Jatropha
Production Technology

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Introduction

Jatropha curcas is multi purpose non edible oil yielding perennial shrub originated in tropical America and West Asia. It is commonly known as pysic nut or purging nut. *Jatropha curcas* belongs to the family Euphorbiaceae and has the tendency to produce latex and hence animals do not browse the plant. This is a hardy and drought tolerant crop can be raised in marginal lands with lesser input. The crop can be maintained for 30 years economically.

The genus *Jatropha* has 476 species and distributed throughout the world. Among them, 12 species are recorded in India. The species *Jatropha curcas* is a promising one with economic seed yield and oil recovery. The oil from *Jatropha curcas* can be used as biodiesel blend upto 20%. However, the refined oil is a qualified neat biodiesel.

Climate

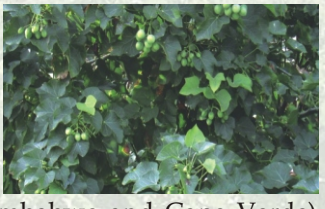
Jatropha grows well under subtropical and tropical climates. It can tolerate extremes of temperature but not the frost.

Soil

It is grown in wide range of soils. For economic returns, a soil with moderate fertility is preferred.

Variety

No variety has so far been evolved in *Jatropha curcas* through out the world. However, high yielding types collected and evaluated at Tamil Nadu Agricultural University and types from African Countries (Madagascar, Zimbabwe and Cape Verde) are ideal for cultivation.



Propagation

Jatropha is normally propagated through seeds. Well developed plumpy seeds are selected for sowing in the raised nursery beds. Before sowing, seeds are soaked in cow dung solution for 12 hours and kept under the wet gunny bags for 12 hours. Germinated seeds are sown in poly bags 10x20 cm size filled with red soil, sand and organic in the ratio of 1:1:1 respectively.

Planting

In one acre, 1000 plants can be planted at a spacing of 2m x 2m. Pits of 30x 30 x30 cm may be dug and filled with soil and organic (500 gm FYM + 100 g Neem cake+100 g super) before planting.

For better establishment of seedlings, monsoon seasons may be preferred for planting (June-July, October-November). Seedling drenched with cow dung and urine solution (5:1) @ 200 ml / plant found to perform better.

Manures and fertilizers

From second year onwards fertilizers are applied. For one acre 20:120:60 kg of NPK respectively applied during September-October respectively. From 4th year onwards, 150g super phosphate is recommended over and above the regular dose.

Irrigation

Irrigation is a must immediately after planting. Life irrigation should be given on third day after planting. The irrigation at fortnight interval is compulsory to ensure year round production of flowers and harvest of seeds.

After cultivation

Weeding may be attended to as and when needed. For early flowering, GA @100 ppm may be sprayed. It also helps better pod development and yield.

Inter cropping

Being a perennial crop, intercrops can be raised in between the rows for the first two years. Crops like tomato, bittergourd, pumkin, ashgourd, cucumber and blackgram can be grown profitably.

Canopy management

The terminal growing twig is to be pinched to induce secondary branches. Likewise the secondary and tertiary branches are to be pinched or pruned at the end of first year to induce a minimum of twenty five branches at the end of second year. Once in ten years, the plant may be cut leaving one meter height from ground level for rejuvenation. The growth is quick and the plant will start yielding in about a year period. This will be useful to induce new growth and yield stabilization there on.

Yield

Seedlings produce flowers 9 months after sowing. However plants established through cuttings, produce flowers from 6th month onwards. Wherever *Jatropha* is cultivated under irrigated condition, the flowering is throughout the year. Economic yield starts from 3rd year end. It is estimated as 3000kg seeds /acre @ 3 kg of seeds per plant). The dried pods are collected and seeds are separated either manually or mechanically. Seeds are dried under sunlight for four days until the moisture is brought to 6-10% before oil extraction.

Pests

Bark eater (*Indarbella* sp) and capsule borer are the two major pest affecting the plant. They may be controlled by spraying endosulphan @3ml/litre of water.

Disease

Collar rot may become a problem in the beginning and be controlled by spot drenching of 1% bordeaux to the affected and neighboring plants.

FAQs

Can Jatropha be a Commercial Venture?

Promoting biofuel as a partial substitute for the fossil fuel is a prudent approach followed by several countries. Fuel alcohol, biodiesel, hydrogen and biofuel-cell are some of the current interests and several technological improvements have been made to produce biofuel in an economically viable manner. While developed countries use edible oils for bio-diesel production, developing countries have opted for cost effective non-edible oils for bio-diesel production. Decentralised production and processing with centralised trans-esterification is a viable and proven approach in Zimbabwe, South Africa, Nicaragua, Mexico, Thailand, Brazil, Nepal, Mali, Pakistan, etc. Planning Commission, Government of India, reviewed the possibilities of biofuel production in India, and has identified Tamil Nadu as one among the six potential States.

In recent years, Tamil Nadu is experiencing continuous drought and severe irrigation water shortage. In response to this adverse situation, Government of Tamil Nadu launched Waste land Development Project and introduced alternate crops in the State to encourage water use efficiency and that farmers earn a reasonable income. Hence an impetus is being given to make agriculture a more profitable proposition and ensure sustainable income from the limited water environment prevailing in the State. Efforts are made to introduce new crops such as jatropha, sweet sorghum and sugar beet which have greater potential for biofuel production. With the technical support of Tamil Nadu Agricultural University and Department of Agriculture, Commercial Agencies have shown interest to process the above crops for biofuel. Jatropha is a perennial and its cultivation through well adopted management practices will certainly ensure economic viability and a successful venture for the investors in Tamilnadu. Several International Development Agencies such as World Bank, Rockefeller Foundation, Appropriate Technology International, Intermediate Technology Development Group - USA, UK & Biomass Users Network are supporting the promotion of Jatropha for bio-diesel purpose. A decision to take this crop to a larger extent by Government of Tamil Nadu is a well thought out measure which culminated after several rounds of discussion with stakeholders and based on preliminary production trials conducted in Tamil Nadu.

Will there be a glut in glycerol market?

Glycerine is a by-product of jatropha seed processing and is an input in many consumer products such as personal care preparations, cosmetics, pharmaceuticals and foods because of its contribution to product properties, stability and compatibility with wide variety of chemicals and relative non toxicity. It has 1500 known end uses and for example, it is used as humectant, plasticizer, emollient, thickener, solvent, dispersing medium, lubricant sweetener, anti-freeze agent and processing aid. Most of the glycerine marketed to-day is manufactured to meet the stringent requirements of the United States Pharmacopeia and the Food Chemicals Codex. In the days of preference for natural products, glycerine produced from petroleum is replaced by glycerin obtained from natural sources. Considering the widespread requirement of anti-freeze agents in cold countries, the Japanese Researchers have developed an antifreeze agent from glycerine. For this environment friendly innovation the scientists were awarded Innovation Award in 2004. For the past fifteen years the world production is increasing by 2.2 % per year and totally absorbed by the consuming industries. The scenario which is unfolding shows that there will not be any glut in glycerine as a consequence of Jatropha biodiesel production.

Are the Jatropha oil and cake toxic?

Like Castor oil, the Jatropha oil and cake contain traces of toxins. The components associated with toxicity can be denatured or inactivated by heat. The toxic components in Jatropha cake are curcin a phytotoxin similar to ricin in castor and HCN in young Sorghum leaves and Tapioca rind and purgative oil as in castor and croton oil. Heat treatment or the combination of heat and chemical (NaOH and NaOCl) treatments can inactivate the above toxic components. Extraction with 80-90% ethanol or methanol also holds promise in detoxification. The oil cake cannot be used as animal feed because of its toxicity at present. But fermentation processes will eliminate the toxins. Jatropha oil cake compares well with any

other oil cake and poultry and farm yard manure in terms of N, P and K content of 4.4, 2.09 and 1.68 per cent respectively. The consumption of Jatropha oil cake will not be a problem due to the awareness among the farmers in the use of organics like Neem, Pongamia etc.

When does Jatropha give economic yield?

Research at TNAU has clearly shown that the cuttings come to yield from sixth month onwards. But the non availability of the cuttings for bulk planting is the constraint. If seedlings are raised from the seeds, the yield stabilizes at third year onwards. Since more productive branches are needed, it is better to clip the growing terminals so as to have a minimum of twenty five growing branches at the end of second year. Two minimal irrigations per month ensure year round production of pods If these practices are followed, we can get economic yield in three years reaching maximum in 5th year onwards. To get income during the first two years of the crop period, the farmers are advised to go for inter-cropping such as pulses, oil seeds, and vegetables like ash gourd, tomato and bitter gourd.

Is Jatropha based biodiesel project viable?

It is claimed that biodiesel from soya, rape seed etc will offer higher returns than from Jatropha. One has to remember that the seed cost of soya and rape seed are easily four to five times higher as compared to Jatropha. Further soya and rape seed are already in great demand for edible oil production. The Planning Commission (GOI) estimating the benefit cost ratio has indicated a price of Rs.5 per kilogram of Jatropha seeds and few of the processing firms are ready to offer Rs.5 per kg of seed. It is felt in some quarters that Jatropha and biodiesel will require massive subsidy. The economic analysis of Jatropha and biodiesel production by Tamil Nadu Agricultural University, and analyses by Indian Institute of Petroleum, Dehradun, and Indian Institute of Science, Bangalore provide evidence that Jatropha cultivation with better crop management practices and processing with modern technologies will result in significant reduction in unit cost of production thereby ensuring Jatropha as a viable proposition not warranting any subsidy. Government of Tamilnadu is keen to fetch remunerative price for the farmers by facilitating contractual arrangement with processing firms. The Jatropha oil price is highly correlated with that of the diesel price and the secular rise in the diesel prices offers greater scope for realizing higher Jatropha seed prices for farmers in the future.

Can Jatropha oil be esterified?

Trans-esterification technology is a downstream processing of glycerine removal from vegetable oils and Jatropha oil is no exception. The trans-esterification technology for Jatropha has been standardized at Tamil Nadu Agricultural University. This is in line with technologies developed by the national and international institutions.

Carbon trading benefits sustainable?

Availability of more oxygen in biodiesel helps in almost complete exhaustion of hydrocarbons. The fixation of up to 10 t/ha/year CO_2 by Jatropha that could be internationally traded is an additional advantage. Question is raised about sustainability of carbon trading as Kyoto protocol would be valid only up to 2012. There is a growing pressure currently on those countries to sign the Kyoto protocol.

Will the import of biodiesel compete with local Jatropha based diesel?

The Common Agricultural Policy of European Union enables the farmers to receive a premium for growing industrial oil seeds. But recently the EU is considering changes in government agricultural policy to eliminate premiums to farmers in as much as it is non - food production. For every country it may take some time to meet the internal demand to go for 100% biofuel and even if they choose to export there will not be any competitive advantage for the developed countries due to removal of premiums. What is introduced to day in Tamilnadu is the outcome of continued research, adaptive field trials and participatory research in farmers' holdings. By practice and recorded information it is clear that the industrial crops with multiple utility and value addition through bioprocessing have bright future on this planet.

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