


JATROPHA PROJECT - MEXICO

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Executive Summary

Bio-fuels, particularly bio-diesels, are fast emerging to become one of the more viable, sustainable and cleaner options for meeting the ever increasing energy demand. Emerging economies with vast unproductive lands and tropical climates can benefit greatly from the renewable energy resources such as Jatropha cultivation which has been identified as a thrust area for the initiation of projects to capitalize on its vast potential. Besides productively utilizing the lands available, this agro based initiative is likely to be more adaptable for the community than other options. Being a perennial crop Jatropha would ensure a minimum regular sustenance income to communities that are used to fluctuations in their income streams.

January 2007

The Jatropha Plant

Jatropha Curcas is a plant for bio-diesel production. Jatropha crop alleviate soil degradation, desertification and deforestation. Also it can be used for soap production, climatic protection and carbon capture, and to increase the income from plantations and agro-industries. The seeds of Jatropha plant grow on low fertility soils in low and high rainfall areas, have high oil content, small gestation period, and can be harvested in non-rainy season.

The size of the plant is convenient for collection of seeds. Produces seeds with high oil content (30-40%) after 2 to 5 years depending on soil fertility and rainfall, and lives producing seeds for over 30 years. The oil from the seeds can be transformed into bio-diesel fuel through esterification process. The by-product from oil (press cake) can be used as organic fertilizer. The oil of seeds contains insecticide.

Feasibility on Jatropha cultivation in Mexico

The centre of Jatropha origin is Mexico and South America. The agro climatic conditions prevailing in Mexico are conducive for Jatropha cultivation on commercial scale. A feasibility analysis of Jatropha cultivation can be done on a pilot scale over various regions in the country where climatic and agricultural conditions are suitable for this crop. The primary focus of the project would be on the cultivation part to get Jatropha seeds and/or oil as final output.

Estimated Costs of Jatropha Cultivation (US$)

1600 Jatropha Trees Per Hectare	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Site Preparation *(14 man-days).*	210	-	-	-	-	**210**
Conservation Tillage *(15 man-days or tractor)*	225	-	250	-	270	**745**
Alignment & Stalking *(10 man-days).*	150	-	-	-	-	**150**
Digging, Planting & Refilling Pits (*60 man-days).*	900	-	-	-	-	**900**
Fertilizers & Bio-Pesticides *(0.200 Kg./Tree).*	600	630	660	690	730	**3,310**
Cost of Plants 1st Year *(US$0.50 per plant).*	800	-	-	-	-	**800**
Re-Planting 1st Year (*15%)*	135	-	-	-	-	**135**
Maintenance & Irrigation *(50 man-days).*	750	790	830	870	910	**4,150**
Harvesting & Pruning (50 man-days).	750	790	830	870	910	**4,150**
Contingencies	140	140	140	140	140	**700**
Re-Planting 2nd Year (*10%).*	-	90	-	-	-	**90**
Plants for Re-Planting 1st & 2nd Years	120	80	-	-	-	**200**
Total	**4,780**	**2520**	**2,710**	**2,570**	**2,960**	**15,540**

Actions

1. Identification of land and regions adequate for cultivation of Jatropha in Mexico. The identification of land must consider that Jatropha plants may invade other crops.
2. Identify producers potentially interested in cultivating Jatropha in Mexico.
3. Provide a business proposal among farmers, land owners, government agencies, municipal authorities, agricultural related associations and agro-industry. regarding cultivation of Jatropha for the Bio-Fuel project.
4. The business proposal should include information on:
   - Funding and extension services.
   - Technology and suggestions on appropriate cultivation practices for Jatropha.
   - Cultivation cost.
   - Production estimate per hectare.
   - Profitability.
   - Purchasing back the produce.
   - Selling arrangements.

Supplemental Information

Production Expectation

- Total Jatropha tress per hectare: 1600
- Irrigation during dry season: 5 months.
- Fruiting trees per hectare: 1200
- Yield of seeds per fruiting tree: 2.5 Kg.
- Seeds per hectare: 3.0 Ton.

Mexico

In Mexico there is a strong interest in developing bio-energy to create jobs in rural areas, particularly within unproductive lands in states such as Oaxaca, Guerrero and Chiapas on the pacific coast where climate is adequate for cultivation of Jatropha among poor people.

Development & Implementation

My services for development and implementation of the project.

Weekly fee:

- US$430

Communication expenses:

- Revolving fund: US$250

Travelling:

- Transportation: US$0.35/Km.
- Lodging: US$80/night.
- Meals: US$30/day.

Incentive:

Yearly on Jatropha cultivation,

- US$10 per hectare.

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Botanical Characteristics of Jatropha I

Family

Euphorbiaceae.

Flowers

Petiole length between 6 to 23 mm. Inflorescence formed in the leaf axil. Flowers are formed terminally, individually, with female flowers usually slightly larger occurring in hot seasons. Where continuous growth, an unbalance of pistillate or staminate flower production results in a higher number of female flowers.

Environment

It can thrive on the poor soils. Grows even in the crevices of rocks. The leaves shed during winter months form mulch around the base of the plant. The organic matter from shed leaves enhance earth-worm activity in the soil around the root-zone of the plants, which improves the fertility of the soil.

Propagation

Direct seeding if good quality seeds available. Transplantation of pre-cultivated plants when good length, age and type. Direct planting cuttings during rainy season. Propagation must be based on rainfall conditions. Cultivation method on the basis of maximum survival rates. Collect seeds when capsules split open. Fresh seeds improves germination. Pre-soaking & drying, or partial removal of the testa, is better than pre-soaking alone. With good moisture, germination takes 10 days. Seed shell splits, radicula emerges and 4 small peripheral roots are formed. After development of 1st leaves, cotyledons wither & fall off. Further growth is sympodial.

Size

Jatropha plant is a small tree with smooth grey bark, which exudes a whitish coloured, watery, latex when cut. It grows between 3 to 5 meters in height, and up to 8 to 10 meters under favourable conditions.

Fruits

Fruits are produced in winter when the shrub is leafless, or it may produce several crops during the year if soil moisture is good and temperatures are sufficiently high. Each inflorescence yields a bunch of approximately 10 or more ovoid fruits. A three, bi-valved cocci is formed after the seeds mature and the fleshy exocarp dries.

Climate

Altitude: 0-500 meters above sea level. *Mid-annual temperature:* 20-28 °C. *Annual rainfall:* 300-1000 mm., or more.

Cultivation I

Weeding timely -4 times per year, surface ploughing and pruning. With these management practices a yield around 15-20 kg of fruit per tree can be obtained even if the plants did not reach full maturity. Fertilizer: After transplantation and annually, 20 gr. of Urea, plus 120 gr. of Triple 17 (N-P-K 17%) and 16 gr. of micro-nutrients should be applied per plant. Besides, 1 kg of manure per seedling (2500 plants/Ha = 2.5 ton of manure/Ha.).

Crop Density & Yield I

Density: 2.5 metres between plants (1600 plants per Ha). Yield: Seed production ranges from about 2 tons per hectare per year to over 12.5t/Ha/year after five years of growth.

Habitat

The centre of Jatropha origin is Mexico and South America. It has been introduced to Africa and Asia. Introduction of Jatropha has been most successful in dry tropics with annual rainfall of 300 to1000 mm. or more. It occurs mainly at lower altitudes from 0 to 500 meters, in areas with average annual temperatures well above 20° C but can grow at higher altitudes and tolerates slight frost. It grows on well-drained soils with good aeration and is well adapted to marginal soils with low nutrient content.

Location

Jatropha is found in tropics & subtropics because likes heat. It does well also in lower temperatures and can withstand light frosts. Its water requirement is extremely low and it can stand long periods of drought by shedding most of its leaves to reduce transpiration loss. Is also suitable for preventing soil erosion and shifting of sand dunes.

Cultivation II

From 2nd Year Fertilizer: 40:60:20 (NPK) Kg./Ha. 1st Year Pruning : When branches reach a height of 40-60 cm. Pest & Disease control: No disease or insects noticed to be harmful. Flowering: Sept.-Dec. & March- April. Fruiting: After 2 months of flowering. Collection and processing: Ripe fruits collected from trees.

Crop Density & Yield II

Production range may be also attributable to low and high rainfall areas as well as soil fertility.

Leaves

Jatropha has large green to pale-green leaves, alternate to sub-opposite, 3 to 5 lobed with an spiral phyllotaxis.

Seeds

The seeds become mature when the capsule changes from green to yellow, after two to four months.

Flowering & Fruiting

Deciduous. Shed leaves in dry season. Flowering during wet season and two flowering peaks are often. In permanently humid conditions flowering occurs throughout the year. Seeds mature about three months after flowering. Early growth is fast, and with good rainfall nursery plants may bear fruits after the 1st rainy season. Direct sown plants after the 2nd rainy season. Flowers are pollinated by insects especially honey bees.

Soil

Grows on well-drained soils with good aeration and is well adapted to marginal soils with low nutrient content. On heavy soils, root formation is reduced. Jatropha highly adaptable, but its strength comes from its ability to grow on poor and dry environments.

Cultivation III

1st Prune: Plants must produce side shoots for maximum sprouting, flowers and seed. Between 90 and 120 Days top of all plants at 25 Cm. Cut the top off cleanly and cut top to produce 8 – 12 side branches. Keep the tree less than 2 meters tall to facilitate harvesting.

Botanical Characteristics of Jatropha II

Seed Management

Because Jatropha seeds are oily should not be store for long. Seeds older than 15 months show viability below 50%. High levels of viability and low levels of germination shortly after harvest indicate innate (primary) dormancy.

Freshly harvested seeds show dormancy, and after-ripening is necessary before the seeds can germinate. Dry seed will normally germinate readily without pre-treatment. If this is the case, it is not recommended to remove the seed-coat before sowing. Although it speeds up germination there is a risk of getting abnormal seedlings.

Fruit Handling

The fruits should be transported in open bags to the processing site where they will be dried until all the fruits have opened. Direct sun has a negative effect on seed viability, so seeds should be dried in the shade. When the seeds are dry they are separated from the fruits and cleaned. The seeds should be dried to low moisture content (5 to 7%) and stored in air-tight containers. At room temperature the seeds can retain high viability for at least one year. However, because of the high oil content the seeds cannot be expected to store for as long as most species.

Irrigation

Moderate irrigation it is required only in the initial 2 years during the dry season.

Nursery Raising

Nurseries may be raised in poly-bags filled with mixture of soil and farm yard manure in the ratio of 4:1. Two seeds are sown in each bag. *Plantation*: 30 cm x 30 cm x 30 cm pits are dug. Farmyard manure (2-3 kg), 20 gm urea, 12 gm Single Super Phosphate (SSP) & 16 gm Mono Phosphate (MP).

Labour Estimate

-Planting: 60 man-days per hectare. -Maintenance: 50 man-days per hectare. -Harvesting and Pruning: 50 man days per hectare.

Jatropha Additional Uses

Jatropha oil has a very high saponification value and is ideal for soap manufacture. Soap manufactured from non-petroleum sources is gaining increasing popularity especially in the European countries. It can also be used as an illuminant in lamps as it burns without emitting too much smoke. The latex of Jatropha contains jatrophine, an alkaloid which is believed to have anti-cancerous properties. It is also used as an external applicant for skin diseases, rheumatism, livestock sores, piles and as an antidote for certain snake-bites The dark blue dye extracted from the bark of Jatropha is a useful dye. Jatropha oil cake is rich in nitrogen, phosphorous and potassium and can be used as organic manure. Jatropha leaves are used as food for the tusser silkworm. The seeds are considered anti helmintic in Brazil, and the leaves are used for fumigating houses against bed bugs. In addition, the ether extract shows antibacterial properties against Staphylococcus aureus and Escherichia coli.

The Trans-Esterification Process

The Trans-Esterification Process

Bio-Diesel Production: The process of converting the triglycerides (fatty acids) in the vegetable oil into methyl or ethyl esters (the methyl/ethyl ester is bio diesel) is called trans esterification. Chemically, trans esterification involves taking a triglyceride molecule or a complex fatty acid molecule, neutralizing its free fatty acids, removing the glycerol component and creating an alcohol ester or bio diesel. If 100 gr. of vegetable oil is taken, then 1 gr. of the alkaline catalyst (Potassium Hydroxide), and 12 gr. of Methanol would be required. At first step, the alkaline catalyst is mixed with methanol and the mixture is stirred for half an hour for its homogenization. This mixture is mixed with vegetable oil and the resultant mixture is made to pass through reflux condensation at 65 °C.

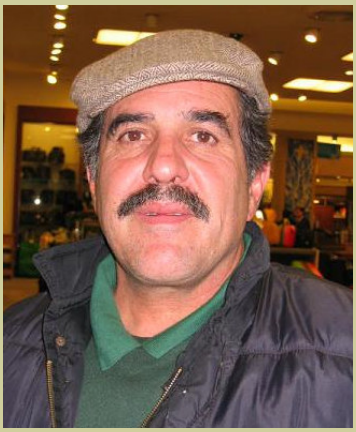
The mixture at the end is allowed to settle. The lower layer will be of glycerine and is drained off. The yield of glycerine (a by-product having medicinal value) is about 11%. The upper layer of bio-diesel (a methyl ester) is washed to remove entrained glycerine. The excess methanol is recycled by distillation. This reaction works well with high quality oil. If the oil contains up to 1% Free Fatty Acid (FFA), then difficulty arises because of soap formation. If FFA content is more than 2% the reaction becomes unworkable and the FFA will have to be removed or transformed into bio diesel using special pre-treatment technologies. Methanol is inflammable and Potassium Hydroxide is caustic, hence proper and safe handling of these chemicals is a must. The bio diesel yield is 90%.

CURRICULUM VITAE

JORGE ALEJANDRO DELAVEGA LOZANO

Development and Implementation of Projects

Environmental Conservation.
Alternative Energy Resources.
Rural Development.
Agriculture & Livestock.
Organic & Conventional Production
Industry & Agro-Industry.



Experience

2007 to Date. Independent Consultant and Analyst. –Development and implementation of projects and elaboration of proposals for NGOs concerning renewable energy and rural development.

2005-2006 Crew Chief. –Implementation of work methods to improve production and the relationship between workers and enterprise. Evaluation and supervision of production systems. Avigrupo, S. A. de C.V. (Live chicken: 120,000 daily -83 workers)

2002-2004 Technical Sales Director. – National and international technical assistance on sales of equipment for grain processing. Nixtamex, S.A. de C.V. (50 years in the market -5 sales agents).

1998-2001 Project Director. -Planning, development and direction of an agricultural project for milk and beef production. Design and construction of facilities. Establishment of crops for cattle feed. Consultancy re animal husbandry. Livestock health and reproduction programs.
Aequus, S.A. de C.V. (750 Holstein cows -35 workers).

1992-1997 Sales Director. –Import of agricultural products and livestock for reproduction. Trade service and advice on agricultural projects. Stro-Wold International, Ltd. (since 1854 -7 sales agents in Mexico).

1985-1991 Plant Manager. –Fabrication of plastic containers for agri-food and pharmaceuticals. Coordination and evaluation of industrial operations. Maintenance of equipment & facilities.
Plásticos Industriales Mexicanos, SA de CV (-120 workers.)

1975-1984 Production Manager. -Beef cattle management (5000 heads). Coordination of feed-yard and grazing operations. Maintenance of equipment & facilities. Personnel training. Animal health and reproduction programs. Empacadora Xalostoc, S.A. de C.V. (-200 workers).

Co-Owner -Landscape Gardening construction and maintenance. Greenhouse production (tomato). Jardines Nicolás (7 workers).

Personal

Openness and transparency in communications.
Good interpersonal skills.
Good judgment in evaluating situations.
Independent and self motivated.
Service oriented personality.
Technical Flair.
PC MS Office.
Fluency in English and Spanish.
Travel flexibility.
Age 56.
Mexican nationality.
Height: 1.75 m. Weight: 78 Kg.
High school in Canada.
Agricultural & food sciences.
Mechanical engineering practical.
Writer, & Translator (English-Spanish).

Abilities

Development and implementation of projects.
Coordination and evaluation of operations.
Implementation of strategies y solutions.
Agri-food & agro-industrial development.
Organic and conventional production.
Alternative energy systems.
Environmental conservation.
Trade of agricultural related products.
Design and construction of facilities.
Coordination of work areas and tasks.
Follow through on potential developments.
Search results cost/benefit based.
Creative alternatives.
Public relations and promotion.
Personnel training and management.
Development of work methods.
Rural Sustainable Development.

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