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Research paper

Assessment of *Jatropha curcas* Growth Performance as Affected by the Different Sources of Water

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Countries like Nigeria where water availability to serve both agriculture and industrial demands continues to be a problem of great concern. Water quality control and watershed management would only be possible with adequate information on the water bodies within a given locality, region or a country. Therefore, continuous assessment of the quality of water supplied to agriculture and nursery production is very paramount and necessary, in order to meet the United Nations' campaign for providing good quality water for all human activities and uses by the twenty-first century. For this research, combinations of field and greenhouse studies were used. The water was sourced from three different locations (River water, Borehole water and Fish pond water) the water was stored each in three jar cans making a total of nine jar cans in all. River sand and cow dung were mixed thoroughly in the ratio 3:2 respectively, polyethylene bag and led out in Randomized Complete Block Design and replicated three times. The result revealed that pond water is the best water for *Jatropha curcas* growth performance followed by river water and the least among the sources of water is borehole water. This is due to the quality or state of being distinctiveness between the three (3) sources of water.

Keywords: Nursery, water quality, *Jatropha Curcus*, green house and agriculture

INTRODUCTION

The Greek philosopher Pindar described water as the "best of all things". This view is not surprising since the need for water, throughout human history, has always been appreciated. Water is present everywhere without which life will simply cease to exist. It is constantly in motion, passing from one state to another and from one location to another. Irrespective of its movement as rivers or streams or stationary as it is in lakes, it invariably contains extraneous materials, due to natural causes and human activities (Biswas, 2008). Almost all of the planet's water (97%) occurs as salt water in the oceans (Bouwer, 1978) of the remaining 3%, two-thirds occur as snow and ice in polar and mountainous regions, and only about 1% of the global water as freshwater (Bouwer, 1978).

Global water problems are neither homogenous nor constant or consistent over time. There is a spatio-temporal variation within a particular country as well as from one region to another. Solutions to these problems depend not only on water availability, but also on many other factors such as competence and capacities of institutions that manage them, availability of funds, and climatic, social and environmental conditions of the countries concerned. They also depend on the levels and availability of technology, modes of governance and quality of academic research (Biswas, 2008).

Jatropha curcas is multi-purpose plantation to ameliorate soil degradation, desertification and deforestation, which can be used as an alternative energy to replace petroleum diesel for a sustainable production and climate protection. Bio-diesel from *jatropha* reduces pollution by up to 75%. Bio-diesel offer safety and benefit over petroleum diesel because it is much less combusted with flash point greater than 150°C compared to 77°C of petroleum diesel (Williams, 2007). *Jatropha curcas* is believed to have originated in South America, where from ancient times extracts from its leaves and seed where use as medicine. *Jatropha curcas* medicinal qualities derived from curcin, a chemical present in a plant's shoots and lives which are effective as an antiseptic but can be anti-nutritional if ingested in

large qualities (Anon and Westcot, 2008). It is said that Portuguese sailors learned of *Jatropha* medicinal qualities when they came to South America in the 16th century. They took *Jatropha curcas* to Africa and India, where its fast growths and inedible leaves made it ideal as a stock fence to prevent animals grazing crops. It is also widely grown as a shade tree for dwelling. *Jatropha* now grows from the forest of Brazil to the tropical Island of Fiji. *Jatropha* is still use as a traditional medicine in India and Africa (World Agro Forestry Centre WAC, 2008). Hence, the main objective of this research is to identify the best source of water for *Jatropha curcas* growth performance.

MATERIALS AND METHODS

Description of the study area

The experiment was performed in Kano University of Science Technology, Wudil, Department of forestry, Fisheries and Wildlife Nursery. Wudil is located on latitude 11.570317N, 11.869425N and longitude 8.779696E, 8.936728E of the Green which Meridian. The geology of falls within the Northern Nigerian basement complex rocks consisting on non-intrusive rocks form during the free Cambrian period (Olofin,987; Olofin and Tanko, 2002), as well as igneous and sedimentary structures. The three soil types found within the region are Lithosols, Hydromorphic and Regosols (Baba, 1979). The natural vegetation of the area is woof land characterized by the moderately tall grasses and scattered trees that are deciduous in nature. The present climate of the region is basically wet and dry session classified by Koppens as the mean annual rainfall is about 850 mm (Olofin, 1987). The mean annual temperatures in the area is about 26°C, but mean monthly temperature value ranges between 21°C in the coolest month of December/January and 31°C in the hottest months of April/May (Olofin, 1987).

Experimental materials

The materials that was used in carrying out the research were: seeds, Polybags, River sand, Organic manure (cow dung), Watering can, shovel, wheel barrow, water, tape, ruler, biro-pen, book and water containers (Jar-cans) for storing the different water.

Experimental design

For this research, a combination of field and green house studies were used. The water were sourced from three different locations (River water, Borehole water and Fish pond water) the water were stored each in three jar cans making total of nine jar cans in all. River sand and cow dung were mixed thoroughly in the ratio 3:2 respectively. The mixture was put in polyethylene bag and led out in Randomized Complete Block Design and replicated three times. Pre-planting irrigation was carried out one week before planting in order to stabilize soil structure. The watering was done early in the morning to each block and in the same amount (1 liter) each. The seed were treated by soaking in cold water and last for 24 h before planting.

Sampling procedure

The study area was carefully chosen by avoiding any chance of unwanted water to touch the seedlings. In each block, 4 seedlings were sampled for height measurement and a total of 4×9=36 seedlings were sample in each replication. Therefore, a total number of one hundred and eighty seedlings (180) formed the sample of the research, Proper attention while separating the replication and also when watering was ensured. Each sample was given the same treatments without bias.

Data analysis

The data were analyzed using inferential statistics, Analysis of Variances (Anova) was used to answer the stated objectives of the research, least significance differences (L.S.D) was also adopted to separate the best water for *Jatropha curcas* seed at 5% and 1% level of significant.

RESULTS AND DISCUSSION

Plant height parameters

Result of plant height of *Jatropha curcas* as affected by different sources of water is presented in (Table 1). The result revealed a highly significant effect ($P< 0.001$) of the different sources of water at week one on the plant height. The result further stated that the water sourced from pond three (P3) has the highest effect on the plant height with 12.40 cm. Though, P4, R3, P2 and B2 are statistically the same. Furthermore, B4 showed and arrearage height of the plant with 11.21 cm.

The result of the analysis of variance revealed highly significant effect ($P< 0.001$) of the different sources of water at week two on the plant height of *Jatropha curcas*. It indicate that B2 produced the highest plant height with 16.95cm followed by P3 with 14.50 cm R2 with 14.05 cm, B4 with 13.14 cm and all the rest are statically the same. Furthermore, it indicated in the 3rd week, the source of water was highly significant ($P< 0.001$) on the plant height of *Jatropha curcas*. It showed that the sources of water P3 has the highest plant height with 17.05 cm

Table 1. Response of *Jatropha curcas* to different sources of water on plant height.

Treatment	Number of weeks					
	1	2	3	4	5	6
R1	8.40b	8.98b	11.70b	13.25b	14.25b	16.15b
R2	9.98bcd	14.05d	15.00cde	18.23cd	19.25.bc	21.65ab
R3	11.60d	12.25cd	13.98bcd	15.53bcd	1735bc	18.83ab
R4	8.76bc	10.23bc	12.98bc	14.18bc	16.62bc	17.32ab
B1	5.29a	5.94a	2.64a	7.71a	6.07a	6.13c
B2	11.48d	16.95e	16.95e	18.68d	20.33c	22.20a
B3	10.78bcd	12.88cd	14.08bcd	15.95bcd	17.53bc	19.08ab
B4	11.21cd	13.14cd	15.71de	16.06bcd	17.97bc	18.25ab
P1	11.48d	12.58cd	14.80cde	17.25bcd	18.35bc	19.58ab
P2	10.80bcd	12.98cd	13.04bc	14.65bcd	15.23bc	17.70ab
P3	12.40d	14.50de	17.05e	16.63bcd	16.63bc	19.00ab
P4	11.62d	12.78cd	16.29de	16.89bcd	17.19bc	18.74ab
SE (±)	1.128	1.272	1.079	1.729	2.477	2.503

Table 2. Comparison of *Jatropha curcus* height performance treated with different sources of water (River, Bohal and Pond Water).

River	Height	Bohal	Height	Pond	Height
R1	12.12	B1	5.63	P1	15.68
R2	16.36	B2	17.77	P2	14.07
R3	14.92	B3	15.45	P3	16.04
R4	13.37	B4	15.39	P4	15.56
Σ	56.7	Σ	54.84	Σ	61.35
Average	14.198	Average	13.46	Average	15.33

followed by B2 with 16.95 cm than P4 with 17.05 cm followed by B2 with 16.95 cm than P4 with 16.29 cm, B4 with 15.71 cm, R2 with 15.00 cm, p1 with 14.80 cm, than P3 and R3 with 14.80 and 13.08 are statistically the same. P2 and R4 with 13.03 cm and 12.98 cm as well are the same. R1 with 11.70 cm and finally B1 produced the least plant height of *Jatropha curcas* in the 3rd week with 2.64 cm.

Also, the result in week 4 indicates that the water source is highly significant (P< 0.001) on the plant height of *Jatropha*. It revealed that the source of water of B2 with 18.68 cm has the highest plant height followed by R2 with 18.23 cm, P1 with 17.25 cm and all the rest are statistically the same, while B1 has the least with 7.71cm. The result further showed that there is highly significant effect (P< 0.001) of the source of water on the plant height. It showed that B2 has the highest with 20.33 cm followed by R2 with 19.25 cm and all the rest are statistically the same except B1 which has the least with 6.07cm. Lastly, the result also revealed a highly significant effect (P< 0.001) of the different sources of water at week 6 of the plant height. It showed the source of water on B2 has the plant height with 22.20 cm R2 with 21.65 cm and all the rest at the statically the same except R1 and B1 with 16.16 cm and 6.13 cm respectively.

The result revealed that, pond water is the best water for *Jatropha curcas* growth performance followed by river water and the least among the sources of water is borehole water. This is due to the quality or state of being distinctiveness between the three (3) sources of water (Table 2). The different parameters present in pond water were: ammonia, nitrogen, Phosphate, phosphorus, turbidity and dissolved oxygen. Dissolved oxygen (DO) or temperature is the most critical indicator of water quality. Followed by river water the parameters were: Turbidity, temperature, PH, ammonia, dissolved Oxygen and other heavy metals.

Lastly the borehole water parameters were: magnesium, calcium, sodium, silica and potassium. The result indicated that *Jatropha curcas* required more of ammonia, nitrogen, phosphorus which are exactly absent or may be very law in order sources of water.

Conclusion

It was concluded that pond water performed best by producing the highest yield of Jatropha's height. This is due to the quality of being distinctiveness between three (3) sources of water. The different parameters present in

pond water were pond to be highly alkaline with presence of calcium, nitrate and magnesium as a major and essential element that makes the water fertile and other two sources are of course different there is high amount of ammonia, nitrogen, turbidity, phosphate, and dissolved oxygen in pond water followed by river water and borehole water produced the least with different parameters. Further research is needed to ensure the variability and element required by *Jatropha sp* so as to ensure effective and successful growth response of *Jatropha curcas.*

Recommendation

Based on the findings of the research, the following recommendations are made in order to produce *Jatropha curcas* particularly on the best water needed for it successful growth. The gardeners/forest should be encouraged to produce *Jatropha curcas* using pond water. Another similar research should be conducted again to confirm the findings of this research so that, the effectiveness of the treatments on field can be evaluated,

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