“The Jatropha System” and Human Capacity Strengthening to Realize the Economic Potential of Jatropha curcas L. (JCL)

Presentation of “the Jatropha System” at the expert workshop “Marketing Strategies and Human Capacity Strengthening to Realize the Economic Potential of Underutilized Species” in Macerata, Italy, 28 – 31 January, 2004

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This presentation will be deal with 7 points:

1. Remarks;
2. The plant Jatropha curcas L.;
3. The Jatropha System;
4. Economic potential of the utilization of JCL;
5. Strategies to disseminate the know how of the Jatropha System;
6. Strategies to improve the commercialization of the Jatropha System;
7. Promotion of the Jatropha approach.

1. Remarks

This paper contains only some information concerning “the Jatropha System”, just to understand its potential to contribute to rural development by its utilization.

A lot of papers can be found on the Jatropha website for downloading: www.jatropha.org.

The economic evaluation of the Jatropha activities in Tanzania are based on real data. In other countries the Jatropha activities also show positive economic results, as far as soap making is concerned. The economic use of Jatropha oil as fuel (direct or as biodiesel) depends very much on the level of rural labour costs.

2. Description of the plant, distribution, ecology

Jatropha curcas L. (JCL) or physic nut, is a bush or small tree (up to 5 m hight) and belongs to the euphorbia family. The genus Jatropha contains approximately 170 known species. The genus name Jatropha derives from the Greek jatrós (doctor), trophé (food), which implies medicinal uses.

The plant is planted as a hedge (living fence) by farmers all over the world around homesteads, gardens and fieldes, because it is not browsed by animals.

2.1 Botanical description

Jatropha curcas L., or physic nut, has thick glabrous branchlets. The tree has a straight trunk and gray or reddish bark, masked by large white patches. It has green leaves with a length and width of 6 to 15 cm, with 5 to 7 shallow lobes. The leaves are arranged alternately.
Dormancy is induced by fluctuations in rainfall and temperature/light. But not all trees respond simultaneously. In a hedge you may have branches without leaves, and besides ones full of green leaves.

The branches contain a whitish latex, which causes brown stains, which are very difficult to remove.

Normally, five roots are formed from seeds: one tap root and 4 lateral roots. Plants from cuttings develop only lateral roots.

Inflorescences are formed terminally on branches. The plant is monoecious and flowers are unisexual. Pollination is by insects.

After pollination, a trilocular ellipsoidal fruit is formed. The exocarp remains fleshy until the seeds are mature. The seeds are black and in the average 18 mm long (11 – 30) and 10 mm wide (7 – 11). The seed weight (per 1000) is about 727 g, this are 1375 seeds per kg in the average.

The life-span of the Jatropha curcas plant is more than 50 years.

**Varieties** (there are 3)

The Cape Verty variety is the one which is spread all over the world.

A Jatropha variety in Nicaragua has fewer, but larger fruits. The yield per ha seems to be the same.

A non-toxic variety exists in Mexico which is used for human consumption after roasting. It does not contain Phorbol esters. (“This non-toxic variety of Jatropha could be a potential source of oil for human consumption, and the seed cake can be a good protein source for humans as well as for livestock.”, Becker et al, 1999).

**2.2 Distribution**

Jatropha curcas originates from Central America.

From the Caribbean, Jatropha curcas was probably distributed by Portuguese seafarers via the Cape Verde Islands and former Portuguese Guinea (now Guinea Bissau) to other countries in Africa and Asia. Today it is cultivated in almost all tropical and subtropical countries as protection hedges around homesteads, gardens and fields, since it is not browsed by animals.

**2.3 Ecology**

Jatropha curcas L. is not a weed. It is not self propagating. It has to be planted.

It grows well on marginal land with more than 600 mm of rainfall per year, and it withstands long drought periods. With less than 600 mm it cannot grow except in special conditions like
on Cape Verde Islands, where the rainfall is only 250 mm, but the humidity of the air is very high (rain harvesting).

It cannot stand frost. It survives a very light frost, but it lose all leaves. The production of seeds will probably go down sharply.

3. Description of the Jatropha System

3.1 The Jatropha System

The Jatropha System is an integrated rural development approach. By planting Jatropha hedges to protect gardens and fields against roaming animals, the oil from the seeds can be used for soap production, for lighting and cooking and as fuel in special diesel engines. In this way the Jatropha System covers 4 main aspects of rural development:

- promotion of women (local soap production);
- poverty reduction (protecting crops and selling seeds, oil and soap);
- erosion control (planting hedges);
- energy supply for the household and stationary engines in the rural area;

The obvious advantage of this system is that all the processing procedure, and thus all added value, can be kept within the rural area or even within one village. No centralised processing (like in the cotton industry) is necessary.

3.2 Possible Uses of the Jatropha Plant

- The Jatropha plant is used as a medicinal plant:
  - The seeds against constipation;
  - The sap for wound healing;
  - The leaves as tea against malaria; etc.
- Jatropha is planted in the form of hedges around gardens or fields to protect the crops against roaming animals like cattle or goats;
- Jatropha hedges are planted to reduce erosion caused by water and/or wind;
- Jatropha is planted to demarcate the boundaries of fields and homesteads;
- Jatropha plants are used as a source of shade for coffee plants (on Cuba);
- In Comore islands, in Papua New Guinea and in Uganda Jatropha plants are used as a support plant for vanilla plants;

4 Economic Aspects

This is an example of a successful project in Tanzania. The Jatropha plant is already known by the population since a long time, but its utilization was limited to the use of the plant as protection hedge around homesteads and gardens. The seeds were not used.

The KAKUTE project convinced the Massai women as well as a women group in Mtu Wa Mbu of the interesting economic potential of this plant. Especially the medicinal property of the soap makes it interesting for the rural population. And KAKUTE was able to maintain the image of the soap to be “medical soap”.

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4.1 Economy of Small Scale Jatropha Utilization in Tanzania (data from KAKUTE, 2003)

Collection of seeds:

<table>
<thead>
<tr>
<th>Collection of seeds: 2 kg in 1 hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale of seeds: 150 TZS per kg</td>
</tr>
</tbody>
</table>

Value added for 1 hour work 300 TZS 0,29 USD per hour

Oil extraction

5 kg of seed for 1 litre of oil is 1.7 hours of work
1.0 hours of work to extract 1 litre of oil

<table>
<thead>
<tr>
<th>Input:</th>
<th>5 kg of seed</th>
<th>750 TZS</th>
<th>0,71 USD per litre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,5 hours of work to extract 1 litre of oil</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>depreciation of ram press 0,02 USD / kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for 5 kg:</td>
<td>105 TZS</td>
<td>0,10 USD per litre</td>
</tr>
<tr>
<td>Output:</td>
<td>Sale of 1 litre of oil</td>
<td>2.000 TZS</td>
<td>1,90 USD</td>
</tr>
</tbody>
</table>

Value added for 1 hour work 1.145 TZS 1,09 USD per hour

Soap making

16 hours work for 252 bars of soap
1 bar sold for 500 TZS

| Purchase of 20 litres of oil à 2.000 TZS = 40.000 |
| Purchase of 3 kg of Caustic Soda à 2.000 TZS = 6.000 TZS |
| Plasic for wrapping soap = 3.000 TZS |
| 10 hours for miscellaneous work (organising purchase of oil, wrapping the soap, etc) |

| Input: | 20 l oil | 40.000 TZS | 38,10 USD |
|        | Plastic | 3.000 TZS | 2,86 USD |
|        | Caustic Soda | 6.000 TZS | 5,71 USD |
|        | Total input for 26 hours work | 49.000 TZS | 46,67 USD |
| Output: | 252 bars à 500 TZS | 126.000 TZS | 120,00 USD |
| Total of revenues | 77.000 TZS | 73,33 USD |

Value added for 1 hour of work 2.962 TZS 2,82 USD per hour

The added value by 1 hour of work of the utilization of the Jatropha plant can be summarized as follows:

- Collection / harvesting of seeds 0,29 USD
- Extraction of Jatropha oil with hand press 1,09 USD
- Soap making 2,82 USD
4.2 Economic aspects of large scale Jatropha plantations in South Africa

The diesel price in South Africa is actually (Jan. 2004) at 3,78 ZAR = 0,52 USD

The Jatropha Task Team in KwaZulu-Natal proposes 30% of the price of diesel as the price for 1 kg of seeds:

1 kg of seeds = 1,13 ZAR = 0,154 USD per kg of seeds

For the production of 1 litre of Jatropha oil 4 kg of seeds are need = 4,52 ZAR = 0,62 USD; i.e. the biomass for 1 litre of oil has already a price of 0,62 USD.

For transport, maintenance of the equipment, depreciation and buildings we estimate 30%, which mounts the price by 0,19 USD to 0,81 USD.

The esterification process costs about 0,10 USD per litre, so the price will be about 0,91 USD per litre for biodiesel, which is 6,67 ZAR.

This price compared with the actual diesel price of 3,78 ZAR shows, that there is still quite a difference to bridge until biodiesel will be feasible as diesel substitute.

4.3 Comparison of economic aspects of small and large scale Jatropha utilization

This calculation might be different in other countries with lower wages for rural work. But it also shows clearly, that the added value of Jatropha oil utilization for soap making is very high and that this is a real possibility of creating rural income without big investments.

Therefor the central hypothesis of the Jatropha System is:

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The Jatropha System creates a positive reciprocity between raw material/energy production and environment/food production.

i.e. the more seeds/oil Jatropha hedges produce, the more food crops are protected from animals and erosion.
Also additional income is created, mainly for women.
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5. Strategies to disseminate the know how of the Jatropha System

Creation of “Centres of Excellence” in each country. This is a number of persons which are familiar with all the aspects of Jatropha production, oil extraction, soap production and marketing. These people have to be up to date with regional development in extraction technology and marketing techniques (“eco-label”).

These persons can easily be invited by some organisations to start Jatropha projects in their region.

Publication of available and useful information concerning the application of the Jatropha know how into the internet. This internet presence will supply up to date information to all members of the “Centre of Excellence” and will facilitate the exchange of information between the “Centres of Excellence” in different countries.
Creation of a Jatropha network for mutual support and exchange of know how, including workshops, seminars and visits of different projects with different approaches and in a different socio-economic environment (capacity building);

Conception of small scale projects, which can be financed by small donor agencies (modular project system) and executed even by small NGOs.

6. Strategies to improve commercialisation of the Jatropha System

Looking for wholesale buyers for Jatropha soap and / or oil in national markets;

Looking for export / import possibilities on international markets;

Presentation of Jatropha products on agricultural exhibitions (national / international);

Approach of national / international trading companys of natural products;

7. Promotion activities

Each country should build up its own “Centre of Excellence” to promote the Jatropha activities in that country and to supply personnel for the dissemination of “the Jatropha System”.

But on an international level there should be an institution (project), which supports the different “Centres of Excellence”, which maintains the website to supply relevant information to all interested persons and institutions, to organise a network people / organisations, which work on Jatropha.

To keep this network alive, regular workshops on regional level should be held, accompanied by some central seminars (capacity building)

This central Jatropha promotion project can also identify research topics and coordinate the work on these topics by different organisations / universities and distribute the results. Such topics could be:

Selection of high yield Jatropha plants (seeds)

Selection of high oil yield Jatropha plants;

Selection of a pure line of the non toxic variety from Mexico (edible oil, press cake as animal feed);

Establishment of a seed bank to provide Jatropha projects / initiatives with high yield and / or non toxic seeds;