Jatropha Cultivation and Oil Production

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Conventionally, biodiesel is produced from different types of vegetable oils and animal fats. However, most of the vegetable oils, which are used for biodiesel production, are edible oils and therefore, **there is competition with other food sources**.

**Jatropha**, a tropical plant yields a considerable amount of non edible oil which can be converted to biodiesel. The Jatropha oil can be used as a direct replacement for kerosene for cooking and lighting, as an engine fuel.

Different parts of Jatropha have medicinal values. Each and every part of the tree from roots to the leaves can be used for various purposes e.g. to make antibiotics, medicine for skin diseases treatment and others.
Occurrence

Jatropha originates from Mexico, central America and South Asia but has spread all over the world and is mostly used for hedges.

**Family:** Euphorbiace

**Species:** *Jatropha curcas*

**English name:** Physic nut, purge nut, pig nut, fig nut, Jatropha

**Local names:**
- **Bangladesh:** Sadamandar/ Erenda/ Jamalgota
- **Mali:** Pourghere
- **Ivory coast:** Bagani
- **Senegal:** Tabanani
- **Tanzania:** Makaean
- **India:** Ratanjut
- **Zambia:** Bemba
- **Zimbabwe:** Shona
- **South Africa:** Venda/Swahili
Agronomy

**Germination:** With good moisture conditions the germination of the seed takes 7-10 days. The shell splits and the radicula emerges and four peripheral roots are formed.

**Flowering:** By cutting the planted branch takes 3-4 months or by seedling the plants take one year for flowering.

**Propagation:** Direct seeding, Tansplanting, Direct planting( cutting), Tissue culture for seedlings(?)

**Intercropping:** Without cutting the lateral roots, inter cropping as maize, Indigo, Lentill, Wheat etc can be successfully grown and farmer will get extra income.

**Irrigation:** There is scope for increasing yield of seed by practicing suitable irrigation method.

**Pruning**
Once a year
Jatropha - composition

Jatropha-capsules

- Minus capsule sheaths (35%) → 350kg

Seeds

- Minus seed shells (35%) → 650kg

Kernels

- Oil (58%) → 245kg
- Seed cake (42%) → 177kg

Total:
- 1000kg
- 350kg
- 650kg
- 228kg
- 422kg
Fig. Multiple use of Jatropha
Critical considerations for Jatropha plantations

- Country-level legislation on cultivation and bio-diesel use
- **Use and reclamation of currently uncultivable land**
- Working capital inputs should be understood
- **Technology should be tuned to maximize income with minimum inputs**
- Decentralized biodiesel production where it is grown
- Marketing of bi-products
Possible areas of the Jatropha cultivation in Bangladesh

1. Highland including hilly areas covers altogether about 4.2 million hectares are suitable for Jatropha cultivation.
2. Char land
3. Road sides
4. Railway sides
5. River bank
6. Forest areas

Source: Benchmark soil of Bangladesh: Morphology, characteristics and classification for research management GIS Laboratory publication No.4. First published in June, 2005
Railway route: 2,854.96km

http://www.railway.gov.bd/gallery.html
1. Pit size: 50 cm* 50 cm
2. 1/3 normal soil, 1/3 sand and 1/3 compost
3. Mixing the soils
4. Fencing
Cutting samples in preparation

5. Cutting preparation
6. Cuttings
7. Planting
Jatropha garden
Germination and jatropha plants

1. Seedling after three days
2. Seedling after five days
3. Seedling after 15 days
4. Seedling after 90 days

- 3 days
- 5 days
- 15 days seedlings
- 3 months
Flowers and Fruits (1st harvest)

1. Flowering in 3rd months
2. Fruiting in 4th months
3. Harvesting in 5th months
4. Dry fruit
Fruits (2nd harvest)

1, 2 & 3. Fruiting in 8th months
Insect and diseases

Aphid attack on leaves

Spraying insecticides, once per month
Processing - Pressing of oil

(1) Ram press
(2) Hole cylinder type press
(3) Strainer type press
(4) Danish BT press
(5) Sundhara oil expeller

Purification

(1) Sedimentation
(2) Centrifugation
(3) Filtration
Expeller for oil extraction
Worm screw
Flow Diagram

Mechanical method

Chemical method
Sectional view of the Mechanical extractor
Table 1: Physical properties of Jatropha seeds

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Weight of seed, g</th>
<th>Number of seed</th>
<th>Volume of seed, cm³</th>
<th>Bulk density, g/cc</th>
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<tbody>
<tr>
<td>1</td>
<td>300.2</td>
<td>590</td>
<td>975</td>
<td>0.307897</td>
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<td>2</td>
<td>169.7</td>
<td>322</td>
<td>510</td>
<td>0.332745</td>
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<td>3</td>
<td>215.2</td>
<td>418</td>
<td>680</td>
<td>0.316471</td>
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<td>4</td>
<td>107.5</td>
<td>227</td>
<td>355</td>
<td>0.302817</td>
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<td>5</td>
<td>94.3</td>
<td>171</td>
<td>280</td>
<td>0.336786</td>
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<td>6</td>
<td>82</td>
<td>165</td>
<td>250</td>
<td>0.328</td>
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<td>7</td>
<td>183.1</td>
<td>381</td>
<td>600</td>
<td>0.305167</td>
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<td>8</td>
<td>283.9</td>
<td>584</td>
<td>960</td>
<td>0.295729</td>
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<td>9</td>
<td>77.6</td>
<td>158</td>
<td>225</td>
<td>0.344889</td>
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<td>10</td>
<td>249.9</td>
<td>493</td>
<td>800</td>
<td>0.312375</td>
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<tr>
<td>Mean</td>
<td>176.34</td>
<td>350.9</td>
<td>563.5</td>
<td>0.318288</td>
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<tr>
<td>STD</td>
<td>84.35411</td>
<td>169.1235</td>
<td>286.1531</td>
<td>0.0164</td>
</tr>
<tr>
<td>Parameter</td>
<td>No. of branches</td>
<td>Perimeter ($\pi d$), cm</td>
<td>Diameter (d), cm</td>
<td>Projected area ($\pi d^2 / 4$), cm²</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------</td>
<td>-------------------------</td>
<td>-----------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td>at 60 cm</td>
<td>at 90 cm</td>
<td>at 120 cm</td>
<td>at 60 cm</td>
</tr>
<tr>
<td>Avg.</td>
<td>21.2</td>
<td>224.32</td>
<td>281.02</td>
<td>71.44</td>
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<td>STD</td>
<td>5.77</td>
<td>47.09</td>
<td>53.75</td>
<td>14.99</td>
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<td>CV %</td>
<td>27.22</td>
<td>20.99</td>
<td>19.13</td>
<td>20.17</td>
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</table>

Fig Plant canopy structure
Next step to be undertaken

(1). To verify the present state of the art on the use of jatropha curcas in Bangladesh (BAU and forest department)
(2) To study the physical properties of seed and plants and suitable cultivation technique (BAU and BUET)
(3) To develop suitable oil expellers for Jatropha seed crushing (BAU and BUET)
(4) To develop methods to verify the Physico-mechanical, electrical and thermal properties of Jatropha oil suitable for diesel engine operation (BUET and BAU)
(5) To develop oil extraction by chemical method (BINA)
(6) To develop bio-pesticide and organic fertilizer (BINA)
(7) Performance studies of small diesel engines with Jatropha oil (BAU and BUET)
(8) Extension of Jatropha cultivation in Bangladesh (Forest department and BAU)
Potential area of cultivation