Diversifying small farms in Cambodia

Luke Simmons, Luy Pisey Rith and Taing Soksithon

Introduction

Rice is the most important crop in Cambodia and the vast majority of farmers rely on it for their food security. Since the early 1980s, much effort has gone into resurrecting Cambodia's agricultural systems and infrastructure following the damage caused by decades of civil war. Initially this work focussed on rice production, rice varietal improvement and repairing irrigation systems. Overall, this has been successful and at the national level the country has achieved a small rice surplus every year since 1995. However, analysis of the situation at the local level provides a less positive picture. Nearly half of the 24 provinces in Cambodia face food deficits with many families not being able to produce enough rice for their own consumption, leading to high levels of chronic malnutrition among children. Added to this, there is increasing pressure for land caused by a rapidly growing population.

Photo: L. Simmons

Mr Kheit Leam talking with friends about his farm improvement plans.

Cambodian farming systems need to be diversified, so that a greater range of crops and livestock are produced and food security guaranteed. Farm components also need to be integrated for improved production and environmental benefits. A local NGO called *Partnership for Development in Kampuchea* (PADEK) is helping farmers to improve their food security by providing affordable credit through self help groups and establishing a community-based agricultural extension network comprised of sustainable agriculture, livestock and fisheries experts who are selected and trained as service providers for their communities. This article presents the experiences of three Cambodian farmers who have used the training and support from PADEK to diversify and improve their farming systems. A checklist of sustainability criteria applicable to Cambodian family farming systems is used as a framework for comparing the three farming systems and highlighting areas where further improvements could be made.

Mr Khut Khoeun

Khut Khoeun lives with his wife Sam Thoun, their four daughters, two sons and two granddaughters in Romchek commune, Prey Veng Province in south-east Cambodia. Twenty years ago they established their own farm. For many years the family grew only rice and struggled to get enough food to eat. Over the years the number of family members increased but the size of the farm stayed the same and Khoeun knew that they had to improve their farming system if they were going to be able to feed everyone, pay for education and healthcare and improve the family assets.

In 2002, PADEK started to work in Romchek commune and began to train farmers on new crop and livestock production techniques, compost making and the benefits of ecological agriculture. Khoeun's family was inspired to try some of these techniques and they haven't stopped experimenting and improving their farm since. They have reshaped their farm into a series of canals, ponds, rice fields and banks for growing a great diversity of fruit, vegetables and herbs and raising livestock. All of the rice produced on their 2.1 hectares of rice land is needed to feed the family, so they concentrate their income-generating activities on their 0.35 hectare homegarden by growing a locally adapted herb, called eryngo (*Eryngium foetidum*) and a number of other crops such as cassava, gourds, chilli and lemongrass (*Cymbopogon citratus*), which they sell in the local market. The family also raise cattle, pigs, ducks and fish on their farm. The cattle are used for ploughing the rice fields and their dung is used to make compost. They are fed rice straw and allowed to graze on the grass growing along the banks of the rice fields. The pigs and ducks are kept in cages underneath the house and are mostly raised for consumption by the family. They are fed with rice bran, broken rice and vegetable wastes. The family have been experimenting with a nutritious pig feed made from the chopped stems of old banana plants, mixed with salt and palm sugar and their pigs have responded well. Two varieties of fish, common carp (*Cyprinus carpio carpio*) and silver barb (*Barbonymus gonionotus*) are raised together in ponds located in the homegarden. They are fed with rice bran and also feed on duckweed, a small aquatic herb that grows in the pond. Some animal manure is periodically added to the pond to stimulate the growth of the duckweed and other aquatic plants, for the fish to feed on.

Mr Kheit Leam

Kheit Leam lives with his wife Em Sarin, three sons, one daughter and her husband and three grandchildren in Por Chamroeun commune, Kampong Speu Province in the south of Cambodia. The family has been member of a self-help group since 1995. The members of the group meet once a month to deposit money into a group fund from which members can take loans. Mr Leam thinks that the self-help groups are an excellent way of saving and borrowing money and helping other people in the community in times of need. They are also a good opportunity to share new farming techniques and to learn from each other. The family has been able to use loans from the group and some of their own savings to buy a rice mill, piglets and chickens for their farm. The production of chickens and pigs is now one of their main income-generating activities.

Before 1995, the food security of the family was not good. They only grew rice on their farm and were heavily dependent on harvesting timber and fuelwood from the forest for additional income. After PADEK introduced self-help groups and new farming techniques to the area, the family began converting some of their rice land into vegetable gardens, fruit trees and ponds for irrigation. They began to grow new crops, such as peanuts, watermelons, cucumbers, tiger paw yams (*Dioscorea* sp.) and longbeans (*Vigna unguiculata*) and to raise chickens, pigs and cattle. They have built new pens for their livestock close to their house and a compost pit, which has facilitated feeding and the collection of manure.

Since diversifying their farm the family now has a relatively small area of rice land, only 0.82 hectares, but they manage this very intensively. In 2003, they started to experiment with the System of Rice Intensification (SRI) on their farm. Rice yields have improved to 3500 kg/ha, almost double the national average, and they have reduced their use of chemical fertilizers from three to one 50-kg bags of NPK, by increasing their use of compost. In the future the family plans to convert even more rice land into ponds for fish production.

Mr Kroch Khorn

Kroch Khorn lives with his wife Chhan Chun and their four children in Leang Dai commune, Siem Reap province, north-west Cambodia. They moved to the area in 1983 because they needed more farmland to support their growing family. However, life was a struggle for many years due to deficient water supply, poor soil fertility and ongoing fighting in the area. Things started to improve in the late 1990s when the fighting ended and in 1999, the family joined a self-help group and was able to save money and take out loans from the group for improving their farming activities and household assets. Most of the livestock and crops produced on the family's 2.9 hectares of rice land and 0.43 hectare homegarden are for subsistence, but as they have become more food secure they are starting to grow some additional crops for income generation.

In 2004 the family constructed a pump well in their homegarden. This has allowed them to start growing pesticide-free vegetables for hotels in the nearby town of Siem Reap. In their first year they made a good profit from this activity. However, rice yields in 2004 were very low due to a drought, exacerbated by the very low inputs of labour and compost that characterize traditional practice in the area. The family raise a small number of cattle, pigs, chickens and ducks on their farm. Cattle are used for ploughing the rice fields and the other animals are mostly for home consumption, although they are occasionally sold when the family needs additional income.

Next season the family plan to experiment with the SRI rice growing system. They also plan to plough their rice stubble into the field instead of burning it and to apply more compost on their fields in an effort to improve rice yields. They plan to grow nitrogen-fixing trees and crops such as sesbania (*Sesbania rostrata*) and swordbean (*Canavalia gladiata*) around their homegarden to be used as ingredients for compost making. They also want to build pens for their cattle, pigs and ducks close to their compost site, allowing for easier transfer of manure to the compost heap.

Sustainability of Cambodian farming systems

It is generally agreed that for agriculture to be sustainable it must be economically viable, environmentally sound and socially acceptable. Sustainability is a moving target and dependent on the time and location in which it is considered. Therefore, a farming system that is sustainable in one location or society may be completely inappropriate elsewhere. Likewise, a farming system that appears to be sustainable now may become unsustainable in the future if conditions change. A checklist of sustainability criteria for family farming systems in Cambodia was developed by PADEK to help assess the effectiveness of their food security programme (Table 1). The checklist is not supposed to give a conclusive answer as to whether a farming system is sustainable or not, but it does give an indication of progress and shows areas where improvements could be made in the future.

The checklist was used to compare the three farming systems described above (Table 2). All input and output data were >>

Table 1. Checklist of sustainability criteria for farming systems in Cambodia

Checklist for sustainability of rice crops

- Apply 5-10 ton/ha of good quality compost annually[1]
- Grow leguminous green manure crop prior to, or after the rice crop
- Plough rice stubble into the field (not burn it)
- Rice straw made into compost or fed to animals and manure used in compost
- The use of chemical fertilizers reduced and replaced by organic fertilizers and nutrient cycling
- Use of botanical pesticides rather than chemical pesticides
- Apply the principles of the System of Rice Intensification
- Save own seed for planting each year
- Irrigation system of ponds and canals integrated into the farm
- Return yields of greater than 2 ton/hectare[2]
- Return profits of greater than US$1.00 per labour-day[3]

Checklist for sustainability of secondary crops, vegetables and fruit trees

- Growing a diversity of trees and crops to optimize the use of space, light, nutrients and water
- Apply more than 5-10 ton/ha of good quality compost annually
- Apply liquid compost, Effective Micro-organism (EM) and Biological Extracts (BE) to crops
- Grow crops in rotation across different fields
- Use of mulch to protect the soil and conserve water
- Crop residues made into compost or fed to animals and manure used in compost
- Grow a green manure crop on the field each year
- The use of chemical fertilizers reduced and replaced by organic fertilizers and nutrient cycling
- Use botanical pesticides rather than chemical pesticides
- Save own seed for planting each year
- Irrigation system of ponds and canals integrated into the farm
- Return profits of greater than US$1.00 per labour-day

Checklist for sustainability of livestock production

- Animals kept in appropriate housing that is cleaned regularly
- Animal manure used in biodigesters, fishponds or for compost
- Animals vaccinated against common diseases
- Animals fed a nutritious diet of locally available fodder
- Return profits of greater than US$1.00 per labour-day

Checklist for sustainability of fish production

- Raising a diversity of fish species
- Fish raised in pond that is integrated with the homegarden, rice fields or animal pens
- Pond has available water for more than 6 months of the year
- Use locally available feed such as duckweed, rice bran and phytoplankton
- Return profits of greater than US$1.00 per labour-day

[1] Good quality compost should be made in a shaded area using a variety of materials such as manure, straw, leaves and other crop residues. It must not be left in the field in the sun or the rain for too long and should be ploughed into the soil prior to crop planting. The amount of compost that should be used varies depending on the soil type and crop variety but this range is a good guide for high crop yields and sustained soil quality.

[2] This is approximately the national average rice yield in 2003.

[3] Achieving a profit of greater than US$1.00 per labour-day would at least mean that the farming activity is returning a benefit roughly equivalent to other labouring sectors in Cambodia. In the case of subsistence crops, the value of the crop in the local markets should be used for the estimation of the value of the crop.

>> calculated on a per hectare basis to allow for comparison between the systems. Khut Khoeun and Kheit Leam are both making a profit in excess of US$1.00 per labour-day for their rice farming, while the rice farming of Kroch Khorn could be improved through greater attention to soil fertility and water management. All the farmers are making a good profit from growing secondary crops and vegetables. Khut Khoeun and two of his family members are employed almost full time growing crops on their 0.35 hectare homegarden and each make a profit of US$1.20 per labour-day. The other farmers make greater profits per labour-day for their secondary crops but they are not employed full-time on their farms and make a lower profit per hectare than Khoeun, who manages his homegarden more intensively.

All farmers use reasonably large amounts of compost on their secondary crops, between one and ten tons per hectare, depending on the crop type. Cattle, pigs and poultry are vitally important for their manure, which is combined with rice straw and other crop wastes to make this compost. However, all farmers mentioned that they did not have as much compost available as they would like and also used other methods for managing soil fertility including: green manures, mulching, crop rotations and liquid composts. Two of the farmers still used some chemical fertilizers on certain crops, but they plan to reduce this in the future by growing more nitrogen-fixing trees and crops on their land and collecting more biomass to make compost.

All farmers were using improved techniques of livestock production such as housing their animals in clean cages, feeding locally available and nutritious fodder and vaccinating their animals against common diseases such as Newcastle disease in poultry, swine fever in pigs and haemorrhagic septicaemia in cattle. The vaccines are bought from the Village Livestock Agents that PADEK has trained in each village. Only one of the farmers, Kheit Leam, was raising animals for sale and the majority of his farm income was derived from selling livestock, primarily pigs and chickens. Khut Khoeun was the only farmer raising fish on his farm, although Kheit Leam planned to start in the next year, after constructing a fishpond.

Conclusion

The three farm families presented in this case study all have different farming systems and income generation strategies, but they demonstrate that with hard work, careful planning and the diversification and integration of crop and livestock components, it is possible to earn a good living from farming and provide for their needs, while reducing the use of external farming inputs such as chemical fertilizers and pesticides. They also illustrate the importance of working together with friends and neighbours and sharing ideas and resources to improve the lives of everyone in the community.

Farm diversification may lead to increased workloads for the family. The three families of this study did not mention increased labour as a constraint, but this may be a potential barrier for other farmers. However, many farmers in the area are not employed for the full year on their farm and males often go to the city in the dry season to search for a job. Diversification activities, especially those involving vegetables but also fruit trees and livestock, may allow farmers to stay working on the farm in the dry season and make an income without depending on labour opportunities in the city.

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Table 2. Overview of farm production for Khut Khoeun, Kheit Leam and Kroch Khorn

Farming subsystem	Khut Khoeun	Kheit Leam	Kroch Khorn
Wet season rice production			
Amount of compost and manure (kg/ha)	1500	2439	207
Grow a green manure crop	No	Yes	No
Rice stubble ploughed into the field	Yes	Yes	No
Rice straw used for fodder and compost	Yes	Yes	Yes
Amount of chemical fertilizer (kg/ha)	0	61 (NPK)	0
Use chemical pesticides	No	No	No
Apply principles of SRI	Some	Some	No
Save own seed for planting	Yes	Yes	Yes
Irrigation system available for rice fields	Yes	Yes	No
Yield (kg/ha)	1500	3512	166
Profit per labour-day (US$)	1.60	1.05	0.35
Annual profit per hectare (US$)	210.30	522.55	11.55
Secondary crops and vegetables			
Growing a diversity of crops and trees	Yes	Yes	Yes
Amount of compost and manure (kg/ha)	3000-10 000	1250-5000	3000-10 000
Apply liquid compost, EM and BE	Yes	No	No
Use crop rotations	Yes	Yes	Yes
Use mulch to conserve water	Yes	No	No
Crop residues made into compost	Yes	Yes	Yes
Grow a green manure crop	No	No	No
Amount of chemical fertilizer (kg/ha)	0	0-100 (NPK)	0-100 (NPK)
Use chemical pesticides	No	Some	No
Save own planting material	Yes	Some	Some
Irrigation system in homegarden	Yes	Yes	Yes
Profit per labour-day (US$)	1.20	4.40	2.90
Annual profit per hectare (US$)	3048.05	309.40	484.60
Animal production			
Appropriate and clean animal shelter	Yes	Yes	Yes
Manure used for compost	Yes	Yes	Yes
Animals vaccinated against disease	Yes	Yes	Yes
Animals fed a nutritious diet of local fodder	Yes	Yes	Yes
Profit per labour-day (US$)	Unknown	Unknown	Unknown
Annual profit (US$)	0	754.25	0
Fish production			
Fishpond integrated into farm	Yes	Yes	No
Pond has water for greater than 6 months	Yes	Yes	N/A
Raising a diversity of fish species	Yes	No	N/A
Fish raised on locally available feed	Yes	N/A	N/A
Profit per labour-day (US$)	Unknown	N/A	N/A
Annual profit per hectare (US$)	306.10	N/A	N/A

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Luke Simmons, **Luy Pisey Rith** and **Taing Soksithon**. Partnership for Development in Kampuchea (PADEK), P.O. Box 554, Phnom Penh, Cambodia.
Website: www.padek.org; Email: padek@everyday.com.kh ;
main author's Email: nomadiccatalyst@yahoo.com.au