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Bio Diesel Potentials of *Jaropha curcas in Sokoto State*

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ABSTRACT

This study aimed at evaluating the yield and biodiesel potential of Jatropha curcas L. In Sokoto area. The field experiment was carried out at bio energy farm and Fadama land of Sokoto. Powdered seed samples used in the research was obtained from cutting seed and seedling raised Jatropha plant. The result revealed that percentage oil yield was significantly higher in distal cutting from lowland area (41%) than in apical cutting with 24% from upland. With regards to volume of biodiesel produced among the cuttings medial cuttings from lowland was significantly higher (2.1) than the apical cuttings with (3.4 grams) (P<0.05) recommended the study therefore suggested that the use of medical apical and distal powdered from lowland should be encouraged to a greater hight for biodiesel production. The use of distal cuttings from upland for out percentage should also be encouraged for better and high quality oil.

Key words: ***Bio-diesel, Jatropha curcas Trans-esterification***

INTRODUCTION

Energy crisis experienced in the 1970s and more recently, in the early years of the 21st century and the danger posed by emission of $C0_2$ from their combustion prompted search for alternative sources of fuel (Anonymous, 2001; Subramanium *et al.,* 2005; Capilan, *et al;* 2007). So far, over 350 species of oil- bearing plants have been identified, out of which 75 species are reported to contain 30% or more oil content in their seeds. The fatty acid and methyl esters of oil from 26 species were found suitable for use as biodiesels (Ramadhas *et al.,* 2005). *J. curcas* contains 30-35% oil that can be converted to biodiesel by chemical or lipases-mediated esterification (Gubitz *et al*; 1999). In despite it high percent content, *Jatropha* oil is toxic and not suitable for consumption. The seed cake is a potential substrate for solid state fermentation that can be employed to grow microbial organisms and to produce extracellular enzymes like proteoses, and cellulose (Aponte, 1978; Azeerado 2002; Anonymous, 2002b;

Germano *et al.*, 2003; Akintayo, 2004; Diaz and Aragamose, 2006; Mahounta *et al.*, 2008).

Biodiesel produced from *J. curcas* seeds may be applied directly as pure biodiesel (B100) or blended with the conventional hydrocarbon- based diesel in varying proportions. This "B' factor system is used to state the amount of biodiesels. For example (B20) refers to mixture of conventional to biodiesel in the ratio of 80:20 on percentage scale. Both pure and mixed forms of Biodiesel have been applied successfully on locomotive trains, aircrafts, motor cars and power generators (Becker *et al*., 1998; Ormic, 2006; Biojet, 2009). Biodiesel is a liquid which varies in colour between golden and dark brown depending on the production feedstock. It is immiscible with water, has a high boiling point and low vapour temperature. The flash point of biodiesel (>130^{0}C, >266^{0}F) is significantly higher than that of petroleum diesel (64^{0}C, 147^{0}F) or gasoline (45^{0}C, - 52^{0}F). The aim of this research is to find out which of the powder of *Jatropha curcas* from the two locations (Upland and Lowland) yields the best biodiesel. Secondly the aim of research is also to determine which of the cutting position gives the best *Jatropha* oil.

METHODOLOGY l

Oil Extraction

Dried seed of *J* curcas were collected from 23 local government areas of Sokoto. The seeds were first crushed into powder using decadicating (decadicator) machine. Soxhlet extraction method was then applied to liberate the oil from the seeds powder. One hundred grams (100g) of the sample was weighed and the oil was extracted using soxhlet extractor at 60^{0}c for 5 hours using n-hexane. The oil was thereafter concentrated

The percentage crude lipid extracted was determined

Trans-esterification

According to Demirbas (2000) this is the reaction involving methanol and sodium hydroxide catalyst. It was employed for the production of methyl ester or biodiesel from the crude vegetable oil. This was carried out by dissolving 1g of NaOH in 20 cm^3 of methanol, this was again mixed with 100 cm^3 of extracted *Jatropha* oil in a 500 cm^3 round bottom flask fitted with the content was stirred thoroughly with magnetic stirred for 5 minutes. The mixture was then heated on

a water bath at 60^0C for one hour and then transferred in to a separating funnel which was allowed to stand overnight separating the mixture under gravity, the separated upper layer (Biodissel) was placed into an evaporating dish and heated on a water bath at 90^0C for 30 minutes to remove the residual methanol.

Twenty percent equivalent of hot distilled water was used for the washing to remove some impurities from the diesel. The hot distilled water was used in the washing until the pH of the water reaches neutral point (7.0).

Data Analysis

Data collected, which was the oil obtain from the cuttings position *J* curcas and also oil obtained from the two locations (upland and lowland) were analyzed using analysis of variance and mean separation using new Duncan multiple range test. Data on the oil yield at different location were Analyzed using ANOVA.

METHODOLOGY II

Sample Collection

Cuttings position of apical medial and distal position were obtained wild and grown in Fadama land (lowland) and upland areas. After harvest, the seeds were crushed to powder and liberate oil. The same procedure adopted for cuttings were also adopted on seed and seeding transplant. Finally, the data obtained was statistically analyzed using ANOVA analysis of varyiance.

RESULT AND DISCUSSION

Effects of Cutting Position and Planting Method on the Percentage of Oils Yield of *Jatropha curcas* from Lowland and Upland Areas of Sokoto

The effect of cutting position on the percentage oil yield of *J. curcas* from lowland areas of Sokoto is presented in figure.27. In the upland areas, *J. curcas* cut at the apical position produced the least percentage oil (24%) while cuttings at the distal position produced the highest percentage oil (41%). However, in lowland areas, *J. curcas* cut at the apical position produced the highest percentage oil (38%) while *J. curcas* cut at the distal position produced the least percentage oil (32%).

The percentage oils produced in lowland and upland areas significantly differ ($P<0.05$) for *J. curcas* cut at the apical, distal and medial positions respectively. *J. curcas* from lowland areas, cut at the

apical and medial positions produced higher percentage oil while *J. curcas* from upland areas cut at the distal position produced higher percentage oil.

Weight of seed samples (kg) of *J* curcas that produce 1 liter of biodiesels from the different cutting position in upland and lowland areas

Figure 2 presents weight of seed sample (kg) of *Jatropha curcas* that produce 1 liter of biodiesels from different stem cutting position in upland and lowland areas. The weight of seeds varied significantly (P<0.05) with cutting position in upland areas, but not with cutting position (P>0.05) in lowland areas. In upland areas *Jatropha curcas* cut at the apical had the highest weight of seeds (3.40kg) which was significantly higher (P<0.05) than that of *Jatropha curcas* cut at the medial (2.80kg) and distal (2.60kg) position respectively. Also in lowland areas the weight of powdered direct seeds, used ranged from 2.10 liter of oil for *Jatropha curcas* cut at the medial position to 2.20 liter of oil for *Jatropha curcas* cut at the apical and distal position respectively.

The result in Figure 1 shows the effect of planting method on the percentage oil yield of *J. curcas* from lowland and upland areas of Sokoto. *J. curcas* planted by seedling transplant produced higher percentage oil compared to *J. curcas* planted by direct seeding in both upland and lowland areas of Sokoto. Also, location significantly influenced (P<0.05) the percentage oil produced from *J. curcas* planted by direct seeding and seedling transplant with the lowland areas having higher values compared to the upland.

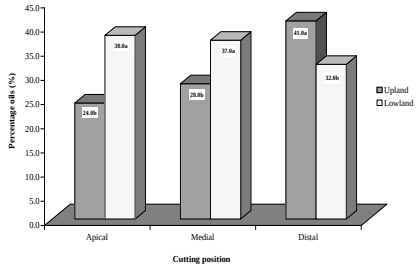
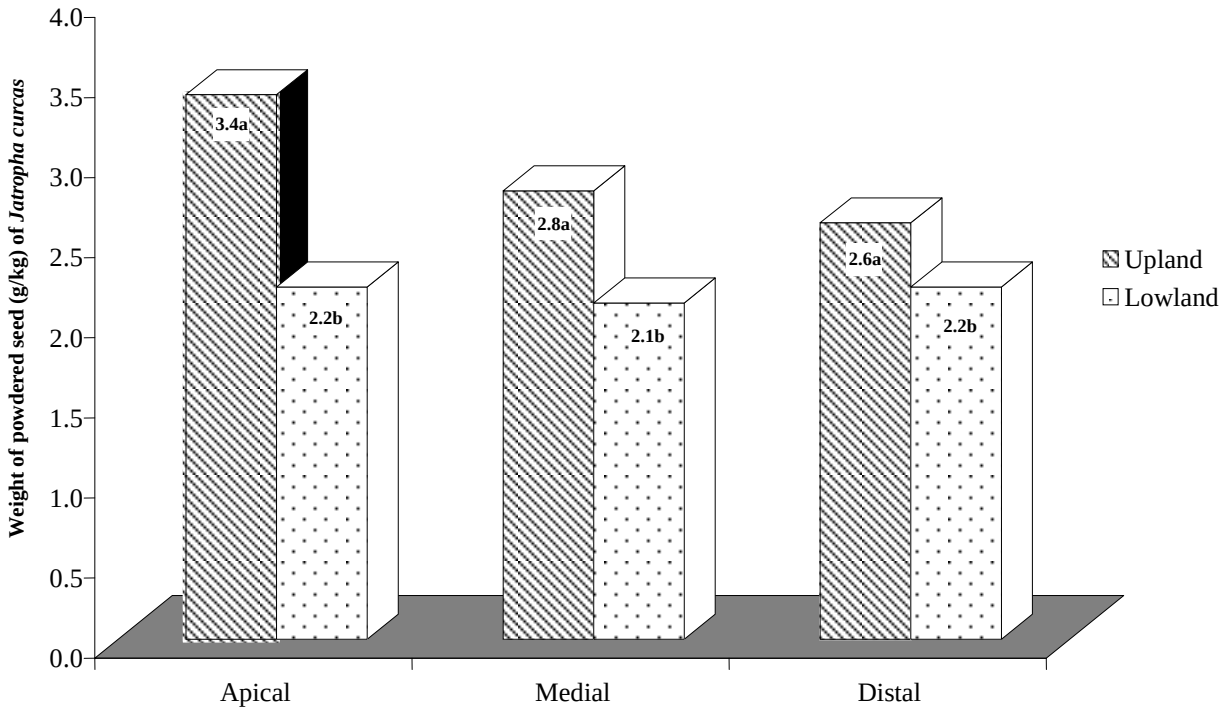


Fig. 23: Effect of cutting position on the percentage oil yield of *Jatropha curcas* from lowland and upland areas of Sokoto a,b – Means with different superscript are significantly different (P<0.05)



CONCLUSION

It is concluded that powdered materials obtained from distal cutting from upland gave the best % oil yield while powdered obtained % yield. It is therefore recommended for the use of distal powder for good oil percentage. In terms of powdered *Jatropha* sample that produces one liter medial from lowland gave the highest yield followed by Apical and distal in the same lowland and lastly the apical in upland with least yield.

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