Cultivation of *Jatropha curcas* (Ratanjot) in Madhya Pradesh, India

A.K. Pandey, Preetesh Kumari and A.K. Mandal
Tropical Forest Research Institute
P.O. RFRC, Mandla Road
Jabalpur 482 021 INDIA

ABSTRACT

The country has nearly 63 million hectares of wasteland, out of which 33 million hectares of wasteland have been allotted for tree plantation. *Jatropha curcas* L. a promising non-edible oil seed, being hardy in nature can survive in harsh soil and climatic conditions and is a suitable species for wastelands and marginal farm lands. It grows widely in Madhya Pradesh as live fence on the boundaries of fields. To augment the supply of non-edible oils for industrial uses efforts were made to promote this species as a plantation crop among the farmers in Madhya Pradesh through public, cooperative and corporate sectors. It was found that though the crop has shown a promise at experimental farm. Being a new crop, it warranted more intensive follow up by the researchers. Nevertheless it is potential source of non-edible oil and needs to be promoted for wastelands development. There is urgent need to evolve cultivation practices under irrigated and rain fed conditions of Madhya Pradesh. In this direction, studies were initiated to standardize cultivation practices of *J. curcas* for tropical climatic conditions of Madhya Pradesh. Preliminary findings of the study indicate that the crop can be raised by planting polypotted/bare-rooted seedlings/sowing of seeds directly in the field. However, polypotted seedlings planted on ridges in the month of July performed better.

Key words: *Jatropha curcas, germination, growth.*

1. INTRODUCTION

Jatropha curcas (L) is easy to establish, grows relatively quickly and lives, producing seeds for 50 years. A perceived advantage of *Jatropha* is its ability to grow on marginal lands and to reclaim and restore eroded areas (Jones and Miller, 1992). *Jatropha* is not browsed, for its leaves and stems are toxic to animals, but after treatment, the seeds or seed cake could be used as an animal feed. Being rich in nitrogen, the seed cake is an excellent source of plant nutrients. Various parts of the plant are of medicinal value, its bark contains tannin, the flowers attract bees and thus the plant has honey production potential. All the parts of the plant exude sticky, opalescent, acrid and astringent latex. The latex has been used for promoting healing of wounds, refractory ulcers and septic gums and as styptic in cuts and bruises. Curcain the protease isolated from the latex of *J. curcas* was found very effective in wound healing (Nath and Dutta, 1992). The latex of *J. curcas also* contains an alkaloid known as Jatrophine, which is believed to have anti-cancerous properties. It is also used as an external application for skin diseases and rheumatism and for sores on domestic livestock. In addition, the tender twigs of the plant are used for cleaning teeth, while the juice of the leaf is used as an external application for piles. Finally, the roots are reported to be used as an antidote for snakebites. Like all trees, Jatropha removes carbon from the atmosphere, stores it in the woody tissues and assists in the build up of soil carbon. It is grown as a boundary fence or live hedge and can be used to reclaim eroded areas (Heller, 1996; Joker and Jepsen, 2003). *J. curcas* is one of the main crops currently being promoted for biodiesel production in several countries, globally (Openshaw, 2000).

Jatropha can be established from nursery seedlings, bare root or containerized, by direct sowing, trans-planting of wildings or planting of cuttings. The choice of propagation method depends on the purpose of plantation. Plants propagated by seeds are generally preferred for the establishment of long-lived plantations for oil production. Direct sowing should only be used in areas with high rainfall and the seeds must be sown after the beginning of the rainy season when sufficient rainfall is certain. It is, therefore, timely to harness the full potential of Jatropha for meeting our energy requirements and also for creating avenues for greater employment. Keeping the above into consideration a study was undertaken to standardize package of practices for cultivation of Jatropha in tropical climate of Madhya Pradesh.

2. METHODOLOGY

Nursery for Jatropha was raised in the month of April-May. The width of seedbeds (1 metre) was adjusted in such a way that the nursery operations could be carried out easily without entry in the beds. Jatropha seeds were sown in nursery in the first week of April in prepared nursery beds. Jatropha seeds were also sown in poly bags of size 6x9" filled with soil, sand, FYM in the ratio of 1:1:1. Germination was fast, it was completed in 10-15 days. Germination was epigeal (cotyledons emerge above ground). Soon after the first leaves have formed, the cotyledons wither and fall off. In the nursery, seeds were sown in germination beds and in containers (poly bags or root trainers). The beds and poly bags were given regular irrigation at nursery stage.

Experiments have been laid out to standardize cultivation practices of Jatropha for central India at the TFRI, Jabalpur campus to optimize fertilizer/manure doses, time of plantation, method of plantation/sowing, age of seedlings etc.

The experimental site soil have high clay mineral, medium in nutrient status normal pH and EC, high water holding capacity, high plasticity and due to high amount of montmorillonite clay mineral swelling and shrinkage problem has been observed. In summer season (May – June) deep creaking were observed therefore sand @ 3 kg. per pit was mixed before plantation of Jatropha. The experiments were laid out in Factorial Randomized Block Design comprising of 48 treatments replicated three times. Accordingly the experimental field was divided into 144 equal size blocks. Sixteen plants were planted in each block at the distance of 2 x 2 m. The pits were digged before one month of plantation and organic manure *viz*, FYM and vermicompost were applied and mixed two weeks earlier to plantation as per design of the experiment. Nitrogen, phosphorus and potassium were applied in the form of urea, single super phosphate and muriate of potash as a basal dose at plantation time. However, urea was applied in two equal splits doses, half at plantation time and remaining dose was applied after three months. The three factors considered in the experiment were (i) Manure/fertilizer doses at 6 levels (F1-control, F2-20 g urea + 120 g SSP + 12 g MOP, F_3 – 20 g urea + 120 g SSP + FYM @ 2 kg/ pits, F_4 – 20 g urea + 120 g SSP + Vermicompost @ 200 g/pits, F_5 – FYM @ 5 kg/pits, F_6 –Vermicompost @ 500 g/pits.)(ii) Time of application at 2 levels (T1-25 July, 2005,T2-10 August, 2005) and method of sowing at 4 levels (M1- Direct sowing of seed in pits, M2- Plantation in ridge, M3- Plantation in pits, M4- Bare rooted seedling planted in pits)

Manual weed control i.e. uprooting of weed by hands was done during the establishment phase. Afterwards hoeing and weeding was done twice in a year to keep the plantation free from weeds and maintain porosity of soil. The plants were irrigated once in the winter months from October to February and twice in the month during hot summer March to June. Prunings were done in the already established Jatropha plants (6-8 years old) during 2004-05 in the month of November-December when the plants shed their leaves.

3. RESULTS AND DISCUSSION

The germination was completed within 12 days after sowing. Manure, during germination phase appears to have a negative impact on germination. However, the results indicated that manure has a positive impact on the growth rate after germination has initiated. Likewise, intensity of watering and temperature seems to have a fundamental impact on germination rate.

The growth parameters like height and collar diameter were recorded from the field on quarterly basis and are depicted in Table 1. Maximum height was recorded in the treatment $T_{26}F_4T_1M_2$ (62.46cm) i.e. Jatropha poly potted seedlings planted on 25th July in ridges with the application of fertilizer (20 g urea + 120 g ssp + vermi-compost @ 200 g/plant) at the time of plantation. This treatment also ranked third in terms of collar diameter (27.05 mm). However, maximum collar diameter was recorded in the treatment $T_{42}F_6T_1M_2$ (i.e. Plantation of polypotted seedling planted on 25th July 2005 in ridges with fertilized doses of vermicompost @ 500 gm per plant. This treatment ranked fifth in terms of plant height (57.36 cm).

Minimum plant height was recorded in the treatment $T_{13}F_2T_2M_1$ (In the treatment seeds of Jatropha were sown directly on 10th August, 2005 with doses of fertilizer (20 g urea + 120 g ssp + 12 g mop) applied at the time of sowing. In the treatment $T_{27}F_4T_1M_3$, the plant had initial height 31.77 cm at the time of plantation. It attained height of 57.37 cm and gained height of 25.60 cm. The survival percentage is more than 95%.

Table 1. Growth data of packages & practices trial planted at 2 x 2 m spacing

S. No	Treatment	Quarter I		Quarter II		Quarter III		Quarter IV	
		Height (cm)	Collar Dia (mm)	Height (cm)	Collar Dia (mm)	Height (cm)	Collar Dia (mm)	Height (cm)	Collar Dia (mm)
01.	$T_1F_1T_1M_1$	23.79	13.62	26.9	15.28	38.81	17.25	35.2	18.92
02.	$T_2F_1T_1M_2$	28.12	11.44	35.56	16.23	40.21	18.55	44.37	20.35
03.	$T_3F_1T_1M_3$	27.51	12.41	31.54	14.80	36.31	17.08	39.62	18.70
04.	$T_4F_1T_1M_4$	42.67	12.72	46.54	17.83	50.82	20.17	54.94	21.36
05.	$T_5F_1T_2M_1$	8.53	5.5	14.78	6.65	16.73	7.34	21.66	9.47
06.	$T_6F_1T_2M_2$	30.74	11.78	39.01	15.9	43.38	18.83	48.42	19.43
07.	$T_7F_1T_2M_3$	28.04	11.13	38.12	15.2	44.62	19.13	49.25	22.24
08.	$T_8F_1T_2M_4$	30.87	13.46	43.29	18.44	49.54	19.01	53.67	23.26
09.	$T_9F_2T_1M_1$	10.16	5.4	11.75	6.12	15.00	7.5	17.38	10.5
10.	$T_{10}F_2T_1M_2$	24.00	9.54	30.16	13.96	32.91	15.27	37.37	18.75
11.	$T_{11}F_2T_1M_3$	33.12	13.8	37.04	16.9	41.48	18.98	44.38	20.34
12.	$T_{12}F_2T_1M_4$	32.99	11.77	33.24	15.93	44.41	17.26	47.42	19.38
13.	$T_{13}F_2T_2M_1$	06.51	4.75	9.58	6.16	13.17	8.33	15.57	10.54
14.	$T_{14}F_2T_2M_2$	42.79	13.90	50.33	16.81	52.75	19.49	54.75	22.54
15.	$T_{15}F_2T_2M_3$	28.41	10.53	36.23	16.38	39.04	16.79	43.24	19.38
16.	$T_{16}F_2T_2M_4$	24.54	12.18	33.5	15.56	38.91	18.09	43.75	21.28
17.	$T_{17}F_3T_1M_1$	14.02	5.70	21.49	9.29	24.37	12.12	31.15	14.98
19.	$T_{19}F_3T_1M_3$	33.00	11.42	44.46	16.45	49.37	19.28	54.64	21.38
20.	$T_{20}F_3T_1M_4$	25.64	11.55	30.37	14.15	34.29	16.71	39.58	18.45
21.	$T_{21}F_3T_2M_1$	9.62	5.9	15.37	7.49	19.87	9.65	21.94	11.76
22.	$T_{22}F_3T_2M_2$	37.54	13.86	46.00	17.00	49.58	20.96	54.37	24.35
23.	$T_{23}F_3T_2M_3$	23.71	11.61	28.24	15.56	32.20	17.27	35.36	19.96
24.	$T_{24}F_3T_2M_4$	40.04	13.54	48.7	17.4	51.70	20.43	55.84	23.64
25.	$T_{25}F_4T_1M_1$	12.6	6.26	20.00	12.02	23.75	14.24	26.38	25.37
26.	$T_{26}F_4T_1M_2$	40.83	17.34	53.41	22.25	58.24	24.71	62.46	27.05
27.	$T_{27}F_4T_1M_3$	31.77	13.10	44.16	19.00	47.98	22.18	57.37	25.98
28.	$T_{28}F_4T_1M_4$	21.99	9.70	33.29	15.10	36.47	18.97	41.58	21.37
29.	$T_{29}F_4T_2M_1$	9.75	5.13	16.71	8.16	21.64	10.36	26.37	14.35
30.	$T_{30}F_4T_2M_2$	26.99	13.15	31.96	15.47	35.28	17.97	37.54	20.57
31.	$T_{31}F_4T_2M_3$	31.16	15.32	36.54	12.83	39.74	16.85	43.64	18.37
32.	$T_{32}F_4T_2M_4$	26.58	9.38	40.71	16.37	44.58	26.74	49.56	28.37
33.	$T_{33}F_5T_1M_1$	11.45	4.77	18.25	10.31	22.21	11.79	26.43	12.97
34.	$T_{34}F_5T_1M_2$	34.50	13.72	41.17	17.58	47.46	19.77	54.34	21.37
35.	$T_{35}F_5T_1M_3$	26.42	12.16	31.14	15.62	34.50	16.13	39.50	19.34
36.	$T_{36}F_5T_1M_4$	29.88	16.83	36.04	17.20	44.29	18.86	49.75	21.34
37.	$T_{37}F_5T_2M_1$	9.88	6.31	19.40	9.9	22.43	10.93	27.75	13.34
38.	$T_{38}F_5T_2M_2$	26.72	13.31	39.67	17.75	42.56	19.65	46.90	22.34
39.	$T_{39}F_5T_2M_3$	31.63	15.12	44.83	19.67	48.62	21.90	54.68	23.40
40.	$T_{40}F_5T_2M_4$	25.06	13.67	31.77	16.40	34.5	17.63	39.50	19.75
41.	$T_{41}F_6T_1M_1$	8.42	6.04	14.50	10.10	17.00	11.20	19.50	12.50
42.	$T_{42}F_6T_1M_2$	41.38	19.13	50.71	32.49	53.50	25.43	57.36	28.45
43.	$T_{43}F_6T_1M_3$	34.96	15.52	42.17	18.06	45.76	19.72	57.75	21.94
44.	$T_{44}F_6T_1M_4$	29.95	11.80	34.63	14.53	37.54	16.57	41.25	19.56
45.	$T_{45}F_6T_2M_1$	6.29	4.86	13.04	7.42	18.14	8.37	20.75	10.25
46.	$T_{46}F_6T_2M_2$	44.75	14.14	52.29	17.36	57.34	18.81	61.36	21.25
47.	$T_{47}F_6T_2M_3$	26.42	11.82	34.74	16.46	38.17	19.25	41.25	22.25
48.	$T_{48}F_6T_2M_4$	26.96	11.29	32.11	14.16	34.66	16.34	37.37	19.75

The pruning of Jatropha shoots had positive impact on the seed yield. There was significant increase in the number of branches and fruit yield per plant. After pruning the total number of branches increased to 167 from 139 and fruit yield 3.334 kg from 2.606 kg from a six-year-old plant.

4. CONCLUSION

The seedlings planted on ridges in the last week of July performed better than the seedlings planted in pits. Bare rooted seedlings performed at par with poly potted seedlings if planted within 24 hours after taken out from the nursery beds. The planting of bare rooted seedlings reduced the cost of plantation considerably. Pruning has positive impact on seed production of Jatropha as it yielded more fruits.

ACKNOWLEDGEMENTS

Authors are thankful to the National Oilseeds and Vegetable Oils Development Board, Govt. of India for providing financial assistance to carry out the study.

REFERENCES:

Heller, J. 1996. Physic nut, *Jatropha curcas* L. Promoting the conservation and use of underutilized and neglected crops. 1. Institute of Plant Genetics and Crop Plant Research, Gartersleben, International Plant Genetic Resources Institute, Rome.

Joker, D. and Jepsen, J. 2003. *Jatropha curcas* L. Seed leaflet No. 83 August 2003. Danida Forest Seed Centre. Denmark.

Jones, N. and Miller, J. H. 1992. *Jatropha curcas*: A multipurpose Species for problematic Sites. The World Bank, Washington DC USA.

Nath, L.K. and Dutta, S.K. 1992. Wound healing response of the Proteolytic enzyme Curcain, *Indian J. of Pharmacology. 24:114-115.*

Openshaw, K. 2000. A review of *Jatropha curcas*: An oil plant of unfulfilled promise. *Biomass and Bioenergy. 19(1): 1-15.*