INTERNATIONAL JOURNAL OF CURRENT
Agricultural Sciences
Available Online at http://www.journalijcas.com
Vol. 6, Issue, 6, pp. 62-64, June, 2016

ISSN: 2277-1026

Research Article

EMPLOYMENT GENERATION TO RURAL AND TRIBAL YOUTH BY THE CULTIVATION OF BIOFUELCROP–JATROPHA

Jyothi Swaroopa V*[1], BharathaLakshmi M[2] and Mounica D[3]

KrishiVigyan Kendra, Pandirimamidi, East Godavari

ARTICLE INFO

Received 24th March, 2016
Received in revised form 21st April, 2016
Accepted 19th May, 2016
Published online 28th June, 2016

Keywords:

Jatropha seed, Medicinal Compounds, Trans-esterification, Metabolism

ABSTRACT

Jatropha is a multipurpose small tree or large shrub and is found throughout the tropical region. In India, Portuguese Navigators introduced it in the 16th century. It occurs in almost all parts of India including Andaman Island and generally grown as live fence. It is well adapted to arid and semi-arid conditions. Jatropha is a vigorous, drought and pest-tolerant plant and unpalatable by animals. Traditionally, Jatropha seed and other plant parts have been used for oil, soap and medicinal compounds.Its cultivation requires simple technology, and comparatively modest capital investment. The seed yield reported for Jatropha varies from 0.5 to 12 ton $year^{-1}$ ha^{-1} depending on soil, nutrient and rainfall conditions. The seeds contain 30–35% oil that can be converted into good quality biodiesel by trans-esterification. The demand of energy for maintaining the societal metabolism of developed and emerging economies like India has lead many governments to promote biofuel crops like jatropha.

INTRODUCTION

Background

Jatropha is a genus of about 175 succulent species,shrubs and trees out of which some are deciduous,like *Jatrophacurcas*L., commonly called Physic nut (English) or Ratanjyot (Hindi) or Baigaba (Odia) belonging to family Euphorbiaceae, has recently received much attention due to more suitability of its oilas bio-diesel. It is grown in low to high rainfall areas under tropical climate and can be used to reclaimland. It is an important plant for erosion control and soil improvement, promotion of women, povertyreduction and renewable energy (Henning, 2002). The extracts from leaves and twigs are having antibacterial(Varadarajan *et.al*., 2006) and fungicidal (Tequida Meneses *et.al*., 2002) properties.Jatropha has been called as a "wonder crop" because of its ability to grow on marginal and semi-arid land.

Jatropha is traditionally grown as a live fence around agricultural fields and not browsed by cattle and the tree has a productive life of over 30 years (Francis *et al.,* 2005). The oil content varies from 35 to 40% in the seeds to 50-60% in the kernel (Ginwal *et al*., 2005). Seed yields under cultivation can range from 1,500 to 2000 kilograms per hectare, corresponding to an extractable oil yield of 540 to 680 litres per hectare (Rao *et al*., 2009).The oil is used as illuminant, lubricant and in soap industry (Kaushik *et al.,* 2007). Jatropha oil is extensively used in soap industry due to its high saponification value (Divakara *et al*., 2009).Tender twigs used in cleaning teeth and juice are said to relieve toothache.Jatropha bark yields a dark blue dye,which is used for colouring clothe and fishing nets in the Phillippines (Thomas *et al.,* 2009).

Geographical Distibution

Jatropha has a broader geographical range. It is globally distributed in wild or semi cultivated fields in Latin America, Africa, India and South-East Asia. Jatropha is a tropical species native to Mexico and Central America where it grows naturally in the forests of coastal regions, but it is found only in the cultivated form in Africa and Asia. In India, it was introduced by Portuguese Navigators in the 16th century. Jatropha grows in almost all parts of India including Andaman Island. It is well adapted to arid and semi-arid conditions. Jatropha is listed as a weed in several countries such as Australia, India, Brazil, Fiji, Honduras, Panama, El Salvador, Puerto Rico and other parts of the Caribbean region.

Jatropha Transplantation

Main field is prepared by digging pits of 30x30x30 cm at 3x3 m spacing. Seed should be sown at a depth of 2-3cm.Seedlings raised in nursery are transplanted when they are 8-10 weeks old. Optimum spacing is 3x3 m which accommodates 1111 plants/ hectare under irrigated conditions. Before transplanting 2 kg organic manure,10g urea,120g single super phosphate and 16 g muriate of potash should be applied to each plant. From the second year onwards application of N,P and K at 20g,120g & 60g respectively per plant gives better growth and seed yield.

*✉ *Corresponding author:* **Jyothi Swaroopa V**
KrishiVigyan Kendra, Pandirimamidi, East Godavari

Harvesting

Seeds are ready for harvesting around 90 days after flowering when the fruits have changed from green to yellow-brown. In wetter climates, fruiting is continuous throughout the year, while the harvest may be confined to two months in semi-arid regions. Even then, the fruits do notripen together, requiring weekly picking and making the harvest labour intensive and difficult to mechanize. The yellow and brown fruits are harvested by beating the branches with sticks to knock them to the ground, or by hand picking.

The fruits are dried and the seeds removed from the fruit shells by hand, by crushing with a wooden board or by using a mechanical decorticator. Work rates for harvesting are given by Henning (2008a) as 24 kg per workday while India's National Oilseeds and Vegetable Oils Development Board (NOVOD) gives a rate of 50 kg of seedper workday (NOVOD, 2007). The seeds are shade dried for sowing but dried in the sun for oil production to reduce moisture content to around 6–10 percent. If kept dry and ventilated, the seeds may bestored for up to 12 months without loss of germination or oil content, although there may be losses to pests in storage.

Utilization

Jatrophacurcus as an Energy Source

Jatropha oil is an important product from the plantfor meeting the cooking and lighting needs of therural population, boiler fuel for industrial purpose oras a viable substitute for Diesel. About one- third ofthe energy in the fruit of jatropha can be extracted asoil that has a similar energy value to Diesel fuel.Jatropha oil can be used directly in Diesel enginesadded to Diesel fuel as an extender or transesterified to a bio-diesel fuel.There are some technicalproblems to using jatropha oil directly in Dieselengines that have yet to be completely overcome.

Soap Making

Jatropha soap is made by adding a solution of sodium hydroxide (causticsoda) to jatropha oil. This simple technology has turned soap makinginto a viable small-scale rural enterprise appropriate to many rural areasof developing countries. Jatropha soap is valued as a medicinal soap fortreating skin ailments. On the one hand, making jatropha soap can behighly profitable, with 4.7 kg of soap produced from 13 litres of jatrophaoil in only five hours (Henning, 2004b).

Livestock Feed

Jatropha seed cake is high in protein 58.1 percentby weight compared to soymeal's 48 percentand would be a valuable livestock protein feed supplement.

Organic Fertilizer

Jatropha seed cake makes an excellent organic fertilizer with a high nitrogencontent similar to, or better than, chicken manure. Its macronutrientcomposition is shown in Table 1.

Table 1 Macro Nutrient Content Of Jatropha Seed

N%	P%	K%	SOURCE
3.0-4.5	0.65-1.2	0.8-1.4	Patolia*et al.*(2007)

As organic manure, the seed cake can make a valuable contributionto micronutrient requirements. Table 2 presents an analysis of themicronutrient content by Patolia*et al.* (2007).

TABLE 2 Micronutrient Content Of Jatropha Seed Cake

S%	Fe mg kg^{-1}	Mn mg kg^{-1}	Zn mg kg^{-1}	Cu mg kg^{-1}
0.2-0.35	800-1000	300-500	30-50	18-25

Source: Patolia *et al.* (2007).

Fruit Shells and Seed Husks

Seed husks can be used as a feedstock for a gasification plant(Staubmann *et al*., cited Achten *et al*., 2008). Jatropha fruit shells and seed husks can be used for direct combustion.Since the shells make up around 35–40 percent of the whole fruit by weightand have a calorific value approaching that of fuelwood, they could be auseful by-product of jatropha oil production. Seed husks have a higher heating value and greater bulk density whichmakes them more valuable than the fruit shells as a combustible fuel.

Table 3 The Value Of Jatropha Fruit Shell And Seedhusk For Energy Production

Particulars	Jatrophafruitshell	Jatrophaseedhusk
Bulk density kg m^{-3}	106.18	223..09
Ash content % dm	14.88	3.97
Calorific value kcal kg^{-1}	3762	4044

Seed Cake

Once the oil is extracted, about 50 percent of the original seed weight remains as seed cake residue, mainly in the form of protein and carbohydrates. The amount of oil left in the seed cake depends on the extraction process. There are trade-offs for the seed cake. It may be used as fertilizer, fuel or, if it is detoxified or if non-toxic varieties are used, it can be used as animal fodder.

Biogas production

Jatropha seed cake can also be used as feedstock for biogas production through anaerobic digestion before using it as a soil amendment as well. It gives 60% higher biogas compared to cattle dung. In an experiment, Jatropha seed cake was utilized as feed-stock for biogas production. Experiments on use of biogas slurry as suitable manure are still in the early stages. Staubmann obtained 0.446 m^3 of biogas, containing 70% CH_4, per kg of dry seed press cake using pig manure as inoculum. Additionally, the other organic waste products such as Jatropha fruit shells, seed husks and pruning waste biomass can be digested to produce biogas (CH_4). Jatropha produces woody by-products suchas pruning waste biomass and fruits shells which are rather more useful for combustion that will reduce pressure on remaining forests and woodlots. The fact that Jatropha seed cake can be used for different purposes makes it an important by-product. Recently experimentation on solid-state fermentation of Jatropha seed cake showed that, it could be a good source of low cost production of industrial enzymes . Recycling of wastes as a fertilizer can help to reduce inputs needed for both Jatropha

cultivation and other agricultural crops or it can produce extra energy in the form of biogas. Digesting the cake and neutralizing the effect of phorbol bringing the effluent back to the field. It is thought to be the best practice at present from an environmental point of view. A number of questions concerning the long-term and cumulative impacts of Jatropha seed cake on soils have not been addressed yet. There is need to work on detoxification issues so that the cake becomes viable for the use as animal feed.

Employment

Jatropha cultivation generates net income for 30–35 years from the 4th year of the plantation. Nursery rising by seedling/cutting, Jatropha plantation, collection of seeds, de-shelling, oil extraction, etc. provides local jobs to restrict the migration of rural and tribal youth to cities in search of employment. National and International organization is working for promotion of tribal communities. Besides, Jatropha cultivation and biodiesel production programme also pro-motes income of tribal communities by several ways, and therefore it may be used for strengthening of economic independency of tribal communities and income through use and sale of Jatropha products. Interest in the cultivation of Jatropha is coming from both the private and public sectors, and a number of public companies are now involved in Jatropha cultivation. These companies are generating employment for our society. Biofuel development may offer income-generating opportunities for tribal farmers, as well as promote smallholder participation in biofuel crop production. Employment generation opportunities in plantation of Jatropha in the states of India are given in Fig.1

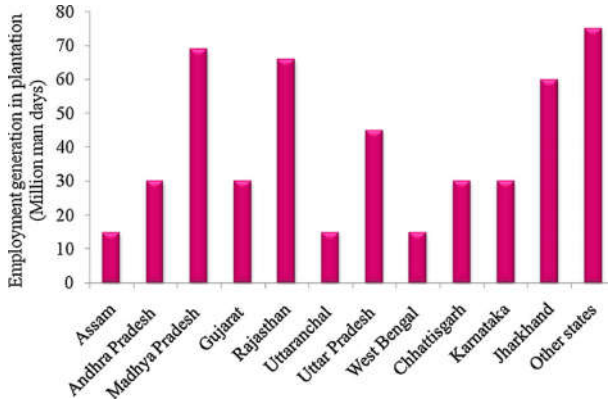

Figure 1

Source: Biswas *et al.,* 2010

CONCLUSION

If enough emphasis is given to jatropha cultivation we can help the below- poverty – line families in rural communities. Jatropha cultivation is a potential sector of employment generation and it provides employment oppurtunities for rural & tribal people, including seed collection, oil production & marketing. Jatropha can play a major role in subsistence strategies for many rural populations.

References

Divakara BN, Upadhyaya HD, Wani SP and Gowda CL Biology and genetic improvement of jatropha DOI: 10.1016/ *J. apenergy*. 2009.07.013, Applied Energy.

Foidl N, Foidl G, Sanchez M, Mittelbach M, Hackel S. Jatrophacurcas L. as a source for the production of biofuel in Nicaragua. Bioresour Technol 1996;58:77–82.

Francis G, Edinger R, Becker K. A concept for simultaneous wasteland reclamation, fuel production, and socio-economic development in degraded areas in India: need, potential and perspectives of Jatropha plantations. Nat Resour Forum 2005;29:12–24.

Henning, R.K.2002. Using the indigenous knowledge of Jatropha: the use of Jatrophacurcas oil as raw material and fuel. IK-Notes, World Bank; Washington (USA).47:4.

Kaushik N, Kumar K Kumar S and Roy S (2007) Genetic variability and divergence studies in seed traits and oil content of Jatropha (*Jatrophacurcas)* . Biomass Bioenergy 31:497-502

Lopez O, Foidl G, Foidl N. Production of biogas from Jatrophacurcas fruit shells. In: Gübitz GM, Mittelbach M, Trabi M, editors. Biofuels and industrial products from J. Curcas. Nicaragua/Austria: Dbv-Verlag; 1997. p. 118–22.

Mahanta N, Gupta A, Khare SK. Production of protease and lipase by solvent tolerant Pseudomonas aeruginosaPseA in solid-state fermentation using Jatrophacurcas seed cake as substrate. BioresourTechnol 2008; 99: 1729–35.

Rao GR, Korwar GR, Shanker AK and Ramakrishna YS (2008) Genetic associations,variability and diversity in seed characters, growth reproductive phenology and yield in *Jatrophacurcas (L..)* accessions. Trees Structure and Function 22:30.697-709.

Shanker C, Dhyani SK. Insect pests of Jatrophacurcas L and the potential for their management.CurrSci 2006;91:162–3.

Singh RN, Vyas DK, Srivastava NSL, Narra M. SPRERI experience on holistic approach to utilize all parts of Jatrophacurcas fruit for energy. Renew Energy 2008;33:1868–73.

Staubmann R, Foidl G, Foidl N, Gubitz GM, Lafferty RM, Arbizu VM, *et al*. Biogas production from Jatrophacurcas press cake.ApplBiochemBiotechnol 1997;63:457–67.

Subramanian KA, Singal SK, Saxena M, Singhal S. Utilization of liquid biofu-els in automotive diesel engines: an Indian perspective. Biomass Bioenergy 2005;29:65–72.

Tequida-Meneses, M, Cortez-Rocha, M., Rosas-Burgos, E.C, Lopez-Sandoval, S, Corrales- Maldonado, C. 2002. RevistaI beroamericana de Micologia.19(2):84-88.

Tewari DN. Jatropha and biodiesel. 1st ed. New Delhi: Ocean Books Ltd.; 2007.

Thomas R, Sah NK and Sharma PB (2009) Therapeutic biology of *Jatrophacurcas:* A mini review. Current Pharmaceutical Biotechnology 9 : 315-324

Varadarajan, M, Guruchandran, V, Nagarajan S. M, Natarajan, E, Nataraj, T, Vignesh, G and Rajesh, R. 2006. Plant Archives. 6(2): 593-595.

****