



## JETROHPA: CULTIVATION TECHNOLOGY

### THE PRODUCTIVE PLANTATION OF JATROPHA CURCAS

The practices being undertaken by the Jatropha growers currently need to be scientifically managed for better growth and production. The growth and yield of Jatropha could be improved through effective management practices.

The key factors that can influence the oil yield of Jatropha Curcas are:

1. Climate
2. Quality of the soil
3. Irrigation
4. Weeding
5. Use of fertilizer
6. Crop density
7. Genotype
8. Use of pesticide
9. Inter-cropping

#### PROPAGATION AND MANAGEMENT

PROPAGATION METHODS	
GENERATIVE PROPAGATION	EFFECTING FACTORS
Direct seeding	<ul style="list-style-type: none"><li>• Quality of seeds</li><li>• Seding depth</li><li>• Date of sowing</li></ul>
Transplantation of precultivated plants Seeds beds (bare roots) Poly bags	<ul style="list-style-type: none"><li>• Type of precultivation</li><li>• Length of precultivation</li><li>• Age of precultivation</li></ul>
VEGETATIVE PROPAGATION (cuttings)	
Direct planting	<ul style="list-style-type: none"><li>• Right time</li></ul>
Transplanting of precultivated plants Seeds beds (bare roots)	<ul style="list-style-type: none"><li>• Right size</li><li>• Right age</li><li>• Right strain</li></ul>



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Poly bags	<ul style="list-style-type: none"><li>• Right source</li></ul>
SUCCESSFULL PRECULTIVATION IS CHARACTERIZED BY	<ul style="list-style-type: none"><li>• High germination rates of seeds</li><li>• High sprouting rates of cuttings</li><li>• High survival rates</li></ul>

Basing the propagation method on rainfall conditions plays a decisive role in the survival and properties of the plant in field.

Method of cultivation should be chosen on the basis of

- Maximum survival rates
  - Intended utilization of the plantation
1. For quick establishment of hedges and plantation for erosion control, directly planted cuttings are best.
  2. For long-lived plantations for vegetative oil production, plants propagated by seeds are better.
  3. With better rainfall conditions, the plantations could also be established by direct seeding.

Direct seeding, pre-cultivation of seedlings, easily propagates the Jatropha transplanting of spontaneous wild plants and direct planting of cuttings. Seed should be collected when capsules split open. Use of fresh seeds improves germination. Intervals of presoaking and drying, or partial removal of the testa, are more successful than presoaking alone. With good moisture conditions, germination takes 10 days. The seed shell splits, the radicle emerges and 4 small peripheral roots are formed. Soon after development of the 1st leaves, the cotyledons wither and fall off. Further growth is sympodial

## Climate

Can withstand severe heat. Likes heating and doing well in warmer areas. When cold will drop its leaves. It can withstand light frost but not for prolonged periods. The older the tree the better it will withstand. Black frost will almost certainly kill young plants and severely damage older plants.

## Quality of the soil

Best in sandy well-drained soils. Can withstand very poor soils and grow in saline conditions. All the actors in the Jatropha sector suggest, anyway, using organic fertilizer in order to obtain higher yield.

## Irrigation

It handles dryness very well and it is possible to live almost entirely of humidity in the air. - See Cape Verde where rainfall is as low as 250 mm a year. Differences are expressed in what is optimum rainfall as some readings say 600 mm and some say 800 mm whilst some areas in India report good crops with rainfall of 1380 mm. Under irrigation 1 500 mm is given.



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500 - 600 mm of rainfall is the limit. Below it the production depends on the local water condition in the ground

It will also stand for long periods without water - up to 2 years - and then grow again when rains occur again.

## **Weeding**

Standard cultural practices are timely weeding (4 times a year), proper fertilization, surface ploughing and pruning. With these management practices a yield around 15-20 kg of fruit per tree can be obtained even if the plants did not reach full maturity.

## **Use of fertilizer**

Although *Jatropha* is adapted to low fertility sites and alkaline soils, better yields seem to be obtained on poor quality soils if fertilizers containing small amounts of calcium, magnesium, and Sulfur are used. Mycorrhizal associations have been observed with *Jatropha* and are known to aid the plant's growth under conditions where phosphate is limiting. It is recommended that 1 kg of farmyard manure/ plus 100 g of Neem waste for every seedling, with a recommendation of 2500 plants per ha this comes up to 2.5 t organic fertilizer per ha. Besides it after transplantation and the establishment of the plant fertilizer such as N, P and K should be applied. Twenty gram urea + 120 g SSP and 16 g MoP should be applied annually

The possibility to return the press-cake (or part of it) to *Jatropha* fields should be carefully considered.

## **Crop density**

References recommend spacing for hedgerows or soil conservation is 15cm - 25cm x 15cm-25cm in one or two rows respectively and 2m x 1.5m to 3m x 3m for plantations. Thus there will be between 4,000 to 6,700 plants per km for a single hedgerow and double that when two rows are planted.

Satisfactory planting widths are 2 x 2 m, 2.5 x 2.5 m, and 3 x 3 m. This is equivalent to crop densities of 2500, 1600 and 1111 plants/ha, respectively. Distance OF 2MX2M BE KEPT FOR COMMERCIAL CULTIVATION

Wider spacing is reported to give larger yields of fruit.

## **Genotype**

Little genetic research seems to be performed, as Information related to the project seems to be rather restricted.

## **Pruning**

Pruning - 1<sup>st</sup> prune

The plants need to produce side shoots for maximum sprouting and maximum flowers and seed.



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Between 90 and 120 Days top of all plants at 25 Cm. Cut the top off cleanly and cut top to produce 8 - 12 side branches.

It is considered good practice. In order to facilitate the harvesting, it is suggested to keep the tree less than 2 meters.

## Inter-cropping

Specific intolerance with other crops was not detected. On the contrary the shade can be exploited by shade-loving herbal plants; vegetables such red and green peppers, tomatoes, etc. (SEE INTERCROPPING PAGE)

## Picking

We have developed the harvest methodology between wet and dry seed crush costing applicable has been compared.

## CROP YIELD

It appears very difficult to estimate unequivocally the yield of a plant that is able to grow in very different conditions.

Yield is a function of water, nutrients, heat and the age of the plant and other. Many different methods of establishment, farming and harvesting are possible. Yield can be enhanced with right balance of cost, yield, labor and finally cost per Mt

Seed production ranges from about 2 tons per hectare per year to over 12.5t/ha/year, after five years of growth. Although not clearly specified, this range in production may be attributable to low and high rainfall areas.

### Without irrigation

MT/HA			
DRY			
	LOW	NORMAL	HIGH
Year 1	0.10	0.25	0.40
Year 2	0.50	1.00	1.50
Year 3	0.75	1.25	1.75
Year 4	0.90	1.75	2.25
Year 5	1.10	2.00	2.75





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With irrigation

MT/HA			
IRRIGATED			
	LOW	NORMAL	HIGH
Year 1	0.75	1.25	2.50
Year 2	1.00	1.50	3.00
Year 3	4.25	5.00	5.00
Year 4	5.25	6.25	8.00
Year 5	5.25	8.00	12.50

## Germplasm management

Seeds are oily and do not store for long. Seeds older than 15 months show viability below 50%. High levels of viability and low levels of germination shortly after harvest indicate innate (primary) dormancy.

## Processing and handling

After collection the fruits are transported in open bags to the processing site. Here they are dried until all the fruits have opened. It has been reported that direct sun has a negative effect on seed viability and that seeds should be dried in the shade. When the seeds are dry they are separated from the fruits and cleaned.

## Storage and viability

The seeds are orthodox and should be dried to low moisture content (5-7%) and stored in air-tight containers. At room temperature the seeds can retain high viability for at least one year. However, because of the high oil content the seeds cannot be expected to store for as long as most orthodox species.

## Dormancy and pretreatment

Freshly harvested seeds show dormancy and after-ripening is necessary before the seeds can germinate. Dry seed will normally germinate readily without pre-treatment. If this is the case, it is not recommended to remove the seedcoat before sowing. Although it speeds up germination there is a risk of getting abnormal seed-lings.



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## Uses

Uses of <i>Jatropha curcas</i> : A petrocrop						
Whole plant	Roots	Leaves	Latex	Seeds	Bark	Twig
*Planted to prevent water erosion and for conservation	* Used as ethnomedicine	* Used as ethnomedicine	*Resembles shellac	*Source of oil (30-40%) suitable as fuel for diesel engine	*Yields tannins (37%)	*Used as medicine
*Promising live fence		*Yield a dye used to give tan & brown	*Used for making ink	*Useful as illuminant, lubricant, in soap and candle making		*Used as Dataun (Herbal tooth brush)
*useful as green manure		*Useful as botanical	*Used as ethnomedicine	*Used as medicine both internally and externally		*Young one cooked and eaten
*useful in controlling sand drift						
*possess Allelopathic properties						

**For successful plantation we have developed *Jatropha* Production Technology for which our TOTAL CULTIVATION PACKAGE can be had**

CONFIDENTIAL DOCUMENT

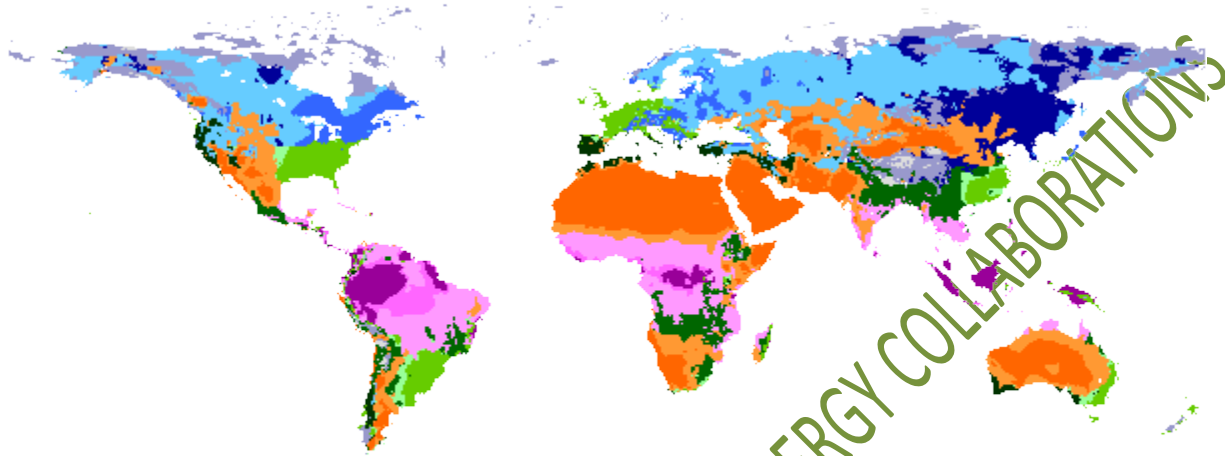


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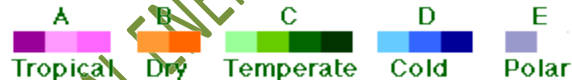
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Area where JETROPHA CAN BE PLANTED WORLD WIDE:



## Koeppen's Climate Classification

by FAO - SDRN - Agrometeorology Group - 1997



## Jatropha Growing Climate

Temperature is an important aspect of climate and can be used to grade climatic zones on a scale of five:

1. Tropical, with annual and monthly averages above 20° C (68° F);
2. subtropical, with 4 to 11 months above 20° C, and the balance between 10° and 20° C (50° to 68° F);
3. temperate, with 4 to 12 months at 10° to 20° C, and the rest cooler;
4. cold, with 1 to 4 months at 10° to 20° C, and the rest cooler; and
5. Polar, with 12 months below 10° C.

The Jatropha can be grown in all countries falling under tropical, subtropical zones and in certain countries fall in temperate climate. Also in certain areas of Arid and sub-Arid regions As per Vegetation Classification it grows in the selva, or equatorial rain-forest belt, the hot tropical belt and in the savanna region perfectly



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## The list of countries qualified for Jatropha fuel crop

Africa	Asia	North America	South America	Australia
1. Algeria	1. Bangladesh	1. Belize	1. Argentina	1. Australia
2. Angola	2. China	2. Bermuda	2. Bolivia	2. Fiji
3. Benin	3. India	3. Costa Rica	3. Brazil	
4. Botswana	4. Indonesia	4. Dominica	4. Chile	
5. Burkina Faso	5. Laos	5. Dominican Republic	5. Colombia	
6. Burundi	6. Malaysia	6. El Salvador	6. Ecuador	
7. Cameroon	7. Maldives	7. Greenland	7. Falkland Islands	
8. Cape Verde	8. Mongolia	8. Grenada	8. French Guiana	
9. Central African Republic	9. Myanmar	9. Guadeloupe	9. Guyana	
10. Chad	10. Nepal	10. Guatemala	10. Paraguay	
11. Comoros	11. Pakistan	11. Haiti	11. Peru	
12. Côte d'Ivoire (commonly known as Ivory Coast)	12. Philippines	12. Honduras	12. Suriname	
13. Djibouti	13. Sri Lanka	13. Jamaica	13. Uruguay	
14. Egypt	14. Syria	14. Martinique	14. Venezuela	
15. Equatorial Guinea	15. Thailand	15. Mexico		
16. Eritrea	16. Vietnam	16. Montserrat		
17. Ethiopia	17. Yemen	17. Nicaragua		
18. Gabon		18. Panama		
19. Gambia		19. Puerto Rico		
20. Ghana		20. Saint Barthelemy		
21. Guinea		21. Saint Kitts and Nevis		





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22. Guinea-Bissau		22. Saint Lucia	
23. Kenya		23. Saint Martin	
24. Lesotho		24. Trinidad and Tobago	
25. Liberia			
26. Libya			
27. Madagascar			
28. Malawi			
29. Mali			
30. Mauritania			
31. Mauritius			
32. Mayotte			
33. Morocco			
34. Mozambique			
35. Namibia			
36. Niger			
37. Nigeria			
38. Rwanda			
39. Saint Helena			
40. São Tomé and Príncipe			
41. Senegal			
42. Swaziland			
43. Tanzania			
44. Togo			
45. Tunisia			
46. Uganda			

CONFIDENTIAL DOCUMENT OF GLOBAL ENERGY COLLABORATIONS



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47. Zambia				
48. Zimbabwe				

The Jatropha hardiness zones are equal to USDA Plant hardiness zones 1 to 10, Australian zone 1 to 5, China hardiness zone 1 to 10 and almost entire Europe

In case of any info or details to take the matter further here are the steps to be followed:

- A) Specific and exclusive NDCandNC
- B) Program implementation agreement for Jetropha plantation, Bio-diesel production unit and Biomass Gasifer power generation implementation etc.
- C) Retainer advance.
- D) Feasibility study undertaken with experts in the segment
- E) Feasibility integration with project costings and project report finalization
- F) Project report presentation to financiers or banks subject to reasonable amount of basic funds made available
- G) On finance approval, project implementations programming
- H) Onsite implementations to be put in place from USA, African and India
- I) Establishment of onsite management controls
- J) Establishing online satellite based and internet coordinated video controls and online reporting set
- K) Actual program flow to proceed simultaneously.

Any questions or points, hence forth, be made specifically with letter of interest and sequence the points which can be replied accordingly and send them to [technology@globalenergycollaborations.com](mailto:technology@globalenergycollaborations.com) with copy to [kam@globalenergycollaborations.com](mailto:kam@globalenergycollaborations.com)

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