Organic Agriculture (OA) and Biofuels in Cambodia

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III.1 Organic Agriculture in Cambodia

The development of organic agriculture in Cambodia is in its early stages. The main focus is on rice, for which a national export strategy has been drawn up. The aim is "to develop the organic rice sector to further enhance economic growth in Cambodia as a whole, to generate employment opportunities for the landless and to reduce poverty among the rural population and improve well-being of farmers" (Ministry of Commerce, Government of Cambodia, 2006, p. 51). Until recently there were no national statistics on the extent of current organic production, or on the targeted levels for the next few years, although a very ambitious statement was made to the author during the mission in January 2007, to the effect that all rice production in Cambodia should become organic in 15 years.[18] Just recently, however, an estimate has been made by the Cambodian Center for Agricultural Studies and Development (CEDAC) that 5,400 ha. of paddy are organic (only 0.02 percent of the total paddy) and only around 5,000 of the 1.8 million rice farmers practice organic farming.[19] It is also interesting to note that, recognizing the negative consequences of inappropriate use of agro-chemicals— particularly by poor farmers—the advertising of chemical fertilizers and pesticides by media has recently been made illegal in Cambodia.

In the absence of any national data, this analysis is based on information from the largest organic rice production program in Cambodia—that of CEDAC, which has been promoting a System of Rice Intensification (SRI).[20] SRI, brought to Cambodia with the donor support of Deutsche Gesellschaft für Technische Zusammenarbeit (German Institute for Technical Cooperation, or GTZ), is a method of practicing OA where some flexibility in the adoption of organic methods is allowed. It encourages the use of organic inputs, as well as promoting changes in the method of planting seedlings (fewer and younger seeds are planted in unflooded nurseries, instead of flooded ones. This implies less use of water—an important factor in Cambodia and the Lao PDR, where most agriculture is rain fed[21]) and other rice cultivation practices. In addition, farmers are encouraged to adopt good agricultural practices in the cultivation of vegetables and chickens. The system is based on trust and has no certification, so it would not qualify as organic according to standards laid out by international organizations such as IFOAM. But it represents a move towards low external inputs and advocates what would widely be regarded as good agricultural practices or GAP.[22] At present about 60,000 farmers in 15 of Cambodia's 20 provinces are engaged in the SRI program and production and numbers have been growing rapidly; rice output under the program has gone up from 20 tons in 2005 to 420 tons in 2006. About 30 percent of these farmers could be described as fully organic, while the rest have adopted a lower external input agriculture, with no or very little application of pesticides.

An evaluation of the program was undertaken by GTZ in 2004, comparing SRI farmers with control groups in five provinces (Kandal, Kampong Thom, Kampot, Takeo and Prey Vang).[23]

The main findings were:

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i. Adoption of SRI practices is not complete among SRI farmers, but is fairly substantial – the age of seedlings has dropped 67 percent and rates of planting by 67 percent.
ii. Yields recorded for SRI farmers were 660 kg/ha. higher compared to control groups; an increase of 41 percent—from 1629 kg/ha. to 2289 kg/ha. This was achieved under a wide range of different agro-ecological environments, individual management practices, and varieties. The increase was seen across all five provinces and throughout the four years for which data was obtained, although the increases were greater where underlying endowments were better.
iii. A risk analysis found that with SRI methods farmers' chances of getting a lower yield after changing from conventional practices was only 15 percent, while the chances of getting an increase were many times greater.
iv. While SRI is more labor intensive in the earlier years when farmers are learning how to use the practices, in the longer term there was no consistent effect. Many farmers mentioned the additional labor requirement caused by the increased weeding operations, but at the same time several farmers expressed their appreciation about the overall labor saving effect during uprooting and transplanting. A quantification of the overall labor demand showed SRI to be more or less labor neutral with respect to family labor. However, it reduced the need for hired labor by a fairly small amount, although the effect was statistically significant.
v. There was a clear advantage of SRI over conventional practices when gross profits/ha. were calculated. These went from US$120/ha.with conventional methods to US$209/ha.with SRI—an increase of US$89, or 74 percent. This was composed of a US$23/ha.saving in variable costs, like seeds and mineral fertilizer, and an increase in the income from higher yields of US$66/ha.

The analysis concluded that if just 10 percent of Cambodian rice farmers would convert just 42 percent of their rice area to SRI, the economic benefit to the nation would be $36 million, more than enough to justify an extensive program of training for SRI within the agricultural extension system. Moreover this conclusion is well supported by the data and analysis from other recent evaluations of SRI.[24]

Another study conducted by CEDAC itself was even more optimistic of the benefits of SRI. They found an increase in yields of 105 percent, increases in gross household incomes of 89 percent, and an increase in gross margins of more than 100 percent.[25]

Based on these results it is possible to estimate the potential benefits of a wider shift to “more organic” rice production in Cambodia. For this purpose, the following assumptions have been made:

i. An extended program would provide SRI extension services to 20 percent of the wet season rice farmers in the country.
ii. The program would tackle poor and non-poor farmers in proportion to their numbers in the communities in which it is carried out—i.e. there is no special targeting to better off farmers or worse off farmers.
iii. In the case of poor farmers, around 19 percent are landless (World Bank, 2006). Since they do not own or rent land, the SRI program would not affect their income.
iv. Incomes from rice cultivation would increase by 75 percent as a result of the program.
v. Shares of income from wet season rice cultivation are as given in Table 3 [PDF 48.7KB | 1 page].

The table provides estimates of the increase in incomes in each of the five regions: Tonle Sap, Coastal, Mountain/Plateau, Plains and Phnom Penh as well as estimates of the number of households (HH) which will move out of poverty as a result of the project.[26]

There are around 1.5 million rural households engaged in wet season rice production in Cambodia, so a 20 percent targeting of this group would involve 300,000 households. This is a feasible program, based on discussions with CEDAC, which claims the present program already covers

60,000 farmers in 1,700 villages.[27] Such a program would increase incomes of rural households by around 68 percent in Tonle Sap, 74 percent in the Coastal Regions and Phnom Penh (there are a few rural households in the capital city region), and 39 percent in the plains. The benefits are however negligible in the Mountain/Plateau region, because very little household income derives from rice cultivation there.

The impacts of the program on poverty reduction are also notable. The World Bank (2006) study defined rural households as being in poverty if they had access to less than 1753 riels per adult, per day in 2004 prices (US$0.44 at the exchange rate of the time). Based on that, and on the distribution of poverty in the different regions, we have estimated the number poor households at around 690,000. An SRI program targeting 20 percent of the poor households would take about 21,300 out of poverty—i.e. reduce the rural poverty rate by about 3.3 percent.[28]

Details are not available, but the costs of such a program are likely to be modest. Based on similar programs in the Lao PDR we estimate the costs at around US$150 million or about $7.50 per family taken out of poverty.[29] In addition some support may be needed in the first two years of the program, when yields can decline and the benefits not be fully realized, although the GTZ and other surveys do not indicate this to be the case in the data they have collected. This is probably explained by the fact that yield decline is common where the areas being converted was previously farmed with high levels of agrochemicals. In Cambodia, where most land is under rain fed conditions using low levels of chemicals, introduction of OA should not cause declining yields.

The program would provide considerable benefits in addition to those already identified:

i. **Food Security**. The program would increase food security considerably for those who adopted SRI. As noted, with SRI methods the farmers' risk of getting a lower yield after changing from conventional practices, are much smaller than the probability of getting a higher yield. Another indicator calculated by the GTZ study found the probability of not achieving a gross margin of $100/ha.was 42 percent with conventional practice, but only 17 percent with SRI. The same study also looked at how many months out of each year the household was able to meet its rice and other food needs. Even with SRI being practiced on only a portion of farmers' total rice area, the proportion of farmers facing rice insecurity declined from 34 percent to 28 percent, while the proportion able to produce a surplus had increased from 20 percent to 33 percent. First-time farmers were using SRI on 21 percent of their total farm area, while those with more experience applied the new methods on 42 percent of their area.
ii. **Access to Organic Markets**. The above estimates of income increases for SRI farmers depend only a little on higher prices for the products sold. Much of the production is for self-consumption and, according to CEDAC, the small amount that is sold in the market in Phnom Penh attracts a price premium of about 15 percent over conventional rice. The benefits of a program of certification and sale of organic rice to export markets therefore have still to be realized. Evidence from other organic sales in Thailand and the PRC indicate price premia of 10-40 percent for rice. In that case, if the lower end of the range prevails, a targeting of organic markets would not provide much more of a premium than can be obtained in the local market. Furthermore it would entail certification costs, which, in the case of Thailand amount to around US$12/ha. This would eat into the additional gross profits from organic rice, which are currently at least US$89/ha. according to the GTZ survey. One of the benefits of seeking certification, however, would be a greater market for the production; if production was expanded without certification one would be more or less restricted to the home market which probably cannot absorb such an increase. With certification exports are opened up, thus expanding the market. The switch to certified organic OA would thus also generate more foreign exchange for the country. Indeed, Cambodia is now self sufficient in rice and exports are a major government strategy. For example, if 20 percent of the current production of 6

million tons could be exported as GAP rice, at a price of $150/ton (in 2004 Cambodian farmers were smuggling paddy rice across the border and receiving US$135/ton), it would generate export earnings of US$180 million, which would be an 8 percent increase in exports relative to 2003 levels.

iii. **Other Benefits**. Although these have not been documented in the case of the SRI program, other studies in the region have found benefits to farmers of a shift to OA in the form of better health effects (less cases of pesticide poisoning, and a better diet as a result of higher output and incomes), more involvement of women on OA farms and higher incomes for the households (Setboonsarng and Markandya, 2007). They also found environmental benefits from the lower applications of pesticides and other external inputs.

III.2 Biofuels in Cambodia

At present biofuel production in Cambodia is in its infancy. Possible feedstocks are cassava, soy, maize, sugar cane and jatropha. Cassava production in 2005-6 was 536,000 tons, grown mainly in Kampong Cham province. Soya is grown mainly in Battambang in the Tonle Sap region and in Kampong Cham in the Plains region of Cambodia. Production there in 2005-6 was 179,000 tons, much of which was exported. Maize is grown especially in Battambang in Tonle Sap and Pailin in the Mountain region. Output in 2005-6 was 248,000 tons. Sugar cane is grown mainly in Kampong Cham and Kampong Thom provinces, with total output at 118,000 tons. All these outputs are of course dwarfed by the output of rice, which amounted to nearly 6 million tons.

Jatropha

No data is available for jatropha production, and a survey to establish the baseline potential is urgently needed.

There have been three reviews of the potential for bioenergy in the country (De Lopez, 2003; Williamson, 2006; and Biodiesel Cambodia, 2007). All find a significant potential: Lopez focuses on biomass, especially agricultural residues from the production of sugar cane, maize and rice. As this report is not investigating biomass production these sources are not covered.

Williamson notes the potential for straight vegetable oils (SVO) from jatropha and most of his study lays out the commercial potential for this fuel. Unfortunately he does not provide an estimate of the potential output that is possible in the country, or the likely impacts on the livelihoods of Cambodian farmers.

The most optimistic assessment for jatropha is made by Biodiesel Cambodia (2007). It reports several private sector initiatives that include:

- A 20,000 ha. plantation of jatropha curcas planned by a multinational company called Pan Asia with a biodiesel refinery.
- 2000 ha. of jatropha nurseries that will be ready to plant in 2008.
- 3 local enterprises are in the preliminary planning stages of a total of 1000 ha. of land.
- Canadia Bank, the largest local Bank in Cambodia will be planting 3000 ha in Kompong Speu province next year.

None of these are as yet operational, but the interest is clear and Biodiesel Cambodia report new inquiries every week. The only operations that have actually taken place so far are: (i) a 10 ha. plantation in Kandal province and a 30 ha. plantation in Kompong Som province by Canadia Bank; (ii) a 10 ha. plantation by Biodiesel Cambodia for training purposes and for piloting techniques for pruning and fertilization and (iii) about 500 ha. of jatropha managed by 4 private local companies.

Cassava

The other major development in Cambodia is a private sector initiative to produce ethanol. A Korean company (M-H Bio-Energy Group) has set up a facility 15 km from Phnom Penh with a production capacity of 40,000 kilo liters a year from 85,000 tons of tapioca chips. It aims to procure 300,000 tons of chips by 2010. This would amount to about 20 percent more than

the total cassava production in 2005-6, which was 536,000 tons of fresh roots (about 45 percent of chips by weight are obtained from the roots). The fact that there is private sector investment, means that it is a financially viable option. In this study, however, we review it from a societal perspective.

In this section, we look at the potential of two sources of biofuel: jatropha and cassava. The aim is to see what impacts the growth in use of biofuels, at realistic levels, would have on the incomes of farmers and on the national economy.

Jatropha for Biofuel in Cambodia

As Williamson and others have noted, there is considerable potential to grow jatropha in Cambodia, where it is a commonly found species that has no other commercial value. It is a drought resistant perennial which grows on marginal soil and lives for up to 50 years. The nut produces oil that has similar energy content to diesel oil and can be substituted directly in most types of diesel engine. The seed cake residue, left after expelling the seeds, can be used as a high-grade fertilizer. The plant also prevents soil erosion from wind and water and is used as a natural fence or hedge because animals do not eat it.

A major program for jatropha has been instituted in India, where the aim is to achieve an output of two million tons of diesel, from around 11 million hectares of land. There is considerable interest in the program from the private sector, which will need to invest around US$6 billion to achieve this target. The PRC also has a major program, with wasteland in the three South Western Provinces (Guizhou, Sichuan, and Yunnan) being used for production. The aim is to produce 50,000 tons of biodiesel by 2010 and 7 million by 2020.[30]

In Cambodia we have noted several efforts under way to plant jatropha, some on a very large scale. The institutional arrangements fall into two broad structures:

i. The private sector refiners agree contracts with smallholders and assist them by clearing land, providing the seed etc. These smallholders may be independent farmers already owning land, or land may be give to them by the state on condition they grow jatropha. [31] This is referred to as the “2+3” model, where the farmer provides the land and labor, and the contractor provides capital, materials and technical know-how.
ii. The private sector acquires the land outright or on a lease from the state, and hires rural workers to farm it. This model is referred to as “1+4,” where the farmer only supplies the labor.

Both models have been adopted in the biofuel sector. One trade-off appears to be that the “2+3” model ensures a greater share of benefits to the poor, while the “1+4” model can produce greater output. In fact, concessions on land under the second option have run into a number of problems. A World Wide Fund for Nature (WWF) report (WWF, 2007) notes that concessions have been issued in Cambodia for thousands of hectares of pulp, rubber, sugar, cassava and palm oil plantations. It identifies a number of major legal and administrative failings in the current concessions process. Above all, there is a lack of clarity and transparency in the way concessions are awarded; without environmental and social impact studies or consultation with local people.

There are a number of factors that are responsible for these problems. They include; a recent trend towards decentralization (which has given provincial authorities significant autonomy and greater financial incentives to offer concessions and sign contracts directly with foreign investors[32]), an unclear division of responsibilities between national and provincial authorities, a lack of adequate land-use planning at a landscape level, a disregard for the results of land-use planning processes at the local level, the absence of formal review processes for large-scale concessions (or their ineffective implementation), and a lack of cooperation between agencies with overlapping responsibilities.[33]

The proliferation of industrial plantations is also creating a number of environmental and social problems. On the environmental front these include: increased threats to alreadyunder- funded protected areas due to direct encroachment and the displacement of lowland farming communities by plantations; the fragmentation of ecologically important areas that lack formal protection; greater risks to connective corridors between protected and unprotected areas—which provide valuable habitat for wildlife species; and potential risks for watersheds and river systems.

In terms of social issues, there has already been a significant increase in conflicts between concessionaires and local communities over land and natural resources.[34] Another problem is the tendency towards policies that favor large-scale export agriculture (including industrial tree crops) over high-value smallholder crops, NTFPs, and other more sustainable options for rural development. Indeed, the broader goal of poverty reduction through rural development, promoted by both governments, may be undercut by the resultant surge in land conflict and the scramble for natural resources.

There is a growing perception that both countries are trading off some of their ecological assets (forests, minerals, water) in return for supposed benefits in terms of poverty reduction. Yet given the negative impacts of plantations on rural communities, which also depend on access to land and natural resources (as well as their mostly foreign ownership and external value chains), it is not clear whether a plantation strategy will help to alleviate poverty in rural areas. According to WWF it may further worsen poverty.

Even private sector operators (such as Biodiesel Cambodia) recognize the problems with concessions, citing land speculation and logging as important motives for buying concessions on the part of the private sector.

In view of this we would not recommend the present concession system as the way forward with biofuels. Nevertheless, even with contract farming there can be differences between a more “hands-on” approach—where the contractor specifies the methods to be used in great detail, purchases all of the output from the farmer who only produces jatropha and, in practice, treats the farmer as a worker—and a more “arms-length” approach—where the contractor or the government provide some guidance, materials, and even some credit, but the farmer continues to undertake other activities. The latter may entail lower productivity, but it represents a case of greater freedom for the farmer, and possibly less risk than going for a mono-cropping strategy.

In the section below we look at the possible benefits from the two approaches with jatropha production and expand on the scale indicated by the Biodiesel (2007) presentation. The following assumptions are made:

i. The target allocations of land to jatropha will start from 10,000 ha. in 2008 and go to 20,000 ha. in 2009, and 40,000 ha. in 2010. Following the analysis in Williamson (2006), 56 percent of the land will belong to private farmers, and 44 percent to concessions or arrangements that mimic closely concession operations.
ii. Yields on private farmers' land are around 73 percent of those achieved from larger concessions (Williamson, 2006). The actual yields may vary: from as low as 1,248 liters per ha. to as high as 3,260 liters per ha. The higher figure is taken from Briones (2006), and is based on Indian data. On the other hand, experts in Thailand have indicated that the lower figure may apply, at least initially, in that country.
iii. Costs and average yields are taken from a detailed study carried out for India and reported in Briones (2006). This takes the capital cost of a jatropha plant that processes 114,000 liters a year, as US$34,000. Such a plant would be fed from an area of 35 ha. on average in the case of the high yield, with a correspondingly larger area if the land is owned by the farmers, and a smaller area if it is owned by a concessionaire. In the case of the lower yield, the investment would cover an area of around 80 ha. The investment cost in growing the trees is around US$25,000, and the variable costs of harvesting and operating the plant are $40,000. Time to profitability is 3-4 years.

iv. In the case of smallholders, credit is provided to cover both the investment cost and loss of earnings for the period until the trees planted are profitable. The terms of the credit are 15 percent interest, 3 years grace and 15 years repayment. For the concessionaires, credit is from normal commercial channels at 12 percent over the same period.
v. The output from the plant is sold as diesel at a price of US$0.40 per liter, the current price in Cambodia. In addition, oil seed and glycerin, by-products from the processing, are sold at US$0.013 per liter of diesel produced. The market price of diesel in Cambodia is US$0.64 per liter, but this includes taxes. The price net of tax is around 40 cents a liter.
vi. Farmers invest 15 percent of their land for jatropha. Furthermore the program targets smallholders with an average holding of 1.5 ha. (i.e. the average amount of land held by poor rural households).
vii. Farmers share in any surplus from the sale of biodiesel and its by-products, in proportion to their capital investment.
The opportunity cost of participating in the program is the gross profit lost from conventional rice production, taken as US$46/ha. This is equal to the average land rent in Cambodia and is probably a high-end estimate of the opportunity cost, as the land used for jatropha will have a lower rental value.
viii. The percentage of poor farmers who engage in jatropha production are around 37 percent of the total number so engaged. This is based on projections of poverty from the World Bank Poverty survey (2006).

Table 4 [PDF 53.7KB | 2 pages] provides some of the key indicators of the benefits and costs of the first stage of such a program (i.e. 10,000 ha.).

As the table shows, the results depend significantly on the yields obtained. In the case of the smallholder component the farmers would make a gain of US$0.7 million with the bottom end of the yields but would make a gain of around $2.5 million with the upper end of the yields. In the former case the number of households taken out of poverty is around 6,500 whereas in the latter case is about 7,900. The program also provides employment to between 230 and 520 persons in the processing of the oil. Of these, between 80 and 190 would be taken out of poverty. There is an investment to be made by the farmers if this route is followed, and it carries a risk; if, for example, the yield turns out to be at the lower end of the range. The amount involved, however, is fairly modest—around US$240 per farmer.

The concession component has a higher output from a smaller area of land but does not generate as much in benefits to rural households. Between 1,400 and 1,500 rural working households are taken out of poverty as a result of the program. It does, however, create between 1,600 and 3,600 jobs. The macroeconomic benefits of the small program are also noteworthy; production of between 12 and 27 million liters (low and high yields respectively) would represent between 9 and 20 percent of official imports, but a significantly smaller percentage of actual consumption.[35]

If this program is replicated at a larger scale as indicated above, the benefits will increase in proportion. In 2012, for example, with another 20,000 ha. under jatropha, and in 2013 with another 40,000 ha., the total benefits will be as shown in **Table 5** [PDF 53.8KB | 2 pages]. Up to 193 million liters of biodiesel can be produced, enough to meet a significant part of the country's needs. At the same time 32,000 jobs will be created and around 60,000 rural households can be taken out of poverty. The costs of the program are fairly modest, rising from around US$20 million in 2008-2011, to US$87 million in 2010-2013. Some of this can be provided by the private sector, but part of it—especially providing micro-credit to small farmers—will need some public sector support.

Other issues related to the program worth noting are the following:

i. **Carbon Credits**. The possible carbon credits for a program like this have to be worked out, but the likelihood is that some benefits can be derived from the replacement of diesel with jatropha. This will depend on the processing of the biodiesel, including how much of the produced jatropha oil is used at that stage. To date, however, no Clean

Development Mechanism (CDM) project has credited carbon savings from biofuels, although there have been several where biomass has replaced fossil fuels. At the workshop on Biofuel Assessment in Cambodia in October 2007, it was reported that a price of US$10 per ton of CO2 in the CDM market would translate into a benefit to the producer of jatropha of around US¢4 to US¢5 per liter. This would make the economics of production significantly more attractive.

ii. **Environmental Benefits**. These have been noted qualitatively but should be evaluated in a quantitative manner as well. Reduced erosion and better management of animals should also produce benefits to the farmers, which have not been included in the analysis.

iii. **Risks**. The project has risk in the form of possible failure of the planting program because farmers cannot devote the time and effort required for its success. Another risk is that of a fall in the price of diesel, which would make the program uneconomic. At a price of around US¢40 per liter (before taxes), the smallholder program carries a full financial cost in the first year of around US¢48 per liter with the high yield, and a full financial cost of US¢56 at the lower yield. The concession program on the other hand has a financial cost of only US¢32 in the high yield case, and US¢40 in the low yield case; making it more viable. This makes the financing of the smallholder project problematic, although not impossible, if governments provide some support especially in the initial years, and if improvements in returns occur over time and prices increase in the future. If the price drops even a little however, programs such as these could be in difficulty. Give this relatively tight margin, a risk guarantee component for the project may be considered, which would provide compensatory support in the event of a fall in the price to one below a cut-off value. We would not favor a subsidy in the form of exemption from Value Added Tax (VAT), as proposed by the investors, although reduced tariffs on equipment and raw materials should be considered to make the programs more viable. Any carbon credit that can be obtained will also help make investments financially viable.

iv. **Capacity Building and Research**. These are essential components of a program like this, as farmers and workers need to be instructed in the best methods of planting and management of the jatropha trees. There is also a need for capacity building on fulfilling certification requirements, as applicable to OA, biofuel and GAP. Finally, as many experts have noted, jatropha plantations have many local factors that determine their success. A lot of research is needed to find out the most suitable methods, seeds etc., for Cambodian conditions. Donor support on a significant scale will be needed for all these purposes.

Cassava for Bioethanol in Cambodia

The production of cassava in Cambodia was around 536,000 tons in 2005-06, representing an increase of 48 percent over the previous year. Yields average 17.8 tons/ha., which are comparable to, but slightly lower than those in Thailand (20.3 tons/ha. in 2004-05). It is believed that Cambodian yields can be raised substantially. Thailand started with lower yields of around14 tons/ha. in the late 80s, but achieved large increases through adopting new high-yielding and high-starch varieties. It is also worth noting that yields in the Mekong Region are much higher than the world average, which is about 11 tons/ha.

Until the start of this year cassava was a feed crop, with some small quantities exported. Data on returns per ha. are not available for cassava for Cambodia, but in Thailand the costs are an estimated US$341.7/ha. for the average farmer. If the yield is 17.8 tons, and the root price is US$21.6/ton,[36] the farmer can expect to get a gross income of US$384.4/ha. and a net return of US$42.7/ha., which is slightly below the average for all crops in Cambodia (US$46.3) and well below that of rice (around US$100/ha.). Consequently one would expect farmers to grow cassava on land that is not suited to rice or some of the other higher value crops. Fortunately it is suited to poor soil and water conditions, and hence can complement other activities.[37]

Currently a private sector initiative is seeking to develop ethanol production from cassava, partly by leasing land to grow the plant, and

partly by buying from farmers. In this section we compare the benefits to the country, the farmers and workers, of the two methods of acquiring the feedstock. We also look at possible export benefits from the ethanol that would be produced and most of which will be exported.

The analysis investigates a program where production of cassava in the country is increased from around 535,000 tons fresh root in 2005, to nearly a million tons by 2011. This increase will be used to produce ethanol and some by-products, notably CO_2. Production of the increased cassava is undertaken partly by smallholders and partly by concessions given to the companies producing the ethanol. One such concession has already been granted to the Bio-Energy Group, who will procure 175,000 tons of feedstock from army and other government land, yielding 80,000 cassava chips.

The assumptions of the analysis are as follows:

i. Yields, which average 17.8 tons/ha will be increased by improved harvesting, application of fertilizer, and adoption of better varieties (Watananonata and Howeler, 2006). The estimate is that yields can be increased by about 5 percent to 22.8 T/ha by 2012.
ii. The price of fresh roots, which is given as around US$26/ton in 2006, will also increase as world demand for the feedstock grows. An IFPRI study (Rosegrant et al., 2006) predicts increases of about 33 percent by 2010, and further increases of between 20 and 100 percent by 2020. We take a more conservative estimate of increases of 33 percent to 2010, and 20 percent to 2020, and apply the increases linearly for intermediate years.
iii. The costs of production are taken from Watananonata and Howeler (2005), and adjusted for inflation. After 2006, further increases are at 8 percent in nominal terms for labor (which makes up about half the costs of production), and at 3 percent for other components. These increases refer to the US dollar costs of production.
iv. The opportunity cost for land that is shifted to cassava from other uses is taken at US$46/ha. This is increased at 8 percent in real terms, to reflect general growth in the economy.
v. The impacts of the program on the poor are estimated based on the previous calculation of the number of poor rural households and assumed to affect about 37 percent of the total. This percentage is expected to decline 5 percent reflecting national poverty reduction programs. It is further assumed that the share of farmers who are poor in the program is the same as the national average. The estimates of the numbers brought out of poverty are calculated on the same basis as for the rice program (see Section III.I).
vi. Average holdings are taken as 1.5 ha., which is equal to the national average.
vii. Concessional land is taken as 10,000 ha., which is roughly what the current private sector initiative plans to use.
viii. Wages are set as US$3.75/day, increasing at 8 percent per annum.

The resulting calculations are shown in **Table 6** [PDF 48.3KB | 1 page]. We note the following:

i. The smallholder component of the program would increase net farmer income by nearly US$10 million from 2006 to 2011. This would represent an increase in the household income of participating farmers of 69 percent in the first year, rising to 114 percent by 2011.
ii. Such increases would reduce poverty in about 7,300 of the participating 30,000 households. Recall that only about one-third of the households are actually poor in the first place, so the program effectively reduces poverty in the group by 73 percent. Part of the benefits arise from the higher price for the cassava, part from the higher yield, and part from the increased local demand created by the ethanol program. Without the increase in yields, the number taken out of poverty is only about 3,000, so that component is very important. Without the additional demand from the ethanol program, the increase would be about 5,700, so the ethanol program itself only contributes to about 1,600 of the total reduction.
iii. The concessionaire program is smaller, involving 10,000 ha. instead of 15,000 ha. under the stakeholder program. Its social impact, however,

is proportionately even smaller. Employment is created for about 2100 persons, who would almost certainly be moved out of poverty as a result of this employment. Earnings generated go up from US$7 million to US$12 million, which is comparable to the additional net incomes of the smallholders.

iv. The production of ethanol from the cassava would realise exports of US$32 million in 2008, rising to US$65 million by 2011. In addition, local sales of about US$7-10 million are generated from the CO_2 produced.

v. Other minor benefits include some employment created in the processing of the cassava chips to ethanol.

Issues that need to be addressed in such a program are the following:

i. **Carbon Credits**. The possible carbon credits have to be worked out, but the likelihood is that some benefits can be derived from the replacement of gasoline by ethanol. This will depend on the processing of ethanol, as well as the efficiency of the processes used. An analysis of these possible benefits should be carried out.

ii. **Risks**. The project has risk in the form of the possible failure of the program that is designed to increase yields. Amongst others, another risk is that of a fall in the price of gasoline, which would make the program uneconomic, but this is unlikely. At US¢60/liter, ethanol from this source is more expensive than from Brazilian sugarcane (ca. US¢21/liter), but less than from EU sugar beet (US¢77/liter). At current oil prices (ca.US$90/barrel), one would not need a subsidy to ethanol for it to be competitive—but at a price of US$28/barrel, a subsidy would be needed. Given the extensive program of subsidies being introduced in developed countries, cassava is likely to remain competitive as long as it has access to the Organisation for Economic Co-operation and Development (OECD) country markets.

iii. **Capacity Building**. This is an essential component of a program like this, as farmers and workers need to be instructed in how to increase yields for cassava. A major program would be needed for this purpose and should be costed carefully.

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1. **Chumroen Benchavitvilai**
(posted 16 May 2009 / 05:44:46 PM)

In fact all the LDC government must realize that the cost of Biofuel is /will be much more expensive than the mineral fossil fuel at any time. If the LDC like Lao,Cambodia and Myanmar wants to promote the Biofuel utilization as the national agenda .The policy makers in all countries must be able to find the satifatory answers to the following questions.

(1) Do the people in the poorest countries of LDC really need to pay for the expensive / high cost of Biofuel as teh real cost is w/o governemtn interention ?

(2) Will the governments of the LDC provide subsidies for Biofuel to

keep the Biofuel not to be too much more expensive that the mineral fossil fuel ?
The subsidies are both in term of production subsidies for lower production cost and consumer subsidies by waiving all related taxes eg energy tax, exile taxes VAT ,Energy fund etc.

(3) It is doubtfully that the governments in all LDC are able to effort to provide any sbsidies for Biofuel .
Normally the income from the energy usages is one of the main stream for revenue.
All government in LDC are haing the deficit budget forever.
Althrogh they may want to promote Biofuel and cover all the subsidies.
It is impossible to survive.

LDC countries should be the exporter of the Biofuel not teh teh end user of the Biofuel.