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# Evaluation of the Effect of Different Nursery Media on the Emergence and Growth of Three Tropical Tree Species

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Abstract- An experiment was conducted at the Nursery section of the Department of Crop, Soil and Pest Management, The Federal University of Technology, Akure, Ondo State from June to evaluate the effect of different nursery media on the emergence and growth of three tropical tree species: Citrus paradise (Grape), Citrus aurantium (Bitter orange) and Anona muricata. L (Sour sop) June to August 2014. Seven nursery media were evaluated for their seedling emergence and early growth. Physiochemical analysis was performed on the three growing medium. The experiment was laid out in Randomized Complete Block Design. Growth and yield parameters (number of leaves, plant height, root length, root weight, shoot length and shoot weight) were taken. It was observed that treatment with top soil only performed significantly higher as pertaining to plant height followed by treatment with combination of top soil and river sand in Citrus paradise (Grape). Treatment with top soil only, significantly had the highest number of leaves followed by treatment with top soil +river sand, rice hull + river sand + rice hull and river sand in grape. Plant height of Anona nuricata. L (Sour sop) was greatly supported significantly by treatment with the combination of rice hull+ river sand+ top soil followed by treatment with river sand only. Treatment with river sand only support significantly the yield in Anona nuricata. L (Sour sop) while treatment with river sand only support significantly the yield of Citrus paradise (Grape). Phytochemical analysis of the juices of Anona nuricata. L (Sour sop) and citrus aurantium (Bitter orange) reveals the presence of tannin, phenol, phytate, oxalate and flavoids which indicate their medicinal functions.

#### I. INTRODUCTION

For the substrates in which plant will grow, they provide anchorage for the plant's roots, air spaces to allow respiration and retain sufficient available water to enable plant growth. [2][6]Different growing media that can be used are cocoa shells, sewage sludge, tobacco waste, sugar waste, vermin-compost, saw dust, paper waste, biomass by product, leaf mould, straw products, loam sea weed, hop waste, wood waste, spent mushroom compost, lignite, rice hulls, animal waste, food processing wastes[1]. Growing medium is known to affect plant performance in bare roots and container nursery production [9].

Nursery medium have been found to influence the emergence and growth of seedling produced and it is therefore necessary to find a suitable medium that will enhance its vigour [7]. It is necessary to find a suitable soil mixes that will help to produce vigorous root growth in the nursery before they are transplanted to their permanent site to ensure good seedlings for plantation or orchard establishment[10][1].

Citrus auratium (bitter orange) belong to family Rutaceae and it is distributed in tropical and sub-tropical region. It is commonly used in various traditional systems as an antihelmintic, mosquito repellent and antiseptic and many other chronic diseases. Anona muricata. L (sour sop) is also known as guanabana, graviola and sir sak in African and some countries [3]. It has a wide spread pan tropical distribution and has been pridely known as corossol. It is a wide spread small tree and has its native in Central American. It is cultivated throughout the tropical regions of the world. The most abundant antioxidants in fruits are polyphenols and vitamin a, b, c and e. this plant contains annonaceous acetogenins in the twigs, unripe fruits, seeds, roots and bark tissues which display antitumor, pesticidal, anti-malaria, and antiviral antimicrobial effect [7].

Citrus paradisa (grape) have a long and abundant history. During the ancient Greek and roman civilizations, grapes were revered for their use in wine making. Grapes fruits contain various nutrient elements, such as vitamins minerals, carbohydrates, edible fibers and phytochemicals [14][5]. Thus this study was to determine the effect of different growing media on seedling emergence and early seedling growth of three tropical tree species (grape, sour sop, and bitter orange) so as to identify the most appropriate medium for each species that will ensure the production of vigorous seedlings for plantation or orchard establishment. And also to evaluate the vegetative growth response of selected fruit tree crops to rice hulls, top soil and river sand. And the examination the bio active components of the selected fruit trees for their medicinal functions were also done.

#### II. MATERIALS AND METHOD

The experiment was conducted at the nursery of the department of Crop, Soil, and Pest management,

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Federal University of Technology, Akure with (7°16'N, 5°12'E) located in the rain forest vegetation zone of Nigeria between July and August 2014. The rainfall pattern of Akure is bimodal with a wet season of about seven months occurring during April to October/ November and through February to March. The mean daily temperature ranges between 25°C and 37°C.The mean monthly maximum and minimum relative humidity were 83% and 65%.

The seed were obtained from Isinkan Market. Akure, Ondo State and were authenticated at the Department of Crop, Soil and Pest Management. The seeds were air dried and planted. Three different growing medium were used during the experiment viz; top soil, river sand and rice hulls. Top soil was collected from Oba Kekere, Futa Area, Akure, Ondo State, river sand was collected by the river side of Ilara- Mokin, Ondo State and rice hulls was collected from rice milling factory, Ipetu-Ijesha, Osun State, Nigeria. The different media were thoroughly mixed on a flat surface in ratio 1:1 and were filled into a perforated polythene pots with diameter 11.4cm and length 20cm, the pots were prepared, filled with the medium and arranged in the nursery. Different media were used with the following treatment combination;T1=Rice hulls +River sand + Top soil, T2= Top soil + River sand, T3=River sand only, T4=Top soil only, T5=Rice hulls only, T6=Rice hulls + Top soil, T7=Rice hulls + River sand.

The major agronomic practice was thinning (removal of excess seedling from each poly pot), weathering and manual weeding. Data collection began at 4 weeks and 5 weeks which was when the seed emerged. It was taken weekly till the seedlings were 12 weeks old. The parameters considered included plant height, number of leaves, leaf area and root length. The data were collected with the use of ruler for the length of the shoot and Root length. Resultant plant parameters were analysed using SPSS statistical software package and means separated by Duncan Multiple Range Test.

The soil analysis was done using the procedure in the csp laboratory manual booklet. Soil pH was determined. Magnesium was determined with an atomic absorption spectrophotometer. Exchange acidity was determined by Cabonoglu et al., [3] titration method. Soil organic C was determined by the procedure of Walkley and Black using the dichromate wet oxidation method, total N was determined by micro-Kieldahl digestion method, available P was determined by Bray-1 extraction followed by molybdenum blue colorimetry. Exchangeable K, Ca and Mg were extracted using 1.0 N ammonium acetate. Thereafter, K was determined using flame photometer and Ca and Mg were determined using the EDTA titration method while sodium (Na) was determined by flame emission photometry. Particle size distribution was determined with a hydrometer [11]Juice were extracted with the use of a blender, sieved and taken to the laboratory for analysis. The following were considered for test;

The total phenol content of the juice was determined by the method [12]. The total flavonoid content of the juice was determined using a colourimeter assay developed by [9]. The reducing property of the juice will be determined by [15]. The free radical scavenging ability of the juice against DPPH(1, 1-diphenyl-2-picryhydrazyl) was tested using Rauf [13] method.

#### III. Results

Table 1 : Physiochemical Properties of the Growing Medium

Media	OC%	OM%	N%	Р	Κ	Ca	Mg	Ph
M1	0.71	1.22	0.06	5.17	0.93	2.3	3.3	6.30
M2	1.51	2.60	0.13	2.95	0.59	0.8	5.2	6.33
M3	98.98	170.64	8.53	28.70	0.67	2.8	4.4	5.86
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\*M1=Topsoil, M2=River sand, M3=Rice-hulls, OC=Water holding capacity, OM=Organic matter,

The results from the physiochemical properties of the growing medium in Table 1 showed that rice hulls contains moderate to high level of organic carbon and organic matter which can support plant growth. Additionally all the media pH levels shows moderately acidic level.

Table 2 :	Effects of	the Growi	na Media	on the	Plant Height (	(Cm)	of Grap	e (Citrus Paradisi	)
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			0		0	· · ·			,
Treatments	4	5	6	7	8	9	10	11	12
				(WAG)					
T1	1.29a	2.58ab	2.58b	2.77ab	2.77b	3.13b	3.30b	3.45a	3.73a
T2	0.71a	2.97a	3.74a	4.08a	4.24a	4.54ab	4.69ab	4.96a	4.96a
Т3	0.71a	1.41b	1.41c	2.36b	2.77b	3.13b	3.13b	3.45a	3.59a
T4	1.1a	3.36a	4.08a	4.24a	4.68a	4.96a	5.09a	5.23a	5.34a
T5	1.1a	2.34ab	2.58b	3.13ab	4.24a	4.24ab	4.54ab	4.54a	4.81a
T6	1.1a	3.36a	3.55a	3.91ab	4.53a	4.83a	5.09a	5.23a	5.34a
T7	1.1a	3.36a	3.91a	3.91ab	4.24a	4.24ab	4.09a	4.96a	5.10a

\*T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand, T3 = River sand only, T4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG= weeks after planting. Means are separated with Duncan Multiple Range Test

The data shows (Table 2) that the different growing media had significant effect in the plant height of grape at 5-10 weeks after germination. The maximum plant height (4.67 cm) was recorded at T 4 (top soil only)

followed by (4.0 cm) in T7 (rice hull+ river sand) and (3.83cm) in T 6 (rice hull +top soil) while the minimum height was (2.33cm) was observed in T 1(rice hulls+ river sand+ top soil)

Treatments	4	5	6	7 (WAG)	8	9	10	11	12
T1	1.29a	2.58ab	2.58b	2.77ab	2.77b	3.13b	3.30b	3.45a	3.73a
T2	0.71a	2.97a	3.74a	4.08a	4.24a	4.54ab	4.69ab	4.96a	4.96a
Т3	0.71a	1.41b	1.41c	2.36b	2.77b	3.13b	3.13b	3.45a	3.59a
T4 T5	1.00a 1.00a	3.36a 2.34ab	4.08a 2.58b	4.24a 3.13ab	4.68a 4.24a	4.96a 4.24ab	5.09a 4.54ab	5.23a 4.54a	5.34a 4.81a
T6	1.00a	3.36a	3.55a	3.91ab	4.53a	4.83a	5.09a	5.23a	5.34a
T7	1.00a	3.36a	3.91a	3.91ab	4.24a	4.24ab	4.69a	4.96a	5.10a

Table 3 : Effects of the Growing Media on the Number of Leaves Grape (Citrus Paradisi)

\*T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand T3 = River sand only, T4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG=weeks after planting. Means are separated with Duncan Multiple Range test.

No significant difference was noticed at 4, 11 and 12 weeks of germination but there was significant differences in the number of leaves of grape across the treatment. There was a significant difference across the weeks for all the treatment except T1, T4 and T7

Treatment	Shoot length(cm)	Shoot weight(kg)	Root length(cm)	Root weight(kg)
T1	9.50a	0.52b	11.75bc	0.43b
T2	10.00a	1.02ab	12.67abc	0.82ab
Т3	8.75a	0.52b	15.00a	0.35a
T4	13.50a	1.87a	11.33bc	1.20a
T5	9.00a	0.80ab	9.67a	0.35b
T6	8.00a	0.37b	14.00ab	0.75ab
T7	9.67a	0.76ab	12.00abc	0.75ab

\*T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand, T3 = River sand only, T4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG = weeks after planting. Means are separated by Duncan Multiple range test

In the table above (Table 4) it was observed that there was no significant difference in the shoot length across and along the treatment

*Table 5* : Effects of the Growing Media on the Plant Height (Cm) of Sour Sop (*Annona Muricata*)

Treatments	4	5	6	7 (WAG)	8	9	10	11	12
T1	0.00	2.67a	3.17a	3.17a	4.00a	4.00a	6.33ab	9.16a	11.17a
T2	0.00	2.30a	2.50a	3.17a	4.67a	4.67a	4.83ab	5.33a	9.33a
ТЗ	0.00	0.00	1.33a	1.83a	7.33a	7.67a	9.33a	10.00a	11.33a
Τ4	0.00	0.00	0.00	0.00	0.00	0.00	1.00b	6.50a	10.00a
T5	0.00	0.00	0.00	0.00	0.00	0.00	0.33b	5.00a	9.00a
T6	0.00	0.00	0.00	0.00	0.00	1.83a	1.33b	7.67a	11.00a
T7	0.00	0.00	0.00	0.00	0.00	0.00	1.67b	7.50a	10.00a

\*T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand, T3 = River sand only, T4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG=weeks after germination. Means are separated with Duncan Multiple Range Test

According to the data in Table 5 there was delay in the emergence and growth of sour sop, this may be due to environmental variation. Significant difference was only noticed at week 10 after germination. The maximum plant height (6.33cm) was recorded at T 1 (rice hull + river sand + top soil) followed by (5.33cm) in T 3(river sand only) and (4.83cm) in T 2(river sand + top soil) while the minimum height (0.3) was noticed in T 5(rice hull only).

Table C . Effects of the	Crowing Madia and	ha Numahar af Laguag	Cour Com (Ar	none Muricata)
Table 0 : Ellects of the	Growing wedia on i	ine number of Leaves	3 3001 300 (Ar	inona muncala)

Treatments	4	5	6	7	8	9	10	11	12
				(WAG)					
T1	0.00	0.71a	0.88a	1,39a	1.72a	1.72a	1.80a	2.06a	2.36a
T2	0.00	0.71a	0.71a	1.00ab	1.57ab	1.57ab	1.72a	1.32a	1.77a
ТЗ	0.00	0.71a	0.71a	0.71b	0.71b	0.71b	0.71a	2.18a	2.39a
T4	0.00	0.71a	0.71a	0.71b	0.71b	0.71b	0.71b	1.93a	2.24a
T5	0.00	0.71a	0.71a	0.71b	0.71b	0.71b	0.71b	1.29a	1.48a
Т6	0.00	0.71a	0.71a	0.71b	0.88ab	0.88ab	0.88ab	1.66a	1.94a
T7	0.00	0.71a	0.71a	0.71b	0.71b	0.71b	0.71b	1.77a	2.04a

\*T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand, T3 = River sand onlyT4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG=weeks after planting. Means are separated with Duncan Multiple Range Test

The data in table 6 showed that there was significant difference across the treatment at week 7-10. There was no significant difference in T1 across the week but other treatment has significant differences in the number of their leaves, there was also no significant differences across the treatments at 4, 11 and 12 weeks respectively.

Table 7 : The Effect of Growing Media on Yield Parameters of Sour Sop (Annona Muricata)

Treatment	Shoot length(cm)	Shoot weight(kg)	Root length(cm)	Root weight(kg)
T1	10.75a	0.57a	12.00a	0.31a
T2	9.33a	0.61a	9.67a	0.26a
Т3	11.00a	0.70a	11.00a	0.32a
T4	10.67a	0.53a	9.67a	0.37a
T5	10.67a	0.59a	9.00a	0.35a
T6	10.83a	0.59a	9.00a	0.39a
T7	11.50a	0.57a	7.67a	0.24a

T1 = Rice hull + river sand + top soil, T2 = Top soil + river sand, T3 = River sand only, T4 = Top soil only, T5 = Rice hull only, T6 = Rice hull + top soil, T7 = Rice hull + river sand, WAG=weeks after planting. Means are separated with Duncan Multiple Range Test

There no significant differences in all the yield parameters

Table 8 : Phytochemical and Antioxidant Test on the Juice of Sour Sop and Bitter Orange. (Annona Muricata and Citrus Aurantium)

Samples	Tannin (mg/100g)	Phenol (mg/100g)	Phytate (mg/g)	Oxalate (mg/g)	Saponin (g/100g)	Alkanoids (g/100g)	Flavoids(g/100g)
A1	2.70	1.28	5.77	2.61	ND	ND	0.02
A2	2.65	1.30	5.78	2.57	ND	ND	0.01
AVG	2.68	1.29	4.17	2.59	ND	ND	0.02
B1	1.15	0.60	6.59	2.25	ND	ND	0.03
B2	1.18	0.63	6.62	2.16	ND	ND	0.05
AVG	1.17	0.62	6.61	2.21	ND	ND	0.04

\*A=Sour Sop, Avg=Average, B=Bitter Orange

Based on the juice of sour sop and bitter orange, it was observed that bitter orange has higher phytate than sour sop. Sour sop was higher than bitter orange in the other component.

#### IV. DISCUSSION

Nursery medium has been found to influence the quality of seedling emergence and growth, this research confirms the efficacy of rice hulls which has been successfully used as growing media [16]. The reason for the use of rice hulls is due to its light weight than top soil or river sand, it provides good aeration, high water retaining capacity and it stimulate warmth which facilitate growth and germination[3]. According to the research work, top soil support the growth of seedling significantly which was in support to the research by Agbo et al., [1]. Jessica [9] also worked on top soil as a medium for *M.myristica* but his work was in contrast to this research.

According to Mehwish, 2007 who stated that river sand showed the least response to the growth of *Dahlia pinnata* was in contrast to this research as it was not the medium that showed the least in response to seedling emergence and growth. Top soil supported significantly taller seedlings, all through the experiment, the tallest seedling were those with top soil only. It was noticed that when rice hulls was mixed with top soil or river sand, humus increases and vigorous growth is supported [4][20]. This was in support of this research.

Agbo, 2006 stated that rice hulls and top soil performed the same way was in contrast to this research. During the research, it was noticed that rice hulls had micro-organisms more than other media which help to break down litter and release nutrients. Rice hulls had organic matter and improve the structure of the soil. Rice hulls, fresh or aged can be successfully used as a sphagnum peat moss substitute for the production of selected short term cut flowers because it support taller seedlings. Einert and Baker,[6] stated that rice hulls increases root weight which was in support with this research. Laiche and Nash [10] stated that rice hulls are a good replacement in growing medium. Although during this research, there was adequate rainfall which helps the seedlings performance, as high humidity helps in quick decomposition of the organic component.

According to the analysis ran on the juices of *Annona muricata and C.aurantium* reveals the phytate was the highest bio active component presence and this indicate several positive effect on human health. [12][15]. Phytate was reported to prevent kidney stone formation, protect against diabetes mellitus and coronary heart diseases as well as a variety of cancer.[14][15]. Saponin was noticed to be absent from the juices this could be due to Jessica [9], who stated that saponin occurs in a wide range of plants, including pulses and oil seeds and since the fruit of the juices was neither pulses nor oil seed, it could be the reason for its absence. The oxalate presences in the juices help to bind calcium and prevent its absorption to human body.

Presence of flavoids, phenol and tannins leads to the use of the fruit for pharmaceutical activities. It has been investigated that high flavoids intake may be correlated with a decreased risk of cancer.[17][19]. Flavoids possess wide spectrum of biological activities that may be able to influence some process during cardiovascular diseases [18][21]. Phenols acts as resistance mechanism of plants against fungal pathogen and insect, they are used in plant pigmentation, growth and reproduction [21]. They are also regarded as preservatives against microbes and oxidation for food [20]. Tannin has been closely associated with plant defence mechanism towards mammalian, herbivores, and insects. They defend plant against large herbivores by decreasing protein availability [11][12]. Fruits with both flavoids and phenolic acids component plays an important role in the control of cancer and other human diseases [8][15]. This research work indicate the use of these fruits (Annona muricata and C.aurantium) for medicinal purposes, for example, cure of different types of cancer, cure of kidney diseases, protection against coronary diseases, diabetes mellitus e.t.c. The result from my experiment shows that top soil and river sand are the best media for planting Citrus *paradisi* (grape) and river sand is the best for planting sour sop *Annonamuricata*. Rice hull supports seedlings vigour. As the data was recorded on three month research trail, therefore, it is recommended that for the confirmation of the results, this trial should be repeated for another year.

#### V. CONCLUSION

The result from my experiment shows that top soil and river sand are the best media for planting Citru *sparadisi* (grape) and river sand is the best for planting sour *sopAnnonamuricata*. Rice hull supports seedlings vigour. As the data was recorded on three month research trail, therefore, it is recommended that for the confirmation of the results, this trial should be repeated for another year.

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