Ministry of Agriculture and Forestry
National Agriculture and Forestry Research Institute

Farming Systems Research/Extension Component

RESEARCH UPDATES

FSRE On-Farm Trials
2004-2005 Cropping Season

Lao-Swedish Upland Agriculture and Forestry Research Program
June 2005
Field Report No. 2005/05

Farming Systems Research/Extension Component

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Farming Systems Research Component

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Lao-Swedish Upland Agriculture and Forestry Research Programme
Acknowledgement

We thank the men and women staff of the Farming Systems Research/Extension Component for their hard work and commitment in planning, implementing and monitoring the on-farm trials for the 2004-2005 cropping season. This is despite the many challenges faced while working with farmers, with their research teammates and within the program.

We value the active involvement of our farmer partners in the project villages. To them we are thankful for sharing their time, labor, land and local knowledge in conducting the on-farm trials.

The review by research managers and senior program coordinators for each of the trials and their recommended plan of activities is much appreciated.

We welcome your comments and feedback to this report.

Blesilda M. Calub
Farming Systems Research/Extension Adviser
Lao-Swedish Upland Agriculture and Forestry Research Program
Summary

In the cropping season, April 2004 to March 2005, the Farming Systems Research/Extension Component implemented 12 On-Farm Research topics. This is in response to one of the main objectives of the Lao-Swedish Upland Agriculture and Forestry Research Program (LSUAFRP), namely:

“To develop productive upland technologies and land management recommendations that are acceptable to farmers for poverty alleviation and sustainable use of natural resources.”

The on-farm trials conducted by LSUAFRP in 2004 were grouped according to three major categories: (1) crop-animal systems; (2) integrated annual crop-based systems; and (3) integrated perennial crop-based or agroforestry systems.

The trials are now in various stages of implementation. The trials which are well-accepted by farmers include: fish + rice; ducks + rice; goat + fodder bank; corn + legumes; fruit trees + crops; agarwood + crops and rubber + crops. These trials are being refined and explored for expansion in terms of area coverage and number of farmer participants. The other trials need further study and adjustments. Factors affecting technology performance at bigger scale will be studied. Adoption behavior of farmers, reasons for adoption or non-adoption of the technology options will be documented.

This report highlights the progress of those on-farm trials, the relevance and justification of the technology design, methods used, what has been achieved so far and what remains to be done in the coming 2005 cropping season.
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1. Introduction

Outstanding agricultural technologies developed in research stations do not necessarily perform similarly under farmers’ fields, where environmental conditions are highly variable and not normally within the control of farmers. Likewise, the interplay of socio-cultural, economic, policy and institutional factors affect the actual performance as well as adoption of such technologies.

Thus instead of developing technology packages in research stations and transferring them to extensionists and farmers, the trend now is to develop and fine-tune potential technology options in farmers’ fields and with active participation of farmers. This is the essence of On-Farm Research.

More recent terms like *farmer participatory research* and *participatory technology development*, have their roots from on-farm research. These approaches have evolved as development workers realize more and more the importance of farmers’ active involvement in developing technologies that are relevant to their needs, priorities and prevailing environments.

On-farm research has the following objectives:

1. To compare a recommended technology with that of farmer’s technology or traditional practice in terms of: (a) productivity; (b) profitability; (c) acceptability; and (d) sustainability
2. To test the performance of a recommended technology under farmers’ conditions
3. To adjust a recommended technology so that it can fit into the existing farming system

Aside from refining technologies together with farmers, on-farm research plots serve as demonstration areas where other farmers can observe promising integrated farming systems. It also cultivates or encourages farmers to experiment with new crops or new farming techniques.

In the cropping season, April 2004 to April 2005, the Farming Systems Research/Extension Component implemented 12 On-Farm Research topics. This is in response to one of the main objectives of the Lao-Swedish Upland Agriculture and Forestry Research Program (LSUAFRP), namely:

“To develop productive upland technologies and land management recommendations that are acceptable to farmers for poverty alleviation and sustainable use of natural resources.”

This report presents an overview of the progress of those on-farm trials, the relevance and justification of the technology design, what has been achieved so far and what remains to be done.

2. The project areas

The LSUAFRP modestly operates in 2 of the 10 priority poorest districts classified under the National Poverty Eradication Program (NPEP, 2003). These are Phonxai District in Luang Prabang Province and Namo District in Oudomxay Province. Both are located in Northern Laos where 45% of the poorest of the country live.

In Phonxai District, LSUAFRP currently serves the villages of Huaymanh, Nambo, Thapo Tai/Thapo Neua and Huaymaha. Future activities are planned to be implemented further into the more remote villages of Phongthong, Que Lai, Nang Neu and Nang Ngoi.

In Namo District, the villages currently being served are Namo Neua, Saysamphan, Mixay, Pangdou and Pangthong. Future areas planned to be served are Namo Tai and Kokfaad.
Ethnic groups in the Phonxai villages generally consist of Lao Loum, Khamu and Hmong. Those in Namo villages are Hmong, Tai Dam, Phousang and Khamu.

Both project areas are characterized by moderate to rugged mountain slopes and small valley bottoms where lowland rice cultivation is possible. Vegetable gardening and annual cropping is usually done along stream banks and riverbeds. The steep slopes are generally subjected to shifting cultivation which has resulted to receding forest cover and declining soil fertility. The soils in Phonxai consist of heavy clay to sandy loam of low to medium fertility. In Namo, soils consist of heavy clay to clay loam of medium to high fertility.

Figure 1. Location map of LSUAFRP project areas (2002-2005).

3. Focus of on-farm trials

3.1. Problem-solving focus

Solving farmers' problems is the main focus of on-farm trials. Problem diagnosis is therefore the first step. This focus on solving farmers’ problems ensures that research is not done for the sake of research alone but that it is done for the purpose of development or improvement.

It is important that researchers, extensionists and farmers jointly diagnose the problems and their root causes. Problem-diagnosis though is not a one-time activity. The iterative nature of FSR needs a constant review, re-diagnosis and re-planning as new situations and problems develop. The FSR researcher therefore needs to be dynamic and be able to respond to these new changes and challenges.
In the LSUAFRP, problem-diagnosis was done through several activities, namely: (a) the diagnostic and household surveys of 2003; (b) Participatory Rural Appraisal (PRA) of 2004 and (c) regular field monitoring.

3.2. Research focus

Next to problem-diagnosis is listing of possible solutions to problems. The listing should segregate solutions which can be achieved by conducting research versus those which can be done by alerting the extension service. For example, the problem on lack of fodder resources for goats can be responded to by conducting research on fodder species suitable to existing conditions and management in the site. However, for problems like common animal diseases and parasites, research is not necessarily needed. The technology for vaccinations and anti-parasitic compounds already exist. This problem can be solved through proper delivery of services by extension agents.

Because on-farm trial is a research activity, it therefore needs to have clear research objectives, methodologies and systematic ways of implementation, data collection, analysis and report write-up. For the staff of the FSRE component, stepwise on-the-job training modules were conducted to strengthen their ability to conduct on-farm research.

3.3. Integrated farming systems focus

Farming systems research (FSR) does not only deal with one commodity. Rather it focuses on the integration of several components like crop, soil, tree or animal combinations. It studies the interactions of these components and how they can be optimized to solve farmers’ problems.

Thus, the on-farm trials conducted by LSUAFRP in 2004 were grouped according to three major categories: (1) crop-animal systems; (2) integrated annual crop-based systems; and (3) integrated perennial crop-based or agroforestry systems. The specific on-farm research topics per category are presented below.

Crop-Animal Farming Systems
- Fish + lowland rice
- Duck + lowland rice (rice varietal trials superimposed)
- Duck + lowland rice + improved feeds
- Chicken+ cassava + pigeon pea
- Pig + cassava + pigeon pea
- Goat + fodder bank

Integrated Annual Crop-based Farming Systems
- Corn + peanut/soybean intercropping + lemon grass hedgerows
- Green manure - lowland rice – soybean relay cropping
- IPM for off-season cabbage (Use of neem extract as bio-pesticide)
- IPM for off-season cabbage (Use of Diadegma as bio-control agent)

Perennial Crop-based Intercropping Systems
- Fruit trees + hedgerows (stylo + pineapple) + upland rice
- Agarwood + Sesbania + Lychee+ Banana hedgerows (stylo) + annual crops
- Rubber tree + lychee + job’s tears
- Teak + pigeon pea hedgerows + annual crops

4. Research Program Basic Information
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<tr>
<th>Research Unit</th>
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<td>Research program</td>
<td>Lao-Swedish Upland Agriculture and Forestry Research Program</td>
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<td>Implementation Period</td>
<td>2002-2006</td>
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<td>Program Objectives</td>
<td>• To develop productive upland technologies and land management recommendations that are acceptable to farmers for poverty alleviation and sustainable use of natural resources.</td>
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<td>• Strengthen the capacity of NAFRI and its local partners to undertake research and provide effective research support activities.</td>
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<td>• Provide information, feedback and methodologies for natural resource planning/management and policy development</td>
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<td>Component</td>
<td>Farming Systems Research/Extension Component</td>
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<td>Expected Outputs from this Component</td>
<td>• Technologies and recommendation domains are developed based on indigenous and new knowledge that improve the sustainability and productivity of existing upland farming systems.</td>
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<td>• Staff are trained in FSR/E methodology and research/extension coordination capacity is developed that enables multi-disciplinary teams, extension agents and farmers to work together effectively.</td>
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<td>• On-farm research is complemented by appropriate extension support and research results are disseminated to farmers in a timely way.</td>
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## 5. Research Updates

### 5.1. Research Project

<table>
<thead>
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<th>Crop-Animal Farming Systems</th>
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<td><strong>Period Covered:</strong></td>
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### 5.1.1 Research Study

<table>
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<tr>
<th>Performance evaluation of a goat + fodder bank system compared to farmers’ practice</th>
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<tr>
<td><strong>Research type:</strong></td>
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<tr>
<td>On-farm research</td>
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<td><strong>Objectives:</strong></td>
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<tr>
<td>To compare the performance of a goat + fodder bank system with that of farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.</td>
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<td>To find out a suitable system of adapting the technology to suit farmers’ practices and preferences.</td>
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<tr>
<td><strong>Justification &amp; relevance:</strong></td>
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<tr>
<td>Farmers’ traditionally raise their goats by free-grazing in communal lands and forests. Fodder for goats becomes a problem during the dry season when most forages die. Weight gained by goats in the rainy season is likely to be lost during the dry periods of fodder scarcity. With inadequate nutrition during the dry season, goats become highly susceptible to diseases and parasites in the following rainy months. Experience has shown that high animal mortality usually occurs at the onset of the rainy season.</td>
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<td>Under the alternative technology of having a fodder bank, good quality and quantity of feed is provided as supplement to free grazing. The semi-confinment with cut-and-carry system assures adequate nutrition and helps farmers monitor the health status of the animals. Deworming is done to eliminate parasites. If properly managed, the system will result to faster growth, better reproductive performance and more healthy animals. This can thus lead to more animals that can be sold or consumed by farmers over a shorter period of time.</td>
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<tr>
<td>Adoption of the technology can be affected by social structures in the village, since traditional farmers’ practice is to raise goats under a communal system. By understanding this social system, the program will be guided on how to adjust this technology to suit local needs.</td>
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<td><strong>Expected output:</strong></td>
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<tr>
<td>A goat +fodder bank technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.</td>
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<tr>
<td><strong>Review of related work:</strong></td>
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<tr>
<td>On-station trials conducted in the Agroforestry Research Station in Tongkhan, Luang Prabang revealed good growth and herbage production of guinea grass and stylo.</td>
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In the Asian region particularly Vietnam, Indonesia, Thailand and the Philippines, properly managed goat + fodder bank systems have been promoted successfully. In Laos, the CIAT program has good experience of this system in Luang Prabang and Xiengkuang Provinces.

**Highlights of results**

In Saysamphan, on-farm trials in 2004, showed higher live weight gains of goats after four months raising in the fodder bank system. Some of the goats are now pregnant. Farmers say the added advantage of the system is that goats do not get lost in the forest and that health of the animals is easier to monitor. Five farmers under $T_0$, five farmers from $T_1$ and five new farmers want to join together to establish a 2-hectare fodder bank within the village. They intend to raise their goats together.

The goat repayment system could be an entry point for organizing a goat raisers’ group in the village. Farmers propose to modify the goat+fodder bank system from cut-and-carry to rotational grazing. Farmers will then need training on rotational grazing.

In Nambo, on-farm trials in 2004 was not able to continue. The farmer group planted the guinea grass, stylo and fodder trees together however they were not able to build a fence to protect the fodder bank. Free roaming goats grazed on the experimental area. The farmers are now being encouraged to build the protective fence first before we can be able to continue the trial.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Ban Saysamphan, Namo District and Ban Nambo, Phonsay District.

**Methods**

The study will retain the 2 treatments, namely:

$T_0$ = farmers’ practice; free grazing in natural communal lands and forests

$T_1$ = goat + fodder bank system; goats raised in semi-confinement; free grazing is supplemented by feeding guinea grass and stylo; deworming and vaccination is practiced; fodder bank consisting of guinea grass, stylo and fodder trees was established 4 months before the goat feeding started.

Replication is 10 goats assigned to 5 farmers (2 goats per farmer) under 2 treatments. Experimental design is RCBD.

Data to be collected:

In Saysamphan: Goat reproduction data (date to first pregnancy, date to parturition; number of live births; live birth to still birth ratio; birth weight of kids). Herbage production of fodder bank; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ adoption behavior; farmers’ organizational agreements

In Nambo: Growth reproduction data from experimental goats; Growth and herbage production of fodder bank; farmers’ adoption behavior; farmers’ modification of the technology.
Plan of Activities for 2005

In Saysamphan: The goat repayment system could be an entry point for organizing a goat raisers’ group in the village. Farmers propose to establish a bigger fodder bank but want to modify the system from cut-and-carry to grazing. The trial will be adjusted to be able to promote rapid rotational grazing system.

In Saysamphan: Plan with farmers how to organize their group; Agree on location of new site; Work schedule to establish the fodder bank; Repayment system of the goats; Pass forward to other farmers the “repayment goats”; Agree on criteria to use in selecting new farmers (giving priority to poorest and women) who will be receiving the “repayment goats”; Continue the remaining data collection activities for the 2004 trials.

Farmers will need training on
1. How to manage fodder banks under a rotational grazing system. Focus should be on:
   1.1. how to make sure that the fodder bank will not be overgrazed by using paddock system; multipurpose live fence/fodder trees are recommended to be used for the paddock borders;
   1.2. recommend rapid rotational grazing (moving the animals out of the paddocks every three days) to control internal parasite infestation.

2. Community organizing and action planning
   2.1. organizational management
   2.2. simple book keeping

In Nambo: Plan with farmers how they can revive the fodder bank making use of fodder tree cuttings as live fence. Assign farmers to the treatments being studied.

In other villages: Possibility to initiate Cycle 1 (On-farm trials) of Farming Systems Research

Need to present economics information on start-up investment costs and cost-benefit analysis

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved

NAFReC; Vaya,
DAFO Namo; Keoprasert; Southana
DAFO Phonsay; Vongsith transferred to PAFO; replacement to be named.
5.1.2 Research study title | Performance evaluation of an integrated duck + lowland rice system compared to farmers’ practice

5.1.2.1 Sub study a: Ducks raised in lowland rice paddies versus raised in village backyards

Research type | On-farm research

Objective | To evaluate the performance of an integrated duck + lowland rice system compared to farmers’ practice of duck raising in village backyards in terms of productivity, profitability, farmers’ acceptability and sustainability.

Justification & relevance | Farmers of Thapo Tai, Phonsay traditionally raise their ducks in village backyards through scavenging system. Sometimes they are fed crop by-products like rice bran, broken rice, corn grits and some kitchen scraps. The total feed available is not enough to sustain the nutritional requirements of ducks.

Raising ducks in rice fields results to beneficial effects both to the rice crop and to the ducks. While ducks are in the rice fields their droppings provide some nutrients to the soil. The rice crop likewise benefits from the biological control that ducks provide. Ducks eat snails, insects and weeds that are otherwise pests to the rice crop. After rice harvest, ducks are released in the rice fields to consume leftover grains.

Proper timing of integration is key to the success of this technology option. As this technology is new for this village, this study will look into how it can fit into farmers’ existing system.

For this trial, a rice varietal trial was superimposed to determine the most suitable rice variety for this system.

Expected output | A duck + lowland rice technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.

Review of related work | The duck + rice technology has been practiced with success in other areas in Laos such as in Namo Neua, Namo District, Oudomxay. It is also well documented in other Asian countries like Vietnam, Thailand and Philippines.

Rice-duck systems in Vietnam eliminate the need for herbicides and insecticides. Ducks in rice fields consume weeds, insects, white and brown plant hoppers, mosquito larvae, other pests and snails. The scavenging ducks also fertilize the growing rice crop with their droppings, thus reducing the need for chemical fertilizers and improving yields (Ogle and Bui Huy, IRDC Currents 13/14).
The two components (rice and ducks) can benefit from each other from the integrated scheme. With the ducks free-ranging in the paddy fields, they are able to control golden snail (*Pomacea sp.*), insect pest and weed populations, hence reducing the costs on pesticides. Also, the manure of the ducks can serve as organic fertilizer for rice and other crops thus, a savings on the cost of inorganic fertilizer. On the other hand, the paddy fields and the surroundings serve as good feeding grounds for ducks resulting to a substantial reduction in feed costs. Irrigated rice farms provide the natural aquatic habitat of these waterfowls. Growing rice and ducks in the same piece of irrigated land leads to maximum utilization of resources while adopting organic farming and nutrient cycling principles in a way that would promote agroecosystem's health including soil biological activity (Escobin et al. 1988, UPLB Philippines).

**Highlights of results**

Total weed population was reduced by 30-87% in rice fields with ducks.

Data on live weight gain of ducks and mortality are still being analyzed. Data on feed consumption is being traced.

Data on yield of different rice varieties with and without ducks is being analyzed. TDK 5 rice variety was the most acceptable to farmers.

There were delays in planting the rice crop and in the delivery of ducks. High duck mortality occurred in several farms. This could be due to delayed vaccination against Duck Cholera and predisposition to disease due to inadequate nutrition. Some farmers were not so clear regarding ownership of the ducks so that they were quite hesitant in giving enough feeds to the duck.

Several changes of research staff assigned for this study resulted to coordination problems. This in turn affecting the smooth implementation of activities and data gathering.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Ban Thapo Tai, Phonsay District.

**Methods**

The study will continue to have 2 treatments, namely:

\[ T_0 = \text{Farmers’ practice; ducks raised in village backyards with usual feed supplementation} \]

\[ T_1 = \text{Ducks raised in the rice fields with usual feed supplementation} \]

Replication is across 5 farmers per treatment. Statistical design is RCBD.

Data to be collected:

- Weight gain, egg production and mortality of ducks; data on insect pest occurrence, weed composition, growth and yield of rice with and without ducks; cost of inputs; selling prices; farmers’ evaluation of the technology.
Plan of Activities for 2005

The trial will be continued in Thapo using the best performing and most preferred rice variety by farmers based on 2003 and 2004 trials (TDK 5). Egg production data and duck mortality will be monitored. More timely start up of activities will be done.

Additional farmers’ training on the technology will be conducted. Use of locally available feed resources will be encouraged more. There will be closer monitoring of duck diseases. Farmers’ PM&E will be conducted again at the end of the cropping season.

Criteria for selection of new farmer partners should consciously ensure that the poorest in the community are able to participate. Causes for inability to participate needs to be documented and addressed.

The technology may need to be redesigned for poor farmers who do not have rice lands. They may opt to raise ducks in their backyards using local breeds like “black duck”. This breed can survive on low quality feeds and requires minimal care.

Information on performance of different duck breeds (Peking, Vietnamese or Lao black duck) will be checked if available from the Livestock Research Center. If not, NAFReC will conduct on-station research to evaluate various duck breeds in terms of live weight gains, reproductive capacity, egg production, feed consumption, feed conversion efficiency, disease resistance, market demands.

Need to present economics information on start-up investment costs and cost-benefit analysis

Workplan

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Staff involved

Souvanh (NAFReC); Vongsit (DAFO Phonsay) (transferred to another office); Mr. Somchan (NAFRI) took leave for English studies.

Research partners

Chief Veterinarian, Animal Health Unit, PAFO, Luang Prabang
Senior Students of Nabong and Pakseuang Faculties of Agriculture
5.1.2 Research study title | Performance evaluation of an integrated duck + lowland rice system compared to farmers’ practice
---|---

5.1.2.2 Sub study b: Improved feeding system for ducks raised in lowland rice paddies (Namo District)

<table>
<thead>
<tr>
<th>Research type</th>
<th>On-farm research</th>
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<tbody>
<tr>
<td>Objective</td>
<td>To evaluate the performance of an integrated duck + lowland rice technology using improved feeding system in terms of productivity, profitability, farmers’ acceptability and sustainability.</td>
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</table>
| Justification & relevance | Farmers of Namo Neua have been traditionally raising their ducks in rice paddy fields. However, their main constraint is high duck mortality due to diarrhea and lameness. Diarrhea was most likely due to Fowl Cholera. Lameness was attributed to low calcium, phosphorus and B vitamin complex in the diet.  

Fowl cholera can be checked through proper vaccination by the extension office. On the other hand, lameness can be addressed by improved feeds and feeding system. This study therefore focused on understanding the constraints in the existing feed resources and feeding system. This became the basis for recommending technology options to address such constraints.  

Farmers were found to use locally available rice bran which contains a high proportion of rice hulls. Sometimes when feeds become scarce farmers deliberately feed pure rice hulls. This negatively affects animal growth due to high silica and lignin contents; low feed intake; reduced proportion of energy, proteins, B vitamins and other minerals.  

Improved feeds (Ca-P supplementation) and feeding practices (removal of rice hulls) will result to better animal growth and resistance to disease. Farmers will then have more and better animals for home consumption or for sale. |
| Expected output | A duck + lowland rice technology with improved feed recommendation to suit prevailing bio-physical and socio-cultural conditions in the target villages. |
| Review of related work | The duck + rice technology has been practiced with success and is also well documented in other Asian countries like Vietnam, Thailand, Philippines ([http://www.palawan.com/agriculture/riceduckfarming.html](http://www.palawan.com/agriculture/riceduckfarming.html)) and Japan.  

In Japan, ducks ("aigamo" in Nipongo) are allowed to stay and swim in the rice field from shortly after seedling transplanting. The ducks eat the weeds as they sprout (but not the rice seedlings as they do not like the rice plant’s stiff, high-silica leaves) and any insects that may land on the rice plants. The ducks’ excreta then fertilize the soil providing nutrients for the rice growth. A well-known practitioner husband and wife team of this system, Mr. Takao Furuno and his wife in Keisen Town, Fukuoka Prefecture has obtained yields of 6,470 kg/ha of unpolished rice, where the average rice yield in his area is 3,830 kg/ha. ([www.jha.brs.nihon-u.ac.jp/~asano/aigamo1-e.htm](http://www.jha.brs.nihon-u.ac.jp/~asano/aigamo1-e.htm) - 11k) |
Highlights of results

Improved feeds resulted to higher live weight gains of T1 ducks. This was most apparent from the 2nd to 3rd months.

Data on rice yields, weed population, duck mortality and feed consumption are being analyzed.

Farmers observed less weeds in rice fields with ducks therefore they only had to do the weeding once instead of the usual two times. They also observed that the rice leaves were greener and have more tillers indicating better growth. They claim this resulted to better yields than the usual rice without ducks.

Farmers recommend though that ducks should have been given much earlier so they can be released at (1) plowing time, (2) at 2 weeks after transplanting until the rice starts to flower, and (3) again after rice harvest.

Growth and production data are being analyzed.

Location

The study will continue to be conducted in Namo Neua. New farmers in Namo Tai signified interest to try this technology.

Methods

The study will continue to have 2 treatments, namely:

\[ T_0 = \text{Farmers’ practice (ducks are fed rice bran with high percentage of rice hulls; feeding of pure rice hulls when other feeds are no longer available; other usual feeds like root crops and weeds are given)} \]

\[ T_1 = \text{Improved feeds (Farmers’ usual feeds except rice hulls*+ supplementation with bonemeal and salt)} \]

\[(* \text{rice bran is sieved to separate the bran from hulls; feeding of pure rice hulls was discouraged)} \]

Replication was across 6 farmers per treatment. Statistical design is RCBD.

Data collected:
Live weight gain, egg production and mortality of ducks; data on insect pest occurrence, weed composition, growth and yield of rice with and without ducks; cost of inputs; selling prices; farmers’ evaluation of the technology;

Plan of Activities for 2005

The existing trial will continue to be monitored for additional data on egg production. Data collection on duck weight gain should continue longer to be able to plot age of maximum weight gain and compared against feed conversion efficiency. A documentation will be done regarding:

1) Farmers’ adoption behavior
2) Farmers’ adaptations and modifications of the technology to suit their needs

These duck farmer groups will be activated to discuss repayment schemes that will be able to provide initial ducks to other interested farmers.

New farmers of Namo Tai are interested to join this trial. Their indigenous practices for raising ducks will be documented and assessed. Preference for meat or egg production will be noted. Depending on the problems and
constraints they face regarding duck raising, a suitable on-farm trial will be
designed to address those constraints. These farmers will be given training
and assistance to set up their on-farm trials.

Need to present economics information on start-up investment costs and
cost-benefit analysis (in collaboration with Socio-Economics Component)

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved: Souvanh (NAFReC), Southana (DAFO Namo)

Research partners:
- Chief Veterinarian, Animal Health Unit, PAFO, Luang Prabang
- Senior Students of Nabong and Pakseuang Faculties of Agriculture

5.1.3 Research study title

Performance evaluation of an integrated fish + lowland rice system compared to farmers’ practice of growing rice only

Research type: On-farm research

Objective: To evaluate the performance of an integrated fish + lowland rice system in terms of productivity, profitability, farmers’ acceptability and sustainability.

Justification & relevance:
Fish in rice paddies offer another opportunity to take advantage of the more positive interaction between these two components than if they were raised separately. Fish eat some weeds, insects and larvae. They can aerate the soil in the paddies to promote better rice growth. Animal manure intended to favor growth of phytoplanktons for fish also benefits the rice crop. The fish component provides nutritious food and/or income for the farm family.

The proper kind of fish or combinations of fish, sourcing of fingerlings, proper feeding, fish management and timely integration into the rice fields needs to be studied in order to fit it properly into the existing rice production activities as well as to farmers’ existing resources.

Expected output: A fish + lowland rice technology recommendation to suit prevailing biophysical and socio-cultural conditions in the target villages.

Review of related work: The fish + rice technology has been practiced with success and is also well documented in other Asian countries like Vietnam, Thailand, China and the Philippines.
### Highlights of results

Data on rice yields, fish growth, feed consumption, weed dynamics and economics are being analyzed.

Farmers observed less weeds in the paddy fields with fish. They also see fish eating some insect larvae. The initial farmers who joined the trials are eager to expand their areas for fish +rice cultivation. There are about 20 other farmers who are interested to try this technology.

The constraint for expansion however is in sourcing the fingerlings. At present, the fingerlings come from the Fishery Center in Oudomxay. Farmers say it is too far from Namo, the fingerlings are likely to die during transport and cost for transportation is high.

In view of this and because of their own request, some farmers were brought to Oudomxay for training on fingerling production. However, after the training they say they still cannot produce the fingerlings due to lack of water in the fields and lack of other technical inputs. It would be good to invite a fishery expert to come to Namo Neua to assess the potentials of the area for fingerling production and advise farmers on how to set it up in the village.

Another constraint faced is that the rice plants had the tendency to lodge because the water cannot be taken out early enough. Proper timing and water management needs to be improved to avoid lodging of the rice plants but still allow maximum time for the fish to grow. Use of lodging-resistant varieties can also be evaluated.

Growth and production data are being analyzed.

### Location

This study was implemented in Namo Neua, Namo District.

### Methods

This study had 2 treatments, namely:

- \( T_0 \) = Farmers’ practice (rice crop only)
- \( T_1 \) = fish +rice technology

Replication is across 6 farmers. Statistical design is RCBD.

Data to be collected:
- Rice and fish production data; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modifications on the technology; farmers’ coping strategies regarding fish fingerling production.

### Plan of Activities for 2005

Many farmers of Namo Neau are interested to try this technology by themselves but need help in terms of sourcing or producing fingerlings.

Technical advice regarding suitable location of fish breeding ponds (in Namo Neua or Mixay), water harvesting and management and other technical aspects will be coordinated with fish experts from LARREC or the Fishery Station in Oudomxay or in Luang Prabang.

Not all farmers have to be trained. Only selected farmers who are very interested, are willing to invest time and effort for fingerling production and are
willing to supply the fingerlings to other farmers will be trained. The rest of the other farmers may be involved in the grow-out operation.

We need to look into the most appropriate mechanisms to enable farmers to set-up fingerling production groups. Technical and fund assistance may be needed. Mechanisms for availing and managing funds by farmer groups will be studied.

The technology can be further refined by using different fish combinations (polyculture) to maximize habitat and to appeal to consumer preferences.

Most appropriate rice varieties especially those resistant to lodging will be evaluated. Proper water management will be looked into to favor fish growth but not cause lodging to the rice crop.

This technology may need to be adjusted to suit constraints of poor farmers who do not have rice lands.

Criteria for selection of new farmer partners should consciously ensure that the poorest in the community are able to participate. Causes for inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and cost-benefit analysis (in collaboration with Socio-Economics Component)

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved
Aloun (NAFRI); Latdavone (NAFReC); Southana (DAFO Namo)

Research partners
LARREC, Fishery Center in Oudomxay and Luang Prabang
### 5.1.4 Research study title

**Performance evaluation of an integrated cassava + pigeon pea feed for chicken system compared to farmers’ practice**

<table>
<thead>
<tr>
<th>Research type</th>
<th>On-farm research</th>
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<tbody>
<tr>
<td>Objective</td>
<td>To evaluate the performance of an integrated cassava + pigeon pea feed for chicken technology in terms of productivity, profitability, farmers’ acceptability and sustainability.</td>
</tr>
<tr>
<td>Justification &amp; relevance</td>
<td>Chickens are important sources of protein and income for the farm family. But according to farmers, pests and lack of feeds are the biggest constraints that prevent them from making chicken production a reliable source of income or food. Lack of proper vaccination and inadequate nutrition makes chickens highly susceptible to diseases. Chickens mainly subsist by scavenging food from village backyards and remaining crop residues in the fields. When available they are given rice bran, some corn and kitchen left-overs. Our trials look into cassava as energy feed and pigeon pea as protein feed for chickens. This is intended to supplement farmers’ traditional feed sources. Cassava and pigeon pea are hardy crops that can be grown in small plots. They are intercropped to take advantage of the nitrogen-fixing ability of pigeon pea. It is important to know how farmers will manage this crop-animal system to make it fit into their existing practices.</td>
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<tr>
<td>Expected output</td>
<td>An integrated cassava + pigeon pea feed for chicken recommendation to suit prevailing bio-physical and socio-cultural conditions in the target villages.</td>
</tr>
<tr>
<td>Review of related work</td>
<td>Processed cassava has been used extensively as feed ingredient for various animals. It is an important feed ingredient exported by Thailand to Europe and the US. Pigeon pea and other legumes have been used as protein sources for animal feed. Planting both crops in an intercropping system have been studied in a limited scale.</td>
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<tr>
<td>Highlights of results</td>
<td>Cassava is ready for harvesting while pigeon pea is waiting to mature before it can be harvested. Different farmers suggest different ways of storing and utilizing cassava as feed for chickens. Khamu farmers say they leave the cassava in the soil and harvest a few plants as needed. They cook the cassava before feeding to chickens. Some Hmong farmers do the same while others prefer to chip and dry the cassava for storage. They usually boil pigeon pea before feeding to chickens. The experimental chickens have already been released to farmers. They have been vaccinated against Avian Pest before release. Some chickens died</td>
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due to colds during quite cold temperatures in February. Monitoring and data collection is on-going.

Growth and production data are being analyzed.

**Location**
The study is being conducted in Pangthong and Pangdou, Namo District and in Thapo Tai, Phonsay District.

**Methods**
The study will retain the 2 treatments, namely:

\[ T_0 = \text{Farmers' practice for raising chickens (scavenging + local feed sources)} \]

\[ T_1 = \text{Cassava + pigeon pea as supplement feed for farmers traditional practice} \]

Replication is across 5 farmers per treatment per village. Statistical design is RCBD.

Data to be collected: cassava and pigeon pea production and dry matter biomass; chicken growth and mortality; egg production; feed consumption; cost of inputs; selling prices; farmers’ practices in utilizing cassava and pigeon pea as feed for chickens; farmers’ evaluation of the technology;

**Plan of Activities for 2005**
For establishment in new fields, recommend the use of improved varieties of cassava with better yields and early maturity. The local variety of pigeon pea being used is performing well therefore can be continued to use. Explore the suitability to plant cassava and pigeon pea in small unutilized areas and borders so it does not compete for area that can be otherwise devoted to high value cash crops.

Need to monitor poultry diseases particularly bird flue. This is a potential problem therefore there is a need to be cautious. Movement of chicks from Vientiane for distribution to farmers in the Northern Provinces should be avoided.

Continue data collection, monitoring and evaluation.

Criteria for selection of new farmer partners should consciously ensure that the poorest in the community are able to participate. Causes for inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and cost-benefit analysis (in collaboration with Socio-Economics Component)

**Fieldwork; Data collection; Data analysis; Report writing.**

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Lao-Swedish Upland Agriculture and Forestry Research Program
Farming Systems Research/Extension Component
2005
5.1.5 **Research study title**  
Performance evaluation of an integrated cassava + pigeon pea feed for pigs system compared to farmers’ practice

**Research type**  
On-farm research

**Objective**  
To evaluate the performance of an integrated cassava + pigeon pea feed for pig technology in terms of productivity, profitability, farmers’ acceptability and sustainability.

**Justification & relevance**  
Pigs are raised by farm households as a source of additional income. Pigs mainly subsist by scavenging food around the village. Some Hmong farmers feed boiled banana stalks and wild vegetables mixed with rice bran. Banana stalks are mainly water, fiber and some minerals. It has no energy and protein value. Rice bran supplies energy and some protein but is not enough to sustain good growth and reproductive capacity of pigs.

Inadequate nutrition results to slow growth, poor reproductive rates and high susceptibility to diseases.

Additional feed resources need to be identified to improve pig performance. Use of cassava and pigeon pea as energy and protein feed for pigs needs to be tested with farmers to determine suitability to existing farming systems.

**Expected output**  
An integrated cassava + pigeon pea feed for pig recommendation to suit prevailing bio-physical and socio-cultural conditions in the target villages.

**Review of related work**  
Cassava has been traditionally used by some Hmong people for feeding to pigs.

Cassava and pigeon pea grown as an intercrops have been studied in a limited scale. Cassava as feed ingredient has been better documented than pigeon pea.

**Highlights of results**  
Intercropped cassava and pigeon pea grew well and harvests are expected soon. Piglets will be dewormed and vaccinated before releasing to farmers.

Growth and production data are being analyzed.

**Location**  
The study will continue to be conducted in Pangdou, Namo District; Nambo and Thapo Tai, Phonsay District.
Methods

The study will retain the 2 treatments, namely:

\[ T_0 = \text{Farmers’ practice for raising pigs (scavenging + limited feed supplements)} \]

\[ T_1 = \text{Cassava + pigeon pea as supplement feed for pigs} \]

Replication is across 5 farmers per treatment per village. Statistical design is RCBD.

Data to be collected:
Cassava and pigeon pea production and dry matter biomass; pig growth and mortality; reproductive performance; feed consumption; cost of inputs; selling prices; farmers’ practices in utilizing cassava and pigeon pea as feed for pigs; farmers’ evaluation of the technology;

Plan of Activities for 2005

For next planting in new areas, explore the use of better cassava varieties with higher yields and early maturity. Explore the use of cassava leaves as feed.

Conduct trials using other root crops such as sweet potato (shorter growing cycle) to use tubers and leaves as feed. However, economic benefits have to be weighed. It could be more profitable to sell the sweet potato tubers directly than to use it as feed and later sell the animal.

Need to document and assess other potential pig feed resources in the village.

Continue data collection, monitoring and evaluation.

Criteria for selection of new farmer partners should consciously ensure that the poorest in the community are able to participate. Causes for inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and cost-benefit analysis (in collaboration with Socio-Economics Component)

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved

Chanpeng (NAFReC) on leave for advanced studies; Keoprasert (DAFO Namo), to be named (DAFO Phonsay)

Research partners

Chief Veterinarian, Animal Health Unit, PAFO, Luang Prabang
Senior Students of Nabong and Pakseuang Faculties of Agriculture
5.2 Research Project  
Integrated Annual Crop-based Farming Systems

Period Covered:  
April 2004- April 2005

5.2.1 Research study title  
Performance evaluation of a corn + legume intercropping system compared to farmers’ practice

Research type  
On-farm research

Objective  
To evaluate the performance of a corn + legume intercropping system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.

Justification & relevance  
Farmers in the target area traditionally plant corn in pure stands. Corn seeds are dibbled in “plu-pli” (random layout) sometimes sprinkled with other crops like job’s tears, sesame or rice or whatever seeds are available during the time of planting.

A certain area is usually planted to corn successively for two years after which the soil has become too poor to support a third cropping. Thus farmers move on to a clear a new area and leave the previous area to rejuvenate as fallow.

The integration of legumes with corn enriches the soil through its nitrogen-fixing ability. It is possible that a third cropping can be made with this system. The corn + legume intercropping system has the added advantage of harvesting two crops in a given area in a given time, thus maximizing the use of land. It spreads the risk from total crop failure and from unstable market prices. Additionally, it also helps control diseases to some extent. Promoting this system to farmers can lead to more diverse income and food sources, improved productivity, profitability and soil fertility.

Expected output  
A corn + legume technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.

Review of related work  
On-station trials conducted in the Agroforestry Research Station in Tongkhan, Luang Prabang revealed good growth of corn intercropping with legumes.

Corn + legume intercropping has been promoted widely and with good success around the Asian region since the mid-1980s.

Highlights of results  
Eight out of 15 farmer partners like to try this integrated system again for next cropping season but with wider distance between corn to reduce shading. The women particularly like the idea of being able to harvest 2 crops from one area. They also said the legume intercrop suppresses weeds therefore they save on labor by only having to weed twice instead of the usual three. The performance of the succeeding crop and soil tests will verify if the soil...
benefited from this intercropping. The other seven farmers are thinking of planting in patches of pure stands of corn, peanut or soybean. Ethnicity affected the preference for soybean or peanut.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Ban Saysamphan and Pangdou, Namo District and Ban Thapo Tai and Thapo Neua, Phonsay District.

**Methods (original method as was done in 2004)**

The study had 3 treatments, namely:

- $T_0 =$ Farmers' practice; corn planting as monoculture with or without rows.
- $T_1 =$ Corn + soybean row intercropping (row spacing between corn was 80cm; spacing between corn and soybean was 40 cm; spacing between soybean was 20cm.)
- $T_2 =$ Corn + peanut row intercropping (row spacing between corn was 80cm; spacing between corn and peanut was 40 cm; spacing between peanut was 20cm.)

Replication is across 5 farmers per village. Statistical design is RCBD.

Data collected:
Yields of corn, soybean and peanuts; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ recommendations to modify the technology.

**Methods (modified for 2005)**

The study will be adjusted to have 3 treatments, namely:

- $T_0 =$ Farmers' practice; corn planting as monoculture with or without rows.
- $T_1 =$ Corn + soybean/peanut row intercropping (row spacing between corn is adjusted to 1.5-2.0m versus 0.80cm as was done in 2004)
- $T_2 =$ Corn + soybean/peanut block rotation cropping

Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected:
Yields of corn, soybean and peanuts; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modifications of technology; farmers’ adoption behavior; soil fertility status

**Plan of Activities for 2005**

This trial will be modified in terms of having wider spacing (1.5-2.0m) between corn rows. Another modification will be the testing of block rotation cropping which is intended to accommodate the desire of farmers to plant by blocks instead of rows. By rotation cropping, soil improvement due to legumes can still be taken advantage of.

For 2005 cropping season, more interested farmers will join the trials. Planting will be done at actual farm scale instead of in experimental plots.
Supplementary farmers’ training will be conducted to clarify the technical aspects of the system (Why intercrop?). Farmers will be encouraged to make the modifications in plant spacing according to how they see it fit. Our research will focus on documentation and assessment of such changes.

Establishing this cropping system in the same plots of 2004 is desired. This will enable us to measure the changes in soil fertility on the second cropping as affected by the corn-legume planting.

Ensure the use of good quality seeds of corn, soybean and peanuts. LVN 10 and Hatdokkeo corn varieties are being evaluated at Thongkhang station.

Document how farmers deal with corn stumps after harvest. These can be used for erosion control but should be aware that they can also serve as hiding place for pests.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Because this technology involves cash crops, it is desirable to document the market and trading policies which can affect the net income that can be realized by farmers.

Conduct soil sampling and analysis to document soil fertility dynamics.

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved: Outhai, Viengmany (NAFReC); Xaybansa (DAFO Phonsay)

Research partners: Senior Students of Nabong and Pakseuang Faculties of Agriculture
Performance evaluation of an integrated rice-legume crop rotation system compared to farmers’ practice

**Research type**
On-farm research

**Objective**
To evaluate the performance of an integrated lowland rice-legume crop rotation system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.

To evaluate performance of recommended rice varieties from the Agriculture Research Center (ARC).

**Justification & relevance**
Farmers observe low yields of rice due to declining soil fertility. Likewise they want to increase and diversify productivity of their lands.

Integration of legumes into the lowland rice cropping system maximizes land use, increases soil fertility due to Nitrogen fixation and high-N biomass addition to the soil. Legumes contribute to diversified food and income sources for the farm household. Proper timing of integration and proper crop choice is key to this system and therefore needs to be studied in view of prevailing farm conditions in Namo Neua.

**Expected outputs**
A lowland rice-legume crop rotation technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.

A recommended rice variety suitable to prevailing bio-physical and socio-cultural conditions in the target village.

**Review of related work**
The lowland rice-legume crop rotation technology has been practiced with success in other Asian countries like Vietnam, Thailand, China and Philippines.

**Highlights of results**
Farmers observed that rice had more tillers per hill and more “filled seeds” when grown in fields where the previous black bean grew well (more green manure biomass). This remains to be confirmed with actual data on yield parameters. Farmers’ evaluation of the rice varieties showed preference for TDK5 in terms of yield and eating quality. Soybean was grown after the rice harvest to take advantage of remaining soil moisture while at the same time enriching the soil and providing additional income or food to farmers. However, start up for this trial was quite late.

Black bean planting was delayed while the rains came early. Thus the black bean crop only produced a limited amount of biomass for green manuring.

Farmers prefer to grow the black bean earlier to be able to grow them until they can harvest the beans before incorporating the plant biomass into the soil. Growing it earlier will also allow them more time to prepare the land in time for rice cropping. Farmer partners say they know the technology so they want to try again but will plant in bigger areas.

Neighboring farmers who saw this technology also want to try. They observed from our farmer partners that the rice grew better and the soil texture was improved (became less compact). They like the idea of having 2 crops from...
the same area. Because they do not have previous experience, they ask to be given seeds and some training about this technology.

Other production and economics data are being analyzed.

Soybean was planted after the rice harvest but was late by one month.

Growth and production data are being analyzed.

**Location**
The study will continue to be conducted in Ban Namo Neua, Namo District.

**Methods**
The study will have 2 treatments, namely:

\[ T_0 = \text{Farmers’ practice; rice only} \]

\[ T_1 = \text{black bean-rice-soybean crop rotation system} \]

Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected:
Yields of rice, soybean and black bean; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modification of the technology; soil fertility status.

**Plan of Activities for 2005**
The trial will be continued in Namo Neua using the best performing and most preferred rice variety (TDK 5) by farmers. New interested farmers and bigger areas will be served. Proper timing of integration of black bean and soybean will be ensured. Farmers’ will be encouraged to identify other legumes that they may like to test using this crop rotation system.

Look into the potential of introducing this technology in lowland rice growing areas of project villages in Phonsay.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Conduct soil sampling and analysis to document soil fertility dynamics.

**Fieldwork; Data collection; Data analysis; Report writing.**

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5.2.3 Research study title

Performance evaluation of integrated pest management (IPM) for off-season cabbage compared to farmers’ practice

5.2.3.1 Sub study a: Use of Diadegma parasitoid as bio-control agent (Phonsay District)

Research type

On-farm research

Objective

To evaluate the performance of an integrated pest management (IPM) for off-season cabbage using Diadegma parasitoid as bio-control in terms of productivity, profitability, farmers’ acceptability and sustainability.

Justification & relevance

Farmers in Phonsay were introduced to the technology for growing off-season (rainy season) cabbage in 2003. It proved profitable because off-season cabbage has limited competition from other growers and thus commands a high price in the market. Because of this and some funds provided by “action research” many farmers continued to grow cabbage.

The constraint however is that growing cabbage during the rainy season results to heavy pest infestation. Farmers respond to this by spraying chemical pesticides. There is a need therefore to study alternative less hazardous methods of pest control.

Expected output

An IPM recommendation for off-season cabbage that suits prevailing bio-physical and socio-cultural conditions in the target villages.

Review of related work

In Taiwan, strains of *Diadegma semiclauusum* parasitoids have been identified by the Asian Vegetable Research and Development Center (AVRDC) to be effective against Diamond Back Moth, the most destructive pest of cabbage.

In the Philippines, Diadegma has been found to be most suited to cool, high elevation areas of more than 800m above sea level (asl) with temperatures lower than 24°C. An indigenous parasitoid, *Cotesia plutella* was tested to be most effective in low or mid-elevations less than 800 m asl with temperatures above 25°C (Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, 2000).

The Diadegma parasitoid can be produced at the Hatdoko Horticulture Research Center in Vientiane.

Highlights of results

Better coordination, better understanding of the research design, earlier start-up and timely release of Diadegma parasitoids could have demonstrated better results to farmers.
Some farmers became curious with the parasitoids but wonder where to get them as they are only available from the Hatdokkeo Horticulture Research Center in Vientiane. This technology seems to be too “high tech” at the moment. Production of Diadegma requires a special laboratory and expertise which currently is available only in HHRC, Vientiane. NAFReC, the nearest center which can possibly supply this is yet to build this capability. Thus more practical options like using locally available plants as botanical pesticides need to be tested.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Ban Nambo/Thapo Tai, Phonsay District.

**Methods**

The treatments will be revised as follows.

T₀ = Farmers’ practice (off-season cabbage production without IPM)

T₁ = Off-season cabbage production with IPM using botanical pesticides

Replication is across 5 farmers per treatment. Statistical design is RCBD.

Data to be collected:
Pest occurrence and dynamics; growth and production of cabbage; cost of inputs; selling prices; farmers’ evaluation of the technology.

**Plan of Activities for 2005**

This trial will be revised. Instead of using Diadegma parasitoids for pest control, botanical pesticides will be tried. Locally available plants with will be used. This study may need to be complemented by on-station research to test different plant species using various formulations.

The use of “BE” bio-extracts will also be explored. The Northern Agriculture and Forestry College in Pakseuang has some experience using BE as bio-pesticide. Collaborative studies with them will be explored.

The use of bio-fertilizers can also be explored.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Fieldwork; Data collection; Data analysis; Report writing.
**Research study title**

Performance evaluation of integrated pest management (IPM) for off-season cabbage compared to farmers’ practice

**Sub study b:** Use of neem extract as botanical pesticide superimposed on varietal trial of cabbage (Namo District)

**Research type**

On-farm research

**Objective**

To evaluate the performance of an integrated pest management using Neem extract in terms of productivity, profitability, farmers' acceptability and sustainability.

To evaluate performance of Haya and KY variety of cabbage

**Justification & relevance**

Promoting the production of high-value crops can provide diversified sources of high income for farmers. Farmers of Namo Neua have never planted off-season cabbage before but would like to try planting because it commands good price in the market. Two promising varieties (Haya and KY) from Hadtokeo Research station were recommended for trial.

Because it is expected that off-season cabbage is usually attacked by many pests, it was recommended to introduce this technology with an IPM component before the farmers think of using chemical pesticides. The potency of neem extract as botanical pesticide for cabbage needs to be tested.

**Expected outputs**

An IPM recommendation for off-season cabbage that suits prevailing biophysical and socio-cultural conditions in the target villages.

A recommended cabbage variety suitable to prevailing bio-physical, socio-economic conditions in the target villages.

**Review of related work**

Botanical pesticides are plant extracts that contain chemicals toxic to certain insects. Botanicals are considered relatively safe for the environment because they breakdown more readily than conventional pesticides with longer residual activity.
Neem (*Azadirachta indica*) contains the main active chemical, *azadirachtin* which acts as feeding deterrent and as insect growth regulator. Leaf juices, oil from seeds and extracts from seed kernel can be used to control insects. In Ghana, Africa it is effectively used against cabbage caterpillars (FAO).

**Highlights of results**

Farmers prefer “KY” variety than “Haya” because of higher transplanting survival, more compact “head” and better taste according to consumers. However, the PM&E revealed that farmers do not like to continue planting cabbage because of limited markets in Namo. These farmers would like to try planting other vegetables like cucumber and watermelons.

Coordination difficulties prevented timely outplanting of cabbage seedlings which resulted to high seedling mortality. Because this is a new technology for Namo Neua farmers, they could have benefited more with better training and closer guidance in the field. Some coordination problems were also encountered in sourcing the neem extracts hence the botanical pesticide treatment was not undertaken.

Growth and production data are being analyzed.

**Location**

Namo Neua, Namo District.

**Methods**

This study had 4 treatment combinations, namely:

- $T_{11} =$ Haya cabbage variety without neem as botanical pesticide
- $T_{12} =$ Haya cabbage variety with neem as botanical pesticide
- $T_{21} =$ KY cabbage variety without neem as botanical pesticide
- $T_{22} =$ KY cabbage variety with neem as botanical pesticide

Replication is across 6 farmers. Statistical design is 2x2 factorial in RCBD.

Data to be collected:
Growth, yield and mortality of cabbage; insect pest occurrence and dynamics; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ adoption behavior.

**Plan of Activities for 2005**

Postpone the on-farm trial. Instead conduct a focused PRA or case study in Namo Neua to document and assess the following:

1) Current situation, practices and potentials for cultivation of vegetable and fruit crops;
2) Existing farming systems which can be intensified by the integration of vegetable and fruit crops;
3) Problems and constraints related to vegetable and fruit growing in the area
4) Market demands and trading factors

A proper understanding of the above factors should then be the basis for planning the subsequent on-farm trials.

Explore the potential of introducing new high value vegetable and fruit crops but consider prioritizing them according to important factors such as disease.
and pest susceptibility, ease of growing, perishability and consumer preferences.

Conduct market studies for priority high value vegetable and fruit crops. Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Fieldwork; Data collection; Data analysis; Report writing.

### Workplan

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### Staff involved

Khouan (NAFReC); Khambo (DAFO Nam)

### Research partners

Senior student interns from Faculties of Agriculture in Nabong and Pakseuang; Hatdokeo Horticulture Research Center
B.3 Research Project | Perennial Crop-based Intercropping Systems
---|---
Period Covered: | April 2004- April 2005

B.3.1 Research study title | Performance evaluation of an integrated fruit tree + annual crops hedgerow system compared to farmers’ practice
---|---
Research type | On-farm research
Objective | To evaluate the performance of an integrated fruit tree + annual crops hedgerow system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.
Justification & relevance | The integration of fruit trees + pineapple + stylo hedgerows in existing upland areas is one alternative technology that promotes permanent agriculture. This conforms to the government’s effort to reduce shifting cultivation. With proper management, the trees are expected to provide high value products and good income over longer term than would annual crops alone. Meanwhile, short to medium term crops are integrated during the first 2-4 years while waiting for the main tree crops to become productive. This enables the farmer to have a regulated source of income or food through strategic timing of harvests.

Planting hedgerows along the contour helps control soil erosion. However, the choice of hedgerow species and fruit trees to plant will be determined by farmers’ preference as well as bio-physical factors that will favor good growth of the crops.

Expected output | An integrated fruit tree + annual crops hedgerow technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.
Review of related work | Integrated fruit tree systems are traditionally practiced in Indonesia and the Philippines. Also called multi-story agroforestry systems, it features a mixture of various fruit and tree species mixed with biennial and annual crops. The trees and crops of different canopy structure grow at different heights which allow maximum use of sunlight. The system mimics the tropical rainforest. (ICRAF)
Highlights of results | The recent Participatory Monitoring and Evaluation (PM&E) of 2004 trials reveal that farmers want to expand areas planted to fruit trees. They are also requesting to be trained on proper fruit tree management and pest control. Farmer partners chose job’s tears as the annual crop to be interplanted between the trees. Some farmers however started planting sesame and rice when the rains have started but our planting materials were not delivered on time.
Farmers suggest to replace stylo hedgerows with other crops like galangal, black ginger or lemon grass. Only a few farmers know how to use stylo as feed for animals.

While most of the lychees are growing well, some farmers reported insect attacks (a kind of stink bug) on young shoots of lychee.

Some farmers who tried this system in 2002 and 2003, have begun harvesting pineapples and some fruits. Others are in various stages of growth depending on how well the plots were maintained. It would be good to conduct a PM&E with these 2002 and 2003 farmers.

Some farmers were not clear regarding the planting techniques for example the need to remove the plastic bags when planting the seedlings.

The lychee trees planted are being attacked by a shoot sucking insect.

Growth and production data are being analyzed.

**Location**
The study will continue to be conducted in Namo Neua, Pangthong, Pangdou and Mixay in Namo District and in Nambo, Phonsay District.

**Methods**
The study will continue to have 2 treatments, namely:

\[ T_0 = \text{Farmers’ practice (shifting cultivation with annual crops)} \]

\[ T_1 = \text{Fruit tree + pineapple + stylo hedgerows + annual crops in the initial years} \]

Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected:
Growth and mortality of fruit trees and pineapples; yields of intercropped annual crops; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modifications of the technology; farmers’ adoption behavior; soil fertility status.

**Plan of Activities for 2005**
Data collection will be continued. Replanting of missing or dead tree seedlings will be done. A low-growing leguminous crop (soybean or black bean) will be recommended as intercrop so as not to shade out the fruit trees. Farmers will be encouraged to plant other suitable and preferred crops as hedgerows.

Additional farmers training will be conducted to explain the technical merits of this integrated agroforestry system. They will then be encouraged to make use of other crops which they think is suitable to the area and to their preference.

Because many farmers are interested, this trial is intended to be conducted with more farmers and in larger areas. However, because this system is a long term investment, it would be necessary to check first the bio-physical
suitability of the new areas for fruit tree growing. Species-site matching is important. Agro ecological zoning maybe needed.

Because of high demand for seedlings by interested farmers, mechanisms so that farmers themselves can form production groups to operate village tree nurseries should be looked into and encouraged.

Being a long term investment, ensure the use of superior quality and disease-free or disease-resistant planting materials. Need to address the problem of insect attack on young shoots of lychee.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component). Conduct market studies for priority fruit trees including consumer demands.

Conduct PM&E of farmers who started to try this technology in 2002 and 2003. Some of them are already harvesting some fruits. Many lessons can be learned from their experience.

Conduct soil sampling and analysis to document soil fertility dynamics.

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved: Saysongkham and Somsay (NAFRI); Soumvang (NAFReC); to be named (DAFO Nam), Thongsamay (DAFO Phonsay)

Research partners: Hatdookeo Horticulture Research Center; Soils Research Center
5.3.2 Research study title  
Performance evaluation of an integrated agarwood + fruit tree hedgerow system compared to farmers’ practice

<table>
<thead>
<tr>
<th>Research type</th>
<th>On-farm research</th>
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<tbody>
<tr>
<td>Objective</td>
<td>To evaluate the performance of an integrated agarwood + fruit tree hedgerow system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.</td>
</tr>
<tr>
<td>Justification &amp; relevance</td>
<td>Farmers are interested to plant agarwood or eaglewood because of its highly valued resin. However it takes at least 6-7 years before the wood can be harvested for resin extraction. Older trees have higher resin yields. Because of the long waiting period, short duration fruit trees, bananas and annual crops can be interplanted to provide some intermediate income and food to farmers. Outplanted agarwood seedlings require partial shade, thus a fast growing nurse crop like <em>Sesbania grandiflora</em> is recommended to be planted near agarwood trees. In addition to partial shade, Sesbania’s nitrogen-fixing ability and high N-containing litterfall will provide additional nutrients to support growth of the young agarwood trees. The areas chosen by farmers to plant agarwood are sloping areas thus planting of hedgerows are recommended. Properly laid out hedgerow systems can minimize if not totally prevent soil erosion. However, it is one of the challenges to identify hedgerow species which have multiple uses aside from serving as erosion barriers.</td>
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<tr>
<td>Expected output</td>
<td>An integrated agarwood + fruit tree hedgerow technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.</td>
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<tr>
<td>Review of related work</td>
<td>In Sri Lanka, agarwood trees performed best when grown under the light canopy of an N-fixing nurse tree, <em>Sesbania grandiflora</em>. As the agarwood trees develop, the branches of sesbania are gradually cut back to allow more light penetration. The leaves from the cut branches are mulched around the young agarwood trees to serve as organic fertilizer. The mulch also helps control weeds. Natural production of the highly-valued resin is induced when branches of agarwood trees are wounded or attacked by a certain kind of insect. However, the agarwood processing plant near Vangvieng, Vientiane Province is able to extract resin from 6-7 year-old agarwood trees. Older trees, however will yield higher amounts of resin. The demand of this processing plant is hardly met so it tries to promote planting of agarwood by farmers around the area. One constraint though is production of good quality seedlings. Their current practice is to get wildlings from the forests and grow them in nurseries to reach a height of 30cm before outplanting. Agarwood seeds are recalcitrant, requiring immediate planting in moist media after harvest. Delayed planting negatively affects seed viability and</td>
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Lao-Swedish Upland Agriculture and Forestry Research Program  
Farming Systems Research/Extension Component  
2005
germination rates. Limited trials of agarwood seeds without treatment showed 30% germination at 25-35 days after sowing.

**Highlights of results**

To those farmers who were clear on the role of the different components (Sesbania, fruit trees, etc) of the system, they are eager to expand the integrated system. To other farmers who were not given enough explanation about the function of the other crops in the system, they only want to plant pure agarwood. It is therefore important that farmers and researchers are both clear on the advantages of the integrated system.

There was high mortality of the sesbania trees therefore its role as nurse tree did not materialize. There was also high mortality of agarwood seedlings due to transport shock as seedlings came all the way from Vientiane. Better growth of the trees and bananas could have been possible with better coordination and timely delivery of the planting materials.

Rats and termites affected some of the outplanted agarwood seedlings.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Pangthong and Saysamphan, Namo District and in Huaymanh, Nambo, Thapo Tai and Huaymaha in Phonsay District.

**Methods**

The study will continue to have 2 treatments, namely:

\[ T_0 = \text{Farmers' practice (shifting cultivation with annual crops)} \]

\[ T_1 = \text{Agarwood} + \text{Sesbania} + \text{Fruit tree} + \text{stylo hedgerows} + \text{annual crops in the initial years} \]

Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected:

- Growth and mortality of agarwood and fruit trees; yields of intercropped annual crops; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modifications of the technology; farmers’ adoption behavior; soil fertility status.

**Plan of Activities for 2005**

This trial was initially recommended to be turned over to the Forestry Component but was finally decided to be retained under Farming Systems Research Extension Component.

Data collection will be continued. On its second year of cropping, soybean will be intercropped between the trees. Replanting of missing or dead agarwood tree seedlings will be done. Missing hills for banana and sesbania will be replaced with pigeon pea.

Being a long term investment, ensure the use of superior quality and disease-free or disease-resistant planting materials. Rat and termite attack on agarwood seedlings should be documented and proper measures be done to prevent further damage.
This trial is intended to be expanded to cover more farmers and larger areas. Better coordination and more timely planting should be done.

Because of high demand for seedlings by interested farmers, mechanisms so that farmers themselves can operate village tree nurseries should be looked into.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Conduct soil sampling and analysis to document soil fertility dynamics.

Fieldwork; Data collection; Data analysis; Report writing.

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<th>Workplan</th>
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Staff involved: Viengsouk and Mrs. Somchan (NAFRI); Vanpeng (NAFReC); Khmanphan (DAFO Namo), to be named (DAFO Phonsay)

Research partners: Forestry Component

5.3.3 Research study title: Performance evaluation of an integrated rubber + fruit tree agroforestry system compared to farmers’ practice

Research type: On-farm research

Objective: To evaluate the performance of an integrated rubber + fruit tree agroforestry system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.

Justification & relevance: The integration of trees and other perennial crops in upland farms means that these areas cannot be subjected to slash-and-burn anymore but will become converted to permanent agriculture through time. This conforms to the government’s effort to reduce shifting cultivation. With proper management, the trees are expected to provide high value products and good income over longer term than would annual crops alone. Meanwhile, short to medium term crops are integrated during the first 2-4 years while waiting for the main tree.
crops to become productive. This enables the farmer to have a regulated source of income or food through strategic timing of harvests from the combination of crops.

Integrated tree-based systems favor agro-biodiversity which minimizes the risk of total crop failure due to pests, maximizes land utilization and allows diverse use of soil nutrients by the various crops.

As large scale monoculture rubber plantations are being actively promoted, this study proposes an alternative cropping system that could be more ecologically and economically sound in the long term.

**Expected output**

An integrated rubber + fruit tree agroforestry technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.

**Review of related work**

Literature review and experiences from Thailand, China and Indonesia show increased productivity, profitability and sustainability of rubber integrated with other crops than growing monoculture rubber.

The study conducted in 2004 sponsored under the Lao-German Program for Rural Development in Mountainous Areas of Northern Lao PDR (RDMA) recommends that efforts at rubber planting should be towards mixed agroforestry systems to reduce ecological and economic risks.

**Highlights of results**

Based on the PM&E, Namo farmers like this integrated technology. They called the system “3 in 1”, meaning one weeding operation benefits 3 crops at the same time. They also mean 3 products can be harvested from one area; Farmers request for more training on how to take care of the rubber trees; when and how they can tap, and how to market them. The job’s tears intercrop was attacked by seed borers and black fungus. The lychee seedlings are growing well.

High mortality due to poor rubber seedling quality was the major constraint of this trial. The buds were newly grafted and therefore not yet fully established when the seedlings were outplanted. Many of the buds dried up before they can get established. During heavy rains, splash erosion caused the surrounding soil to cover the small buds which led to decay. The less vigorous seedlings which were barely surviving became predisposed to termite attack.

Growth and production data are being analyzed.

**Location**

The study will continue to be conducted in Namo Neua, Pangthong and Pangdou, Namo District. This year, 2005, it is planned to be started in Phonsay District.

**Methods**

The study will retain the 2 treatments, namely:

\[T_0 = \text{Farmers’ practice (rubber only + annual crops in the initial years)}\]

\[T_1 = \text{rubber + fruit tree + annual crops in the initial years}\]
Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected: Growth and mortality of rubber and fruit trees; yields of intercropped annual crops; cost of inputs; selling prices; farmers’ evaluation of the technology; farmers’ modifications of the technology; farmers’ adoption behavior; soil fertility status.

Plan of Activities for 2005

This trial was initially recommended to be turned over to the Forestry Component but was finally decided to be retained under Farming Systems Research Extension Component.

Data collection on tree growth and survival will be continued. Soybean will be recommended as intercrop on the second year so as not to shade out the rubber and fruit trees. Replanting of missing or dead tree seedlings will be done.

Being a long term investment, ensure the use of superior quality, fully established and disease-free or disease-resistant tree seedlings.

This trial is intended to be expanded to cover more farmers and larger areas. It is also intended to be done in Phonsay District and our new project village, Ban Kokfaad, Namo District.

Because of high demand for seedlings by interested farmers, mechanisms so that farmers themselves can operate village tree nurseries should be looked into.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Conduct soil sampling and analysis to document soil fertility dynamics.

Fieldwork; Data collection; Data analysis; Report writing.

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Staff involved
Somboun (NAFReC); Khmanphan (DAFO Namo), to be named (DAFO Phonsay)

Research partners
Forestry Component
B.3.4 Research study title | Performance evaluation of an integrated teak + annual crops hedgerow system compared to farmers’ practice

**Research type** | On-farm research

**Objective** | To evaluate the performance of an integrated teak + annual crops hedgerow system compared to farmers’ practice in terms of productivity, profitability, farmers’ acceptability and sustainability.

**Justification & relevance** | Teak is usually planted closely at 2m x 2m. Some farmers even plant at closer spacing and in random. With such close spacing, there is a higher number of seedlings required per unit area and annual cropping is only possible in the first 2 years.

Teak takes at least 25 years before it can be harvested. Because of this, it is important that farmers are able to maximize use of the land during the growing period of teak. Hedgerows of leguminous species will be integrated into the system to enrich the soil from N-fixation and at the same time help minimize soil erosion. Cereal and leguminous annual crops will be planted between hedgerows and teak during the initial years. As the teak canopy closes in later years, shade tolerant crops or NTFPs maybe integrated into the system. To enable this integration, teak will be planted farther apart at 4m x 4m spacing.

**Expected output** | An integrated teak + annual crops hedgerow technology recommendation refined to suit prevailing bio-physical and socio-cultural conditions in the target villages.

**Review of related work** | Literature review and experiences from Myanmar, Thailand and India show increased productivity, profitability and sustainability of teak integrated with other crops than growing monoculture teak.

**Highlights of results** | Farmers say they want to plant teak as source of income and as source of wood for house construction when their children have their own families. Farmers find the system easy to weed because the trees are planted in rows as opposed to their random planting. Non-participating farmers who see our trial plots are interested to try it in their farms, especially if free seedlings will be provided.

As expected, teak is growing slowly. There was high mortality of teak because seedlings were quite small and because delivery of seedlings to the farms was delayed. Some teak seedlings are being attacked by caterpillars and termites.

Not all trial plots were able to establish pigeon pea hedgerows due to lack of seeds. Leucaena or broom grass are being considered instead of pigeon pea. The job’s tears intercrop has been harvested. Data is being analyzed.

Farmers appreciate the technical assistance provided by the staff.

Growth and production data are being analyzed.
Location
The study will continue to be conducted in Nambo, Thapo Tai and Thapo Neua, Phonsay District.

Methods
The study will retain the 2 treatments, namely:

T₀ = Farmers’ practice (teak, closely planted at 2x2m + annual crops in the initial years)

T₁ = teak planted farther apart at 4x4m + annual crops and hedgerows in the initial years

Replication is across 5 farmers per village. Statistical design is RCBD.

Data to be collected:
Growth and mortality of teak; growth and productivity of hedgerows; yields of intercropped annual crops; cost of inputs; farmers’ evaluation of the technology; farmers’ adoption behavior; soil fertility status.

Plan of Activities for 2005
This trial was initially recommended to be turned over to the Forestry Component but was finally decided to be retained under Farming Systems Research Extension Component.

Soybean will be recommended as intercrop so as not to shade out the teak trees. Replanting of missing or dead teak seedlings should be done using fully established seedlings.

Continue to source pigeon pea seeds to complete the hedgerow system in all trial plots.

This trial is intended to be expanded to cover more farmers and larger areas in Phonsay District. Establishment on new areas will be done in collaboration with the Forestry Research Component. The farmers will decide on what annual crops to interplant with teak during the initial years.

Because of high demand for seedlings by interested farmers, mechanisms so that farmers themselves can operate village tree nurseries should be looked into.

Criteria for selection of new farmer partners should consciously ensure that the poorest and the women in the community are able to participate. Reasons for ability or inability to participate needs to be documented and addressed.

Need to present economics information on start-up investment costs and comparative cost-benefit analysis (in collaboration with Socio-Economics Component)

Conduct soil sampling and analysis to document soil fertility dynamics.

Fieldwork; Data collection; Data analysis; Report writing.
### Workplan

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### Staff involved
- Somboun, Thansamay (NAFReC); Somphon (DAFO Phonsay)

### Research partners
- Forestry Research Component
Annex 1. Number of farmer partners for each topic per village per district (2004).

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<thead>
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<th>Topics</th>
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<th>Namo District</th>
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<td>1.1 Fish + lowland rice</td>
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<td>1.2.1 Duck + lowland rice (vareitral trials superimposed)</td>
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<td>1.2.2 Duck + lowland rice + improved feeds</td>
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<td>2.1 Corn + peanut/soybean intercropping + lemon grass hedgerows</td>
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