Effect of Planting Method and Source of Germplasm on the growth of *Jatropha curcas* L. in Sokoto, Nigeria

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Abstract

Field experiments were conducted at the Bio-energy farm of Sokoto Energy Research Centre (SERC) and Fadama Research farm in Sokoto during 2009 and 2010 dry seasons. The objective was to investigate the effect of planting method and source of germplasm on the growth of *Jatropha curcas* L. The experiment which consisted of three planting methods and four seed sources obtained from Sokoto South, Sokoto Central, Sokoto N/East and Sokoto N/West areas in Sokoto state was set up as a randomized complete block design. A significant effect ($P<0.05$) in planting method and seed source was observed for plant height in lowland area. Stem girth differ significantly ($P<0.05$) with planting method and seed source in upland area. The results revealed that seedling transplant produced the highest values for stem girth, plant height and number of branches than direct seeding and cuttings. The study suggests that seedling transplant is the most suitable planting method for the propagation of *J. curcas*. The Sokoto lowland appears to enhance better growth performance than the upland.

Introduction

Jatropa curcas L., also referred to as physic nut belongs to the 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 seed cake can be a good protein source for humans as well as for livestock (Makkar and Becker, 1999; Aregheore *et al.*, 2003) and as a source of organic fertilizer (Aliero *et al*., 2011). In Nigeria, five species of jatropha commonly found were; *J. curcas, J. gossypifolia* and *J. cheveleria* (Nana) *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. 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 the type of germplasm available and its vegetative growth potentials. Successful cultivation should, however be 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 planting

method and source of germplasm on the growth of *Jatropha curcas* in the Sudan savanna agro ecological zone of Nigeria.

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 is in semi arid (Sudan Savanna) agro-ecological zone. Seeds and full length cuttings of *J. curcas* were obtained from four different locations along precipitation gradients in Sokoto state. The four locations were Sokoto South, Sokoto Central, Sokoto N/East and Sokoto N/West. The full length stems was further divided into smaller size cuttings, along the vertical axis from the base to the apex and each cutting consisted of four lateral buds. Similarly, seeds from the existing wild species were collected from the four locations. Seedlings were raised in a polythene bags and were later transplanted to the field as seedling transplant. 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 was analyzed using descriptive statistics and analysis of variance with a Statistical Package for Social Sciences (SPSS) version 15 and significant means were separated using Duncan Multiple Range Test.

Results and Discussion

The effect of planting method and seed source on the growth of *J. curcas* in upland and lowland areas of Sokoto is presented in Table 1. Results revealed a significant effect ($P<0.05$) of planting method and source of germplasm for plant height in lowland area and stem girth and number of branches are not significantly ($P>0.05$) affected. In upland area, there was a significant difference ($P<0.05$) in the stem girth. For all seed sources used in this study, seedling transplant in the upland areas produced the highest mean girth followed by direct seeding. Cutting had the lowest girth values. The result revealed that method of planting significantly ($P<0.05$) influenced the girth of *J. curcas* in the upland areas of Sokoto.

Method of planting showed a significant ($P<0.05$) effect on plant height for all seed sources and seedling transplant had the highest values for plant height and cutting produced the lowest values for all seeds sources. Similarly, planting method did not show a significant effect ($P>0.05$) on the number of branches for all the seed sources in both lowland and upland areas of Sokoto state. However, seedling transplant produced the highest number of branches while, planting by cutting had the highest number of branches for seeds collected from Sokoto Central and Sokoto N/East. Direct seeding produced the least number of branches for *J. curcas* collected from all the seed sources. From the result obtained it was observed that, planting by cuttings produced the lowest values for the parameters evaluated, while planting by direct seeding and seedling transplant produced the same values for most of the growth parameters studied. According to Ouattara *et al.* (2011), propagation of *J. curcas* is mostly done by cuttings which tend to reduce vigor, transport of diseases, and is associated with shallow rooting system of the propagated plants (Feike *et al.,* 2008). Direct seeding is a method commonly known by most farmers, since they plant several other crops in the same way (Ouattara *et al.,* 2011).

Table 1: Effect of planting method and source of germplasm on the growth of *Jatropha curcas* in lowland and upland areas of Sokoto.

Seed source	Method of planting	Lowland			Upland		
		Girth (cm)	Height (cm)	No. of Branches	Girth (cm)	Height (cm)	No. of Branches
Sokoto South	Direct seeding	9.78 ± 1.48	122.03[a] ± 15.40	56.94 ± 13.03	5.80[a] ± 0.64	93.37 ± 15.56	26.28 ± 5.43
	Seedling transplant	9.84 ± 1.50	124.38[a] ± 14.36	58.61 ± 13.46	6.16[a] ± 0.76	95.50 ± 16.73	32.00 ± 7.08
	Cutting	7.29 ± 0.99	57.73[b] ± 8.41	58.33 ± 9.10	2.71[b] ± 0.15	56.61 ± 7.89	38.28 ± 6.50
	SE ±	1.37	13.09	12.03	0.58	13.95	6.37
Sokoto Central	Direct seeding	9.93 ± 1.47	120.37[a] ± 15.72	53.44 ± 11.72	5.53[a] ± 0.62	92.99 ± 15.95	25.44 ± 5.20
	Seedling transplant	9.84 ± 1.49	123.32[a] ± 14.85	57.44 ± 12.94	6.30[a] ± 0.74	96.83 ± 16.86	31.11 ± 6.87
	Cutting	7.25 ± 0.99	59.31[b] ± 8.96	58.72 ± 9.11	2.76[b] ± 0.13	57.28 ± 7.97	37.22 ± 6.26
	SE ±	1.34	13.52	11.37	0.56	14.17	6.15
Sokoto N/East	Direct seeding	9.94 ± 1.52	116.95[a] ± 14.67	55.61 ± 12.77	5.82[a] ± 0.65	91.79 ± 15.51	22.44 ± 4.59
	Seedling transplant	9.82 ± 1.51	122.16[a] ± 15.19	55.56 ± 12.23	6.29[a] ± 0.73	97.21 ± 17.22	29.28 ± 6.67
	Cutting	7.16 ± 0.99	58.71[b] ± 8.92	58.00 ± 9.07	2.75[b] ± 0.12	139-143	38.33 ± 6.19
	SE ±	1.37	13.23	11.47	0.57	14.11	5.89
Sokoto	Direct seeding	9.91 ± 1.50	117.49[a] ± 14.72	55.61 ± 12.06	5.69[a] ± 0.62	92.58[b] ± 15.86	21.61 ± 4.36

N/West	Seedling transplant	9.86 ± 1.53	122.27[a] ± 14.89	58.06 ± 13.05	6.29[a] ± 0.76	100.78[a] ± 17.30	28.17 ± 6.42
	Cutting	7.29 ± 1.03	60.67[b] ± 9.41	57.94 ± 8.97	2.75[b] ± 0.13	56.72[b] ± 8.07	38.44 ± 6.24
	SE ±	1.37	13.25	11.49	0.57	14.33	5.75

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

The variation in height, girth and number of branches observed could be attributed to soil variation. According to Bijalwan and Thakur (2010) soil types and seasonal variation play an important role in growth of *J. curcas*. Soil and seasonal variation in growth response in the shoot cuttings of some forest species have been reported (Nanda *et al.,* 1968; Bijalwan and Thakur, 2010). In this study, the growth parameters evaluated in lowland areas were comparatively higher than that of the upland areas which may be due to the availability of adequate moisture and nutrients in lowland soils. From the result obtained in this study, it can be concluded that the growth parameters evaluated varies with planting method and seedling transplant had the highest values for the attributes than direct seeding and cuttings. The growth parameters evaluated in lowland area were higher than that of the upland areas and cultivation of *J. curcas* in lowland area by seedling transplant and cutting at the distal portion are recommended for improve growth.

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