Differences in the Generative Propagation of Jatropha (*Jatropha curcas L.*) in Minna, Niger State, Nigeria

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Abstract

*The study evaluates the performance of Jatropha curcas*L*planted using three methods – direct planting to the field; seed planted into potting bags before transplanting into the field and stem cuttings planted straight into the field. The experiment was conducted at the Teaching and Research farm of Federal University of Technology, Minna which is in the Southern Guinea Savannah zone of Nigeria. The experiment was laid out in a Completely Randomized design. Parameters measured included: (i)time of emergence – both on the field and in potting bags; (ii) plant height; (iii) number of branches all at 2, 6, 12, 18 and 24 months after emergence-MAE, (iv) days to first flowering.Results showed that seeds planted in the potted bags emerged first before those sown directly to the field.Those from stem cuttings planted straight to the field started showing signs of germination after 31 days – significantly later than the other two plantings (potted bags or direct seeding). Transplanted seedlings were taller, had more branches and came into flowering earlier than direct seeding or stem cuttings. This study is recommending the use of seeds planted in potting bags first before transplanting.*

Key Words: *Jatropha curcas*, Feedstock, Biofuel, non-edible oil.

Introduction

Jatropha also known as Physic nut-English, *Lapalapa*-Yoruba; *Binidazugu*-Hausa; *Kashia*-Nupebelongs to the plant Family*Euphorbiaceae* and the tribe *Jatropheae*.It is a plant whose nuts have been found to have a good capacity for oil production. Oils from this plant have been used to fuel lanterns, power generators and for the production of biodiesel. The use of this vegetable oil is gaining good prospect especially as it is expected to enhance both national and household energy security, while raising farm incomes at the local level in the country. Fuels from fossil systems are said to be generally very toxic, non-biodegradable and whose sources are not renewable. Energy from biofuels appears to be more environmentally friendly needing little investment to combat the potentially high carbon emissions peculiar to fossil fuels.

Biofuel programmes based on agricultural feedstock (the raw material) have been developed around the world (Villavicencio, and Del Rosario, 2008) in response to recent escalation in prices for fossil-based fuels and growing global cry for more energy. Demands for ethanol and biodiesel from grains, vegetable oils and other crops such as Jatrophaand sugarcane, have grown considerably.
Numerous oil species cultivated in tropical Africa have good potential for feedstock aimed at biodieselproduction;a particular example is the readily produced cram-cram (*Crambehispanica*), a species of the Mediterranean and African highlands that is presently being developed as a temperate crop.

Taking into account the serious need for food security in many African countries, biodiesel production have being focusing on non-edible oil species. It is in this light that governments are developing tough policies to allow the biofuel sector to grow without conceding efforts at achieving food security at the expense of national resources.

It is against this background, that Jatropha(*Jatrophacurcas*) is fast becoming the best candidate for biodiesel feedstock in Nigeria.This plant produces non-edible oil and its cultivation is suitable for once productive and/or marginal lands, it will not compete for prime necessities required for securing food security in many developing countries (Villancio, *et. al.*, 2008). Countries like Ghana, Mali, Burkina Faso, and many east African countries are experimenting with developing Jatrophaprojects aimed at biodiesel production (Gathura, 2006). Nigeria also cannot be left behind as the level of the nations' fossil fuels reserve is said to be dwindling.

The main aim of the present study was to document the difference in the generative propagation of *Jatrophacurcas*L. through direct seeding; transplanting and planting of stem cuttings in Minna, Niger State, Nigeria. It is hoped it will contribute to the knowledge of cultivation of *Jatrophacurcas* Lespecially in the Guinea Savannah of Nigeria. The following hypotheses were tested in the course of this study:

Hypothesis 1: Method of planting has no impact on germination of *Jatropha*.

Hypothesis 2: Planting methods have no impact on longevity of *Jatropha*in Niger State of Nigeria.

Materials and methods

The experiment was carried out at the Teaching and Research Farm of Crop Production Department, Federal University of Technology Minna (9° 30 N and 6° 30 E) in the Southern Guinea Zone during 2009-2011 raining seasons. The experiment was arranged in a CompletelyRandomizeddesign (CRD) with three replications. Each replication consisted of 25 Jatrophastands while three sowing methods (i) direct seeding on the field;(ii) nursery planting in potting bags before transplanting and (iii) using of stem cuttings constituted the treatments. This gave a 25 x 4 x 3 combination. The plant spacing for all the treatments was maintained at 2m x 2m. Before planting (or transplanting), the site was ploughed, harrowed, and prepared to a fine tilth.For the direct seeding, seeds were planted direct to the field after a good rain.

Seeds of*Jatrophacurcas* in the nursery were sown in poly-ethylene bags filled with lose top soil from the University Farm. The seeds were sown in the soil at a depth of 3 cm in each container (Henning, 2000). The assessment was undertaken in April 2009. Watering of potting bags was done two times per week (when the need arose – drought period). Numbers of days to first and last germination for each trial were observed. Transplanting of seedlings was done after 34 days of seed emergence.

For the stem cuttings, strong branches with a circumference of between 2.5 and 3.0 cm and about 35-40 cm from the base of the mother stem;were selected for cutting and planted directly into the soil (at the same day seeds were planted in the farm and into potting bags). This was to keep down any difference the delay in planting may cause.

Five plants from each replication were randomly selected for tagging per plot.All measurementswere taken from the tagged plants. Data collected include time of

emergence; plant height at 2, 6, 12, 18 and 24months after emergence-MAE; number of leaves and branches per plant per plot, days to first flowering. The data collected were subjected to statistical analysis using the Minitab release 14 Statistical software. Means were separated using the LSD test procedure at 5% level of probability.

Results and Discussion

Number of days to emergence of planted seeds and stem cuttings.

Seeds planted directly into potted bags or the soil emerged earlier than stem cuttings. This result is presented as Fig. 1. Seeds planted in the potting bags emerged first after 5.8 days of sowing but directly sown seeds to the field emerged after 5.9 days. This result was significantly lower than that of stem cuttings planted straight to the field that started showing signs of germination after 31 days.

Heller (1996) had reported that cuttings of stems about 30 mm in diameter could provide higher and earlier initial yields than plants raised from seeds, although little or no yield difference was realized for later harvests. It has not being established if cuttings taken from carefully chosen plants with higher yield potential would probably continue to out yield seed raised plants. Raising plantlets from tissue culture is being researched and protocols have been developed but, as it is a latex-producing plant, the procedure is not forthright. There has not being much reports of tissue culture producing very massive Jatrophaplantlets for large scale production.
The result of this study was in agreement with report of Heller (1996) who reported nursery-raised plants to have a higher growth potential (more than 80%) than seedlings planted directly in the field (less than 50%). Only fully developed seedlings stand the chance of being transplanted compared to empty spaces that would have resulted when directly seeded material fails to germinate or stem cuttings fail to germinate.
The result also agreed with earlier findings(Kobilke 1989) that five roots are formed from seedlingsfrom stem cuttings - one central and four peripheral and that a "tap root is not usually formed by vegetative propagated plants".

Difference in plant height as affected by method of seed planting or stem cuttings.

Result of plant height was not different from that of plant emergence. Plants sown directly from seeds and the transplanted seedlings were taller than those from stem cuttings (Fig.2). Seeds planted in the potting bags that emerged seemed togrow faster than those planted directly or those established from stem cuttings.

The performance of the below ground parts wasalso not different from the above the ground parts. Plate 1, shows that the roots of directly sown seeds had a tap rooting system, these were absent inplants that were grown from stem cuttings.

Difference in number of branches per plant stand as affected by types of planting-using seeds or stem cuttings.

Seedlings from potted bags produced more branches than those seeds planted directly to the field or those established from stem cuttings. Plants from seeds planted straight to the field had about 1.9 branches while transplanted seedlings had a mean of 2.4 branches. The leastnumber of branches - 1.5 was observed for stem cuttings (Fig. 3 and Plate 2).

Difference in mean number of months to initial flowering as affected by types of planting-using seeds or stem cuttings.

A significant difference (P=0.05), was observed in the number of months to first flowering. Plant from transplanted seedlings started flowering in about 9

months. Although not too different from that of direct seeding in the field (11 months), but it was significantly different from that of stem cuttings (14 months).

This result was in agreement with the work of Kobilke(1989) and RF (1998) who reported that plants from stem cuttings would need time to properly establish before preparing to produce flowers. Wounds due to the cuttings will first heal before germination then arriving at flowering stage.

Conclusion

This study shows that:

- The method of planting (using seeds or from cuttings) greatly affected the time of emergence, height, number of branches and time to flowering of the Jatropha plants
- The observed difference was exhibited for up to two years of the study in the study area.
- The time to initial flower production was earlier in transplanted stands compared with directseeded plants or stem cuttings.

The work is still continuing before strong recommendations can be drawn, but for now, the followings can be put forward as general position statements:

- Thatthe study has observed that transplanted seedlings emerged earlier than direct seeding or stem cuttings.
- That transplanted seedlings were taller, had more branches and came into flowering than direct seeding or stem cuttings.

This study is recommending the use of seeds planted in potting bags first before transplanting.

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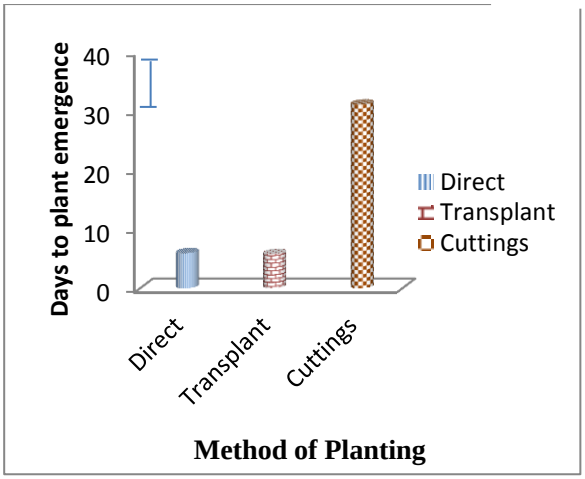

Fig. 1. Mean days to emergence of Jatropha planted seeds and stem cuttings.

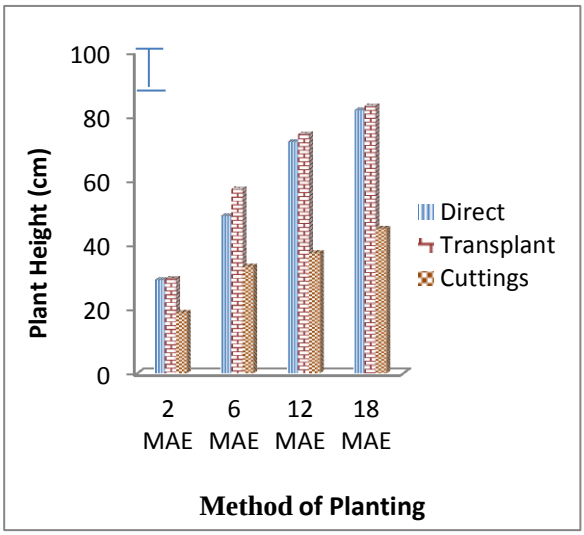

Fig. 2. Mean Plant height of Jatrophagrownfrom seeds or from stem cuttings.

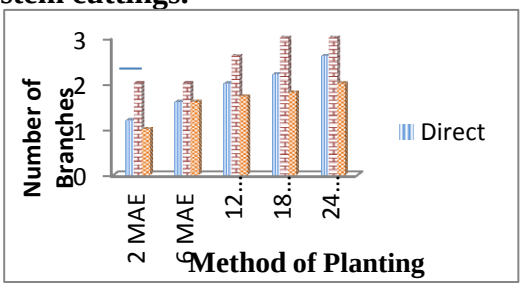

Fig. 3. Mean number of plant branches of Jatropha grown from seeds or from stem cuttings.

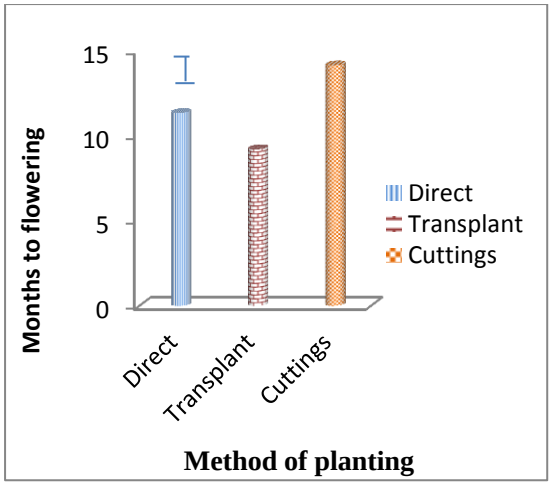

Fig. 4. Mean number of months to flowering of Jatropha grown from seeds or from stem cuttings

Plate 1. A picture of below ground parts of the Jatropha plants

Plate 2. Photograph of number of branches from a transplanted seedling