

Project Resource

Project resources are materials which have been produced during support from the Business Innovation Facility team to a specific inclusive business project. They include inputs provided as part of technical assistance and summaries of findings and outputs. They are adapted for wider use so that other practitioners can also make use of the material.

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Is Jatropha Curcas a viable smallholder biodiesel crop?

What is this resource?

This resource provides an overview of the biofuels debate with a particular focus on the biodiesel crop Jatropha Curcas. It looks at the impact of Jatropha production on smallholders in Zambia and the experience of Bio Energy Resources Ltd operating in Malawi. It is based on work carried out in Malawi and Zambia by Imani Development for the Copperbelt Energy Cooperation (CEC) as part of the Business Innovation Facility support.

Who is it for?

The research provides a useful resource for businesses and practitioners working in the Jatropha sector. It may also be of use to those working with biofuels more generally or those looking to establish smallholder out-grower schemes.



The Biofuel Debate

The recent global attention on biofuels has been inspired primarily by issues concerning climate change and CO₂ emissions reduction targets, alongside geopolitical issues and the need to reduce dependence on fossil fuels. The debate remains highly polarised with NGO's, such as Oxfam and Actionaid, taking an anti biofuels stance on one side, and in contrast the European Union (EU) and several academics taking a pro biofuels stance on the other. However, a more pragmatic 'middle ground' perspective is now emerging that does not view biofuels through such a polarised lens. The cultivation of *Jatropha* is highlighted, by many of those who take this perspective, as a means of moving the debate forward.

Pro Biofuels

Many Governments and policy makers believe that biofuels have the potential to reduce net CO₂ emissions and improve energy security on a global scale. This perspective has been enshrined in EU policy under Directive 2009/28/EC, which requires member states to source a minimum of 10% of transport fuels from biofuels by 2020. Some academics have taken this proposition even further arguing that by 2020, 20% of all OECD gasoline demand could be met from biofuels produced in the global (developing) South⁽¹⁾. They state that this would provide the developed world with a means of protecting biodiversity, helping developing countries prevent deforestation (thus reducing CO₂ emissions), *“and helping shape an international regime of peace, security and economic development in the 21st century”*.



Jatropha fruit on a healthy bush

Anti Biofuels

Many of the NGO community remain highly sceptical over whether biofuel production can actually improve the livelihoods of poor, smallholder farmers. For example, Actionaid⁽²⁾ argue that biofuel targets in developed world regions, such as in the EU, have incentivised biofuel companies to remove low income farmers in developing countries from their fertile land. In just five countries in Africa, 1.1 million hectares, an area the size of Belgium, has already been sold off to the biofuels industry. They argue that this land grab has left poor communities in developing countries landless and unable to grow or afford food at local markets.

Oxfam⁽³⁾ highlight the case of Sun Biofuels who intended to invest \$20 million in *Jatropha* production over 8,200 hectares of land in Tanzania. 11 villages encircle this land and although uncultivated it is used by the villagers for charcoal-making, firewood, and collecting fruits, nuts, and herbs. There is also a water hole on the land that is the only water source during the dry season. Villagers have been assured they will receive monetary compensation, however, the amount is still highly uncertain. Jobs have also been promised, however, villagers are yet to receive written confirmation as to how many will be provided. This case study highlights the uncertainties faced by many communities involved in biofuel led land grabs. This is the primary reason NGO's, such as Oxfam and Actionaid, remain so skeptical of the promotion of biofuel production in developing countries.



Biofuel protests – taken from www.googleimages.com



(1) Mathews, J. (2007). Biofuels: What a biopact between North and South could achieve. *Energy Policy*, (35), pp. 3380-3570

(2) Actionaid. (2012). The Problem with Biofuels. [Online] <www.actionaid.co.uk> [Accessed 30/ 07/ 2012].

(3) Oxfam. (2008). Another Inconvenient Truth: How biofuels are deepening poverty and accelerating climate change. Oxfam International: Briefing Paper 114

The 'Middle Ground' Perspective

Many commentators⁽⁴⁾ now argue that small scale, localised production of the inedible biodiesel crop *Jatropha curcas* could help overcome some of the negative aspects present in popular biofuel focused debates, including concerns over food security and environmental degradation. They argue this could be achieved whilst at the same time significantly increasing the volumes of biofuel generated in Africa. Recent academic research has provided further evidence in support of these claims. The main finding was that small-scale production of *Jatropha* as a boundary fence, rather than as a monoculture, could improve the livelihoods of smallholder farmers without negative environmental or food security consequences. This could be through the sale of *Jatropha* seeds to produce oil, or alternatively if the price of oil is low the seeds could be used to either make soap or for household lighting. The authors assert that although currently the focus of the biofuel debate remains global, if developmental, sustainability and climate change mitigation benefits are to be realised the focus must shift to the local.

Moving the Debate Forward

From the evidence presented above it is clear that much of the biofuels debate remains highly polarised. This includes the pro biofuels position of the EU and the anti biofuels position of many NGO's such as Oxfam. However, a more pragmatic middle ground perspective is emerging that could help the discussion move on, thus ensuring the potential benefits are realised. The main problem with the extremely anti and pro perspectives regarding *Jatropha* production is that they concentrate on the global and take a 'one size fits all' approach. If the debate is to move forward the focus must shift from the global to the local, and begin to investigate ways in which *Jatropha* could be implemented that maximises benefits to farmers without harming the environment. One way of achieving this goal is by growing *Jatropha* as a boundary fence rather than as a monoculture.

The Experience of Bio Energy Resources Ltd (BERL)

Bio Energy Resources Ltd (BERL) was founded in Malawi in 2006 and are establishing a national scale bio fuel business in Malawi. Their extension team work with thousands of smallholder farmers to plant and establish *Jatropha*. The nuts produced by the smallholders are harvested annually and once bought by BERL are processed into *Jatropha* Straight Vegetable Oil and Seedcake at a central facility in Lilongwe. The oil is then blended with both diesel and paraffin for diesel engines and paraffin lamps respectively. The seedcake is sold as a Bio-Fertiliser. All BERL products are sold to institutions that operate in Malawi and not exported at present.

The experience of BioEnergy Resources Ltd is based on findings presented on the *Study on Social Impact of Jatropha Production in Malawi* which was research by Churches Action in Relief and Development and commissioned by the Inter-Church Organisation for Development Cooperation (ICCO).

So far, BERL has overseen the planting of over 6.6 million *Jatropha* trees. To support this they have a fully validated carbon project under the Verified Carbon Standard that ensures they adhere to internationally recognised sustainability criteria. The BERL business model is based upon the smallholder farming system that dominates in Malawi. In order to ensure smallholders continue to grow *Jatropha* in the long term there needs to be a significant positive livelihood impact delivered in a sustainable manner. The following statement displays BERL recognise this concern: *"Our project provides a **triple bottom line** impact; it improves human wellbeing and social equity whilst reducing environmental degradation"*

(4) Achten, J. et al. (2010). *Jatropha*: From global hype to local opportunity. *Journal of Arid Environments*, (74), pp. 164-165.

Dyer, J. Stringer, L. Dougill, A. (2012). *Jatropha curcas*: Sowing local seeds of success in Malawi? In response to Achten et al. (2010). *Journal of Arid Environments*, (79), pp. 107-110.

Facilitating a positive impact

BERL state that they take the following deliberate steps to mitigate the negative aspects of Jatropha production and to enhance the positive features:

1) Land

BERL recognises that the average landholding size in Malawi (approximately 1ha per farmer) is a constraint to the production of cash crops. To tackle this BERL have adopted strict land selection criteria to ensure that Jatropha is only grown as a boundary crop around agricultural fields and homesteads. This ensures normal farming activities can continue as before whilst an additional income source is generated through Jatropha.

2) Labour

BERL has noted that the digging of planting pits for seedlings requires time and effort during the first planting season. To address this and to avoid labour conflict with mainstay agricultural crops they promote the digging of planting pits prior to the onset of the main agricultural season. Moreover, the company promotes the digging of pits in clubs of 10 to 15 farmers to speed up the process.

3) Food Security

BERL only sources seed from farmers that are not growing Jatropha as a mono-crop. Although mono cropping would significantly reduce BERL's business risks it would also result in Jatropha directly competing with food crops for land. In turn, the World Food Programme's socio-economic impact assessment on the production of bio fuel crops concluded that BERL's smallholder business model would not negatively affect food security due to the nature of the boundary model.



BERL farmer with Jatropha boundary fence

Impacts on Smallholders

1) Economic Impacts

BERL estimate that by 2020 they will have approximately 100,000 registered smallholder farmers who will earn an additional income of approximately \$90 - \$135 per annum for a period of 25 to 30 years. Currently as the project is only at an early stage the harvest volumes are still relatively low. In turn, economic figures are not robust at this stage; however, some famers have reported harvesting around 50kg per season for a price of \$0.20 per kg. 97% of BERL farmers stated that income was their primary motivation for growing Jatropha, 64% indicated that their expectations had not yet been met in terms of seed price and market availability, and 44% of farmers indicated that Jatropha does not fetch the same price as other cash crops. BERL state that this is the primary reason Jatropha is not currently being promoted as a monoculture cash crop.

2) Social and Environmental Impacts

In Malawi the gender balance at the household level can be distorted. This occurs when the income from high value cash crops is diverted away from the general household by the male household head. However, this was not found to be the case with Jatropha in Malawi. Although the male household head generally made the decision to grow Jatropha, decisions regarding how additional income was spent were made jointly with the female in an equitable manner.

BERL have an extension team and a lead farmer system that transfers knowledge on the economic and environmental benefits of growing Jatropha. This has resulted in a significant impact on the human skill base with regards to Jatropha production and utilisation knowledge. Extension services covered include: site selection, the boundary fence production model, pitting to facilitate good root development, gap refilling, and group nursery establishment. 82% of BERL farmers surveyed stated that their training expectations had been met with 74% saying the same regarding extension services.



Diseased leaf – extension services are imperative to ensure good yields

3) Land and Food Security Impacts

The volume of land owned has not been extended in order to grow Jatropha due to the boundary fence production model. In turn, land use did not change which was expected as smallholdings generally have fairly rigid land utilisation patterns for income generating activities.

4) Labour Impacts

The majority of farmers stated that when Jatropha is grown as a boundary fence there is no competition, or impact, on the other crops grown by the household. Farmers specified that the labour period for Jatropha, in terms of digging planting pits, is different from their main crops and thus Jatropha production did not require them to pay for external labour.

5) Overall Impact and Future Plans

67% of BERL farmers stated that they would like to extend the area under which they produce Jatropha. This is because Jatropha is a good income source, easy to cultivate, requires few inputs, provides hedging, and improves soil fertility and conservation.

The Impact of Jatropha Production on Smallholders: Recommendations for CEC

CEC are being supported by BIF as they wish to set up a Jatropha out-grower scheme through which they can source Jatropha nuts for their biodiesel processing plant. Generating biodiesel is a profitable venture for the company but by purchasing their raw material from smallholders they hope to have a positive livelihood impact on the rural poor.

The 2012 report '*The Impact of Jatropha Production: The Zambian Point of View*' was produced as a part of the Business Innovation Facility's support to CEC. The objective of the report was to provide insights on the impact that Jatropha production might have on smallholder farmers in the Kapiri Mposhi region in Zambia. CEC have stated the need for such understanding as they have plans to set up a Jatropha out-grower scheme in the area. However, before they do so they wish to have all the necessary information to ensure that when they involve farmers in Jatropha production, it will only have a positive impact.

The benefits and challenges of Jatropha production, as perceived by the target smallholder farmers in Kapiri Mposhi, were identified by the report as follows:

Benefits of Jatropha Production

- Jatropha production offers significant future market and trade opportunities through CEC.
- These market opportunities in turn provided farmers with an additional source of income.
- The husks remaining from the Jatropha fruit can be used as a fertiliser with high decomposition rates.
- If the knowledge exists and the facilities are available Jatropha oil can be extracted from the nuts and used as cooking fuel.
- The nuts can be used to make small candles used as a lighting source at the household level.
- Jatropha leaves can be used as an insecticide



Jatropha used as a domestic energy source – photo courtesy of the Janeemo Project

Challenges of Jatropha Production

The challenges faced by the Jatropha growers were generally not due to the crop itself but due to the way in which it has been introduced to them in previous years. Essentially farmers that were promised a market for their seed were let down when companies backed out thus removing any possible market opportunities. A second issue regarding marketing is the price offered for the nuts. The current market price is ZK800 (\$0.15) per kg, however, growers feel this needs to be closer to ZK1,000 (\$0.19) if benefits are to be realised. Other challenges include termite damage, poor extension services, a lack of inputs such as insecticide, and the high labour requirements to the de-husk the fruit.

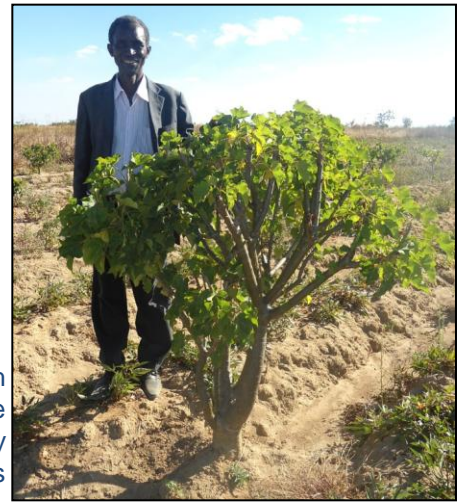
The Way Forward for CEC

Jatropha production by smallholders cannot be polarised into extreme positive and negative scenarios as many global stakeholders would like to think. Instead, it is the individual smallholder engagement mechanism that will determine the impacts seen at farmer level. CEC must determine the best way they can work with smallholders in the specific context they are faced with, but at the same time they can learn significant lessons from the experiences of companies like BERL.

Although BERL have made effort to create a positive impact for smallholders from jatropha production, they are still in the preliminary phases of their project. The true economic impact of Jatropha production for the smallholders in the out-grower scheme is yet to be proven or for the estimated targets of BERL to be met. As BERL buy all the nuts produced by farmers there is very little domestic utilisation of the product, this limits the social, household benefits of the crop. It may be the case that CEC wish to encourage farmers to use some of the crop domestically and then sell the remainder in order to deliver social benefit to the producing households. Uncertainty remains regarding several agronomic practices, such as pruning, it is suggested that CEC take careful effort in designing their extension information system. The core recommendations for CEC are presented in the following box.



BERL Jatropha farmer with four year old trees in Malawi



Potential CEC Jatropha farmer with mature trees in Zambia, Trees are significantly smaller, most probably due to pruning techniques

The recommendations made to CEC based on the BERL case study are as follows:

1. To prevent risk to food security, and to instil a longer term perspective to the crop, Jatropha production should be promoted as an *additional* cash crop. CEC should ensure that Jatropha does not displace any current crop or farming system; this should be possible given that farmers in Kapiri Mposhi have up to 50ha of land. Farmers can either plant the crop as a boundary fence or can convert currently unused land to jatropha. Farmers will need to be sensitised to understand the benefits of the crop and will show dedication and investment the crop in order to secure an additional income whilst avoiding any impact on food production or livelihood support crops.
2. The establishment of Jatropha trees can be a labourious task, therefore the digging of planting pits should take place before the onset of the main agricultural season to avoid conflict with food and other cash crops.
3. To get the full household benefit of Jatropha, knowledge regarding its utilisation as soap, oil, insecticide, fertility tree and candles should be transferred to the farmer. This can either be from CEC staff, through SNV, through the Enterprises, or through a lead farmer system.
4. Jatropha can only give a strong economic impact if good fruit yields are achieved. This can be facilitated through a strong extension programme and lead farmer system. Training is the most critical element but it should not be viewed as a one off, short term activity, but more as a established system that can support farmers on a permanent basis.
5. The main impact that is desired by farmers is the cash income that Jatropha can deliver through the sale of the nuts. A secure and reliable market, provided by the private sector, is the critical element to delivering this positive impact.
6. Stakeholder collaboration and the integration of Government Ministries into agricultural work are important to help ensure policies are set with comprehensive buy in and that there is full support to the project.

Additional resources:

Further information can be found on the 'know how' pages of the **Practitioner Hub on Inclusive Business**:

Farmers as suppliers and clients: <http://businessinnovationfacility.org/page/know-how-farmers-as-suppliers-and-clients>

Climate smart solutions: <http://businessinnovationfacility.org/page/know-how-climate-smart-solutions>

BERL presentation on market linkages: <http://businessinnovationfacility.org/page/partnership-workshop-malawi>

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