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Effect of Different Pot Sizes and Growth Media on the Agronomic Performance of *Jatropha curcas*

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Abstract: This research study was carried out to investigate the effect of different pot sizes and growth media on the growth of *Jatropha curcas*. Two different pot sizes (5 cm by 10 cm) for big pot sizes and (2½ cm by 2½ cm by 6 cm) for small pot sizes and 3 different growth media made up of Top Soil, River Sand and Sawdust were used. Relative comparison in *Jatropha curcas* plant agronomic parameter such as plant height, stem girth and number of leaves, was determined and the values were analyzed using Statistical Package for Social Science (SPSS). The result of the analysis shows a significant difference in the combination factor of treatment and weeks, for plant height, stem girth and number of leaves. From the mean value, River Sand in big pot (RB) has the highest value in height and girth with 7.2217 cm, 0.9950 mm respectively. While the highest number of leave was counted from Top Soil in big pot (TB) with 6.7333 cm. Based on the agronomic result obtained in this study, it can therefore be concluded that the best soil media for growing *Jatropha curcas* is River Sand and the best pot size is big pot (5 cm by 10 cm).

Key words: *Jatropha curcas*, agronomic, stem girth, height, river sand

INTRODUCTION

Jatropha is a genus of approximately 175 succulent plants, shrubs and trees from the family Euphorbiaceae. *Jatropha curcas* L. is a drought resistant perennial, growing well in marginal/poor soil. A perceived advantage of *Jatropha curcas* is its ability to grow on marginal lands and to reclaim and restore eroded areas (Francis *et al*., 2000). It is easy to establish, grows relatively quickly and lives, producing seeds for 50 years. *Jatropha curcas* can be used for decertification and erosion control. *Jatropha* produces seeds with an oil content of 37%. The oil can be combusted as fuel without being refined. It burns with clear smoke-free flame, tested successfully as fuel for simple diesel engine. The byproducts, press cake, are good organic fertilizer, oil contents also as insecticide. Medically it is use for diseases like cancer, piles, snakebite, paralysis, dropsy (Azza *et al*., 2006).

Its propagation can be made by cuttings, seeds sowed directly in soil or seedlings, but the last option has been mostly adopted for allowing plants to have appropriate conditions at initial growth stages and to result in better field establishment. Technology for *Jatropha* seedling is not completely developed, but several studies on this topic are going on in several countries. The problem of great concern regarding the plant is the rate of vegetative growth and seed yield. The plant has profuse vegetative growth but the number of seeds produced per plant is very low. Besides the plants producing seeds after approximately 2-3 years depending on the environmental conditions, seeds have limited viability and the plant is also prone to pathogens like *Cercospora*, *Rhizopus oryzae* and insects (Mousumi and Verma, 2008).

Container volume is a very important factor for seedlings production. On one side, big containers increase substrates consumption and space demand in nursery, influencing directly the costs of production and transport. But on the other hand, small containers can limit seedlings growth and reduce its quality (Lima *et al*., 2006; Gomes *et al*., 2003; Queiroz and Melém, 2001). Low quality seedlings result in plantations of reduced stand and yield. Successful greenhouse and nursery production of container-grown plants is largely dependent on the chemical and physical properties of the growing media. An ideal potting medium should be free of weeds and diseases, heavy enough to avoid frequent tipping over and yet light enough to facilitate handling and shipping. The media should also be well drained and yet retain sufficient water to reduce the frequency of watering. Other parameters to consider include cost, availability, consistency between batches and stability in the media overtime. Selection of the proper media components is critical to the successful production of plants (James and Michael, 2009).

There is a need to intensify research on the nursery preparation of *Jatropha curcas* in order to boost its plantation. Therefore, the objective of this study is to

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investigate the effect of different pot sizes and growth media on the agronomic performance of *Jatropha curcas*.

MATERIALS AND METHODS

Experimental site: The research study was carried out in the Department of Forest Products Development and Utilization, Forestry Research Institute of Nigeria (FRIN), Jericho, Ibadan, Oyo State. An area characterized by two peaks of rainfall typical of tropical West Africa, which occur in the months of June and September/October. The average rainfall recorded for Ibadan within this period is 123.2 cm, while the average temperature is 25°C (77°F) and 35°C (95°F) almost throughout the year. The mean humidity of Ibadan is 68% as reported by the Metreological Station, Federal College of Forestry (FCF), Ibadan.

The materials used in carrying out this experiment include the followings: Top soil, river sand, sawdust, polythene pots of 2 different sizes (2½ cm x 2½ cm x 6 cm), (5 cm by 10 cm), Veneer caliper.

Seed collection: The seeds of *Jatropha curcas* were collected from FRIN arboretum, Forestry Research Institute of Nigeria, Ibadan on 16th march, 2010.

Planting of the seeds: The seeds were planted into germination box on the 25th may, 2010 and transplanted into 3 different soil media in 2 different pot sizes after 10 days of germination. These were replicated 10 times, making 60 polypots altogether.

Data collection: The variable measured were height, stem girth and number of leaves. These variable were measured at 2 weeks interval for 3 months. The following objectives were assessed:

- Investigation of the effect of different pot sizes and growth media on the growth performance of *Jatropha curcas*.
- Determination of the best pot size for raising *Jatropha curcas*.
- Investigation of the best soil type for the growth of *Jatropha curcas* at nursery stage.

This experiment was laid into Complete Randomized Design (CRD) and analyze using SPSS 15.0 version at 5% level of significance.

RESULTS AND DISCUSSION

The Table 1 shows that the mean values for RB treatment has the highest value in height with 7.2217. This was followed by RS treatment with 7.1600 value, moreover the value of TB treatment is 6.8133 and TS treatment is 6.4217. The least value was obtained for SB treatment with 5.1467 and followed by SS treatment with 4.9300 respectively. This study supports the findings of Igboanugo (1990), which showed that when *Triplochiton scleroxylon* seedlings were transferred to more clement environmental conditions, there was an upsurge in their shoot growth and the growth of other morphological parameters than were possible in their previous environment. when *Jatropha* was in a big pot, it performed better in terms of height than when it was in a small pot.

Table 1: The mean values of stem height of *Jatropha curcas* under different growth media and pot sizes

Treatment	Mean	Std. Deviation
Top soil + Small pot (TS)	6.4217	1.51591
Top soil + Big pot (TB)	6.8133	1.48865
Sawdust + Small Pot (SS)	4.9300	1.52040
Sawdust + Big pot (SB)	5.1467	1.30481
River sand + Small pot (RS)	7.1600	1.56359
River sand + Big pot (RB)	7.2217	1.34871

Moreover, in this study *Jatropha* grew inside sawdust and polypots. This shows that the plant is undemanding soil-type. This support the findings of Heller (1996) that *Jatropha* is undemanding soil type, require no tillage, grows well in low rainfall condition (requiring only about 200 mm of rain to survive) and sensitive to ground frost that may occur in the cold season (Bensalem and Falimberg, 1985).

This study also support the findings of Heller (1996) that *Jatropha* is a fast growing plant and achieve a height of three meters within three years under a variety of growing conditions. *Jatropha* in this study achieved a height of 7.2217 cm within 3 months despite it was planted in a polythene pot. In order words before 3 years this same *Jatropha* will achieve a height of 3 meters.

The Table 2 shows that RB treatment has the highest value with 0.9950 and this was followed by TB treatment with 0.8167. Moreover, the value of SB treatment is 0.7167 and SS treatment has the least value with 0.6433.

It can be concluded that the study agrees with the findings of Hopkins and White (1984) who reported that seedling of *Pakia biglobosa* grow on large polythene pot, had higher level of significant compared to small polythene pot. Also, this result agrees with the view of Oni and Caspa (2002), who stated that large polythene pot had an effect on seedlings growth compared with small polythene pot in term of stem girth. This could be due to the ability of large polythene pot containing large amount of soil nutrient and water molecules.

The Table 3 shows that TB treatment has the highest value with 6.7333. This was followed by TS treatment with 5.7000 value. SB treatment has the least value with 4.8500 and SS treatment with 4.6167 value.

This implies that both treatment (growth media and polypots) used for nursery propagation of *Jatropha curcas* under the same geographical and weather

Table 2: The mean values of stem girth of *Jatropha curcas* under different growth media and pot sizes

Treatment	Mean	Std. Dev.
Top soil + Small pot (TS)	0.7483	0.25210
Top soil + Big pot (TB)	0.8167	0.28651
Sawdust + Small Pot (SS)	0.6433	0.15334
Sawdust + Big pot (SB)	0.7167	0.15856
River sand + Small pot (RS)	0.7883	0.24223
River sand + Big pot (RB)	0.9950	0.34318

Table 3: The mean values of number of leaves of *Jatropha curcas* under different growth media and pot sizes

Treatment	Mean	Std. Dev.
Top soil + Small pot (TS)	5.7000	1.68040
Top soil + Big pot (TB)	6.7333	2.40668
Sawdust + Small Pot (SS)	4.6167	1.62701
Sawdust + Big pot (SB)	4.8500	1.51630
River sand + Small pot (RS)	5.4667	1.72191
River sand + Big pot (RB)	5.5833	1.83462

conditions have significant influence on the agronomic parameters determined. Different pot sizes and growth media influenced the agronomic performance of *Jatropha curcas* after assessed for the period of six weeks. This study shows that both the growth media and polypots improved the agronomic performance of *Jatropha curcas*. The study also shows that top soil in big pot has the highest value, the study also support the findings of Igboanugo (1990), which showed that when *Triplochiton scleroxylon* seedlings were transferred to more clement environmental conditions, there was an upsurge in their shoot growth and growth of other morphological parameters than were possible in their previous environments.

Anova Table: The height of *Jatropha curcas* under different pot sizes and growth media

Source	Df	SS	MS	F-cal	Sig.
Treatment	5	4.272	0.854	23.186	000
Error	324	11.939	0.039		
Total	360	247.830			

The above Anova table shows that the treatment (soil mixture + pot sizes) is significant which shows that different growth media and pot size has significant effect on the growth of *Jatropha curcas* in terms of height. The same thing is applicable to girth and number of leaves.

Conclusion: It is evident from this study that different growth media have different effects on the growth of *Jatropha curcas*. The seedling grown in soil media (RB which is river sand) against the other soil media in terms of height and plant girth with the highest mean value, but top soil has highest mean value in terms of number of leave. Also, collected data from the analysis of the parameters measured in this experiment showed that pot sizes have effect on the seedling growth of *jatropha curcas* with pot size 5 cm by 10 cm having the highest height, stem diameter and number of leaf.

Recommendation: Hence, the study carried out on effect of growth media and pot sizes on the growth of *Jatropha curcas* seedlings, shows that growth media (RB) river sand + big pot generally stimulate the growth of *Jatropha curcas* in terms of stem, girth, plant height and number of leaf. Therefore, based on the information gotten so far, the use of river sand in big pot size for raising of *Jatropha curcas* seedlings for optimum growth at nursery stage are thereby recommended.

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