76	27.8 ± 0.28
	R+T+ NPK	19.9 ± 0.33	25.9 ± 0.23
	T+ OM	20.9 ± 0.21	26.8 ± 0.24
	T+NPK	19.0 ± 030	24.9 + 0.23
	T+R	17.9 ± 0.26	22.8 ± 0.26
	Top Soil	15.9 ± 0.26	20.9 ± 0.22
	R + OM	15.9 ± 0.26	20.8 + 0.29
	R+ NPK	14.9 ± 0.26	19.1 ± 0.71

Leaf Area (Cm^2)

Extraction methods and soil media had significant effect on total mean leaf area as depulped seedlings had a higher leaf area of 29.8cm^2 in River Sand + Top Soil + Poultry Manure while

pulped seedlings had 23.9cm^2 and the least was in River Sand + NPK which had 20.8cm^2 in depulped seedling 15.9cm^2 in pulped seedling as shown on the table.

Effects Seed Extraction Methods and Soil Media on the Seedling Leaf Area of *Chrysophyllum albidum*.

Leaf Area. Mean + Standard Deviation

Week	Treatment	Pulped	Depulped
6	R+T+OM	8.42 ± 1.05	12.0 ± 0.25
	R+T+NPK	6.2 ± 2.17	10.0 ± 0.26
	T+ OM	7.0 ± 2.48	10.9 ± 2.27
	T + NPK	5.0 ± 0.25	8.9 ± 0.32
	T + R	5.0 ± 0.3 1	7.9 ± 0.20
	Top Soil	4.0+ 031	5.9 ± 0.25
	R + OM	4.0 ± 0.2 1	5.9 ± 0.26
	R + NPK	3.1 ± 0.15	5.0 ± 0.25
12	R+ T+ OM	14.0 ± 0.28	17.8 ± 0.30
	R+T+NPK	11.9 ± 0.27	14.2 ± 5.00
	T+ OM	12.9 ± 0.27	16.9 ± 0.23
	T+ NPK	10.9 ± 0.23	15.0 ± 0.23
	T+ R	9.9 ± 0.29	14.9 ± 4.11
	Top Soil	8.9 ±0.28	11.8 ± 0.26
	R + OM	8.9 ± 0.31	11.9± 0.31
	R+ NPK	8.0 ± 0.18	9.7 ± 0.25
18	R+T+ OM	18.8 ± 0.28	23.8 ± 0.22
	R+T+NPK	16.9 ± 0.27	2.4 ± 7.33
	T+ OM	178 ± 0.29	22.9 ± 0.38
	T+ NPK	15.8 ± 0.22	20.9 ± 0.28
	T+R	15.0 ± 0.29	19.9 ± 0.28
	Top Soil	12.9 ± 0.25	18.8 ± 0.40
	R + OM	12.4 ± 1.36	18.7 ± 0.37
	R+ NPK	10.9 ± 0.34	16.9 ± 0.21
24	R+T+ OM	23.9 ± 0.26	29.8 ± 027
	R+T+NPK	21.7 ± 052	27.7± 0.58
	T+ OM	22.8 ± 0.24	28.8 ± 0.74
	T+ NPK	20.9 ± 0.31	25.8 ± 0.51
	T+R	19.9 ± 0.31	23.8 ± 0.49
	Top Soil	17.9 ± 0.26	21.8 ± 0.35
	R + OM	17.8 ± 0.27	21.8 ± 0.53
	R+ NPK	15.9 ± 026	20.8 ± 0.66

Biomass(g)

The result on different treatment on depulped and pulped seedlings of *Chrysophyllum* albidum showed that treatment had effect on total biomass, depulped seedlings were significantly different from pulped seedlings by having a higher total biomass of 29.8g while pulped seedlings recorded 26.7g in River sand+ Top soil +Poultry Manure, the least was recorded in

River Sand +N.P.K which had 20.8g in depulped seedlings and 18.8g in pulped seedlings as shown on the table.

Effects of Seed Extraction Methods, Soil Media on the seedling Biomass of *Chrysophyllum albidum*. Biomass Mean + Standard Deviation

Week	Treatment	Pulped	Depulped
6	R+T+OM	8.8 ± 0.25	11.6 ± 0.50
	R+T+NPK	6.2 ± 2.20	9,9 ± 0.26
	T + OM	7.2 ± 2.53	10.9 ± 0.25
	T+NPK	5.2 ± 2.53	9.0 ± 0.29
	T+R	4.38 ± 1.56	7.0 ± 0.23
	Top Soil	3.5 ± 1.23	8.0 ± 030
	R+ OM	3.5 ± 1.25	4.7 ± 0.39
	R+ NPK	2.6 ± 0.91	4.0 ± 0.42
12	R+T+OM	14.8 + 0.26	168 ± 326
	R+T+NPK	12.8 ± 0.28	15.9 ± 0.23
	T + OM	14.0 ± 0.24	16.9 ± 0.25
	T+NPK	12.4 + 0.23	159± 0.23
	T+R	10.8 + 0.30	13.9 ± 0.31
	Top Soil	9.9 ± 0.24	12.9 ± 0.29
	R+ OM	9.9 ± 0.31	13.9 ± 0.23
	R+ NPK	7.8 ± 0.27	10.0 ± 0.29
18	R+T+OM	18.8 0.62	23.9+ 0.22
	R+T+NPK	16.1±5.65	22.1±0.27
	T + OM	17.0 ± 5.98	22.9± 0.22
	T+NPK	17.2 ± 5.24	20.9+ 0.32
	T+R	14.4 ± 5.05	19.7± 0.27
	Top Soil	13.4 + 4.71	18.9± 0.29
	R+ OM	13.3 ± 75	18.9+ 2.60
	R+ NPK	11.8 ±4.17	16.8+ 0.29
24	R+T+OM	26.7 ± 0.38	29.8 ± 0.21
	R+T+NPK	23.9 ± 0.24	27.9 ± 0.19
	T + OM	24.5 ± 0.55	28.8 ± 0.28
	T+NPK	22.9 ± 0.22	26.8 ± 0.26
	T+R	21.0 ± 0.28	24.9 ± 0.19
	Top Soil	19.9 ± 0.30	22.9 ± 0.21
	R+ OM	19.9 ± 0.26	22.9 ± 0.21
	R+ NPK	18.8 ± 0.30	20.8 ± 0.24

Soil Analysis NPK (ppm)

Soil Media	Nitrogen	Phosphorus	Potassium
Top Soil + River Sand + Organic Matter	0.28	56.12	4.00
Top Soil + River Sand + NPK	0.15	54.74	3.39
Top Soil	0.07	15.74	0.17
Top Soil + River Sand	0.13	30.14	1.05

River Sand + Organic Matter	0.07	31.68	0.15
Top Soil + Organic Matter	0.27	33.14	0.16
Top Soil + NPK	0.14	32.10	0.13
River Sand + NPK	0.06	29.68	0.10

Keys:

R - River Sand

T - Top Soil(loamy soil)

Om - Organic Matter (poultry manure)

N_{15} .P_{15}.K_{15} - Nitrogen/Phosphorus/Potassium

Conclusion and Recommendation

The results obtained from the study showed that depulped seeds enhanced germination than pulped seeds. Depulped seedlings were significantly different from pulped seedlings by having a higher root length, plant height, leaf area and Biomass than pulped seedlings.

The soil media that had a higher performance is River sand + Top soil + Organic matter as when compared to other soil media. Also irrespective of the planting density, depulped seeds performed better than pulped seeds, and depulped seedlings were also significantly different from pulped seedlings by having a higher root length, plant height, leaf area and Biomass.

Recommendation

It is recommended that in germination of *Chrysophyllum albidum*, depulping the seed will enhance the germination thereby increasing the volume of uniform seedlings for plantation establishment.

Also addition of Organic matter will enhance seedling growth for better root length, plant height, leaf area and Biomass establishment which will enhance productivity.

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