Effect of Physiological age of Stem cutting on the Growth of *Jatropha curcas* in Sokoto

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ABSTRACT

A study on the physiological age of stem on the growth of *Jatropha curcas* L was conducted in field trials at the Bio-energy farm of Sokoto Energy Research Centre (SERC) and Fadama Research farm in Sokoto during 2009 and 2010 dry seasons. The experiment consisted of full length cuttings of *J. curcas* obtained from four locations along precipitation gradients in Sokoto state. Full length stem cuttings were divided into three pieces of distal, medial and apical. The experiment was carried out in a randomized complete block design (RCBD) with three replicates per experiment. Cutting position did not show significant (P>0.05) effect on the girth, height and branches of *J. curcas* and cutting at the distal position had the highest values for the parameters evaluated. The percentage sprouting ranged from 17.5-30.6% in lowland areas and 12.5-34.2% in the upland areas. The study suggests that propagation of *J. curcas* by cutting at the distal position be encouraged for enhanced growth performance.

Introduction

In Nigeria, five species of jatropha are commonly found which include *J. curcas, J. gossypifolia* and *J. cheveleria*, *J. podatrica* and *J. multipida*. However, special interest is placed on *J. curcas* because of the oil contained in its seeds that is chemically and functionally similar to petroleum diesel. *Jatropa curcas* L., also referred to as physic nut, family Euphorbiaceae, is a large drought-resistant multipurpose shrub with several attributes and considerable potential that has evoked interest all over the tropics as a potential biofuel crop (Openshaw, 2000), renewable and environment-friendly with low sulphur emission (Li *et al*., 2007). The longevity of *J. curcas* for 30-50 years in productivity and its potential for reclamation of degraded land makes it an increasingly important crop (Heller, 1996).

The Cape Verde variety of *J. curcas*, which is economically viable, has existed in Nigeria for over 200 years with a little scientific work on its basic growth parameters especially in the Sudan savanna zone. Considering the economic and environmental potentials of this crop and its ecological adaptability to this zone, there is the need to carry out investigations on

its vegetative growth potentials which is based on sound scientific information and hence, this effort to generate baseline data on *J. curcas* ecotypes found in Sudan savanna region of Nigeria. This paper aimed at evaluating the effect of physiological age of stem

cutting and source on the growth of *Jatropha curcas* in lowland and upland areas of Sokoto.

Materials and Methods

Field experiments were carried out at the Bio-energy farm, Sokoto Energy Research Centre (SERC) at latitude 13'13^{o}N and longitude 5'20^{o}E and Fadama Research farm at latitude 13.09^{o}N and longitude 5.21^{o}E all in Sokoto. Sokoto fall in semi arid (Sudan Savanna) agro-ecological zone. Full length cuttings of *J. curcas* were obtained from four locations along precipitation gradients in Sokoto state. The four locations were Sokoto South, Sokoto Central, Sokoto N/East and Sokoto N/West. The cuttings were further divided into smaller sizes along the vertical axis from the base to the apex each cutting consisted of four lateral buds. Full length stem cuttings were divided into three pieces of distal, medial and apical. The experiment was carried out in a randomized complete block design (RCBD) with three replicates per experiment. The plants were watered twice in a week for the period of experiment. Measurement of shoot height, stem girth and number of branches were taken at 4 weeks after planting initially and at 12 weeks intervals subsequently. Data collected were analyzed using descriptive statistics and analysis of variance using Statistical Package for Social Sciences (SPSS) version 15 and significant means were separated using Duncan Multiple Range Test (DMRT).

Results and Discussion

The effect of cutting position and source on the growth of *Jatropha curcas* is presented in Table 1. Cutting position and source had no significant ($P>0.05$) effect on the girth of *J. curcas* and cutting at the distal position produced the highest girth values which ranged from 7.15 cm for *J. curcas* from Sokoto N/East to 7.29 cm for *J. curcas* from Sokoto South and Sokoto N/West respectively. In upland area, cutting position significantly effected ($P<0.05$) the girth of *J. curcas* collected from Sokoto N/West. For *J. curcas* collected from Sokoto N/West, cutting at the distal position produced the highest mean girth (2.76 cm) which was significantly higher ($P<0.05$) than those at the medial and apical positions with 2.34 and 2.33 cm. The height of *J. curcas* collected from the different cutting sources in lowland and upland areas of Sokoto was not significantly ($P>0.05$). In lowland and upland areas, for all sources of cutting, cutting at the distal position had the highest mean values for height. The number of branches ranged from 57 – 59 in the lowland areas and 31 – 38 in the upland areas. In the lowland area, the highest number of branches was obtained from Sokoto N/West collection planted by cutting at the apical position. Although, cutting position had no significant effect ($P>0.05$) on the number of branches, in the upland and lowland areas, cutting at the medial position gave the highest number of branches for *J.*

curcas collected from Sokoto Central in the upland areas. Cutting at the distal position produced the highest number of branches for seeds collected from Sokoto South with 38 branches. Although, propagation of *J. curcas* by cutting is associated with the problems of reduced vigor, transfer of diseases and a shallow rooting system of the propagated plants (Feike *et al.,* 2008). In recent years, vegetative propagation by stem cuttings has received attention due to its simplicity is widely used for establishment of clonal propagation. Vegetative propagation initiates the early commencement of reproductive phase, produces true to type, disease free and reduces the variability in the seeds to be produced (Nanda and Kochhar, 1987).

The variation in the growth parameters of *J. curcas* in upland and lowland areas could be attributed to soil variation and water availability. Bijalwan and Thakur (2010) reported that soil types and seasonal variation play an important role in growth of *J. curcas*; moreover, cutting size and cutting position also play an important part in growth response of shoot cuttings. Soil and seasonal variation are known to increase growth response in the shoot cuttings of some forest species (Nanda *et al.,* 1968; Bijalwan and Thakur, 2010). Under jatropha, increased potential for carbon sequestration rates are possible as stable micro-aggregates can offer protection to organic carbon. Jatropha cultivation programmes will not only serve as a source of income-generation to resource-poor farmers but will also improve the quality of their soils in the long run.

The percentage sprouting ranged from 17.5-30.6% in lowland areas and 12.5-34.2% in upland areas was observed in this study. A lower percentage sprouting of 13.3% was earlier reported for *J. curcas* planted in Haldwani, India (Kumari *et al.,* 2010). Kumari *et al.* (2010) noted that sprouting (%) was best in *J. curcas* cut from distal position followed by medial and apical positions. Furthermore, percentage sprouting of 44.0% and 33.8% has been reported for juvenile and mature *J. curcas* grown in western Himalaya, India, during the spring season and 34.8% and 24.6% sprouting for juvenile and mature *J. curcas* during the winter season was observed (Bijalwan and Thakur, 2010). For all the locations, the mean percentage sprouting of *J. curcas* was higher in lowland compared to upland areas. This could be attributed to variation in the soil properties. Nanda *et al.* (1968) have also reported variation in percentage sprouting of some forest species with variation in soil properties. Based on the findings of this study, it can be concluded that cutting at the distal produced the greatest growth fallowed by the medial and apical cuttings and growth of *J. curcas* in lowland area were higher than that of the upland area. Cultivation of *J. curcas* by cutting at the distal should be encouraged for greater growth performance.

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Table 1: Effect of cutting position and source of cutting on growth parameters of *J. curcas* in lowland and upland areas of Sokoto

Source of cutting	Cutting position	Lowland			Upland		
		Girth (cm)	Height (cm)	No. of Branches	Girth (cm)	Height (cm)	No. of Branches
Sokoto South	Distal	7.29 ± 0.99	57.73 ± 8.41	58.33 ± 9.10	2.72 ± 0.15	56.61 ± 7.89	38.28 ± 6.50
	Medial	6.24 ± 0.80	57.43 ± 8.40	58.11 ± 9.50	2.36 ± 0.15	48.07 ± 5.26	30.61 ± 4.92
	Apical	5.40 ± 0.72	56.16 ± 8.44	58.78 ± 9.45	2.33 ± 0.16	46.17 ± 4.98	30.78 ± 4.88
	SEM	0.85	8.42	9.35	0.15	8.75	7.76
Sokoto Central	Distal	7.25 ± 0.99	59.31 ± 8.96	58.72 ± 9.11	2.76 ± 0.14	57.28 ± 7.97	37.22 ± 6.26
	Medial	6.09 ± 0.79	57.29 ± 8.78	59.33 ± 9.84	2.36 ± 0.15	48.35 ± 5.39	31.67 ± 4.87
	Apical	5.45 ± 0.73	55.36 ± 8.27	58.56 ± 9.39	2.33 ± 0.15	46.34 ± 5.13	31.56 ± 4.86
	SEM	0.84	8.67	9.45	0.14	8.90	7.59
Sokoto N/East	Distal	7.15 ± 0.99	58.71 ± 8.92	58.00 ± 9.07	2.75 ± 0.12	56.33 ± 7.74	38.33 ± 6.19
	Medial	6.09 ± 0.81	58.26 ± 8.85	57.44 ± 9.19	2.36 ± 0.14	48.68 ± 5.15	31.39 ± 4.89
	Apical	5.45 ± 0.73	55.19 ± 8.34	57.94 ± 9.67	2.34 ± 0.15	45.31 ± 4.75	31.44 ± 4.71
	SEM	0.85	8.71	9.31	0.14	8.52	7.50
Sokoto N/West	Distal	7.29 ± 1.03	60.67 ± 9.41	57.94 ± 8.97	2.76[a] ± 0.13	56.72 ± 8.07	38.44 ± 6.24

Medial	6.09 ± 0.82	58.83 ± 9.22	58.56 ± 9.34	2.34^{b} ± 0.15	47.39 ± 5.10	31.83 ± 4.84
Apical	5.43 ± 0.73	55.49 ± 8.31	59.22 ± 9.48	2.33^{b} ± 0.15	45.88 ± 4.74	31.39 ± 4.71
SEM	0.87	8.99	9.27	0.14	8.70	7.51

Values are mean ± standard error of three replications. Means in a column with the same superscripts are not significantly different (P>0.05)