Evaluation of the energy crop *Jatropha curcas* as a mean to promote renewable and sustainable energy for the Mediterranean region (JatroMed)

تقييم النبتة الطاقية جاتروفا كوركاس كوسيلة لتشجيع الطاقة المتجددة والمستدامة لمنطقة البحر الأبيض المتوسط(جاتروميد)

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JatroMed First International Workshop on
Energy Crops in the Mediterranean Region (ECMR-1)
Opportunities and challenges
Centre de Développement de la Région de Tensift (CDRT)
Friday November 15, 2013: International Workshop
Marrakech Morocco

The multipurpose energy crop of *Jatropha curcas* L. (JCL)

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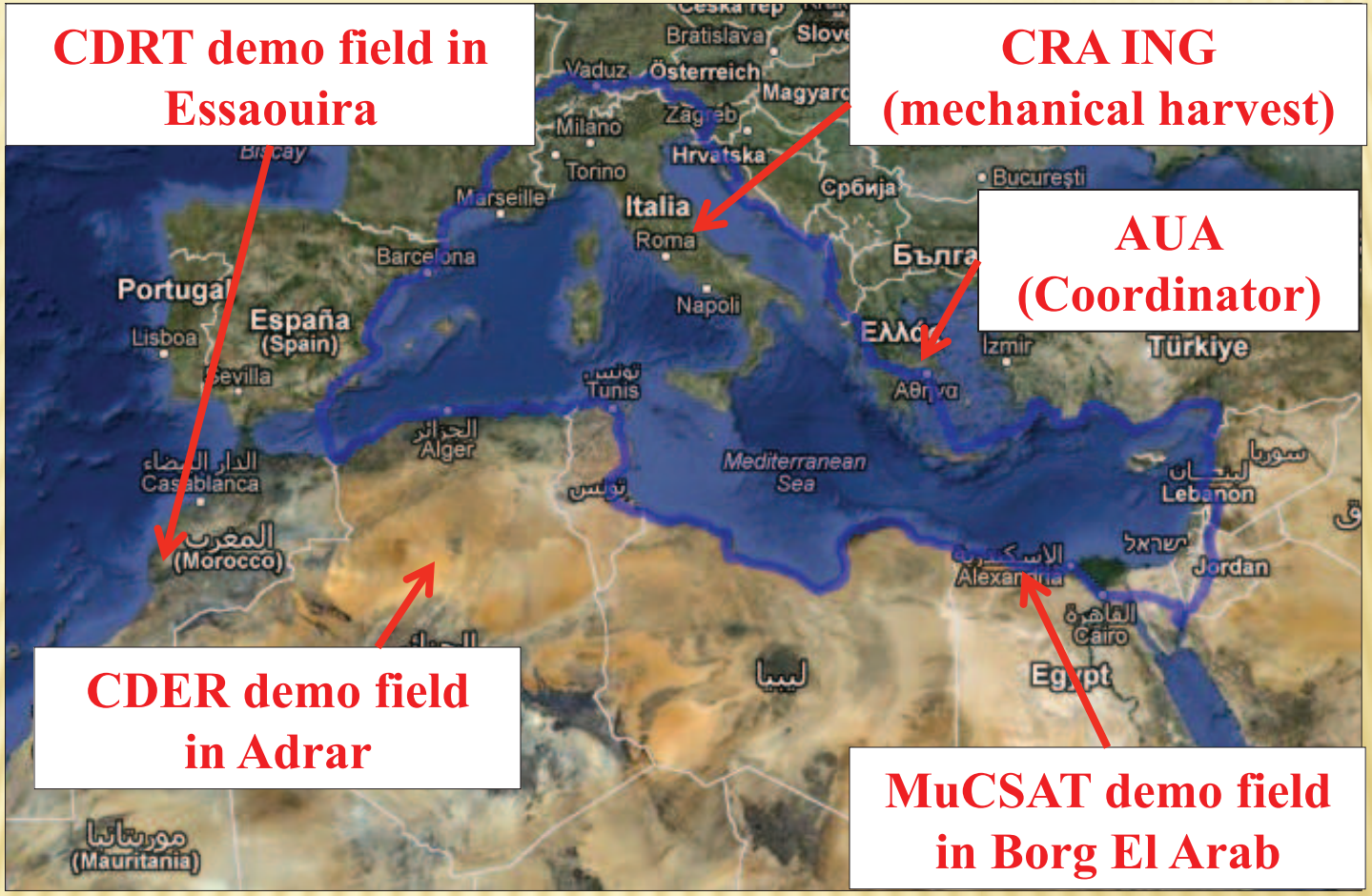
INTRODUCTION

- Before exploiting any plant, it is imperative to have complete information about its biology, ecology, chemistry, and all other applications so that the potential of plant could be utilized maximally.
- *Jatropha curcas* L. (JCL) has received much attention because of its immense role in bio-diesel production an eco-friendly fuel, bio-degradable.
- It promises to mitigate energy crisis and environmental pollution.

JatroMed



Project Consortium

Agricultural University of Athens (AUA), Athens, GREECE (Project coordinator)

Consiglio per la ricerca e sperimentazione in agricoltura, Unità di ricerca per l'ingegneria agraria **(CRA ING), Rome, ITALY**

City of Scientific Research and Technological Applications (MuCSAT), Alexandria, EGYPT

Centre de Développement de la Région de Tensift (CDRT), Marrakech, MOROCCO

Centre de Développement des Energies Renouvelables (CDER), Algiers, ALGERIA

AIMS OF JATROMED PROJECT

- reinforce and upgrade the natural and socioeconomic conditions **of poor rural areas**
- to give local populations the opportunity to produce sustainable energy to **cover their own needs**
- assess the **adaptability of genotypes** collected worldwide under the **pedo-climatic conditions** of the target countries (Algeria, Egypt, Morocco)
- evaluate the **plant productivity** under different treatments (fertilization, irrigation and pruning treatments) in demo field stations

TAXONOMY AND BOTANICAL DESCRIPTION OF JCL (1)

- The genus *Jatropha belongs to the* **Euphorbiaceae family** and contains approximately 170 known species of which **Jatropha curcas L.** (**JCL**)
- Close species : ***Ricinus communis*** (Ricin or Castor)
- The name ***Jatropha*** *derives from the Greek word jatrôs* (doctor) and *trophé (food), which implies medicinal uses*
- JCL is a small tree or large shrub, which can reach a height of 3 to five 5 m, but under favorable conditions it can attain a height of 8 or 10m
- Life-span more than **50 years**
- JCL is a diploid species with 2*n* = 22 *Chromosomes*
- The branches contain **latex**
- The trees are deciduous, shedding the leaves in dry or "cold" season (Essaouira case)

Ricinus communis (Ricin or Castor)

خرواع - أوريور

JCL is a very commun plant in the world

Language/country	Name
English	purging nut
French	pourghère, pignon d'Inde
Dutch	purgeernoot
German	purgiernuß, Brechnuß
Portuguese	purgueira
Italian	fagiola d'India
Arab	dand barrî, habel meluk الدماع
Sanskrit	kanananaeranda, parvataranda
Hindi (India)	ratanjyot, bagbherenda, jangli arandi, safed arand, bagaranda
Nepal	kadam
Chinese	yu-lu-tzu
Thailand	sabudam
Philippines	túbang-bákod, Tuba-tuba
Indonesia	jarak budeg
Côte d'Ivoire	bagani
Togo	kpoti
Senegal	tabanani
Angola	mupuluka
Nigeria	butuje
Tanzania	makaen
Mexico	piñoncillo
Costa Rica	coquillo, template
Puerto Rico	tártago
Brazil	mundubi-assu
Peru	piñol
Guatemala	Pinón

Greek : γιατρόφα

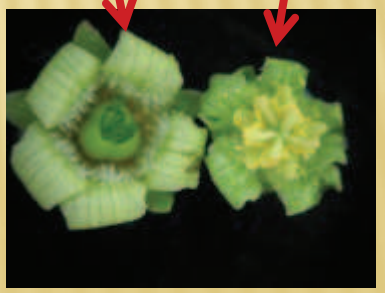
Technical name :
Green gold
Or vert
الذهب الأخضر

TAXONOMY AND BOTANICAL DESCRIPTION (2)

- The inflorescence is axillary paniculate polychasial cymes.
- Plant monoecious and flowers are unisexual ; occasionally hermaphrodite flowers (self pollination)

FF ♂ : 5 S + 5P + 5 St. A
FF f : 5 S + 5P + (3 C) A, Capsule

- The flowers are pollinated by insects especially honey bees (Apiculture)
- Flowering occurs during the wet season and two flowering peaks are often seen, during summer and autumn
- In permanently humid regions, flowering occurs throughout the year.



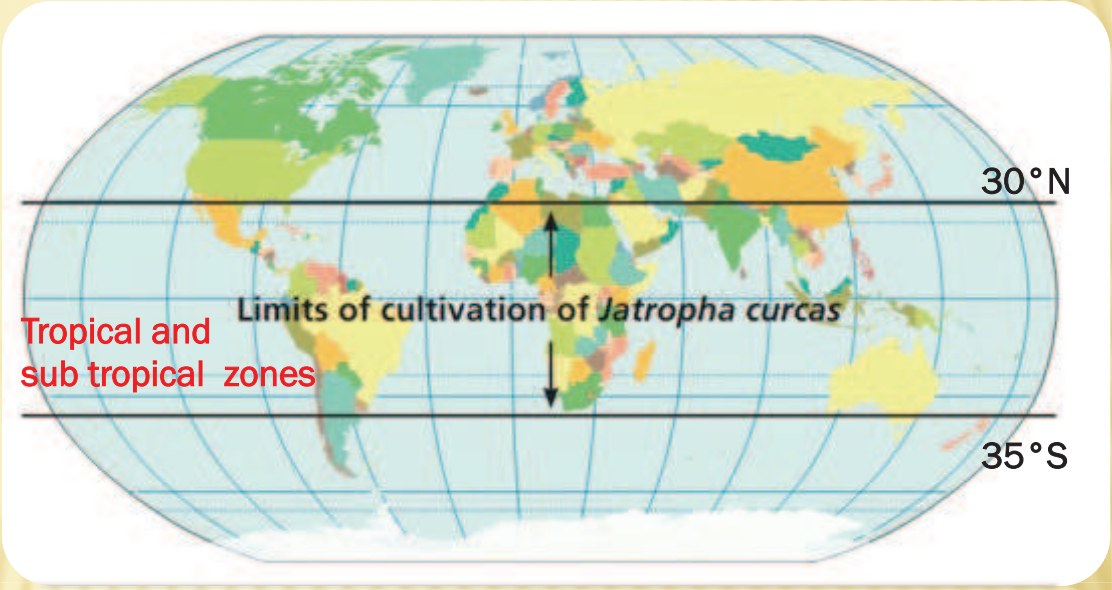
TAXONOMY AND BOTANICAL DESCRIPTION (3)

- Each inflorescence yields a bunch of approximately 10 or more ovoid fruits (Capsule)
- Seeds mature about 3–4 months after flowering.
- 3 black seeds/fruit

Seed production per plant	0.2 kg to more than 2 kg yr^{-1}
Dry seed production per ha	0.4–12.0 t yr^{-1}
Oil content	35-40 % (or 60%) of dry seeds

ORIGINE AND CURRENT DISTRIBUTION

- *JCL is widely* distributed in the **wild** or **semi-cultivated areas** in Central and South America, Africa, India and South East Asia.



Originates from Central America

Today it can be found abundantly in many regions throughout Africa and Asia

ECOLOGY :
HARDY PERENNIAL PLANT
CAN SURVIVE DROUGHT AND GROW IN VERY POOR QUALITY SOILS.

- **Altitude** : Since the sea level until 1600 m a.s.
- **Climate & Bioclimatic zone**
  - Average diurnal temperatures : **18 - 30°C**
  - Mean maximum temperatures: **35 - 45° C**
- **Very Sensitive to frost (High altitude and continentality)**
- **Water requirements**
  - Annual average pluviometry : **300 - 600 mm**/year (**Semi-arid bioclimate zone**)
  - Drought resistant (3 successive years of drought)
  - **Good adaptation with dry climate**
- **Soil :** Marginal and unutilised : **No competition with agriculture area**
  - Prefers deep grounds
  - Preferred pH: 6.0 and 8.0 (Alkaline soil)
  - Best soils: aerated sands and loams

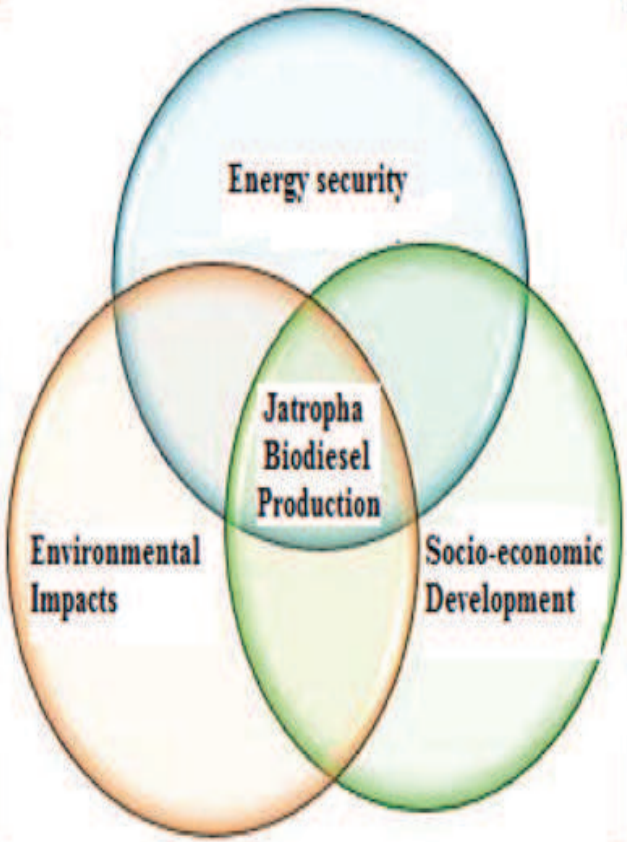
ENVIRONMENTAL INTERESTS

- Friendly environment
- Drought resistance
- Vs desertification
- Reduction of deforestation : Soil retension :
- Land rehabilitation : phytoremdiation – Phyoto-extraction
- Sequestration of CO2 : reduction of greenhouse gases
- Reduction of environmental pollutants
- Vs Wild fires (Latex effect)
- Reduce environmental vulnerabilities
- Improvement of microbial activity, available nutrients and water holding in soil
- Enrichment infertile soil

POTENTIAL BENEFITS AND PROBLEMS DUE TO LONG TERM JATROPHA PLANTATION ON COMMERCIAL SCALE

Benefits

- Renewable energy
- Combating global warming
- Employment generation
- Environmental conservation
- Socio-economic development
- Wasteland restoration
- Prolong engine life



Problems

- Biodiversity threat
- Food security
- Land use change
- Nutrient depletion in soil
- Soil contamination
- Seed poisoning
- Low yield

V.C. Pandey et al. / Renewable and Sustainable Energy Reviews *16 (2012) 2870– 2883*

SEED AND ITS TOXICITY

- In general 2 products toxic to humans and animals isolated from the JCL seeds.
- **Curcin** = toxic protein, inhibition of protein synthesis in *in vitro studies.*
- ***P*horbol esters** = main toxic agent responsible for *JCL toxicity .*

SEEDS IMPORTANCE

- Depending on the variety (genotype), the seeds contain 35% - 40% (60%) of oil, which is used for many purposes such as :
- lighting,
- lubricant,
- for making soap
- …….
- and most importantly as **biodiesel production**.

So the seeds of JCL are a good source of oil, which can be used as a **diesel substitute**.

USES OF *JCL* PRODUCTS

traditional medicine
and veterinary
Antitumor activities
to treat eczema
skin diseases
rheumatic pain

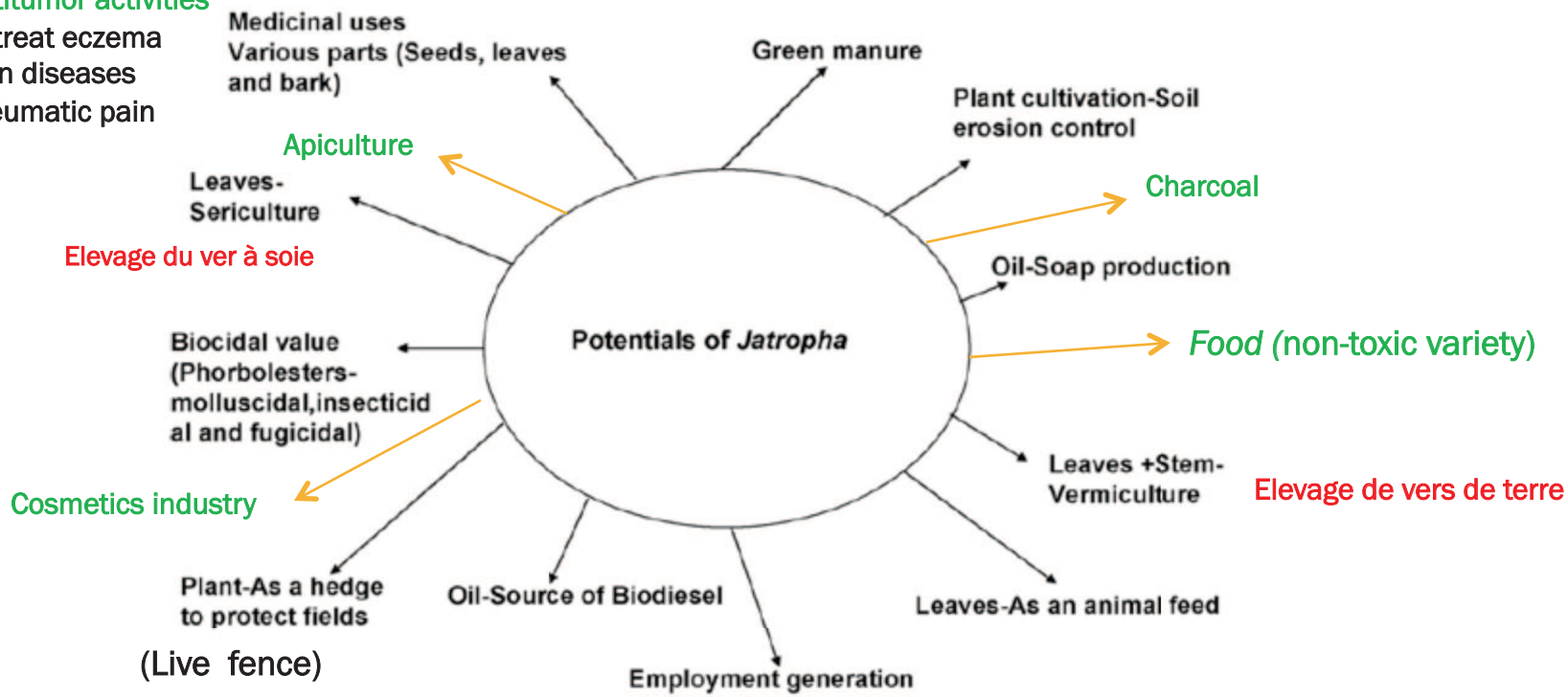
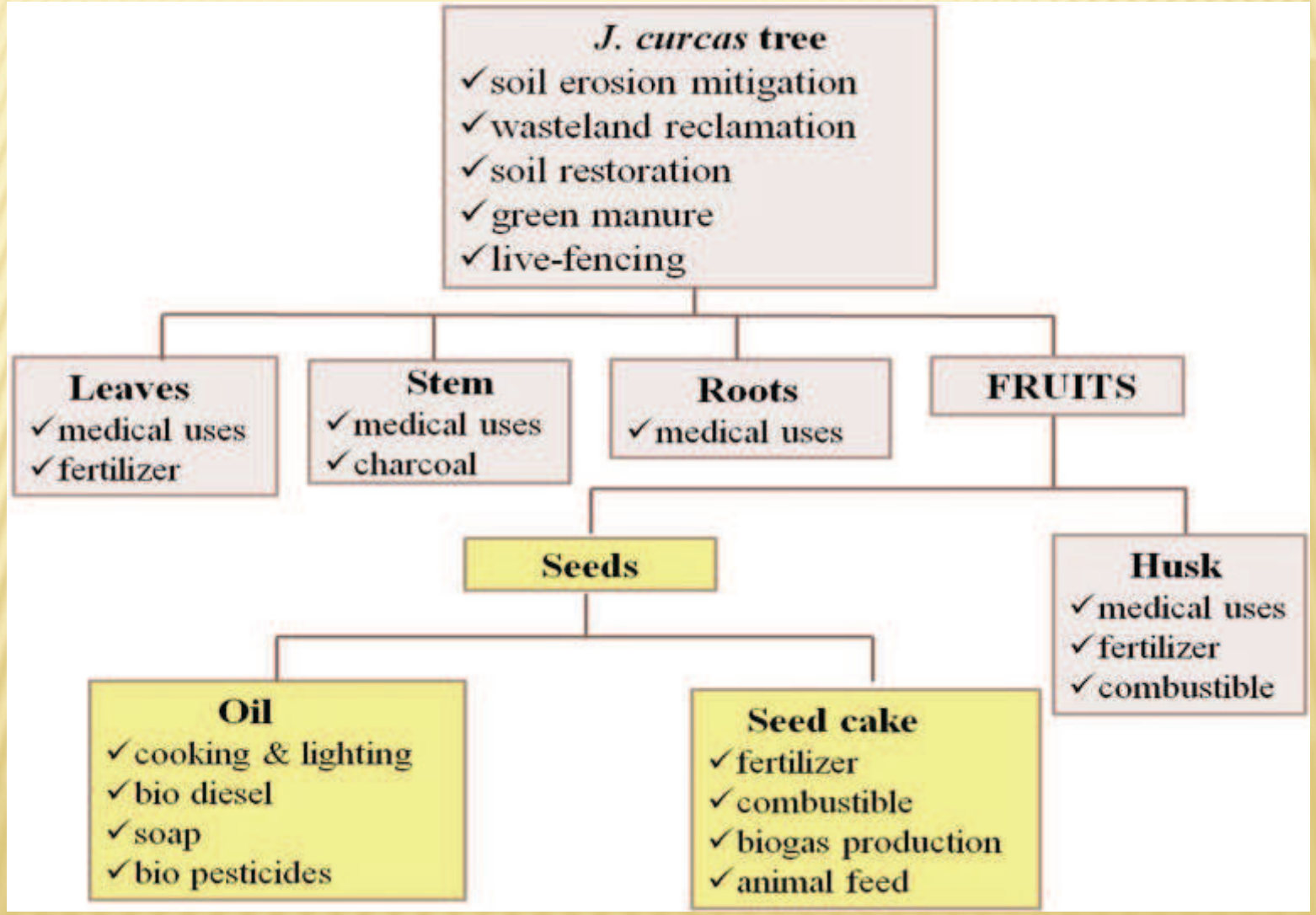


Fig. 1 – Economic significance of *J. curcas*.

(From Kumar, A., Sharma, S., An evaluation of multipurpose oil seed crop for industrial uses (*Jatropha curcas L.): A* review, Ind. Crops Prod. (2008), completed

USES OF DIFFERENTS PARTS OF JCL



USES OF DIFFERENTS PARTS OF JCL IN MEDECINE

Plant part used	Diseases
Seeds	To treat arthritis, gout and jaundice
Tender twig/stem	Toothache, gum inflammation, gum bleeding, pyorrhoea
Plant sap	Dermatomucosal diseases
Plant extract	Allergies, burns, cuts and wounds, inflammation, leprosy, leucoderma, scabies and small pox
Water extract of branches	HIV, tumor
Plant extract	Wound healing

(Heller, 1996; Kaushik and Kumar, 2004)

CONCLUSION

JCL IS WELL KNOWN FOR ITS MULTIPURPOSE BENEFITS

Social

- to fight global poverty
- positive social effect
- alternative energy to rural farmers
- stabilization the population in rural areas,
- providing the population with incomes
- Employment generation
- Easy maintenance (cultivation)
- grown as a live fence (social conflict)

Economy (miracle plant)

- promote sustainable energy
- foster rural development
- to improve livelihoods and energy security in rural area
- substitution for fossil fuels
- vital importance to developing countries
- providing the population with energy
- good source of oil
- *protecting* crops from livestock
- medicinal uses
- honey production potential

Environment

- *highly adaptable species*
- ability to grow on very poor and dry sites
- adapted to marginal soils with low nutrient content
- Stopping wind soil erosion
- improves the fertility of the soil
- Land rehabilitation
- increasing soil moisture retention
- to counter greenhouse gas accumulation in the atmosphere
- fighting Climate Change
- Biofertilizer
- Water consumption, 6 L/week throughout the growing season

THANK YOU FOR YOUR ATTENTION

شكرا على انتباهكم

Tanamight

Merci pour votre attention

Acknowledgement

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