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Research article

Effects of pre-sowing treatments on germination of *Jatropha curcas* L. seeds

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Abstract: Successful production of healthy seedlings in a forest nursery can be ensured through seed treatment to enhance germination. This study assessed the effects of pre-sowing treatments on the germination of *Jatropha curcas*; to provide the best treatment for enhancing seedling production. The experiment was laid in a completely randomized design with four treatments: (i) control (T1), (ii) soaking in; water at room temperature at room temperature for 16 hours (iii) cow-dung slurry for 16 hours (iv) 98% concentrated sulphuric acid for 5 minutes Each treatment received 10 seeds and was replicated 5 times giving a total of 200 seeds sown in sterilized river bank sand. Germinated seeds were counted, converted to percentages and arsine values. The data were further subjected to analysis of variance and significant means were separated using Duncan multiple range test (DMRT) at 0.05 level of significance. The results showed that seeds with no pre-sowing treatment had the highest mean germination (66%), DMRT revealed that significant difference ($P<0.05$) existed between seeds with no pre-sowing treatment and other treatments. The study concluded that viable *Jatropha curcas* seeds have no germination problem; the seeds could be germinated without pre-sowing treatment.
Keywords: Duncan multiple range - Provenance trial - Seed germination - Silvicuture - Sulphuric acid.

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INTRODUCTION

Jatropha curcas L. commonly referred to as "physic nut'' or "purging nut'', belongs to the Euphorbiaceae family and its native to America. It has softwood with subtle grey back which produces white and milky latex when cut, it also produces woody by-products which eases the pressure on the forest (Achten *et al.* 2010), it is classified as a large shrub or a small perennial tree, this is as a result of its height, which could be between 5 m to 10 m depending on the environmental conditions (Divakara *et al.* 2010). *Jatropha curcas* is a drought-tolerant plant which grows in the marginal lands and it's commonly used for hedgerow because it is not usually browsed by animals (Abou-Kheira & Atta 2009).

Jatropha curcas is a plant with several uses and considerable of great potential. In the tropical countries, it is used as a live fence in the fields and settlements and in arid regions; it's also used in controlling environmental pollution, soil erosion and improved water infiltration, reclaim wasteland. The plant also has numerous alternative uses which includes biodiesel production (Fairless 2007, Kant & Wu 2011, Maurya & Yadav 2016). The seed contains 60–68% of kernel which has up to 60% oil, the oil is been used traditionally for soap and candle production, lighting and lubricant. The de-oiled seedcake can be used for organic fertilizer without any detectable phorbol ester both in the crops and soil (Srinophakun *et al.* 2012). Studies (Abou-Kheira & Atta 2009, Sushma 2014) have revealed that different parts of the plant have various medicinal uses, its bark contains tannin, the flowers attract bees and thus the plant has a honey production potential. Ash from the burnt plant is used to produce lye for soap making. Its wood and fruit can be used for numerous purposes including fuel.

Despite the increasing demand and use of *Jatropha curcas* globally, no plantation of its kind exists in the

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study area. Though several researches have been carried out on the pre-sowing treatment of *Jatropha curcas* seeds (Wang & Hanson 2008, Islam *et al*. 2009, Gairola *et al*. 2011, Windauer *et al*. 2012, Valdés-Rodríguez *et al*. 2014), they do not consider the efficacy of using cow dung or water at room temperature. However, it has been reported that the manure of some animals aids the germination of certain seeds (Traveset *et al*. 2001), therefore this study aims to assess the effects of three pre-sowing treatments on the germination of *Jatropha curcas*, with a view to providing best treatment for enhance nursery seedlings production.

MATERIALS AND METHODS

Study site

The experiment was conducted in Prof. E.L.C Nnabuife screen house in the Department of Forestry and Wildlife, Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Anambra State. The University is located in the South-eastern geopolitical zone of Nigeria and lies between latitude 6.245° to 6.283° N and longitude 7.115° to 7.121° E (Fig. 1). The climate of Awka falls within the tropic wet and dry type (Ezewaji *et al.* 2013, Chukwu *et al*. 2020).

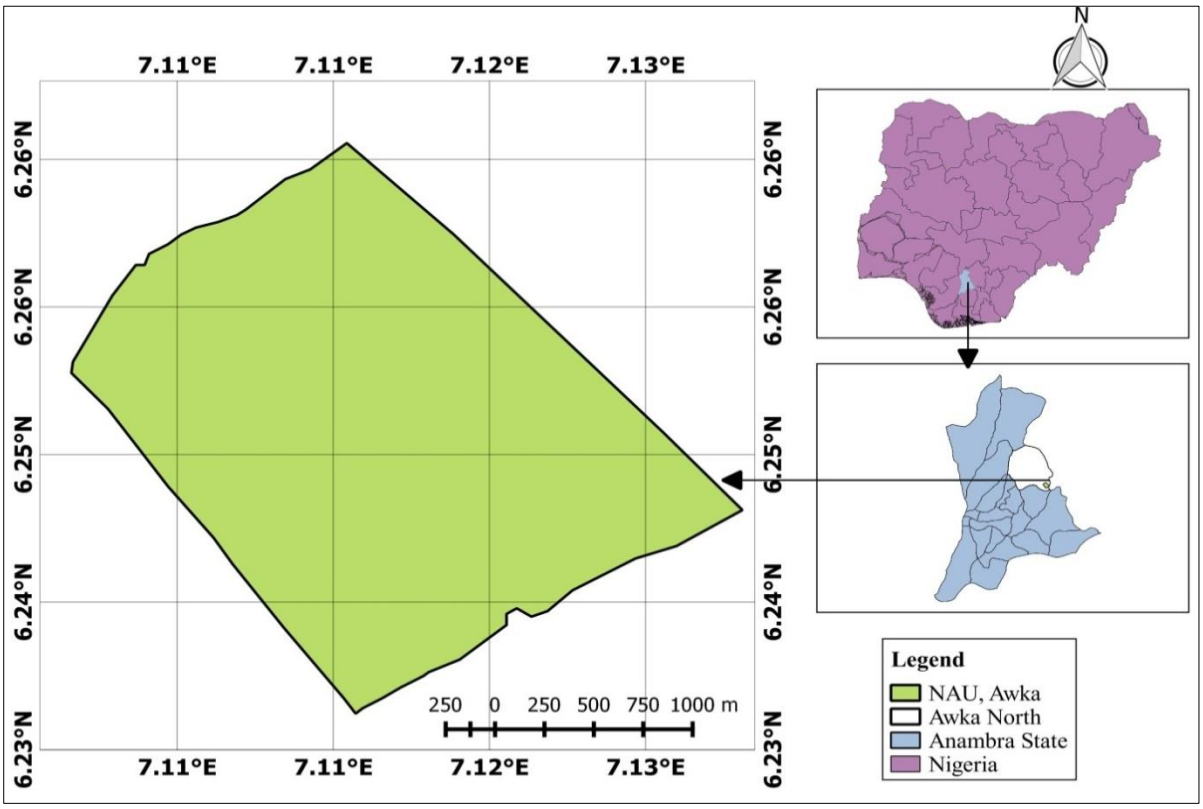

Figure 1. Map of Nnamdi Azikiwe University, Awka, Nigeria. [Source: Chukwu *et al.* (2020)]

Seed collection

The seeds of *Jatropha curcas* were collected in April 2019 from trees around the North Bank Market in Makurdi Local Government Area of Benue State. The seeds of *Jatropha curcas* were first tested for viability through floatation method as described Amusa (2011); this was to ensure viable seeds were used for this study.

Experimental design

The experiment was laid out in a completely randomized design. It involves three treatments, water at room temperature for 16 hours, cow-dung slurry for 16 hours and 98% concentrated sulphuric acid for 5 minutes. Another set of seeds with no pre-treatment was sown, which served as the control, each treatment was replicated five times, as shown in the experimental layout (Table 1). The viable seeds were sown into the germination plastic tray that was filled with sterilized river sand. The sterilized river sand where sieved to remove unwanted materials that might affect the germination of the seeds. Each treatment received 10 seeds and was replicated 5 times giving a total of 200 seeds that was sown. The seeds were considered germinated when the cotyledons become expose above the medium. Germination count was taken every evening and seedlings were pricked-out after counting to avoid error and double count. The numbers of seeds germinated were recorded in each germination tray. Seedlings were watered once a day throughout the experiment. Germination was monitored for 20 days, after which the experiment was terminated, as no germination occurred.

Table 1. Experimental Layout.

	R1	R2	R3	R4	R5
T1	T1R1	T1R2	T1R3	T1R4	T1R5
T2	T2R1	T2R2	T2R3	T2R4	T2R5
T3	T3R1	T3R2	T3R3	T3R4	T3R5
T4	T4R1	T4R2	T4R3	T4R4	T5R5

Note: T- Treatment, R- Replicate, T1- No pre-treatment, T2- Cow dung slurry for 16 hours, T3- Water at room temperature for 16 hours, T4- 98% concentrated sulphuric acid for 5 minutes.

Data analysis

The cumulative germination data were computed, and subjected to descriptive statistics such as percentages in each treatment, histogram, bar chart and line graph. In order to assess the significant difference in germination between each, the percentage data were transformed using Arcsine transformation and further subjected to analysis of variance (Onyekwelu & Akindele 2002, Chukwu *et al*. 2019). Hence, significant means were separated using Duncan multiple range test at a significant level of 0.05.

Germination percentage was computed as:

$$\text{Germination percentage} = \frac{\text{No of seeds germinated}}{\text{Total Noof seeds sown}} \times 100$$

RESULTS

Germination for the experiment started as early as the 4th day for seeds treated with water at room temperature (T3) while seeds on control (T1) and cow dung slurry (T2) started germinating on the 5th day (Fig. 2). However, no germination was recorded for seeds treated with sulphuric acid. Seed germination stopped on the 12th, 7th and 6th day for control (T1), cow dung slurry (T2) and water at room temperature (T3), respectively. The percentage germination ranged from 60–70% for T1, 0–30% for T2 and T3 and no germination was recorded T4 (Fig. 3). Result of the average germination percentage for each treatment showed that T1 had the highest mean percentage germination (66%) while T2 and T3 had 14% each (Fig. 4).

The result of the one-way analysis of variance revealed that there was significant difference ($p<0.05$) in the germination of *Jatropha curcas* seeds subjected to different pre-sowing treatments. Furthermore, Duncan multiple range test result showed that significant difference exit between T1 and other treatment, hence, it had the highest mean of 55.37. Also, the result showed there was no significant difference between T2 and T3, though T3 gave a higher mean of 28.29 (Table 2).

Table 2. Results of seed germination for different treatments.

Treatment No.	Treatment	Mean ± standard error
T1	Control	55.37 ± 1.66^{c}
T2	Cow dung slurry	24.16 ± 3.57^{b}
T3	Water at room temperature	28.29 ± 4.93^{b}
T4	Acid	0.00 ± 0.00^{a}

Note: Means with the same alphabets (superscript) have no significant difference (P<0.05).

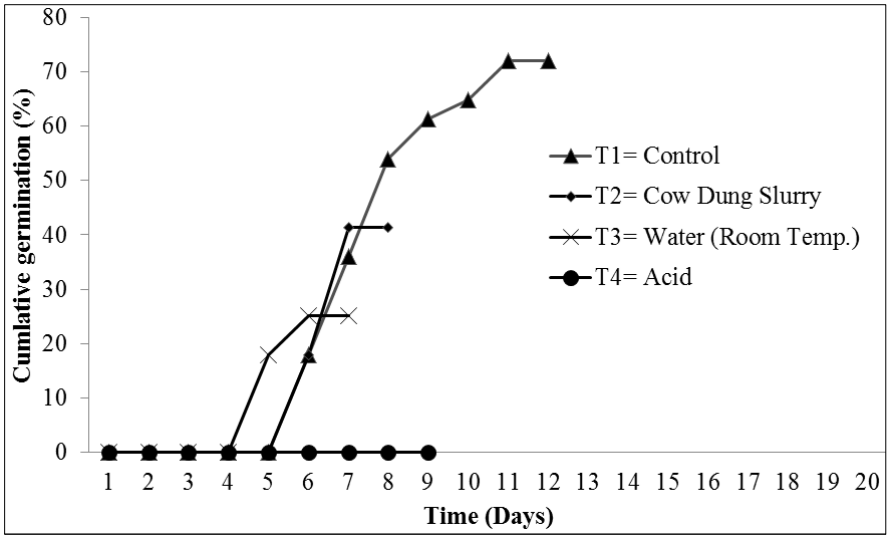

Figure 2. Germination trend of *Jatropha curcas* L. under different treatments.

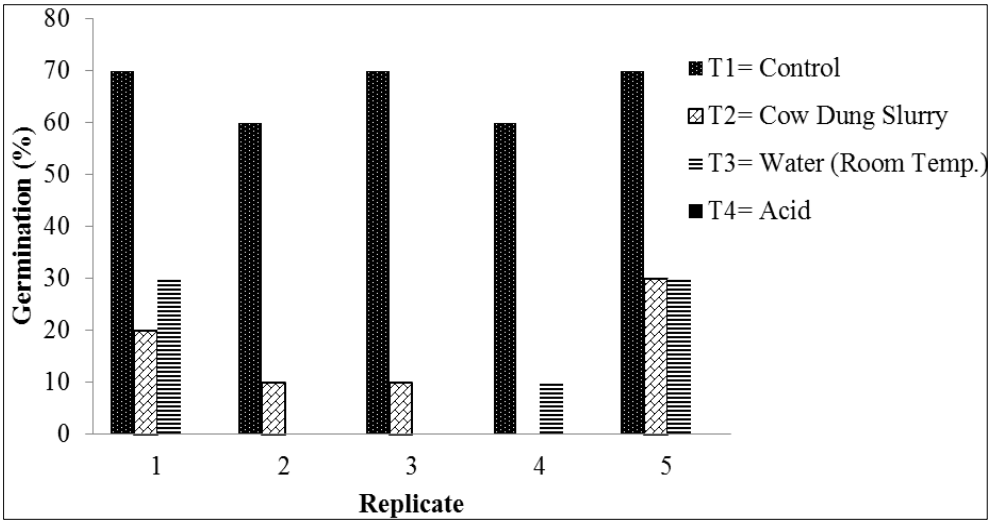

Figure 3. Germination percentage for each treatment and replicate.

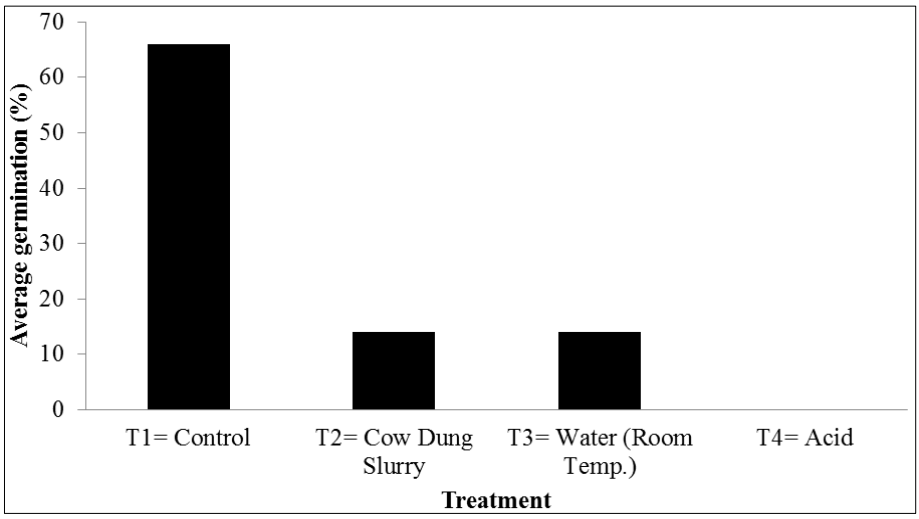

Figure 4. Average germination percentage for *Jatropha curcas* L. under different treatments.

DISCUSSION

From the result of this study, no germination was observed on the first four days. This was comparable to Amonum *et al.* (2019) that assessed germination and early growth of *Jatropha curcas* from different seed sources in Benue State, Nigeria and reported that no germination occurred from all the sources for the first five days. Hence, germination in this study started earlier in seeds soaked in water at room temperature, followed by seeds soaked in cow-dung and control. Seeds pre-treated with 98% concentrated sulphuric did not germinate and this can be attributed to the destructive penetration of seed coat by the acid. This corroborates with the study of Achten *et al* (2008) who reported that *Jatropha curcas* soaked in sulphuric acid did not germinate.

The seeds of *Jatropha curcas* had the highest germination percentage under control (T1) and showed significant from other treatments. This suggests that *Jatropha curcas* has no dormancy issue. This confirmed the result of also Amonum *et al.* (2019) reported 58–86% germination within 15 days for *Jatropha curcas* from different sources sown without treatment. They further stated that high germination percentage is one of the early growth indicators for a successful plantation programme especially in large scale plantings which involve huge capital.

CONCLUSION

Results of the present investigation indicated that seeds of *Jatropha curcas* could be germinated without pre-sowing treatment. Hence, the study concluded that *Jatropha curcas* has no germination problem. It is therefore recommended that a provenance trial be carried out for *Jatropha curcas* in Nigeria.

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