



## Short communication

## *Jatropha curcas*: Sowing local seeds of success in Malawi? In response to Achten et al. (2010)

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## ABSTRACT

Achten et al. (2010) note that small-scale, local shifts towards growing the inedible, biodiesel crop *Jatropha curcas* (*Jatropha*) may overcome some of the negative points inherent in popular biofuel-focused debates, including those on food insecurity and environmental degradation concerns. In this short response, we assess the views expressed by Achten et al. (2010) in light of recent case study-based research in Malawi that identifies and analyses the current context and potential for rural development of both local-level community-led and larger-scale private sector *Jatropha* projects in Malawi.

Although large-scale cultivation of *Jatropha* is at risk of economic loss resultant from knowledge gaps and unpredictable yields, our research shows that small-scale initiatives do have the potential to contribute positively to rural livelihoods. Sales of seeds or production of *Jatropha* oil for stoves, engines, soap and paraffin can result in reduced household expenditure or increased incomes. In order for these benefits to be realised and up-scaled, further institutional support in terms of knowledge and technical provision is vital, and must be communicated through established and context-specific, locally-appropriate channels. While the biofuel debate remains global, we assert that actions should be focused at the local level in order to realise developmental, sustainability and climate change mitigation benefits across a range of scales.

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### 1. Introduction

The global debate on biofuel cultivation continues as governmental, private sector and Non-Governmental Organisation (NGO) actors strive to address challenges relating to climate change, energy security and the rapid depletion of fossil fuel reserves (Ravindranath et al., 2011). Although biofuels remain contentious, Achten et al. (2010) note that small-scale, local shifts towards growing the inedible, biodiesel crop *Jatropha* may overcome some of the negative arguments inherent in popular biofuel-focused debates, including those surrounding food insecurity and environmental degradation concerns. Currently, *Jatropha* cultivation is taking place on a range of scales across developing regions, through both large-scale plantations driven by private-sector companies and local-scale community-led projects typically supported by NGOs (Openshaw, 2000).

In a recent think note published in the Journal of Arid Environments, Achten et al. (2010) evaluate the opportunities and

challenges associated with *Jatropha* cultivation. They express concern that in order to reduce the financial risks of investment into large-scale *Jatropha* cultivation (which might result from inadequate knowledge of *Jatropha*, competition from a global biofuel market and an 'uncertain economic perspective'), investors will be likely to plant *Jatropha* on productive agricultural lands, rather than the marginal lands that *Jatropha* can allegedly reclaim (Francis et al., 2005; Fairless, 2007). Small-scale models of community-based projects are therefore identified as a priority area in need of further research to enable the espoused benefits of *Jatropha* production to be assessed and realised (Achten et al., 2010). They assert that the use of *Jatropha* oil in stoves, lamps and generators can reduce farmers' dependency on fossil fuels, assisting rural development and note the potential benefits that *Jatropha* offers smallholder farmers as an additional income source and/or through conservation of other valuable ecosystem services, and/or by reducing labour demands for fuelwood collection. They further describe how *Jatropha*'s woody by-products can be used for fuelwood, seedcake for manure, and the shrub can act as a living fence with the potential to reduce soil erosion and protect crops from grazing animals. In order for small-scale approaches to be successful and for projects to be sustainable, Achten et al. (2010) recognise the need for *Jatropha* to benefit the adopting farmer(s)

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and stress the importance of extension services through cooperatives and local networks in encouraging uptake.

In this short response, we assess the views expressed by Achten et al. (2010) in light of recent case study-based research in Malawi that identifies and analyses the current context and potential for rural development of both local-level community-led and larger-scale private sector supported *Jatropha* projects.

## 2. Data and methods

Data were collected from 6 case study villages in central and southern Malawi in 2009–2010 using a mixed method approach, focused largely on qualitative information derived from household interviews and village focus groups. Case study villages were purposively selected because they were associated with organisations involved in *Jatropha* cultivation on different scales with 2 study villages chosen for each of 3 project initiatives studied. These were: 1.) Fuel Crops Demeter who are cultivating approximately 800 ha of *Jatropha* as a plantation, 2.) Tolesa Agricultural Enterprises who have approximately 150 ha as plantation and boundary fences around the farm and, 3.) the NGO Janeemo who are promoting *Jatropha* cultivation at the household and village level as boundary fences around homesteads. Exploratory questionnaires ( $n = 206$  in total) were carried out with households within each of the study villages to obtain livelihood data and identify current levels of *Jatropha* cultivation. Results from these initial questionnaires allowed stratification of households, through cluster analysis, according to wealth categories identified by the respondents themselves (classified as 'poorest of the poor', 'common-poor' and 'better off') and their involvement with *Jatropha*. Subsequently, 25 households (consisting of between 3 and 6 households in each of the study villages) that had been involved in completing the exploratory questionnaire were purposively selected for more in-depth qualitative studies that used participatory methods including transect walks, seasonal calendars and semi-structured interviews. Finally, focus groups were carried out within the villages with adopters and non-adopters of the crop (participant numbers ranged between 4 and 12) to obtain data on the factors affecting adoption decisions. In-depth interviews were also conducted with a wide range of expert stakeholders ( $n = 61$ ) including government officials at national, district and local level, NGO workers, traditional authorities and *Jatropha* producers.

### 2.1. *Jatropha* in Malawi: discrepancies in yield?

Several organisations employing different approaches, including those forming the case studies in this research, are actively involved in *Jatropha* cultivation at different scales. These include private-sector enterprises such as Bio-Energy Resources Ltd. (BERL), aiming for large-scale biofuel production through contract farming with smallholder farmers; Fuel Crops Demeter, engaging in intensive large-scale *Jatropha* farming on a commercial plantation farm; and Tolesa Agricultural Enterprises, establishing small-scale contract farming schemes and cultivating *Jatropha* as boundary fences. NGOs such as Environment Africa and Janeemo<sup>1</sup> are also promoting small-scale adoption of *Jatropha* cultivation. Crop performance from different schemes varies greatly and is often confounding growers who are faced with managing a crop that is still largely wild (Gressel, 2008). Janeemo, for example, have reported good yields from a 3-month old crop in southern Malawi

despite previous research reporting it takes 2 years to start producing seed (Singh et al., 2008). Quantitative yield data to support this are not available given that harvesting is only occurring on a limited basis for soap-making for sale at local trade fairs. Fuel Crops Demeter have experienced considerable attacks on their crop by termites and *Zonocerus elegans* (elegant grasshoppers) with subsequent growth reduction, despite claims that *Jatropha* is 'pest-resistant' (Openshaw, 2000; Francis et al., 2005). These findings support Achten et al. (2010) observation, as well as findings by Shanker and Dhyani (2006), that suggest *Jatropha* yields are difficult to predict and monocultures may be vulnerable to pests and diseases. Considering these practical discrepancies, it is pertinent to proceed only cautiously with large-scale cultivation to reduce the risks of economic loss. Fuel Crops Demeter have delayed the introduction of a contract farming scheme until the future of *Jatropha* as a biodiesel is more certain (S. Ross, pers. comm.), however this also means that local-level social and economic benefits of the crop are not yet realised. Furthermore, unsuccessful attempts by innovative smallholder farmers to cultivate the crop in rural communities surrounding larger-scale plantations without the necessary institutional support may affect willingness to adopt *Jatropha* in the future.

### 2.2. *Jatropha*: displacing agriculture and food crops?

Many organisations, such as NGOs, the Department of Forestry and Tolesa Agricultural Enterprises, are promoting *Jatropha* as a boundary crop around homesteads and *mundas* (areas of crop production) for smallholder farmers, rather than choosing to plant on agricultural land. Analysis of interview data from across the 3 case study schemes show that when cultivated as live fences, 100% ( $n = 25$ ) of households stated that *Jatropha* can be tended as part of the farming routine with minimal additional effort, and that the fence protects the food crops from wind and grazing animals as illustrated by one farmer:

*'I planted the trees around the house for shade and to get the seeds easily'.*

(Middle-age female resident, Odilo village – interview statement, 2009)

Results from all the household interviews also suggest that *Jatropha* will not be grown in place of food crops by smallholder farmers. This is due largely to the cultural importance of maize production (Heisey and Smale, 1995). When respondents were asked to rank the importance of household income generating activities, all placed maize cultivation as number 1 ( $n = 25$ ). When asked if *Jatropha* was likely to be grown in place of maize in their household, one interviewee replied:

*'Maize? That's life! You have to have nsima<sup>2</sup>'.*

(Middle-age female resident, Jana village – interview statement, 2010)

Of the 13.6 million population of Malawi, approximately 90% rely on rainfed agriculture and farm smallholdings of 0.2–3 ha (Ellis et al., 2003). Maize is the principal crop, predominantly cultivated for subsistence use, typically with pigeon peas, sorghum, groundnuts and cowpeas (Orr et al., 2009). In this context, it is critical that *Jatropha* does not replace maize or other food crops and the cultural importance of maize cultivation, noted by respondents suggest that this will not happen.

<sup>1</sup> Janeemo is an NGO working in southern Malawi, encouraging the cultivation of three tree species, *Jatropha*, neem and *moringa* for positive livelihood impacts Janeemo, 2007. [www.janeemo.org](http://www.janeemo.org), Last accessed 10/01/2011.

<sup>2</sup> Nsima – staple food of Malawi made from ground maize flour and water.

### 2.3. Small-scale *Jatropha* initiatives: rural development opportunities?

Evidence from the in-depth qualitative household studies also supports claims by Achten et al. (2010) that *Jatropha* has the potential to promote development at the household and village level in a variety of ways. While Achten et al. (2010) propose utilising the oil as an alternative to fossil fuels in stoves and generators, NGOs and private sector enterprises in Malawi are promoting soap and paraffin production. As an alternative fuel in stoves, the use of *Jatropha* oil may lead to a reduction in respiratory diseases, such as tuberculosis, which can be linked to cooking with solid fuel (Akunne et al., 2006). As an alternative to diesel and for soap and paraffin making, *Jatropha* oil can reduce capital expenditure and/or provide an income source through sale of the oil or the subsequent products. This idea was cited as an advantage of *Jatropha* cultivation in a focus group in Samu village:

*'When [Jatropha] starts harvesting you can have soap, paraffin and body oil. The extras you can sell. The advantage is saving money you have spent on these items'.*

(Middle-age male resident, Samu – comment recorded during focus group meeting, 2010)

Interview data suggested that NGOs, such as Janeemo, offer technical support by providing hand presses which allow villagers to expel oil and produce their own paraffin and soap. Consensus among focus group participants at both Janeemo villages studied suggested this can result in a significant reduction in expenditure of up to MWK 1000 (approximately \$7) per month, enabling household funds to be used to purchase maize, thus improving food security. Markets are being sought where this soap and paraffin can be sold to provide a regular income and benefit more people. In addition, leftover seedcake, with a nitrogen content similar to chicken manure, can be used as an organic fertiliser on agricultural land as reported by Van Eijck and Romijn (2008). Janeemo also specifically target villages for their projects where *Jatropha* is already used as traditional fencing material or where soap-making using other oils is already taking place. This approach reduces start-up risks and safeguards initial investments. Toleza Agricultural Enterprises are embarking on a similar project, encouraging surrounding villages to grow *Jatropha* by employing local innovators to train farmers in planting techniques, as well as in soap and paraffin making. Toleza Agricultural Enterprises are purchasing the locally-produced seeds to achieve fuel self-sufficiency across the farm, and offer the option for farmers to press their seeds to make soap and paraffin should they prefer. This negates the need for farmers to invest in technology such as seed presses and reduces diesel emissions at a local-scale.

Households that cultivate cotton as a cash crop (16 of 25 interviewees) see *Jatropha* as offering a potential additional or substitute income source that can reduce the impacts of market fluctuations in global cotton price, such as those evident in the 2009/2010 cotton harvests:

*'When [cotton] flops you don't have a fall back and it's not stable in terms of price due to market forces. When the markets are flooded then farmers suffer and this is worse recently, especially last year (2009)'.*

(Middle-age male resident, Samu village – interview statement, 2010)

If *Jatropha* can be used within the household for soap and paraffin production, there is a greater independence from market forces. Farmers can sell the seeds and products when the prices are high, rather than being forced to sell crops on an already flooded market at low prices.

The majority of farmers also engage in *ganyu*<sup>3</sup> labour at some point during the year, most notably to undertake weeding and land preparation activities on others' land before the harvest, at a time when food is in short supply (Bryceson and Fonseca, 2006). The availability of *ganyu* coincides, necessarily, with the need for smallholder farmers to spend time on their own fields. Perhaps most significant therefore, is the potential that *Jatropha* can offer in terms of providing a regular income, allowing households to accrue savings, which would permit farmers to devote less time to *ganyu* labour and to spend more time tending their own crops. This benefit came across strongly in focus group discussions in Jana village:

*'If we could sell lots of [Jatropha], we could stop doing piecework... we still hate having to work really hard on someone else's garden and then be too tired to work on our own'.*

(Middle-age female farmer, Jana village, 2010)

### 2.4. Small-scale *Jatropha* cultivation: what role for extension networks?

In contrast to the findings of Ariza-Montobbio and Lele (2010) in Tamil Nadu, development benefits from *Jatropha* projects in Malawi appear not to be exclusive to farmers with larger landholdings or resource endowments. Rather benefits are realised by those who have access to information on crop cultivation practises and seed processing. This supports assertions by Achten et al. (2010) that extension networks are key to the success of *Jatropha* initiatives and that institutional support plays a vital role in achieving positive outcomes of projects. This is well demonstrated in the case of Janeemo, who are working closely with extension officers from the Department of Forestry, as well as with the traditional authorities, in promoting knowledge exchange and best practises. Consequently, the core messages on the cultivation and management of *Jatropha* underpinned by the local development and empowerment goals of the organisation have been reinforced by government extension workers. Traditional authorities have also helped the process of communication since they have considerable influence at the local level as opinion leaders in the adoption of new technologies and practises (cf. Rogers, 1995). In villages where the Chief was unconvinced by the benefits of *Jatropha*, adoption was notably less widespread than in villages where the Chief was an advocate of the crop. For example, one interviewee stated that:

*'It's important to go through the chief and traditional structures that are in place – that way they will support you and win more farmers round'.*

(Agricultural Extension Development Coordinator (AEDEC), Ntubwi – interview statement, 2010)

Toleza Agricultural Enterprises has yet to utilise the traditional authority networks and as such has seen far lower uptake of *Jatropha* than experienced by Janeemo in their target villages.

## 3. Conclusion

The qualitative information extracted from the described case study villages in Malawi, has further supplemented and endorsed the views expressed by Achten et al. (2010). We argue that this local case study research indicates that small-scale initiatives do have the potential to contribute positively to rural livelihoods. Sales of seeds or production of *Jatropha* oil for stoves, engines, soap and paraffin

<sup>3</sup> *Ganyu* is casual labour arrangements between households for cash or other payment e.g. maize.

can result in reduced household expenditure and/or increased incomes, offering a supplementary livelihood activity, or in some cases, a substitute for less attractive current activities. In order for these benefits to be realised and up-scaled, further institutional support in terms of knowledge and technical provision is vital and must be communicated through established, locally-appropriate channels. In future, small-scale, rural development initiatives such as these could be incorporated into operations by large-scale biofuel producers to supplement *Jatropha* yields and produce benefits for all stakeholders, as demonstrated by the Toleza Agricultural Enterprises case study. While the biofuel debate and hype remains largely at the global level, we assert that actions should be focused at the local level in order to realise developmental, sustainability and climate change benefits across a range of scales.

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