Experiences and Status-quo of Jatropha Cultivation in Southern Africa

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1.0 Introduction

- **Jatropha curcas is an energy crop used for the production of first generation biodiesel. It is a biofuel crop increasingly grown in southern Africa, with Malawi, Zambia and Zimbabwe being the main growing countries.**

Biofuels are liquid fuels produced from biomass for transport or burning purposes. The two main types biofuels, ethanol and biodiesel, account for 90% of the total global consumption of biofuels (Dufey, 2006).

The interest in producing biofuels in SA driven by the following factors:

- concerns about the increasing prices of fossil energy sources (Table 1).
- possible depletion of fossil energy sources (Table 2)
- concerns about environment including climate change.
- Desire to reduce dependence on external energy sources.
- Rural development

Table 1: The Wheat/Oil Exchange Rate, 1950-2005

Year	Bushel Wheat	Barrel oil	Barrel/Bushel
1950	1.89	1.71	1
1960	1.58	1.85	1
1970	1.49	1.79	1
1975	4.06	11.45	3
1980	4.7	35.71	8
1990	3.69	22.99	6
1995	4.82	17.20	4
2000	3.1	28.23	9
2005	3.9	52.00	13

Source: Brown (2006)

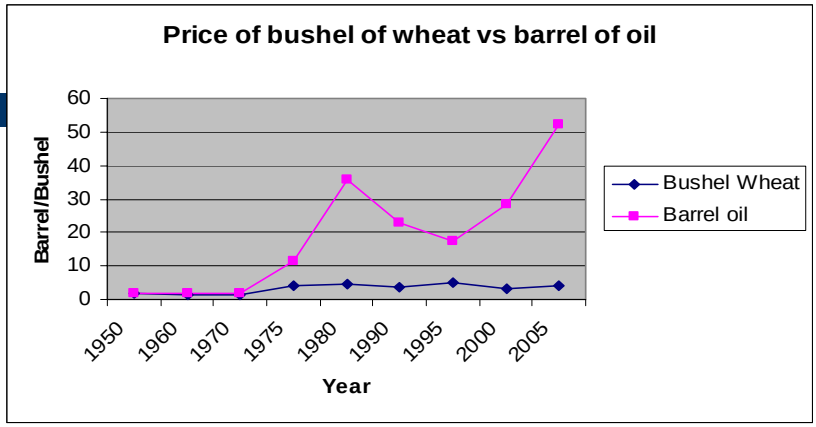

Figure 1
Source: Based on Table 1

Table 2:

Petroleum Fuel	Depletion Period* (Years)
Oil	41
Natural gas	64
Coal	155

Source: Goldemberg (2007). Notes: *assuming that the current consumption and production do not change

Objectives of the presentation:

- **Review the characteistics of *Jatropha curcas* in order to contribute to research and policy**
- **Assess the extent to which *Jatropha curcas* is being grown in SA and the challenges experienced.**
- **Review economic policies adopted to promote its development**

3.0 Study areas and methodology

- **Semi-arid countries of southern Africa**
- **Literature Review**
- **Stakeholder interviews; through e-mail correspondence.**

4.0 Socio-economic and Energy Context

Table 3: Key indicators of development

Country	Population (millions) 2003	Population average annual increase 1990-2003	Gross national income per capita (dollars) 2003	PPP gross national income per capita (dollars)2003	Gross domestic product per capita % growth 2002-2003	Life expectancy at birth 2002	2006 HDI ranking
Angola	13.5	2.8	740	1 890	1.4	47	161
Botswana	1.7	2.3	3 430	7 960	4.0	38	131
Malawi	11.0	2.0	170	600	3.8	38	166
Namibia	2.0	2.8	1 870	6 620	-6.7	42	125
South Africa	45.3	1.9	2 780	10 270	-2.0	46	121
Zambia	10.4	2.2	380	850	3.5	37	165
Zimbabwe	13.1	1.9	480	2 180	-6.7	39	151

Source: World Bank (2005); UNDP (2006).

Table 4: Total Energy and Carbon Dioxide Emissions 2003

Country	**Total Energy Consumption, (Quadrillion Btu)**	**Total Energy Production, (Quadrillion Btu)**	**Net Energy Exports, (Quadrillion Btu)**	**Carbon Dioxide Emissions (million metric tons of CO2)**
Angola	0.135	1.0960	1.825	4.34
Botswana	0.052	0.023	-0.029	1.04
Lesotho	0.007	0.004	-0.003	0.06
Malawi	0.025	0.013	-0.021	0.22
Namibia	0.051	0.015	-0.036	0.63
South Africa	4.901	5.916	1.015	112.16
Zambia	0.108	0.090	-0.018	0.61
Zimbabwe	0.189	0.136	-0.053	3.01
Total	5.468	7.293	0.65	122.07
SADC Total	5.902	8.476	2.574	125.98

Source: Wakeford (2006).

5.0 Policies for Biofuels

•In southern Africa, some countries have already drafted policies for biofuels development, while others have started reviewing their energy policies.

•In South Africa, a strategy for biofuels had already been drafted by the end of 2006.

•Biofuels are among the renewable energy sources being promoted to meet energy supply target of 10 000 GWh by 2013 (Wienesse and Purchase, 2006). These fuels are expected to account for 4.5% of the total consumption of liquid fuels by 2013.

Policies for Biofuels (cont.)

- To achieve this target, incentives have been introduced to increase the production of biofuels (Republic of South Africa, 2006).
- In other southern African countries, there is an increasing interest in the growing of energy plants and strategies for biofuel production have either been developed or are being developed.

6.0 Potential and Status: Energy crops

- Countries with largest potential of biofuel production: Angola, Zambia, and Zimbabwe.
- Angola is a large country with a small proportion of its land currently being used for agriculture.

- The country is estimated to have 69 million ha of land available in 2050 for energy production with the potential to provide 5.945 Ej of energy per year, equivalent to 974.6 million barrels of oil.

- Zambia is endowed with land and water resources. Of the 60 million ha of potential arable land; only 9 million (15%) is cultivated (Hoffman 2006).
- In Botswana and Namibia shortage of water is a major constraint.

Potential and Status: Energy crops (cont.)

- In South Africa, only 14% of the land is available; 10% is irrigated and uses 60% of total water consumption (Republic of South Africa, 2006).
- 3 million ha of land in homelands underutilized. If 1 million ha of this is utilized it could produce diesel accounting for 5% of national diesel usage (Republic of South Africa, 2006).
- A recent study identified the following energy crops for biofuel production in the SADC region:

Table 5: Energy crops recommended by the SADC study on biofuels.

Energy Crop	Rank	Reasons
Sugarcane	1	•already grown in the region for ethanol production •generates a lot of employment •produced from a bye product of sugar, hence there a double benefit •foreign exchange benefit
Soya beans	2	•same reasons as sugarcane •expanded use for biodiesel can be achieved in one season •scores high for biodiesel production
Oil Palm	3	•Scores high for biodiesel
Sunflower	4	•Ranked fourth because not widely grown in the region
Sweet Sorghum	5	•Ranks low because not yet commercially grown
Jatropha	6	•Not yet commercially grown

Source: Takavasha et. al (2005).

Summary of Table 5

- **Some of these crops are not widely grown in the region.**
- **there is evidence that some of them have a great potential of being grown as energy crops.**
- **Great potential for growing *Jatropha curcas* in the region.**

7.0 *Jatropha curcas* and policies on biodiesel production

7.1 Characteristics of the plant (General).

- Jatropha curcas is native to South America, but widely grown in Central America, Africa and Asia.
- Drought and pest resistant
- Not eaten by animals (protects cropland from animals).
- Cultivated by simple technology

7.1 Characteristics of the plant (cont.)

- Yield of the seeds harvested varies from 0.5 to 12 tonnes/ha/year (soil, nutrient and rainfall conditions) (Francis et al., 2005).
- Different from other first generation energy crops;
- Unlike other feedstocks, it is not a source of food or animal feed
- Lifetime of over 30 years; and seed production of three times/year (Eijck and Romijn, 2007; Francis et al., 2005).
- Can be grown on marginal land; in areas not suitable for other crops.

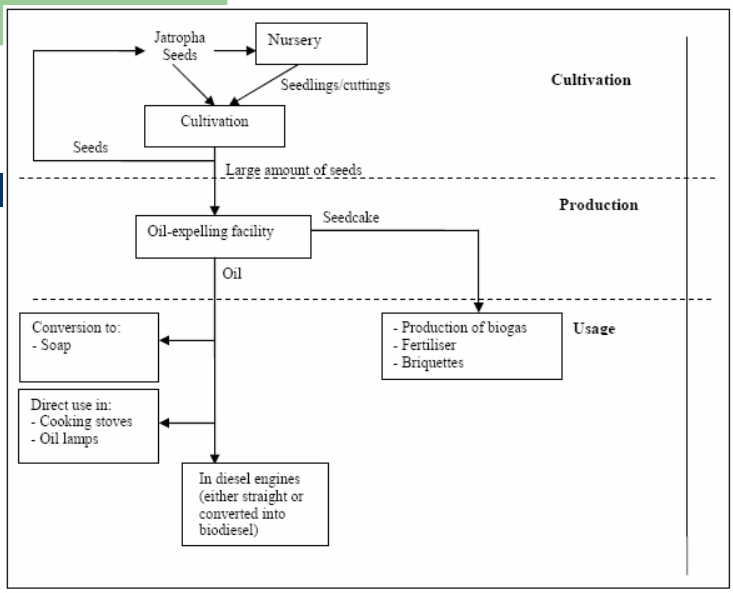

Figure 2: Jatropha production chain

Source: Eijck and Romijn (2006)

7.2 Characteristics of the plant (Health related)

- Leaves and nuts toxic (contain Phorbol esters and curcin),(non-toxic variety in Mexico and Central America). Although purgative the nuts are sometimes eaten (Benge, 2006).

- Seed is medicine for skin diseases and rheumatic pain

7.3 Characteristics of the plant (Benefits)

- Used for diesel production (second highest in oil content), medicine, and
- manufacture of soap (made from by-product of glycerin and oil).
- Seed is medicine for skin diseases and rheumatic pain
- Oil is a pesticide

7.4 Characteristics of the plant (Environmental)

- Noxious weed in Australia and classified as weed in other countries (e.g. Brazil, India, Jamaica and Salvador) (Benge, 2006).
- Opinion is varied on the potential for invasiveness. Most studies reveal that the potential is low (particularly under controlled management) and the threat to biodiversity is even lower. People are the main agents of dispersal.
- "Well to wheel" reductions in greenhouse gases of jatropha biodiesel in SA not known; but commentators think they may be larger.
- Jatropha, as a perennial crop, has higher energy content as compared to annual and biannual crops.

7.4 Jatropha Plantations and Policies for Biodiesel Production

- **7.4.1 South Africa**
- South Africa highly dependent on fossil fuels; contributed 1.4% of global CO2 in 1998. Energy efficiency strategy now adopted.
- In South Africa, a biodiesel fuel levy exemption of 30% was approved from 2003; and increased to 40% in 2005.
- Other incentives introduced e.g. (tax depreciation write-off of 50:40:20 per cent over a three year period equivalent to a support of $ 2/bbl.).
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South Africa Cont…

- **No mature crops, but sunflower and soya being grown for food production.**
- **There is interest to grow *Jatropha curcas* in Kwa-Zulu Natal and North West Province. In the North West Province, a 400 million tree nursery was being considered for Jatropha plantation (45 000 ha) in 2004.**
- **However, commercial production of Jatropha banned in South Africa**
- **Environmentalists cautious about the potential for invasiveness.**

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7.4.2 Botswana and Namibia

- In Namibia, local company is planning to grow 63 000 ha. Revenue equivalent to 0.5% of Namibian GDP (Colin Christian and associates, 2006).
- Farmers will be assisted to obtain formal land tenure rights.
- Farmers expected to switch from food to fuel production.
- Not allowed to plant on land cleared prior to 1990; Kyoto Protocol

Botswana and Namibia cont…

- Although farmers will obtain cash from the fuel produced from the Jatropha trees- will no longer produce maize and *mahangu*
- Income will be received: use of oil, sale of waste products, and carbon credits.
- In Botswana, a feasibility study on-going to assess
  - production and use of biofuels; and
  - compare the potential of *jatropha curcas*, palm oil, sunflower, soyabeans, sugar cane, maize, sweet sorghum and impacts on environment, employment, trade and economic growth.

7.4.3 Zambia and Zimbabwe

- In Zambia, 174 000 ha of land committed to D1 Oils Africa
- D1 was to plant 15 000 ha in cooperation with Kamuchu Community development Network
- Contract farming projects- D1provides technical advice, seeds, and guarantees to purchase crop.
- In Zimbabwe, 30 000 ha of Jatropha was to be planted in 2005/2006 (Japsen, 2006).
- Government policy is that Jatropha should be planted on marginal lands (Hall 2006).
- Non-marginal land available for food production.

8.0 Production and Usage

- D1 Oils plans to establish Jatropha refineries in Durban, South Africa.
- SA is not yet at the stage of using Jatropha biodiesel in engines.
- There is no information on use of Jatropha in engines.

9.0 Conclusion

- Development of Jatropha-based fuels at an early stage.
- Information needed on different genotypes and varieties.
- Need to use marginal land for Jatropha plantations in order to

  Improve food security and land restoration.

  Problem- marginal lands associated with marginal yields.
- Need to determine the net energy and environmental impacts ("well to wheels" reductions in greenhouse gases and energy balances)
- Develop environmental standards to guide production of Jatropha.