

# Cropping Potential of Physic Nut (*Jatropha curcas* L.) in Nepal

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# Introduction

## **Physic Nut (*Jatropha curcas* L.)**

- Perennial shrub belonging to family Euphorbiaceae
- Drought resistant plant
- Grows up to 3-5 m
- Originated in Central America and Mexico
- Distributed throughout the arid and semi-arid tropical and sub-tropical region
- Mainly grown in Asia and in Africa
- Emerging as an energy crop
- Introduced rapidly in various rural programmes



# Introduction (contd.)

## Nepal

- Small developing country situated in the northern hemisphere
- Economy is mainly based on agriculture
- About 76% labour force is engaged in this sector
- Altitude ranges from 70 to 8848 masl
- Climate varies from tropical to arctic
- Only 18% of the total land is suitable for agricultural use
- More than 50% holding areas are less fertile to marginal land
- Subjected to erosion, prolonged drought and decreasing surface and ground water



# Objective

## **General objective**

- Description of the plant and its cropping potential in different ecological zones of Nepal.

## **Specific objective**

- To review the economic value of *J. curcas*
- To understand the existing farming system of Nepal
- To study the present status of *J. curcas* in Nepal
- To explore the feasibility of *Jatropha* farming in Nepalese condition
- To identify the possible implications and major socio-economic aspects of *Jatropha* farming in Nepal

# Hypothesis

- Access relevant information for scientific works on *J. curcas*
- Facilitate the agriculture policy decision makers and planners for further development potentials in agriculture sector in Nepal
- Encourage the mineral fuel importers, industrial producers and agro-entrepreneurs to establish Jatropha business
- Improve socio-economic condition of rural Nepalese people through the establishment of Jatropha based income generating activities



# Materials and Methods

- Relevant literatures (articles, papers and documents) both published as well as unpublished were identified and reviewed
- Various relevant projects were consulted
- Government agencies and other line agencies were also consulted
- Some information were collected from web sources



# Ecology of *J. curcas*

- High adaptability in the natural environment
- Commonly found in the tropical and sub-tropical environment
- Can tolerate extremes of temperature
- Ability to withstand extreme drought and light frost
- However, more than 600 mm annual rainfall is preferred
- Can be grown on low fertile to marginal, degraded, fallow and waste land like along the canals, roads, railway tracks and even on alkaline soils
- A well-drained sandy soil with good aeration and moderate fertility is preferred



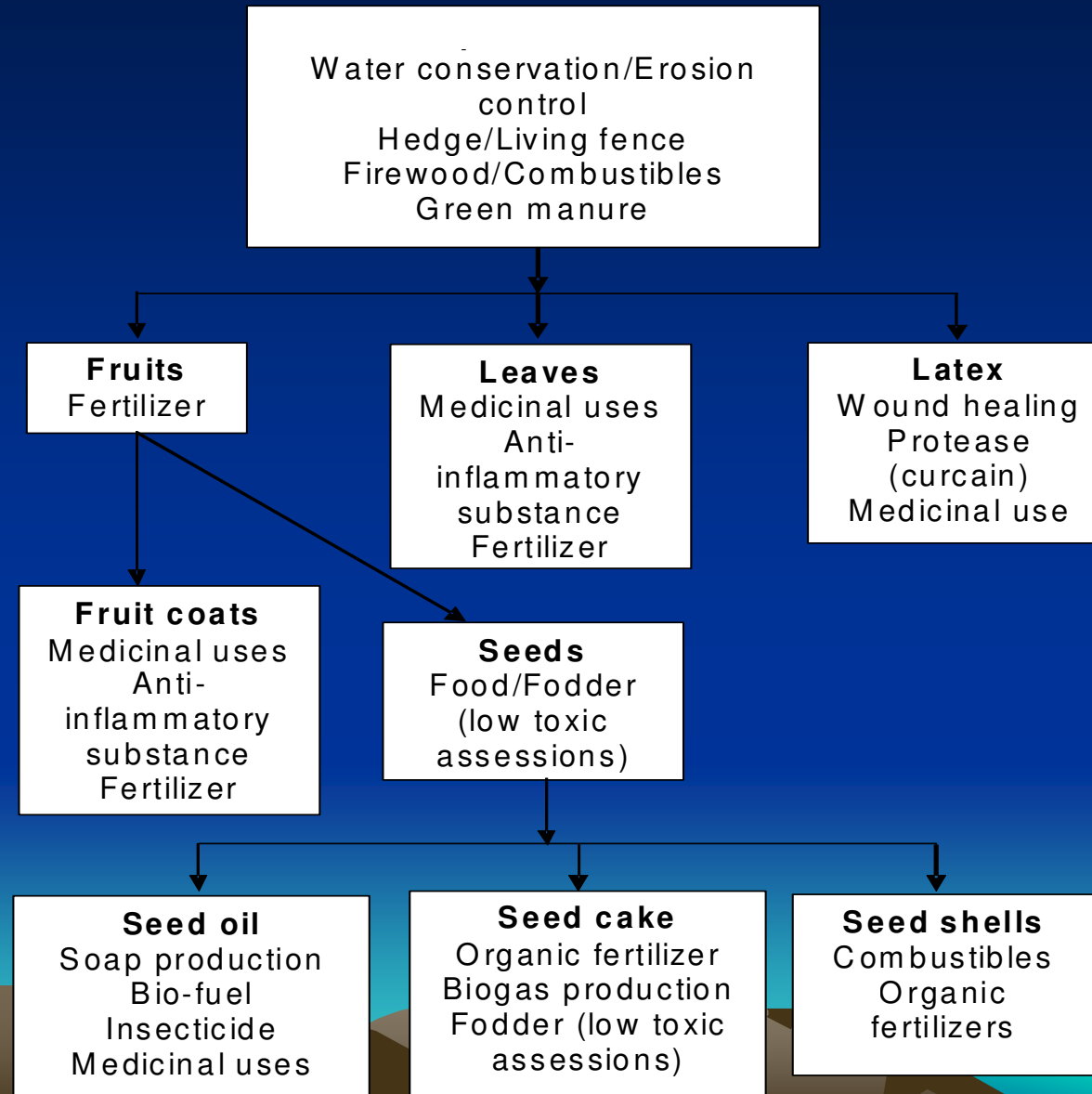
# Seed yield

- Economic yield can be found five years onwards
- Seed production ranges from 2 -12.5 t/ha/year, after five years of plantation
- In India, an average seed yield of 8 t/ha from irrigated plantation and 3-5 t/ha from rain fed plantation are found

Photo



# Economic importance of *J. curcas*



## Economic importance (contd.)

- Oil is mainly used for biodiesel and soap production
- Similar chemical composition of Jatropha oil with diesel
- 12 kg of seeds gives 28 pieces of soap (170 g each), which is 4.760 kg and 9 kg of press cake
- Press cake is very good source of organic fertilizer
- Higher percentage of N,P,K
- Lateral roots cover the soil surface
- Organic matter from shed leaves enhance earth-worm activity



# Oil Processing Machine built in Nepal

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Photo



# Physical and chemical properties of *J. curcas* oil and diesel fuel

Property	<i>J. curcas</i> Oil	Diesel Oil
Viscosity (cp) (30°C)	5.51	3.6
Specific gravity (15°C/4°C)	0.917/ 0.923(0.881)	0.841 / 0.85
Solidifying Point (°C)	2	0.14
Cetane Value	51	47.8 to 59
Flash Point (°C)	110 / 340	80
Carbon Residue (%)	0.64	< 0.05 to < 0.15
Distillation (°C)	284 to 295	< 350 to < 370
Sulphur (%)	0.13 to 0.16	< 1.0 to 1.2
Acid Value	1.0 to 38.2	N.A.
Saponification Value	188 to 198	N.A.
Iodine Value	90.8 to 112.5	N.A.
Refractive Index (30°C)	1.47	N.A.

Source: Reyadh, 1999.

## Comparative study of NPK composition in *J. curcas*

Fertilizer	Nitrogen (%)	Phosphorous (%)	Potassium (%)
<i>J. curcas</i> oil cake	4.44	2.09	1.68
Cow manure	0.97	0.69	1.66
Chicken manure	3.04	6.27	2.08
Duck manure	2.37	2.10	1.09
Neem oil cake	5.00	1.00	1.50
Compost of raw straw	0.81	0.18	0.68
Compost of water hyacinth	1.43	0.46	0.48
Compost of municipal waste	1.25	0.25	0.65

Source: Prajapati and Prajapati, 2005.

# Physiographic regions of Nepal

- Diversity in landscape, altitude, topography and temperature
- On the basis of altitudinal variations, the country can be divided into five physiographic zones

1. Terai (below 500 m asl)

• PHOTO

2. Siwaliks (500-1000 m asl)

3. Mid-Hills/Mountain (1000-3000 m asl)

4. High Mountain (3000-5000 m asl)

5. High Himalaya (Above 5000 m asl)



# Agro-ecological Zones of Nepal

On the basis of climatic variations, the country is divided into four major agro-ecological zones.

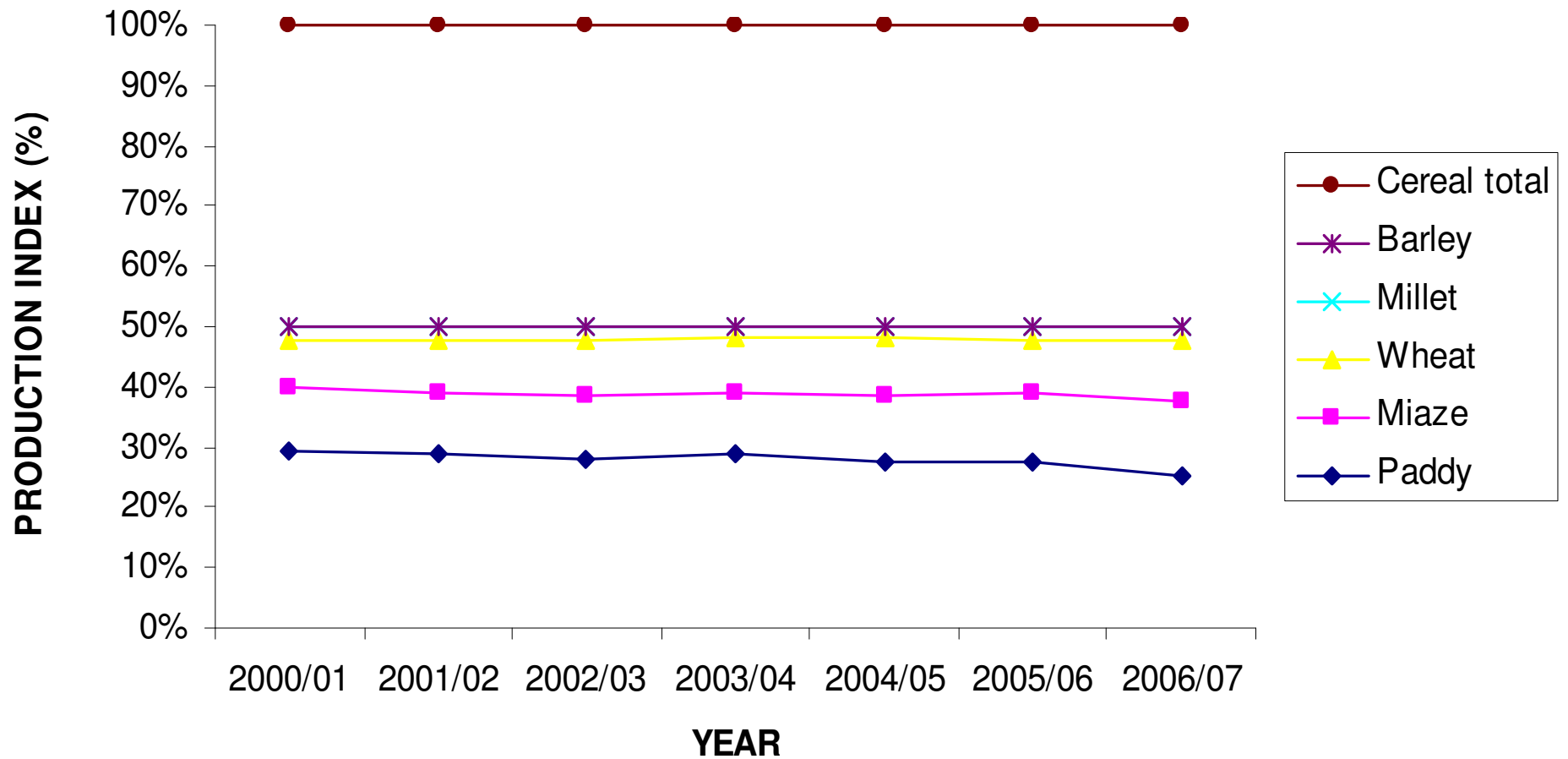
1. Tropical zone (below 1000 m asl)
2. Sub-tropical zone (1000-1500 m asl)
3. Warm temperate zone (1500-2000 m asl)
4. Cool temperate zones (2000-3000 m asl)



# Existing Nepalese farming system

- Long tradition of mixed farming with animal husbandry and crop production
- Total cultivable area is 3.1 million hectares
- Subsistence farming system
- Rain fed agriculture system
- Cereal crops dominate cropping pattern
- Cereal production is limited to specific areas and their productivity is low
- Small scale farmers, marginal land, irregular rainfall distribution, lack of irrigation facilities, underdeveloped markets, monocropping are the major constraints of Nepalese farming

## Existing Nepalese farming system (contd.)



# Present status of *J. curcas* in Nepal

- Two types of Physic Nut; *J. curcas* L. and *J. gossipifolia*
- Several names; Kadam, Battibal, Sajyoon or Saruwal
- Farming is not commercialized till now
- Familiar as a living fence
- Research Centre for Applied Science and Technology (RECAST), Tribhuvan University, Nepal has been working on the various aspects of *Jatropha*
- Ministry of Finance, Government of Nepal has now given emphasis by budget allocation in fiscal year 2007/08 to intensive development of herbs such as *Pipla*, *Timmur*, *Sajyoon* (*J. curcas*) which carry commercial potential
- Many innovative and farmer groups have started planting

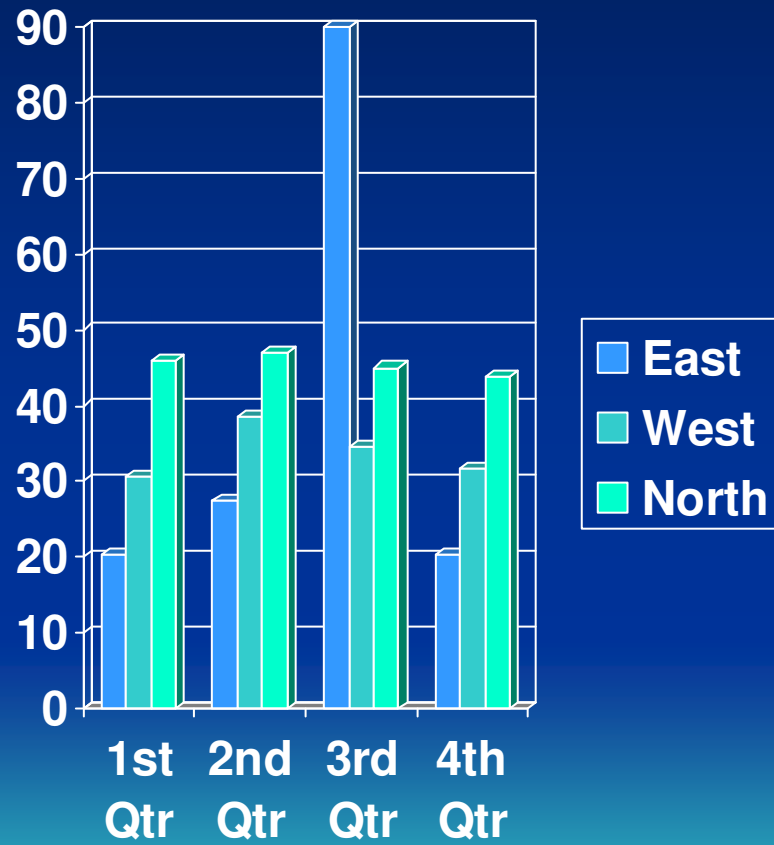
# Results and Discussion

## Ecological feasibility

- The climatic requirements for optimum production of *Jatropha* are present in Terai, Siwalik and Mid Hills area of Nepal
- Viable option to utilise the marginal land of Western, Far-western and Hilly slopes of Nepal.



# Ecological feasibility



Annual minimum temperature in Nepal

## Economic feasibility

- Estimated cost of cultivation-400 USD/ha in the first year of plantation
- Maintenance cost-100 to 110 USD/ha/year from the third year onward
- Average farm gate price of the seed in Nepal- 0.15 to 0.20 USD/kg.
- Total revenue may vary from 600 to 1600 USD/ha/year.
- If the initial investment cost is not taken into account, the net benefit may vary from 500 to 1500 USD/ha/year after 5 years onward

# Estimated cost of Jatropha cultivation in Nepal (per ha/year)

Land	Normal soil		
Spacing	2m X 2m		
Density	2500		
Cost Item	I year	II year	III year
Land preparation	3000	0	0
Planting of seedlings	12500 (Rs.5/seedlings)	0	0
Cost of FYM	2500	0	0
Fertilizer	0	2000	0
Irrigation	4000	4000	4000
Intercultural operation/Harvesting	3000	3000	3000
Total (NRs.)	25000 (US \$ 390)	9000 (US \$ 140)	7000 (US \$ 109)

# Average yield, market value and revenue of some cereal crops and Jatropha in Nepal in 2006/07

Crop	Average yield (kg/ha)	Average market value (Rs/kg.)	Average revenue per ha (Rs)
Rice	2557	10	25570 ( \$ 399.5)
Maize	2091	9	18819 (\$ 294.0)
Wheat	2156	11	23716 (\$ 370.5)
Jatropha seed	5000	10	50000 (\$ 781.2)

# Possible implications of Jatropha farming

- Utilisation of marginal land
- Utilization of rangeland
- Management of protected area
- Possibility of intercropping
- Substitutes for diesel
- Renewable energy for rural area
- Soil conservation and landscape management
- Promotion of women and ethnic groups
- Source of income generation
- Possible intercropping (cereal crops, seasonal vegetables, cucurbits and leguminous crops, annual and perennial grasses, timbers or important medicinal plants)

# Major limitations for adopting Jatropha farming

- Subsistence type of farming system
- Farming communities dominated by small holders
- Lack of technical know how and poor extension program
- Underdeveloped markets
- Lack of subsidy and complex credit facilities
- Plant toxicity



# Conclusion

- Ability to grow on marginal, waste or arid land
- Seed oil is mainly used for biodiesel and soap production
- Commonly found in the Terai and Mid-hill area of Nepal
- Terai, Siwalik and Mid Hill area are more suitable for commercial scale plantation
- Potential crop up to warm temperate zone
- Estimated cost is about 400 USD/ha for the establishment and about 100 to 110 USD per year thereafter
- Average yield is 4-5 t/ha in Nepalese condition, which gives a net profit of 500 to 600 USD (two times higher than that of cereal crops).



## Conclusion (contd.)

- Direct economic advantage of Jatropha cultivation over the traditional crops
- Several possible implications for Nepal
- Help to supply basic energy for the household and stationary engines
- Help to reduce Nepal's complete dependency on foreign oil for its fuel needs
- Improve the living conditions of rural people, socio-economically backward women and various ethnic groups
- However, study on various aspects of Jatropha in order to commercialise this is still necessary



**THANK YOU**

