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Will Indian farmers respond to the call for increased biofuel production? – Evidence from Northeastern India

In India, biofuel has gained in popularity in recent years because of its potential as a clean energy source and a means to stimulate rural development. Yet, growth in Jatropha, a key bio-fuel crop, is not increasing as expected. In order to better understand whether biofuel can be an alternate energy source, a SANDEE study assessed the factors that influence the adoption and continued production of Jatropha plantations in North East India.

The study finds that land availability and farmers' willingness to take risks contribute to adoption of Jatropha plantations. An important conclusion is that expansion of credit and extension services to Jatropha farmers can help with further growth in biodiesel supply. This Brief is based on research conducted by Kishor Goswami and Hari Kanta Choudhury from the Indian Institute of Technology, Kharagpur.



Figure 1: Annual production of biodiesel in India

India's Energy and Biofuel Challenge

India ranks sixth in the world in terms of total energy demand, with demand growing at a rate of some 5 percent per annun. India's oil import expenditures have grown nearly three folds since 2004-05 and India is expected to become the fourth largest net importer of oil in the world by 2025. Thus, energy security is a pressing issue for the Indian government and domestic production and use of biodiesel important policy goals.

India's biofuel policy aims to increase demand for biodiesel to nearly 17 million tons by 2017 and encourages 20 percent blending of biodiesel with other fuels. The main source for biodiesel is the plant Jatropha. To meet biodiesel targets, some 38 million hectares of wastelands will have to be brought under Jatropha plantations by 2030. This is a challenge as Jatropha is a relatively new perennial crop for Indian farmers, who see considerable risk and uncertainty associated with its production.

Source: Energy Information Administration (2012)

This policy brief is based on SANDEE working paper No. 82-14, 'To Cultivate or Not? Examining Factors that Influence Jatropha Agriculture in North East India.' by Kishor Goswami and Hari Kanta Choudhury, Indian Institute of Technology Kharagpur, West Bengal 721302, India. E-mail: kishor@hss.iitkgp.ernet.in; kishor_00@yahoo.com ; Tel. +91 3222 281770 (O). The full report is available at: www.sandeeonline.org

Jatropha Production and Use in India

An estimated 120 million liters of biodiesel is produced in India from multiple feed stocks. While biodiesel is only slowly growing in popularity (consumption in 2013 (75 million liters) was lower than supply), given India's huge energy needs, demand for biofuels is expected to grow.

Jatropha is India's most important biofuel crop. It can be mixed with diesel in an 80:20 ratio with no additional costs to the consumer or to the vehicle. Jatropha's fixed price is also some 50 percent lower than diesel— making it cheaper to use. Jatropha production is being encouraged by the Indian government through it's 2009 National Policy on Biofuels. Biofuels have a special status and enjoy unrestricted movement across states with no taxes or duties levied.

In order to meet the Government of India's 2030 target of 20 percent blending of biodiesel with petro diesel, about 38 million hectares of wastelands need to be brought under Jatropha plantation (given a potential yield of 5 tons per hectare).

However, there are reports that Jatropha farmers are abandoning their plantations for alternate uses, while others are not taking care of their plantations. Furthermore, there are questions related to whether Jatropha should be encouraged since it may replace staple crops. Thus, this study sought to obtain a better understanding of the micro-economics of Jatropha production.



Source: Authors' Survey



WM Jatropha nursery in Diphu Assam

Biofuel Production in North-East India

Northeast (NE) India contains approximately 10 percent of India's wastelands, which are considered to be suitable for Jatropha plantations. This study focused on the states of Assam and Arunachal Pradesh. Of the various northeastern states, Assam has the largest area under Jatropha plantation (33,900 hectares).

Figure 2: Jatropha plantations in NE India



Source: D1 Williamson Magor Biotuel Limited (n.d.) Available at http://d1wm.co.in/ [Accessed on 5th July 2009]

Private companies, such as D1 Williamson Magor Bio Fuels Limited (D1WMBF Ltd.) and Sun Plant Agro Limited, have been targeting farmers in NE India for establishing Jatropha plantations. D1WMBF Ltd. started a major initiative in 2007-08, which led to 85,000 hectares of Jatropha plantations in the north-east. The hope was that these plantations would provide a bio-fuel crop, income to farmers and act as a 'green cover' to reduce soil erosion and landslides.

Surveying Jatropha Farmers

The study set out to examine why farmers choose to cultivate Jatropha, why some farmers stopped growing these trees after a while and what could encourage them to persevere. The authors collected secondary data from various government and private sector agencies and primary data from 144 current Jatropha farmers (current farmers), 137 farmers who had previously grown the crop (previous farmers) and 145 who had never grown the crop (non-growers). These farmers were drawn from 22 villages in five districts in Assam and 6 villages in the Papumpare district of Arunachal Pradesh.

Figure 4: A comparison of Current, Previous, and non Jatropha growers



Differing Perceptions about Profits and Loans

In Assam and Arunachal, most farmers who were interviewed (both previous and current farmers) say that they started cultivating Jatropha in order to increase their income. The next most popular reason was financial support provided by the government. Some 36 percent of all sampled farmers received loans from the government for Jatropha plantations— yet, only 42 percent of these farmers actually used their loan for the given purpose. However, there is certainly improvement is loan use. While only 7 percent of previous farmers used the loan correctly for growing Jatropha, some 72 percent of current farmers have put their loan to correct use.

Several farmers in the area started a Jatropha plantation and abandoned it in short order. Interestingly, sampled farmers who abandoned their Jatropha plantations did so, on average, after 2.5 years. A Jatropha plant provides yields only after the sixth year. Thus, farmers were un-willing to wait for yields before abandoning their plantations. Indeed, the main reason cited for abandoning Jatropha was lack of profits.

A previous grower Mr. Gyamar Sikap of Kakoi village (Block: Lower Kimin, Papumpare district of Arunachal Pradesh) narrated his abandonment of Jatropha in the following way:

"Company officials provided the seedling at a price of INR 0.50 per plant. The growth of the plants was good in the initial two years, but after that growth was not that satisfactory. Production of seed was also not as high as I expected at the initial stage. Per plant I was getting 250 to 320 gram of seed. Moreover, I could not sale my seeds. I have already invested a lot but in return I have not got anything. In case of Jatropha plantation gestation period is also long, more than five years. Due to that I followed intercropping. As a result of which I could cover little bit of my loss. However, due to low production level and lack of proper market facility, I abandoned the plantation."

Farmers in the north-east have differing perceptions about how long it takes for a plantation to became profitable. Farmers currently growing Jatropha expect plantations to payback their costs in 16 years, while farmers, who have abandonded planations, expected the average payback period to be 24 years. On the contrary, the broader literature on Jatropha suggests that the expected payback period is about 7 years. Thus, there seem to be various mis-perceptions about profits from Jatropha.

Land Availability and Type of Land Matter

How much land a farmer has and the type of land available to him/her has a strong influence on the decision to continue with Jatropha after starting a plantation. Farmers with a sizeable amount of cultivable land, i.e. over 3 hectares, seem to

Wastelands and Jatropha

Jatropha is supposed to be grown in wasteland and the Indian government has policies in place to stop the conversion of normal agricultural land into Jatropha production. In the study area, some eleven percent of land currently under Jatropha plantation was converted from regular agricultural use. However, the percentage of agricultural land converted into Jatropha plantations is higher for previous farmers (16%) relative to current farmers (8%). This suggests that farmers are increasingly becoming more compliant with wasteland use policy.

preserve their plantations. Also, if farmers are able to grow Jatropha in land that is not economically viable for alternate uses, then they are more likely to continue.

The Impact of Credit, Extension Services and Technical Knowledge

The availability of credit, extension services and technical knowledge related to cultivation have a strong influence on the production of Jatropha. The authors analyses suggest that the availability of extension services increases the probability of Jatropha adoption by 15 to 46 percent. Furthermore, technical knowledge about cultivation increases the likelihood of farmers' planatation continuing with the beyond a three-year period. Risk is

Mr. Gyamar Tayang of Kakoi village (Block: Lower Kimin, Papumpare district of Arunachal Pradesh) narrated the story about his abandonment of Jatropha in the following way:

"I do not have proper information about plantation and maintenance. Even, I do not have any practical knowledge about the pruning, cleaning, and planting. Low production and price level, and high maintenance cost are the major reasons of abandonment of Jatropha in my locality."

SANDEE

The South Asian Network for Development and Environmental Economics (SANDEE) is a regional network that seeks to bring together analysts from the different countries in South Asia to address their development-environment problems. Its mission is to strengthen the capacity of individuals and institutions in South Asia to undertake research on the inter-linkages among economic development, poverty, and environmental change, and to disseminate practical information that can be applied to development policies. SANDEE's activities cover Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka.

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Seedling Nursery near Balijan, Assam

another important factor in explaining farmers' adoption behavior. If a farmer is a risk taker then the probability of him/her adopting Jatropha increases by around 15 percent (and farmers are also more likely to continue with cultivation).

Factors that Count Against Jatropha

NE India receives a great deal of rainfall, which, in general, facilitates high Jatropha yields. However, yields can decline if heavy rainfall occurs in the flowering season. High rainfall also increases seed maintenance and storage costs.

Labor availability is another important factor. With increases in non-farm employment opportunities, the probability of Jatropha adoption declines. Similarly, any shortage in labor reduces the likelihood of a farmer continuing to grow Jatropha. Clearly, when faced with labor shortages or non-farm opportunities, farmers prioritize primary crops and give up secondary options such as Jatropha.

Implications for Policy Makers

Results from the study suggest that practices related to Jatropha production are slowly improving in northeastern India. However, the availability and cost of land and labor continue to be significant constraints. Thus, Jatropha production is more likely to be successful if promoted among farmers who have slightly larger land-holdings and who have land that is only marginally useful for regular agriculture.

Credit availablility and extension services that provide technical know-how enhance the adoption of Jatropha. Although credit is currently available through commercial banks in some districts such as Cachar and Lakhimpur districts of Assam and Papumpare district of Arunachal Pradesh, bank credit needs to be further expanded to other districts where Jatropha is being encouraged. Credit provision also needs to be coupled with improved monitoring of credit use. Also, expansion in extension services can enable farmers to make the best use of their land and available credit.

Since labor and land costs, in addition to the long gestation period, are a significant burden on farmers, one possibility is to increase the market support price for biodiesel established by the Government of India. The price of biodiesel in India is less than half of that of subsidized fossil diesel of subsidized fossil diesel. A more competitive price may make Jatropha more attractive to farmers.

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