

# Economics of production and utilisation of Jatropha and competing crops in Tamil Nadu: A discounted net return analysis

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## ABSTRACT

Farmers have been chosen randomly for each of the crop in the blocks concerned in two Development Blocks identified (1. Periyanaicken Palayam in Coimbatore district representing irrigated/semi irrigated Jatropha cultivation and Aruppukkottai in Virudhunagar district representing rainfed system), the following major rainfed /Semi irrigated crops were identified as potentially competing crops. A. Periyanaicken Palayam Block: Crops are 1. Sorghum, 2. Maize, 3. Chickpea, 4. Cowpea; B. Aruppukkottai: crops are 1. Sorghum, 2. Maize, 3. Black gram, 4. Green gram, 5. Groundnut, 6. Sunflower, 7. Sesame, 8. Cotton. The major area for each of the above crops is selected to study the feasibility of jatropha along with other suitable crops through discounted net return analysis. The economic analysis revealed that jatropha was proved to be a loss making crop in the rain fed condition and in the irrigated condition, even while found to be relatively more profitable when compared to many of the competing crops. In the absence a competitive market and lack of flexibility in altering crop composition as in the case of annual crops led to farmer's preference towards other crops. Jatropha replacing food crops in irrigated conditions will be against the policy of ensuring food security in India. Hence, introduction of new crop must address the mitigation of global warming, creating regional employment, economically viable.

**Key words:** Jatropha, discounted net return analysis, economics.

India is the seventh largest country in the world after Russia, Canada, China, USA, Brazil and Australia covering geographical area of 328.73 million ha, which constitutes 2.42 percent of earth's surface. India with 121 crores population is the second most populous nation of the world after China. The varied landscapes and widely divergent environmental conditions of India accounted for the magnificence of its flora and fauna. India ranks sixth in the world in terms of energy demand. The economy is projected to grow 8-9 percent over the next two decades and there will be a substantial increase in demand for oil to manage transportation and to meet various other energy needs. While India has significant reserves of coal, it is estimated that relatively poor in oil and gas resources. The energy consumption of India is mainly dependent on fossil fuel sources of hydrocarbon *viz.*, coal and petroleum

oil together contributed to about two-thirds of total energy use. India is world's fifth largest net importer of oil, importing more than 2.2 million bbl./ day, or about 70 percent of consumption at a huge cost of Rs. 80,000 crores a year (Misra and Murthy, 2011). Petrol and diesel consumption have been rising rapidly over the past few years. For example, diesel consumption grew at a cumulative average growth rate (CAGR) of 7.19% between 2004-05 and 2009-10 while Petrol consumption grew at a CAGR of 9.18 % between 2004-05 and 2009-10. Among various petroleum products, being developed from crude oil, diesel is being consumed maximum (i.e.80%) for transport of industrial and agricultural goods and operation of diesel driven tractors and pump sets in agricultural sector. The depletion of available vital fossil fuel resources and our over commitment to use the fossil fuels is likely to lead us

to the energy crisis situation in the years to come. The demand for diesel is likely to touch 111.9 million tones in 2020 and 202.8 million tones in 2030. Contrary to the demand situation, the domestic supply is in position to cater to only about 30% of the total demand. The increasing trend is a matter of very serious concern for the country. Its economy is projected to grow 8-9 percent over the next two decades and there will be a substantial increase in demand for oil to manage transportation and to meet various other energy needs. While India has significant reserves of coal, it is relatively poor in oil and gas resources. Petrol and diesel consumption have been rising rapidly over the past few years. Therefore, attempt needs to be made to reduce dependence on imports and seek better alternatives. As a result of increasing vehicles, the petroleum demand in the transport sector is expected to grow further in the forth-coming years. Hence, the study was conducted with the following objectives such as to analyses of the socio-economic profile of sample cultivator, analyses the comparative economics of Jatropha and the competing crops and to provide necessary information economic suitability of crops.

## MATERIALS AND METHODS

The two Development Blocks identified (1.Periyanaicken Palayam in Coimbatore district representing irrigated/semi irrigated Jatropha cultivation and Aruppukkottai in Virudhunagar district representing rainfed system), the following major rainfed /Semi irrigated crops were identified as potentially competing crops. A. Periyanaicken Palayam Block: Crops are 1. Sorghum, 2. Maize, 3. Chickpea, 4. Cowpea; B. Aruppukkottai: crops are 1. Sorghum, 2. Maize, 3. Black gram, 4. Green gram, 5. Groundnut, 6. Sunflower, 7. Sesame, 8. Cotton. One village accounting for major area for each of the above crops is selected. There are ten sample farmers was chosen randomly for each of the crop in the blocks concerned. Hence, there will be collectively 120 sample cultivators have been chosen. In addition, Jatropha cultivators was identified and separated from the sample. If necessary, data on Jatropha cultivation and utilisation will be gathered from specific cases identified for comparison. The discounted net returns for 15 years at 7% Discount rate was worked out for the location Periyanaicken Palayam block and Aruppukkottai blocks based on the cost of cultivation and gross return. The cost of

cultivation was worked out based on the average money spend to grow crops. Likewise, gross return was worked out based on the market value of crops. Initially the cost of cultivation was collected based on the agronomical field operations. The discounted net return was worked out based on the information collected from the farmers at 7 and 12 per cents.

## RESULTS AND DISCUSSION

The comparative economics of Jatropha and the competing crops in irrigated conditions in the P.N. Palayam block are given in Tables 1-2. The results reveal that maize is the most profitable crop under the three scenarios of discounting (i.e., at 7%, 10% and 12% discount rates.). Among the crop, maize is the superior competing crop to Jatropha which registered highest net discounted returns for 7 and 12 per cent discounted return. However, when compared to the discounted returns of other competing crops namely, bengal gram (chick pea), cow pea and sorghum, jatropha performs better. But, the issue is twofold; (i) Jatropha market is characterized by oligopsony wherein only few buyers are available (the oil marketing companies), more so, the enforcement of bio-fuel mixing is not strictly enforced, whereas the competing crops operate in a near perfect competitive market and there is flexibility altering area depending on market on year to year basis; (ii) Even while, the competing crops yield positive net returns in all the years, Jatropha starts yielding only in the third year, moreover, to recover the initial investment of two years coupled with the maintenance expenditure from the third year onwards, it takes four years. These are the discouraging factors in cultivation of jatropha. However, out of 10 farmers who previously had jatropha, seven of them up rooted the crop in the absence of market. As a result of lower yield in the first three years, farmers are changed the crop from Jatropha to other crops. The main reason behind the shift in crop that occur in the farmers field are due to failure of crops under medium term benefit. Similar findings were also observed by the Shinoj *et al.*, 2010. Hence, the jatropha seed processing industry has been found to be viable if operated at sufficient economies of scale, which in turn determined by the level of backward integration with the seed market and a forward integration with biodiesel distribution channels. Similar findings was also reported by Cynthia and Teong (2011).

**Table 1. Comparative Economics of cultivation of Jatropha and the competing crops: Discounted net returns for 15 years at 7% Discount rate in Periyanaicken Palayam block (Rs.)**

| S. No | Name of crop    | Discounted cost (A) | Discounted return (B) | Net discounted returns (B-A) |
|-------|-----------------|---------------------|-----------------------|------------------------------|
| 1     | Jatropha        | 108730.9            | 258495.5              | 149764.6                     |
| 2     | Competing crops |                     |                       |                              |
|       | i.Maize         | 499423.4            | 694143.3              | 194719.9                     |
|       | ii.Bengal gram  | 481307.7            | 609393.7              | 128086                       |
|       | iii.Cowpea      | 230814.6            | 337448.2              | 106633.6                     |
|       | iv.Sorghum      | 218891.4            | 263826                | 449934.62                    |

**Table 2. Comparative Economics of cultivation of Jatropha and the competing crops: Discounted net returns for 15 years at 12% Discount rate in Periyanaicken Palayam block Rs.)**

| S. No | Name of crop    | Discounted cost (A) | Discounted return (B) | Net discounted returns (B-A) |
|-------|-----------------|---------------------|-----------------------|------------------------------|
| 1     | Jatropha        | 92176.41            | 206537.8              | 114361.4                     |
| 2     | Competing crops |                     |                       |                              |
|       | i.Maize         | 417071.8            | 579683.7              | 162611.9                     |
|       | ii.Bengal gram  | 401943.3            | 508908.7              | 106965.4                     |
|       | iii.Cowpea      | 192754.8            | 281805.2              | 89050.46                     |
|       | iv.Sorghum      | 182797.7            | 220322.9              | 37525.2                      |

**Table 4. Comparative Economics of cultivation of Jatropha and the competing crops: Discounted net returns for 15 years at 7% Discount rate in Aruppukkottai block (Rs.)**

| S. No | Name of crop    | Discounted cost (A) | Discounted return (B) | Net discounted returns (B-A) |
|-------|-----------------|---------------------|-----------------------|------------------------------|
| 1     | Jatropha        | 83384.17            | 179365.92             | 95981.75                     |
| 2     | Competing crops |                     |                       |                              |
|       | i.Maize         | 373466.9            | 519077.8              | 145610.8                     |
|       | ii.Bengal gram  | 359920.1            | 455702.3              | 95782.21                     |
|       | iii.Cowpea      | 172602.3            | 252342.5              | 79740.24                     |
|       | iv.Sorghum      | 163686.2            | 197288.1              | 33601.94                     |

**Table 5. Comparative Economics of cultivation of Jatropha and the competing crops: Discounted net returns for 15 years at 10 % Discount rate in Aruppukkottai block (Rs.)**

| S. No | Name of crop               | Discounted cost (A) | Discounted return (B) | Net discounted returns (B-A) |
|-------|----------------------------|---------------------|-----------------------|------------------------------|
| 1     | Jatropha                   | 100802.65           | 69516.4               | -31286.23                    |
| 2     | Competing crops            |                     |                       |                              |
|       | i. Green gram              | 224470.55           | 373201.35             | 148730.78                    |
|       | ii. Black gram             | 162200.11           | 292905.05             | 130704.95                    |
|       | iii. Cumbu                 |                     |                       |                              |
|       | a. Traditional CO1 variety | 94817.95            | 165764.05             | 70946.1                      |
|       | b. Pioneer hybrid          | 100292.72           | 259519.43             | 129226.73                    |
|       | iv. Cotton                 |                     |                       |                              |
|       | a. Traditional variety     | 148641.17           | 250467.64             | 101826.48                    |
|       | b. Bt hybrid               | 163942.45           | 322420.16             | 158477.7                     |
|       | v. Sorghum                 | 114618.54           | 182158.28             | 67539.74                     |

**Table 6. Comparative Economics of cultivation of Jatropha and the competing crops: Discounted net returns for 15 years at 12% Discount rate in Aruppukkottai block (Rs.)**

| S. No | Name of crop                | Discounted cost (A) | Discounted return (B) | Net discounted returns (B-A) |
|-------|-----------------------------|---------------------|-----------------------|------------------------------|
| 1     | Jatropha                    | 77382.76            | 47783.1               | -29599.7                     |
| 2     | Competing crops             |                     |                       |                              |
|       | i. Green gram               | 167858.3            | 279078.6              | 111220.3                     |
|       | ii. Black gram              | 121292.6            | 219033.3              | 97740.67                     |
|       | iii. Cumbu                  |                     |                       |                              |
|       | a. Traditional CO 1 variety | 70904.5             | 12395.7               | 53053.23                     |
|       | b.Pioneer hybrid            | 74998.52            | 171633.8              | 96635.27                     |
|       | iv.Cotton                   |                     |                       |                              |
|       | a. Traditional variety      | 111153.3            | 187298.8              | 76145.46                     |
|       | b.(Bt hybrid)               | 122595.6            | 241104.6              | 118509                       |
|       | v.Sorghum                   | 85711.32            | 136217.3              | 50505.97                     |

The comparative economics of Jatropha and the other competing crops in rainfed conditions are given in Tables 3-6. The results revealed that Bt cotton, green gram are the most profitable crops under the three scenarios of discounting (i.e., at 7%, 10% and 12% discount rates.). Discounted returns of other competing crops namely, black gram, cumbu (Traditional Co1 variety) and (Pioneer hybrid), cotton (traditional variety) and sorghum also indicate these are profitable, whereas Jatropha in Aruppukkottai block under rainfed condition resulted in heavy loss, when discounted over a period of 15 years. Besides, as in the case of Periyanaicken Palayam Block, the issue is again twofold: (i) Jatropha market is characterised by oligopsony wherein only few buyers are available (the oil marketing companies), more so, the enforcement of bio-fuel mixing is not strictly enforced, where as the competing crops operate in a near perfect competitive market and there is flexibility of altering area depending on market on year to year basis. Similarly it was also observed that farmers have uprooted the Jatropha plantations in most case, as a result of marketing problems. From the study, the full potential of the plant has to be realized for growing and management of *Jatropha curcas* under aruppukkottai region. Likewise, and more information is needed on the actual and potential markets for all its products and by-products. Openshaw (2000) was reported that growing techniques and potential market has to be introduced. Otherwise, newly introduced crop may

become failure (Openshaw, 2000). Similar finding was also reported in Jatropha (Osei *et al.*, (2016).

## CONCLUSION

The Economic analysis revealed that Jatropha was proved to be a loss making crop in the rain fed condition especially under Aruppukkottai region of Tamil Nadu. The main reason behind that these crop has been not suitable crop under rainfed situation. Therefore, farmers preference have been changed to the crops which are cultivated earlier in same region (eg. Sorghum). Similarly, Periyanaikkan palayam region also shows similar trend. Hence, mitigation of global warming and the creation of new regional employment opportunities can be important cornerstones of any forward looking transportation system for emerging economies will be addressed through suitable crops. Principally such policy should not affect the food production and food crops.

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