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Contract Farming and Agriculture Intensification in Northern Thailand: A Case Study of Thon Phung Village


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ABSTRACT

Author: Zsuzsanna Sápi

"The world's agricultural production is globalizing and as part of this process, more and more farmers have become contract farmers" (Ornberg, 2003). In Northern Thailand at the Upper Mae Pae watershed the situation corresponds with this statement. The local organization namely Royal Project assembles the farmers who are in contractual relationship with them and influences profoundly their agricultural practices and life. Accordingly our main objective is to assess the impacts on the economical and ecological levels in Ban Thon Phung and to understand why the farmers choose to be a participant or not and finally to compare these two marketing strategies. We applied many kinds of tools in the process of searching for answers and we have learnt that the picture is complex. In most cases the cultivation practices, the household economy and personal circumstances varies, thus the reasons for action and the impacts of these actions are very different. But on the whole the most important impacts the RP had are related to irrigation possibility, farming practices, and to the availability of new market and investment opportunities. We can conclude that joining the project means a kind of prestige and safety and ensures higher income in general, but to state that one is better than the other is not appropriate.

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INTRODUCTION

1. Background:

Main Author: Jonathan Rey
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During the past 50 years Thailand has experienced a great population growth (Praneetvatakul, et al. 2001). Particularly in highland areas, this growing population's has created an increased pressure on the natural resource as shifting cultivation methods are widely used in those areas it also led to an increase in deforestation (Tungittiplakorn and Dearden, 2001). In order to reduce this deforestation, the Thai government passed in 1964 the National Forest Reserve Act which defines the areas which should be protected. The areas were divided into three different zones: the conservation-, the utilization- and the agricultural- zones.

Another problem related to population growth is the increasing demand for food and the decreasing areas for cultivating it. Hill tribe populations who had mainly relied on subsistence farming now had to move to more intensive cultivation methods. For many years their main cash crop had been the opium poppy (Rerkasem and Rerkasem, 1994) but in the 70'ties and 80'ties this was replaced by low value cash crops such as cabbage. This is also what happened in Ban Thon Phung in Chiang Mai province, where this study was carried out.

The Karen hill tribes have traditionally been practicing shifting cultivation which consist in clearing a part of forest, cultivate it for a few years and then leave it for a long fallow period (Aagaard & Jørgensen, 2001). This practice is a very extensive method of production and thereby requires very large areas of land in order to have fallow periods long enough to enable the soil to recover its natural fertility. The introduction of cash crops into the area and the promotion of more intensive practices have reduced the possibility of leaving the land under long fallow period and the use of new fertilizing methods have then become necessary.

This study was conducted in Ban Thon Phung in the Chom Thong district in the upper part of the Pae Mae water-catchment, located in the province of Chiang Mai. Ban Thon Phung is situated about 80 kilometers South of Chiang Mai and at a few kilometers from Chom Thong. The climate is characterized by three seasons; the rainy season which goes from June to November, the dry season which goes from December to February and the hot season which goes from March to May. The village consists of approximately 116 households whose main religion is Buddhism with strong believes in spirits. Traditionally the village practiced subsistence farming but in the 70'ties the Hmong hill tribe arrived and taught them how to grow opium. In 1983-84 several development projects and the Royal Project (RP) arrived and stopped the production of opium by informing people about the bad impact (Interview with Mr. Paiboo Trakarnsupakorn, 2007).

In the same years the agriculture in the village became more market oriented and in addition to the climate the farmers now also have to be aware of fluctuations in market prices which make farming even more risky (Lena Ornberg, 2003). One of the possible solutions is to develop contract farming which spread risks among the actors of the production and commercialization chain. In Thailand these practices have been largely developed since the 1980'ties, mainly by private initiatives but also by government projects (Lena Ornberg, 2003).

In Mae Pae watershed, contract farming was introduced in 1983-84 by the Royal Project and about 50% of the households in Ban Thon Phung have now joined. The Royal Project makes contracts with farmers who agree grow certain types of vegetables and herbs. These vegetables and herbs are only grown by farmers who have access to irrigation and farmers who do not have irrigation are not accepted in the project. This means two types of farming strategies exists in the village; a) the strategy of joining the Royal Project and selling the crops to them; and b) the strategy of producing crops which the farmer sell to the middleman or the nearby market.

Literature is rarely side-taking when discussing the pros or cons of contract farming as it can be seen from different perspectives; and it happens to be far from unproblematic from a farmer point of view (Ornberg, 2003). Based on this statement, this study will be looking at the impacts which the Royal Project has on the economy and practices of

farmers in Ban Thon Phung; basing our research mainly on farmers points of view. To assess this topic, the following research question and sub-questions have been used as guidelines for the study:

2. Research question:

How does the contract farming with the Royal Project and non-contract farming affect the household economy and the sustainability of the farming practices in Ban Thon Phung?

This research question was divided into three sub-questions in order to have more direct objectives to refer to. The division also provided a clearer view of the areas to cover and made it easier to answer the main question. The sub-questions were the following:

- **Which factors influence farmers to choose contract farming with the Royal Project or marketing by their own?**

Market accessibility plays a vital role in the degree of intensification (Pant, Demaine and Edwards, 2004), so understanding the market chain, the transportation facilities and the strengths and weaknesses of those elements will provide a better understanding of the reasons for intensification and it will also help to identify the possibilities and opportunities available for the farmers in this area.

This question will first look into the market opportunities offered by the Royal Project to the farmers and into the organization of the other marketing possibilities for farmers who are not joining the Royal project (NRP). The second step will be to compare these different marketing strategies and to understand the factors influencing the choice of one or the other.

- **What are the impacts of agricultural practices on soil fertility, erosion and pest control and are those practices sustainable and are there any differences between Royal Project and non Royal Project farmers?**

The term 'sustainability' covers several aspects such as the bio-physical, economic and social aspects. Due to time constraints this study will focus on only the biophysical aspects.

Thus the study will focus on agricultural aspect and in particular on the main natural resource used for agriculture: the soil. Three main indicators will be used to assess the sustainability of the practices regarding the soil: The nutrient balance, soil erosion and comparison of nutrient content in soil samples from fields joining and not joining the Royal Project and also from non agricultural area.

The last point will be to look into the use of pesticides and the impact of the use on the environment.

- **How do the agricultural and marketing strategies contribute to the household economy?**

This question will look into the economic importance of farming activities at household level. The two farming strategies will be compared to see whether there is an economic difference between the two.

To answer those questions a wide range of disciplines will be covered. This study relies on the interdisciplinary strength of the group. The group is constituted of 11 people: 5 students coming from Copenhagen University, 4 students coming from Thailand and 2 interpreters. The many disciplines within this team (agronomy, soil science, biology, landscape management, geography and economy) give us expert knowledge in many areas and allow us to see and understand the same situation from many angels.

Box 1: A few definition.

A few definitions:

Intensive farming: The main goal for any farmer who wishes to intensify his production is to get a higher output per unit area. According to Mortimer (1995) intensive farming is defined as a process where the farmer either increases the inputs of labour or capital on his field, and/or where the farmer cultivates the land more intensively (area intensification), for example decreasing the fallow period in shifting cultivation.

Livelihood: A livelihood comprises the capabilities, assets (incl. both material and social resources) and activities required for a means of living (Chamber & Conway 1992).

Sustainability: When it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not understanding the natural resources base (Chamber & Conway 1992).

Sustainable development: Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs (Brundtland commission 1987).

1 rai = 1600 m^2

METHODOLOGY

In this project we have several research questions which can be answered using different methods: observation, by analyzing records, by collecting and analyzing documents, by assembling samples and by talking to people (Gillham, 2000). In our case we chose qualitative (interview, observation and some PRA tools) as well as quantitative (questionnaires, sampling and some PRA tools) methods in seeking some understanding about the situation in Ban Thon Pung. Further more, the use of different methods allow us to triangulate and see the same situation from different perspectives.

1. Questionnaires

Main Author: Nina Kirkegaard
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Questionnaires are good for collecting certain types of information in certain situations. The method is normally used when a large number of people are involved and if the information needed is factual and can be collected by asking close ended questions. In cases where the material is not too sensitive or one wishes to preserve anonymity questionnaires are also an excellent method to collect the data. When breadth and representativeness of the data is important questionnaires will also be able to provide this (Gillham, 2000).

In this project the aim was to obtain a general view of a few topics within the village. We wanted to ask enough people to be able to generalize the data and make sure it is representative of the whole village. The majority of the data we needed could be obtained by asking closed ended questions and was more factual than explanatory.

Two different questionnaires were carried out in Ban Thon Pung: A short one which was answered by 36 villagers and a longer more in-depth one which was answered by 10

villagers. Both questionnaires somehow overlapped each other but even so some farmers were given both questionnaires. (Annexes 1 & 2)

The farmers chosen to answer the questionnaires were selected by stratified random sampling and accidental random sampling. The stratified random sampling method was chosen to make sure an equal amount of farmers joining the Royal Project and not joining the Royal Project were asked.

Both questionnaires had mainly closed ended questions. They first part of contained easy to answer questions which were meant as an introduction to make the farmer relaxed and comfortable. The economy questions were put in the end of the questionnaire as we expected them to be more sensitive for the farmers to answer.

The long questionnaire was very detailed and focused on household composition, labor, migration, land use, problems regarding farming and household economy. It was carried out in order to get some detailed information which does not need to be statistically verified. It was tested before going to the field. No problems were discovered at this time and no changes were made. In the field this questionnaire was carried out by Thai students only and they did not discover any problems.

The short questionnaire was less detailed and focused on farming methods and farming economy. It was designed to be fast to carry out, which should make it possible to reach more farmers within the research period.

The short questionnaire was tested on a farmer from a different village but doing this testing we did not discover any problems. As we went on filling the questionnaires and later when we began to type the results we realized that some of the questions had not been asked the same way by all students. This was especially the case with question 8 about fertilizer. From the interview with the RP officer we got the impression that few types of fertilizer were used. However, when we went to the field we discovered a wide variety of chemical fertilizers and realized it was important to also ask which chemical formula was used. Another problem with that same fertilizer question was that not all farmers were asked whether he also used manure as fertilizer and we therefore believe many farmers forgot to mention this type of fertilizer. To make up for this missing data a

focus group discussion was carried out (see the results and methodology part of PRA) to discuss exactly those issues.

Another thing that turned out to be problematic was concerning the formulation of questions. This problem occurs especially when you have an interpreter, as some meaning might be lost during the translation. Box ?? illustrates a conversation with a farmer while we where sitting in his field and encountered this problem; it shows the importance of considering the possible translation when formulating questions.

Box 2: Translation problem during the questionnaires.

Information lost in translation:

Discussion with the village headmen during a questionnaire in his field.

Researcher: Do you use any soil conservation methods on your fields?

Interpreter: What do you do to avoid soil erosion in your field?

Respondent: I don't have any erosion in my field.

Looking at his field at this moment we could see some terracing and some grass lines around the field.

Researcher: So why do you do some terraces if you don't have erosion problem?

Respondent: Because other ways they would be some erosion, it because of those terracing and grass that I don't have any problem.

Luckily this happened for one of the first questionnaire and we could discuss with the interpreter to make sure the meaning of the question didn't change during translation.

Originally all questionnaires were meant to be given to farmers selected by stratified random sampling. However as the survey went on, we found it difficult to locate the farmers from the stratified random sampling list and we began to also give the questionnaires to farmers we met. Some questionnaires are therefore filled by farmers sampled by accidentally random sampling.

The data will be analysed using one-way-anova and t-test (SPSS software); and will be considered significant when $p < 0.05$.

2. Interviews:

Main Author: Zsuzsanna Sápi

Interviews are good for gaining qualitative information in situations where the interviewer mainly asks open ended questions to the interviewee. It is especially used in situations where the interviewee is a key informant with special knowledge within the research area but can also be used when the interviewer wants information from a "normal" person. Interviews are the easiest to carry out when the distance between the interviewer and the interviewee is small. Accordingly our interviews were used to obtain data and to understand issues relevant to the sub questions of our research project. The interviews followed an interview guide and had four stages: first an introductory phase where general questions were asked to make the interviewee feel comfortable. Secondly an opening of the interview followed by deeper questions and finally the interview was broad to and end, both socially and in the terms of content following Gillham's idea (2000).

Several interviews were carried out in Ban Thon Pung with farmers joining the Royal Project as well as with farmers who did not join. Royal Project Officer and previous village headman were also interviewed.

The interviews with the farmers were carried out in the farmer's home, in his field or in the community hall in a time arranged in advance and followed a semi structured interview guide (Annex 3). The interviews were either carried out by a Thai student or Danish students in corporation with an interpreter. The purpose of the interviews was to get more in-depth qualitative information about the farmer's agricultural practices and marketing strategies and help us to understand the answers from the questionnaires. The interviews and questionnaires were therefore related in topics and the interviewed farmers were partly selected from the questionnaires.

The interview with the Royal Project officer also followed a semi structured interview guide and was carried out with the whole group listening and asking questions. The purpose of this interview was to help us understand what the Royal Project is and

how it works. The interview with the previous headman of the village was spontaneously done by a Thai student and did not follow any interview guide.

To implement and process the interviews we were following the "Validation of seven stages": themetizing, designing, interviewing, transcribing, analyzing, validating and reporting (Kvale, 1996).

Overall we can say that our interviews were carried out productively; to arrange the appointments went smoothly - which was due to our Thai group members who were familiar in the village –, the interviews went according to our plan and we gained some insight from them. The information gathered will also be used for triangulation with information collected from other methods. During the interview less relevant questions were asked but it is unavoidable and sometimes helped to keep the spirit high during the interview.

3. PRA:

Main Author: Theresia Niba

The term Participatory Rural Appraisal (PRA) covers a range of information gathering techniques which are aimed at learning directly from community members based on how they analyse their own situation. Larsen and Larsen (2006) state, that this method facilitates the identification, preparation and design of community projects based on reality and criteria agreed by the inhabitants themselves. The visualisation techniques often make it easier for the participants to pass on information.

Two PRA sessions were conducted in the Ban Tong Phung village. Both were done in collaboration with the group 6 members working in the same village; not to take up too much of their time.

During the first session, a mapping of the village was done by four different groups. These included two groups made up of men, one made up of women and the third made up of children. This was randomly done and anyone who showed up was welcome.

The second PRA was the last and most important. It consisted of three different kinds of exercise namely; a historical diagram, a table summarizing the use of fertilizers for different crops and an annual calendar with information based on production, work load, water availability, selling prices and finally income and expenditure (Annex 4).

When the exercise began, the interpreter was asked to communicate to the villagers what we wanted to know and how we wanted the exercise to go on. At this juncture we were mainly observers rather than participants allowing them to express and put down all what they want about themselves, without us interfering in their discussion.

In a nutshell, the PRA session was a success in spite of its few short comings. Its advantages were that the whole village was represented that is men, women and children.

During both PRA sessions the men were really active and spoke up whereas the women were timid, shy and offered little or no word.

Conclusively, we can say that our goal was achieved to some extent. We might have had more representative data if we had had the opportunity to select who we wanted to join the PRA, but even if we had had this opportunity it would have been difficult for us to decide who we should ask and the chosen villagers might not be interested to participate.

We sometimes wished for more enthusiastic villagers. The fact that they were not so enthusiastic was probably partly due to our own inexperience in this field and the language barrier. With this strategy combined with a mass and active population one can obtain very useful first hand qualitative information.

4. Soil sampling methodology for soil Fertility analysis

Main Author: Joao Bila

In order to analyze the soil fertility status, soil samples were collected in three types of fields. The first two types were selected according to the farmers marketing strategy (farmers joining Royal Project and non RP farmers). To compare with a non cultivated field, a forest soil sample was also collected.

To avoid sampling error and ensure uniform sampling areas, the soil samples were collected on fields with similar slopes, slope length and farming practices (e.g. cultivation for more than ten years). Other criteria used for selection were land-use intensity and the type of crop grown. Thus 3 fields which were farmed for the RP and were used throughout the year; and 2 fields from the NRP, one which was used year round and one which only had one crop per year were selected.

During the soil sample collection, the owners of the plots were interviewed for specific information such as agricultural practices and past land-use. Schickluna (1981) states that before sampling topography, texture, structure, drainage, color of topsoil, and past management of the land should be considered.

The co-ordinates of the soil sample locations were recorded by GPS. About 20 sub samples were collected in each field and were mixed together to make a composite sample. Thus, Sabbe (1987) argue that statistical studies have led to recommendations that 15-20 cores or sub-samples should be collected to make a good composite sample.

There is no standard depth for soils sampling. It is, however, important to sample the depth which is recommended by the laboratory that will analyze your sample (Schikluna, 1981). The sample was collected in zigzag way, in the first 10 cm of the topsoil. The methodologies used for soil analysis are shown in table 1.

Table 1: Soil analysis methodologies

Soil Parameter	**Methodology**
Soil pH	1:1, H_2O: Soil
Organic matter content (%OM)	Wet oxidation (Walkley and Black, 1987)
Total Nitrogen (tot N)	Kjeldahl method
Available Phosphorus (P avail)	Bray II
Exchangeable Potassium (exch. K)	NH_4OAC 1 N pH 7

To see if there is any difference between farmers joining RP and farmers doing their own marketing with respect to the soil analysis results, the data were compared using Analysis of Variance (ANOVA) and a multiple comparison test (SPSS software). The results will be considered significantly different when $p<0.05$.

It was not possible to find fields within the contract fields and non contract fields with the same crops. Usually, the crops grown for the Royal project are not grown for self marketing strategy. The number of samples was too low to perform a statistics analysis.

5. Erosion measurement

Main Author: Jonathan Rey and Zsuzsanna Sápi

In order to answer our second sub question related to sustainability of the farming practices, not just in terms of soil fertility but also erosion, we decided to use some tools to get some quantitative data besides the qualitative - which we gained from interviews and observation -, thus we have been using two different methods to get more reliable data. Both methods were applied to two fields selected according to the slope, the actual practices and to the fact that the farmers were or not joining the Royal Project.

According to those criteria, the chosen fields were the followings. The first field belonged to Mr. Takne Sawangrattanachaiyo who is not joining the Royal Project. It was situated just under the water reservoir and thereby had access to irrigation so it was cultivated all year with red onion with only 15 days between the harvest and the next crop; it had a slope of 24%. The second one belonged to Mr. Poopuei Jaroenwiwortkul, even though the owner was joining the Royal Project this field was not used for the contract farming due to the lack of water. The field had a slope of 23% and was cultivated only in the rainy season with beans, the rest of the year the field was left to fallow.

As the time spent in the field was during the dry season, we could not do any direct measurement of the erosion. Instead we used two methods to get some theoretical data. Despite this theoretical approach, the combination of the two tools allowed us to get a good idea of the situation in terms of erosion. The first methods consisted of comparing the nutrient content up and down hill on each field and the second method was to use the Universal Soil Loss Equation (USLE).

Comparing the nutrient content up and down hill:

When erosion exists on a field the nutrient content is usually different on the top and the bottom of the hill because the water flowing brings down the top soil to the

bottom of the slope. As the top layer of the soil is usually the richest part in nutrient, the quality of soil in result of erosion will be better downhill.

In order to measure the importance of this process in the two selected fields, we took some soil samples of the first 5 cm of the soil, as we assumed this layer to be the richest part, both on the upper parts and on the lower parts of those fields, in order to compare the nutrient content.

Second method:

The second method used to estimate the soil erosion was the USLE (Box 3). In order to do this equation, some data have been collect directly in the field and were completed by data from literature.

Box 3: The universal Soil Loss Equation (USLE)

$$A = R \times K \times LS \times C \times P$$

Where:

A= soil loss t ha^{-1} yr^{-1}

R= the rainfall factor (ca ½ mean annual rainfall in mm)

K= the soil erodibility factor (range: 0-1)

L= the slope length factor

S= the slope steepness factor

C= the cover factor (range: 0-1)

P= the support practice factor

RESULTS

In this chapter we are presenting our collected data, the results from analyzing and comprehending it and a discussion of it according to the sub questions. After each question we finish with a pre conclusion.

Box 4: Overall description of farming practices in the village from the annual calendar.

Main Author: Theresia Niba **PRA description about activities in the village**

Ban Tong Phung is specialized in the production of both cash crops and staple food. The cash crops include vegetables such as cabbage and red onion. Highland and paddy rice are subsistence crops grown solely for consumption.

Cabbage is an important crop that is grown. Seedlings are prepared in the month of January and sown in February (table 2465). During this period, water accessibility is low so farmers depend on the irrigation system to get the water they need. Before the seedlings are sown, the soil is fed with chemical fertilizer and manure. 100kg of manure and chemical fertilizer (16-20-0) respectively is applied per rai. This is the first session.

The second growing period begins in July during the rainy season. Sowing starts at this time and the second dose of chemical fertilizers (21-0-0) and manure application takes place shortly after weeding. September and October are the months during which harvesting is done, also for this reason the work load is very high, but in general the work load is always very high from the month of April till November because this period encompasses all the major tasks around all the cash crops and rice and it is overlapping essentially with the rainy season, of course. However the price of cabbage is lower in the harvesting period - about 4bahts per kilo – than from June until August. The majority of the farmers' income in the months until September comes from this sale compared with the other months which the lettuce and mitchilli selling also contribute to. On the other hand, their expenditure is very high in June and July before harvesting since money has to be spent on the purchase of seedlings, pesticides, herbicides, paying of tuition fees and the provision of household needs.

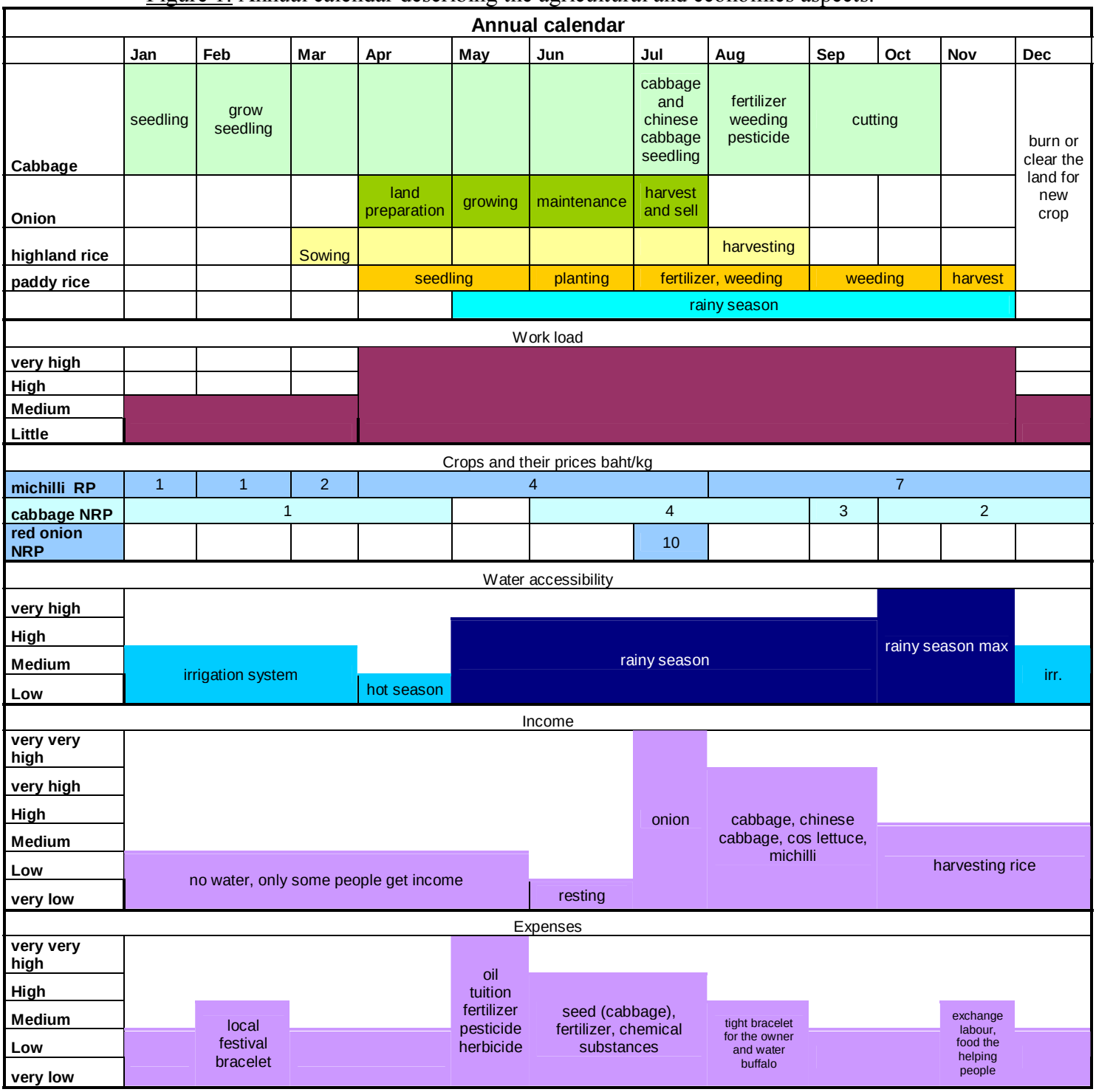
Red onion is the second major cash crop grown by the farmers. It requires a lot of labor since much work has to be done from its initial stage till when it is harvested. Land preparation takes place in early April. By the end of April and early may, the onion is sown on land that has been enriched with 75kg chemical fertilizer (13-13-13) and 25kg manure. Maintenance takes place in June and at this time more chemical fertilizer is applied now using the formula 13-13-21. Onion growing strictly uses the irrigation system since this period is very hot and water is scarce. Its cultivation provides the best source of income for most farmers. A kilogram of onion is sold for 10bahts. This income helps to solve the problems of tuition, purchase of seedlings, chemicals and household needs. In addition it enables the farmers save a little money for future use.

Highland and paddy rice are the staple food for the Ban Tong Phung villagers. As such, rice cultivation is strictly for consumption. Highland rice is sown in March almost at the end of the hot season and the beginning of the rainy season. For sure rice growing needs a lot of labour and the work load is high from the time when the rice is sown till harvesting in August. Rain is the main source of water for rice cultivation. It starts gradually in April and is heavy in the months of May, June and July. Highland rice gives relatively no income since it is grown for consumption.

A major necessity for paddy rice is the availability of plenty of water hence the reason why it is cultivated in the rainy season. It starts with seed preparation at the end of April and early May. Before planting takes place in June, the soil is fed with chemical fertilizer and manure. About two bags of chemical fertilizer is applied per rai using the formula 46-0-0 whereas 25kg of manure is used per rai. However, chemical fertilizer and manure application depends on the individual farmer and also the fertility of the soil. Weeding occupies the months of July and August. Rice harvesting is done in the month of November which is the dry season. During the period farmers organize what is called exchange of labour, helping each other during the harvest.

Conclusively, one can see that even though rice growing entails a lot of labour, it is not a source of income for farmers since it is used mainly to satisfy subsistence needs.

Figure 1: Annual calendar describing the agricultural and economics aspects.



1. Sub research question 1:

Main Author: Zsuzsanna Sápi

Which factors influence farmers to choose contract farming with the Royal Project or marketing by their own?

The first sub question explores and compares the pros and cons of the two farming strategies, i.e. to join the Royal Project or not. It also describes the factors which affects the farmers to choose one strategy and not the other and identifies the opportunities available for farmers. Before we go any further we must know what Royal Project is indeed as it is described in box 5.

Now we can begin to think whether the Royal Project is good or bad and whether it has more advantages than disadvantages. We can also compare it with the self-marketing strategy.

The factors which influence the farmers to choose contract farming with the Royal Project or marketing by their own can be divided into social, economic and physical factors.

1.1.Social factors :

There are social factors which affect the farmers to either join the RP or not. First of all, a lot of farmers joined the RP already when it was established in this area, because the King came to the village and convinced the people about the positive aspects of growing vegetables instead of opium. Other reasons for joining are convincing conversations with friends or a project officer. And still others say they joined to get good image. Here we can already see that joining the RP gives prestige. Another argument for joining is that the officers give advice on how to use fertilizer, pesticides and inform them about new technologies and conservation methods. All the people we asked in the village thought that the RP secures an improved living standard compare with the times before and helps the village to develop.

Box 5: What is the Royal Project

Royal Project

In 1983-84the Royal Project came to Chon Thon district with the aim to stop the opium growing and to help the farmers to grow other cash crops. A head office is located in Chiang Mai and here are the basic principles, rules and conditions and the daily prices decided, moreover they also arrange some of the crop distribution. The management plans are sent from head office to the local offices where they receive the harvest from the dependent area and are responsible for quality ranking of the crops, money deals, transportation to market and communication with the villagers.

In Ban Thon Pung village 49 households have joint the project. There are no households who join with 100% of their land. The Royal Project supports different kinds of products which are the following: Cos lettuce, Head lettuce, Chinese Cabbage, Michilli, ornamental plants and Different kinds of herbs. Thus the crops which are not supported by the project are sold on the market by the farmers themselves.
When someone wants to join the RP the officer investigates the demands of the farmer (what they have cultivated in the past; and what and how much they want to cultivate now) and whether the farmer fulfills the requirements of the Royal Project. The most important requirements for a farmer to be selected are the farmer's skills (cultivation history), water accessibility, capital (labour and money), cultivation plan (compatibility between type of crop desired by the farmers and land characteristics) and also his amount of land is considered.
The farmer must accept the Royal Projects conditions regarding price and quality when the contract is made. The farmer can make a wish of which products he would like to grow and the RP will decide whether it is possible or not. The RP will also decide the quantity of the crops and will calculate the amount of fertilizer and pesticides needed by the farmer. They also tell him when to plant, when to add the fertilizer and pesticides and later on they go to the field to check if the farmer followed the plan.

The RP offers two types of contracts where the main difference is how the price for the crop is calculated:
1) Prices on a consignment basis, or
2) Fixed price

When the farmer chooses the fixed price arrangement he makes a contract with the RP which includes the amount of ex. vegetables he will bring and which prices the different qualities will pay. After harvesting the quality will be assessed and he will get paid.
When the farmer chooses to be paid on consignment basis (according to the market price) he also signs a contract which states how much of a certain product will deliver. Only products of grade 1, 2 and U are accepted. The products will be sent to a high quality market and if it is sold there the farmer will receive a good price. If that market does not buy the high quality products it will be sent to a different market where it is sold cheaper and the farmer will receive a lower price. If the product cannot be sold at that market either, it will be returned to the farmer and he can try to sell it himself.

The products which the farmer brings to the RP will be classified according to this quality ranking:
1=best
2=fair
U=poor
3=has been rejected by the RP but has still the outside markets requirements
R=cannot be sold (used as animal feed)
F=has been sold to Muang Mai market (an arrangement which belongs to the RP officers)

The RP supplies the farmers with fertilizer, pesticides, seedlings and plastic to cover the fields if necessary. However, the farmer will pay for this when he receives his payment from the RP. The price the farmers receive from the RP is furthermore reduced by 25% which covers the transportation and other marketing costs.

Some villagers who cannot join the RP feel that they are not supported by anybody.

Some elderly farmers find it difficult to change their farming practices according to the Royal Project's requirement and therefore choose to farm their land on their own.

The personality of the RP officer is very important. Many farmers feel that some of the officers do not truly care about the farmers and that at times they are very rude. This sometimes makes the famers feel like quitting the RP but not enough to actual do it. Lately one RP officer was caught changing and decreasing the fixed price coming from the head office. He thereby paid to the farmers less and kept the difference to himself. This has - according to Mr. Mongkol - led some farmers to leave the RP.

1.2. Economic factors

From the economic part there are many factors to consider. Almost all our interviewees agreed that their income is higher after joining the RP. They feel the RP gives a fair price and even if it sometimes is low they appreciate the safety the RP offers. The farmers find the market system with the RP a relief since they do not have spend time looking for a market and also only have to transport their products to the RP office.

Moreover when the farmer chooses the contract with the fixed price they do not depend on the market prices anymore so the risk of low prices are smaller. The cost of chemical material provided by the project is also lower.

On the other hand there are also some negative aspects for the people who join the project. For instance the prices are sometimes higher on the market compared to the price which the RP offers. Also the price which the RP offers varies day by day which means that the farmers do not all get the same price for the same quality adding to this problem is the fact that it is the RP officers who decide on which day the individual farmers can bring in their products.

Some farmers are dissatisfied with the 25% reduction of the market price; they think it is too much. The RP have limits to how much they can sell on the market so of course this also limits the quantity they can buy from the farmers.

The RP always selects the best quality to sell and in some cases this means the famer is left with the lower quality to sell by himself. This can leave the farmer with a loss since it is difficult to sell a small amount of lower quality.

1.3.Physical factors

With respect to the physical aspects we can see mainly negative characteristics which are all related to the RP's requirements; irrigation to the field is absolute necessary, those who lack water are not allowed to join and since the lower reservoir is broken many people are excluded. The RP also decides with how much land the farmers can join, and from the farmers point of view it is not equally distributed. Finally only a certain amount and certain types of pesticides can be applied and some farmers claims to therefore have problems with pests.

In conclusion we can say that the most important factors influencing farmers to participate in the Royal Project are water accessibility, the possible higher income which can be earned with the RP and finally the support in terms of advices and chemical agricultural inputs.

2. Sub research question 2:

What are the impacts of agricultural practices on soil fertility, erosion and pest control and are those practices sustainable and are there any differences between Royal Project and non Royal Project farmers?

This part discusses the farming practices in the village in term of use of fertilizer, soil conservation methods and pest management. To do so we compared fields from RP farmers and NRP farmers to understand how this institution affects the sustainability of those practices.

2.1 Soil fertility:

Main Author: Joao Bila

The RP fields investigated were all irrigated and cultivated year round with cos lettuce, head lettuce and normal lettuce. For non RP farmers, rotation of cabbage and onion were done in a non irrigated field and the second sample was collected in an irrigated field with onion year round. The slope of the selected field ranged from 30% to 35%. In order to supply the plants with nutrient the selected farmers relied mostly on animal manure.

According to ANOVA results (table 2), there are differences in terms of organic matter *(P=0.006)*, availability of phosphorus *(P=0.009)* and Nitrogen content *(P=0.006)*, among the selected fields. However the different fields are not statistically different with respect to the levels of exchangeable potassium *(P=0.458)*, and Cat ion exchange *(P=0.669* and *P=0.050),* for Ca and Mg respectively.

Table 2: Comparison of soil contents among forestry, RP and non-RP fields using Analysis of Variance (*P<0.05*).

		Sum of Squares	Df	Mean Square	F	Sig.
OM	Between Groups	13.284	2	6.642	22.866	.006
	Within Groups	1.162	4	.290		
	Total	14.445	6			
Nitro	Between Groups	.033	2	.017	22.866	.006
	Within Groups	.003	4	.001		
	Total	.036	6			
AvailableP	Between Groups	61306.243	2	30653.121	18.980	.009
	Within Groups	6460.038	4	1615.010		
	Total	67766.281	6			
Ca	Between Groups	12976.190	2	6488.095	.445	.669
	Within Groups	58286.667	4	14571.667		
	Total	71262.857	6			
K	Between Groups	670224.762	2	335112.381	.956	.458
	Within Groups	1402730.667	4	350682.667		
	Total	2072955.429	6			
Mg	Between Groups	24104.762	2	12052.381	6.950	.050
	Within Groups	6936.667	4	1734.167		
	Total	31041.429	6			

Source: Soil analysis (Lab results)

In order to see which types of fields are different from each other, 'Bonferroni' multiple comparison test were performed (Annex 5).

According to 'Bonferroni' test the level of Organic matter is significantly (*P<0.05*) lower in non-RP fields (3.24%) than in fields within RP (5.37%) and forestry (6.86%). The highest OM amount found in forestry is statistically equal to the RP fields (Annex 5, Fig. 2). Furthermore, the N level (0.16%) is statistically (*P<0.05*) lower in non-RP fields than in in forestry (0.34%) and RP fields (0.27%). The %N is higher in forestry, but it's not significantly different from the RP fields (Annex 5, Fig. 3).

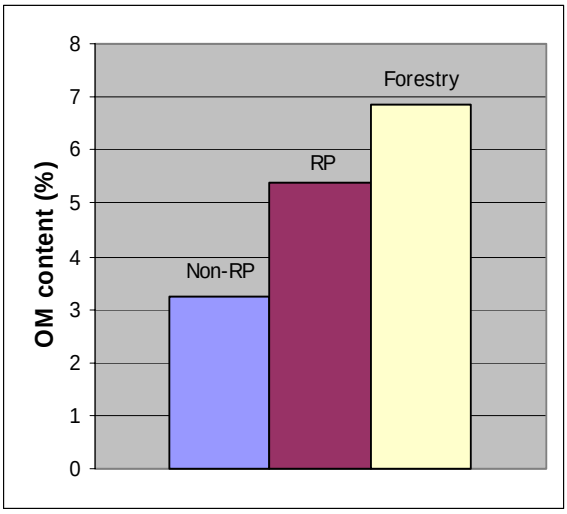


Figure 2: Comparison of OM among forestry, RP and non-RP fields.
Source: Soil analysis (Lab results)

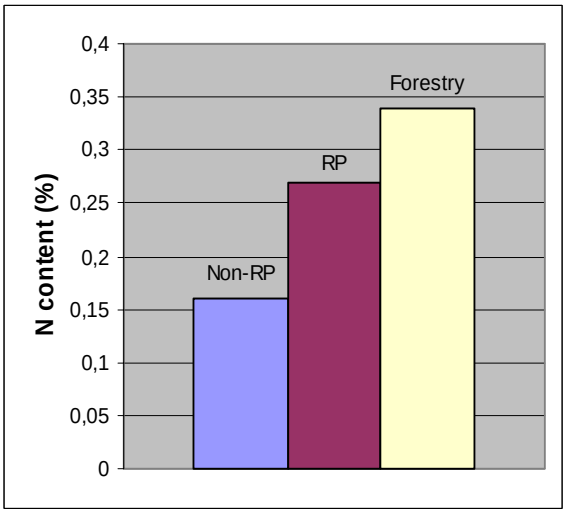


Figure 3: Comparison of Nitrogen level among forestry, RP and non-RP fields.
Source: Soil analysis (Lab results).

The significantly higher amount of OM and N found in forestry rather than in non-RP fields can be linked to agricultural activities. Thus cultivation reduces total vegetative growth, by destroying weeds, and speeds decomposition by mixing which result greatly lower soil humus content are produced. Furthermore, Miller and Donahue (1990) have shown that cultivation of grasslands has lowered soil humus with 40-50% in 30 years. The finding that the equal higher amount of N and OM are found in forest and RP fields and not in non-RP fields is in line with the fact that soil OM contains 90-95% of N in unfertilized soils.

The amount of available-P is significantly higher in forestry (269) than in RP (112.98) and non-RP fields (33.43). However no significant differences were found between RP and RP fields (Annex 5, Fig.4). The same amount of available P in both cultivated fields, even though with slightly different agricultural practices, can closely be related to high retention of it in soil. Similarly Miller and Donahue (1990) state that, whatever the facts, low solubility of soil phosphates are the major problem in getting and keeping soil phosphate available to plants. The higher level of available P in forest can be related to high level of OM matter and obviously to low pressure in this nutrient uptake.

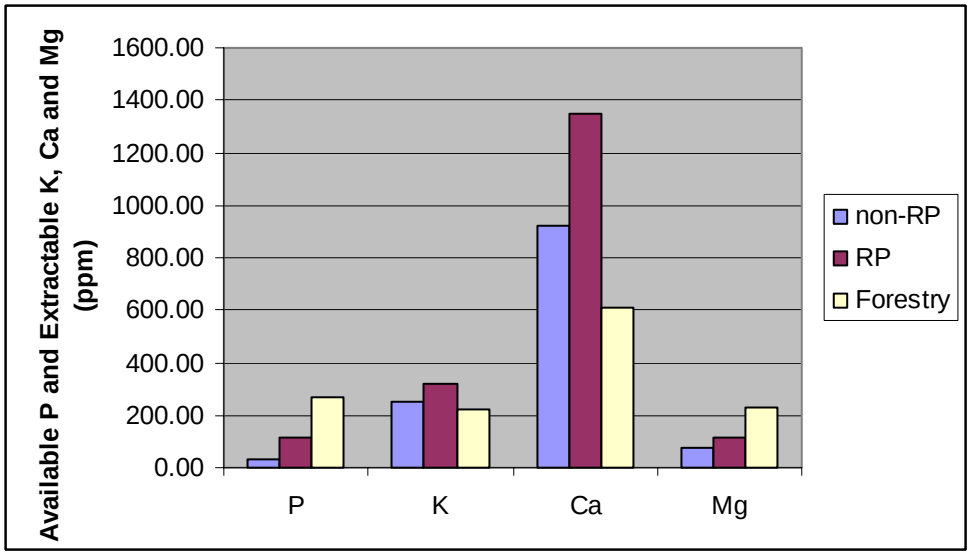


Figure 4: Comparison of available-P, extractable forms of K, Ca and Mg levels, among forestry, RP and non-RP fields.
Source: Soil analysis (Lab results)

The amount of K and Ca extractable is higher in RP Fields with 322.33 and 1348.67 respectively, than in non-RP fields with 252 and 920, and forest with 224 and 612 respectively, however the difference among them are not statistically ($P<0.05$) significant (Annex 5, Fig. 4). Finally the amount of Mg extractable is not significantly ($P<0.05$) different among the several types of field. However the highest (226) amount were registered in forestry, and the lowest (80) in non-RP Fields (Annex 5, Fig. 4).

No differences were found among forest, RP and non-RP fields in terms of K and Cat ion exchangeable. The results are in line with Miller and Donahue (1990) who say that the micronutrients are less often deficient compared to the macronutrients but are still in some instances the growths limiting factors. Furthermore Potassium, K+, is a very soluble cat ion in solution, yet it moves only slowly in soil, it is most abundant metal cat ion (often up to 2 – 3 percent of dry weight) in plant cells, but soil humus furnishes very little potassium during decomposition (Sabbe, 1987), probably that's why the same amount of K exchangeable were found in forest and agricultural fields.

Table 3: Comparison of Soil Fertility Index among Forestry, RP and non-RP fields

Soil Sample	**Fertility Index**
Non Royal Project	Good (21)
Royal Project	Very Good (26)
Forestry	Very Good (25)

Source: Soil analysis (Lab results) and annex 6

The RP fields have a very good fertility index compared to the non RP fields (Table 3). The relatively higher fertility standard of RP fields is also in line with the degree of soil conservation methods (SCM) (data from questionnaire) in which 44 % RP farmers apply SCM, while only 22% of non-RP farmers do so. The quite clear positive correlation between soil conservation methods (SCM) and the content of OM can also support this finding. Soil OM is a particularly rich source of N, P and sulfur (S). Further more it contributes to soil aggregation and to soil cat ion exchange (Miller and Donahue, 1990).

In summary, the RP fields has better fertility standard than non-RP fields. Thus, in terms of soil fertility, the RP fields are being managed in more sustainable way than non-RP fields.

2.2 Use and impacts of Pesticide

Main Author: Joao Bila

In order to understand the sustainability of agricultural practices with respect to pesticide management, the way in which the pesticides are applied were investigated.

From figure 5 it can be noticed that most of the farmers apply pesticide according to the label recommendation (83%) with some bellow (17%) and some above (14%) the label. No big difference was found between RP (42%) and non-RP farmers (40%) applying pesticide according label. On the other hand, slightly big variation was registered between RP and non-RP farmers applying pesticide respectively bellow- and above- label recommendation (Fig. 5). Surprisingly for the above-label category, the RP farmers, with extension services and double check of the use of correct agricultural practices registered relatively higher numbers than non-RP farmers (Fig. 5). Furthermore, pesticides are one of the agricultural inputs provided by the Royal Project to the RP farmers. Probably that is why higher number of RP farmers applying pesticide above the label recommendation was found. Furthermore, it was kind of sensitive question so most farmers tend to be in line with friendly approach, answering that apply according and bellow the label.

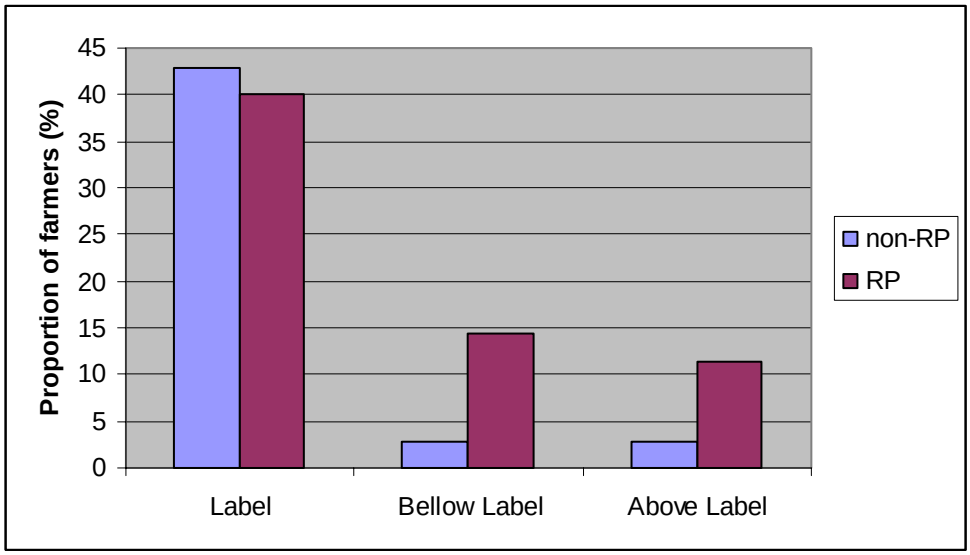


Figure 5: Comparison among the way of pesticide application between RP and non-RP farmers.
Source: Soil analysis (Lab results)

In order to gain more insight of pesticide management, and to understand the long term approach of this agricultural practices, triangulation between qualitative data (pesticide application) and water sampling in main reservoirs for sediments analysis were done. From the laboratory analysis results (Table 4) it can be noticed that, the water of Ton Phung reservoir and the outlet of Upper Mae Pae are contaminated with insecticide sediments namely, mevinphos, choropyrifos and cabufuran. However no contamination were registered in Ton Phung Reservior site, located close to Royal Project office. Probably because the education regarding the pesticide management as well as the respective supervision is more frequent in the fields located nearby the Royal Project office.

Table 4: Organophosphate and carbamate sediments residues in main streams of Thon Phung Reservoirs

Water samples	**Organophosphate**	**Ppm**	**Carbamate**	**Ppm**	**Guideline note**	
					PEL-TWA(ppm	**TLV-TWA(ppm)**
Ton Phung Reservoir	*Mevinphos*	**0.040**			0.011	0.011
	Chlorpyrifos	**0.065**			0.05	0.05
	Malathion	0.045			1	0.74
			Cabofuran	**0.035**	0.011	0.011
			Methomyl	0.015	0.375	0.375
Ton Phung close to Royal Project	*Mevinphos*	0.007				
	Chlorpyrifos	0.025				
	Malathion	Trace	*Methomyl*	0.005	0.375	0.375
The Outlet of Upper Mae Pae	*Mevinphos*	**0.035**				
(after junction of Kong Pae stream)	*Chlorpyrifos*	**0.055**				
	Malathion	0.025				
			Cabofuran	**0.027**	0.011	0.011
			Phosalone	0.017	0.05	0.05
			Methomyl	0.009	0.011	0.011

Source: water sampling

Water contamination with chlorpyrifos can be associated to its high volatility. Chlorpyrifos is volatile enough to make insecticidal deposits on nearby untreated surfaces (Huddleston, 1996). Carbufuran is a broad spectrum systemic insecticide, acaricide and

nematicide. In plants its half life is less than 5 days, but in soil the half life is 30-60 days (Hill and Waller, 1982). Thus water contamination can be linked to its long persistence period in soil. Pesticides that are persistent and water soluble will move through the soil and into the water table. Good water management, low application rates, proper timing of applications and careful handling of pesticide all compensate to reduce the risk of water source contamination (Huddleston, 1996).

In conclusion most of the Ton Phung farmers do not follow the label recommendation in pesticide management. Pesticide user education encouragement and provision of technical assistance should be improved in order to ensure sustainable pesticide management

2.3 Fertilizer:

Main Author: Jonathan Rey

In order to assess the issue of the sustainability of farming practices, we decided to focus mainly on one particular natural resource; the soil. This part will look into the use of fertilizer by farmers and will try to see what the impacts of these practices on soil fertility are.

Since the intensification of practices in the early 1980th, most of the villagers have noticed a decrease in the soil fertility. In order to maintain yields, the use of chemical fertilizer has become necessary.

During the questionnaires we discovered that contrary to our previous assumptions, many different kind of fertilizer were used in the village, especially for crops grown without contract with the RP. The RP officers provided only a few types of fertilizers to their farmers.

The amount of fertilizer used happened to be very different for one farmer to the other, so it is difficult to give any general overview of fertilizing strategy in the village. Anyway, we conducted a PRA exercise in order to get a general idea about the amount of fertilizer used for each crop, as it was done by many farmers together. The results are presented in the fallowing table (table 5).

Table 5: Use of fertilizer per crop.

	Before growing	**During growing**
Onion	13-13-13 75kg/rai manure 30*25kg/rai	13-13-21 75kg/rai
Cabbage	16-20-0 100kg/rai manure(cow) 100kg/rai	21-0-0 100kg/rai
Cos lettuce; head lettuce; mitchilli; chinese cabbage	15-15-15 100kg/rai manure(chicken) 100kg/rai	15-0-0 100kg/rai
Rice	46-0-0 100kg/rai Or (depends on fertility & person) 16-20-0 100kg/rai Manure 50*25kg/rai	Urea 2 month after starting

Source: PRA exercise with the villager.

The results obtained during this PRA are different from the results from the questionnaires in term of quantity, but with respect to the formula the results from the two research methods complimented each other.

According to the interviews we conducted, the big variation in fertilizer consumption is mainly due to the differences in soil quality from among fields. Each farmer seems to be adjusting the quantity of fertilizer according to the productivity and history of each field. In the case of RP crops, the farmers were receiving advice from the RP officer based on theoretical requirements for the different crops, but again we saw that farmers were mainly fallowing their experiences and putting different amounts for each plot.

To discus the sustainability of the fertilizing practices we took a closer look at the nutrients flows in four selected field.

The analyze of the nutrients flow gives us a picture of the nutrient dynamic in the system, and lets us see if the actual fertilizing practices have a tendency to deplete or to increase the amount of nutrient available in the soil. In the four fields we have been looking at, two were with onion and another two with lettuce (lettuce and cos lettuce).

For each of them the nutrient (N, P and K) inputs coming from chemical fertilizer and cow manure were calculated according to data collected during interviews with farmers (Table 6). Table 7 shows the nutrients outputs according to the yields and the content of N, P and K in the crops were calculated according to Warman for the onion and to Jarvän and Põldma for the lettuce (Annex 7). Finally the last table (Table 8) shows the difference between inputs and outputs.

- Field 1: Mr. Papijor; onion
- Field 2: Mr. Mongkol; Onion
- Field 3: Mr. Mongkol; Cos lettuce
- Field 4: Mr. Boodor; Lettuce

Table 6: Fertilizer inputs in 4 different fields and details for N, P, and K.

	Chemical fertilizer					Cow manure				Total		
	Amount (kg)	Formula	N (kg)	P (kg)	K (kg)	Amount (kg)	N (kg)	P (kg)	K (kg)	N (kg)	P (kg)	K (kg)
Field 1	50	15-15-15	7,5	7,5	7,5	0	0	0	0	7,5	7,5	7,5
Field 2	150	13-13-21	19,5	19,5	31,5	400	3,04	0,6	2,68	22,54	20,1	34,18
Field 3	150	15-15-13	22,5	22,5	19,5	400	3,04	0,6	2,68	25,54	23,1	22,18
Field 4	50	15-15-15	7,5	7,5	7,5	2000	15,2	3	13,4	22,7	10,5	20,9

Sources: Interviews and FAO 2005 (Annex 7).

Table 7: Nutrient N, P and K outputs for 4 different fields.

	Yield (kg)	N (kg)	P (kg)	K (kg)
Field 1	2000	68	4	15
Field 2	2700	91,8	5,4	20,25
Field 3	400	11,764	3,156	26,8
Field 4	8000	235,28	63,12	536,1

Sources: Interviews; P.R. Warman; M. Jarvän and P. Põldma 2004 (Annex7).

Table 8: Difference between inputs and outputs for N, P and K.

	Inputs (kg)			Outputs (kg)			Balance (kg)		
	N	P	K	N	P	K	N	P	K
Field 1	7,5	7,5	7,5	68	4	15	-60,5	3,5	-7,5
Field 2	22,54	20,1	34,18	91,8	5,4	20,25	-69,26	14,7	13,93
Field 3	25,54	23,1	22,18	11,76	3,16	26,8	13,78	19,94	-4,62
Field 4	22,7	10,5	20,9	235,28	63,12	536,1	-212,58	-52,62	-515,2
Average	19,57	15,3	21,19	101,71	18,92	149,5	-82,14	-3,62	-128,3

Sources: Table 6 and 7.

Table 8 shows, if we look at the average values, that except for the P, the nutrient balance is highly negative, which means that the soil is being depleted from his nutrients. But if we take a closer look at each field individually, we notice that for the first two fields the inputs and outputs are quite balanced for P and K, only the Nitrogen is strongly negative. The third field is well balance for all nutrients (slightly negative for K) which might be due to the high amount of chemical fertilizer added to this field compared to a very low yield.

The main surprise comes from the fourth field, where the data show a very high depletion of soil nutrients while at the same time the soil analyzes from this farmer's field shows a very high level of nutrient compared to other samples. This contradiction might

be due to an underestimation of the amount of fertilizers added or to the history of the field.

To conclude, we can say that the nutrients flows shown by this table are surprising considering the high level of nutrients in the soil samples collected in the area. But one of the reasons for this could be that these nutrient balances only gives a picture of one cropping season and to get a better idea of the nutrient dynamic in each field the whole rotation process should be studied.

Even if the soil fertility seems to be high (according to the analyses) most of the farmers were saying that it has been decreasing for the past 30 years since intensification started. Facing this problem of decreasing soil fertility, according to an interview with Mr. Mongkol, the practices are starting to change, and people are reintroducing some fallow period in their rotation. Mr. Mongkol was one of the first to introduce fallow periods three years ago and now his fields are not cultivated more than 6 month per year, the rest of the time they are left to fallow. He also started this year to grow some leguminous plants without any commercial objective, just to improve the soil fertility.

2.4 Soil erosion:

Main Author: Jonathan Rey
Co-author: Zsuzsanna Sápi

The results obtained by the two methods used to measure the soil erosion are summarized in the fallowing two tables (Table 9 and10). Table 9 gives the results of the soil sampling collected up and down hill on both fields and table 10 shows the results of the USLE using the measurement carried out in the fields.

Table 9: Nutrient content of the first 5 cm in the upper and the lower part of two fields with similar slope.

	Field 1 – intensive cult. (NRP)		**Field 2 – conventional cult. (RP)**	
	Uphill	**Downhill**	**Uphill**	**Downhill**
pH	5.8 (Higher)	5.5 (Higher)	4.7	5.1 (Higher)
OM (%)	2.74 (Higher)	2.38	3.24	4.16 (Higher)
N (%)	0.137 (Higher)	0.119	0.165	0.208 (Higher)
P (ppm)	69.76	71.60 (Higher)	54.60	92.14 (Higher)
K (ppm)	395 (Higher)	307	291	360 (Higher)
Ca (ppm)	1136 (Higher)	656	660	1020 (Higher)
Mg (ppm)	103 (Higher)	78	78	102 (Higher)
Sand (%)	62.96	70.96 (Higher)	50.96	58.96 (Higher)
Silt (%)	11.28	11.28 (Higher)	5.28	7.28 (Higher)
Clay (%)	25.76 (Higher)	17.76	43.76 (Higher)	33.76
Texture	Sandy clay loam	Sandy loam	Sandy clay	Sandy clay loam

Source: Soil analyze (lab)

The first thing we can see from this table is the big difference in nutrient content between the up- and down- hill samples from the second field. The high content of nutrient downhill compared to uphill could prove that a high erosion activity is going on in this field which is only cultivated in the rainy season. This results is actually confirming the first impression we had in this field, as the colors of the samples we took were different, the sample downhill had a brown color which could be explained as a high OM content compared to the uphill one which was more red.

On field 1, which is intensively cultivated all the year around, the nutrient are almost always higher uphill, also in some cases with very big differences. The first conclusion we can make from this table is that we can find erosion only on field 2, where

the water through the years brought down the nutrients to the bottom of the slope, while on field 1 these nutrients stayed on the upper part.

This result could have happened for different reasons. Perhaps one would expect the erosion to be bigger where the cultivation is more intensive, as leaving the field to fallow usually result in a complete cover of the ground and thereby a good protection of the soil. But looking at this particular case, the fields were left to fallow only during the dry season, so no vegetation can develop on it, which results in having a bare field during at least half of the year and make it more sensitive to wind erosion during this period. Whereas in the case of the first field it can be less significant because the field is always covered, thus the soil is protected all year round.

Even if the results from the first field shows that no erosion is happening, those results should be carefully used, as it is surprising to see such a big different in the nutrient content and especially when it is in favour of the upper part of the field. One way to explain this could be a mistake in the soil sampling. In the upper part of the field, most of the samples were collected in the line between the cultivated rows, while the samples from the lower part were mainly collected in the cropped row where nutrients are taken up by the plants.

Table 10: Annual soil loss (in t/ha/year), calculated according to the Universal Soil Loss Equation, for two fields with similar slope.

	R-factor	K-factor	LS-factor	C-factor	P-factor	Annual soil loss (t/ha/year)
Field 1	506,79	0,0955	5,77	0,6	0,7	117,288
Field 2	506,79	0,0558	4,41	0,7	0,9	78,567

Source: Direct discussion and measurement. (Annex 8)

According to the classification of erosion level for Thailand (Annex 8), the amount of soil loss in field 1 and 2 calculated in this table are respectively “very severe” and “severe”.

Comparing the results obtained by the two methods, we can see that they are completely opposite. This difference can be explained by two facts. First, one method is based mainly on theoretical data while the second is based on soil measurement. The

second reasons is that the USLE has been develop in the USA and it is should be use with care when applied in a tropical environment (Jensen**,** 2006).

Another fact that can bring a doubt in these results is that a lot of soil conservation methods are applied in the village since the Land Development Department promoted them. And according to the interviews there are no erosion problems in the area since this period. The main methods used to limit soil erosion are: terracing, mulching and strip cropping, and according to our questionnaire 2/3 of the respondent are using a least one method. Only one respondent told us that one particular area sometimes experienced erosion, but unfortunately we were not able to make measurements in those fields because this person did not have the time to bring us to the area and he was not able to show us where it was on the map.

To conclude, we can say that even if soil erosion does not seem to be a major problem in the area, as soil conservation methods are well known and used, there is still a net difference between the way fields are cultivated. In the case of the two fields we sampled, the intensification of practices seems to have a good impact against soil erosion, as the fields which are intensively cultivated all the year has less erosion. But to be able to generalize those results and to give any specific conclusion, more samples would need to be done.

3. Sub research question 3:

Main Author: Nina Kirkegaard

How do the agricultural and marketing strategies contribute to the household economy?

The two types of farming strategies somehow implicate the household economies. Under this sub question we describe how these implications appear.

The income in a family who do not join the RP comes mainly from selling red onions and cabbages either to a middleman or at the marked. Some families (7 out of the 17 households we interviewed) also have an off farm income which is earned as a labour on other farms. We did not meet any who did seasonal work or any other kind of work outside the village. The income from off farm work is rather small, 5 of the 7 household earned less than 3000baht last year doing this work and 2 households made more than 10.000baht. Compared to the amount of income they have from farming activities the off farm income contribute to the total income with 3.73% to 17.94% with an average of 9.27%.

The income in a family who do join the RP comes mainly from the RP. On average the household here gets 70% of their farm income from activities in corporation with the RP and 30% from selling onions and cabbages to the local market. Fewer household within this group do off farm work; only 4 households do such activities. They all however make more than 10,000baht per year per household doing this, which is app. 15% of their total income.

When the household income for families joining the RP and families who do not join the RP are compared there is a clear difference (fig. 6). The household who join the RP have an average income of 139,141baht while the household who do not have about 57605baht.

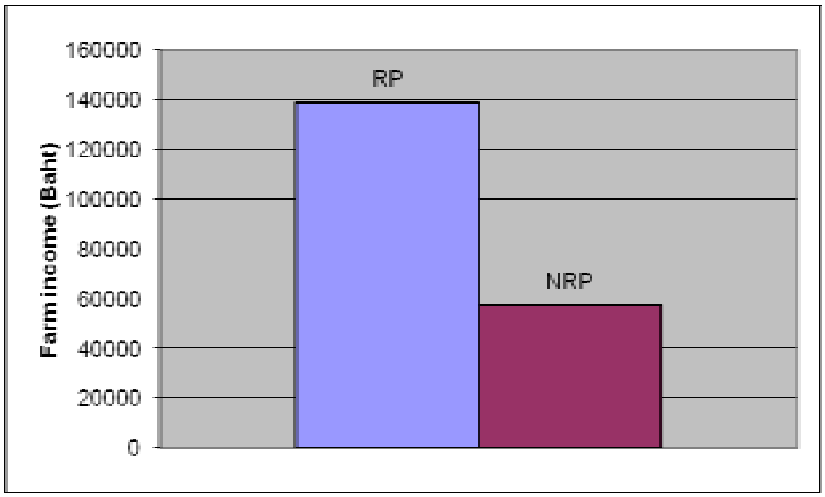


Figure 6: This graph shows the average farm income for the households joining the RP (RP) and those who do not join the RP (NRP). The difference is significant (p=0,033).
Source: short questionnaire

When the two farmer groups are compared with respect to their expenses there is almost no difference (fig. 7)

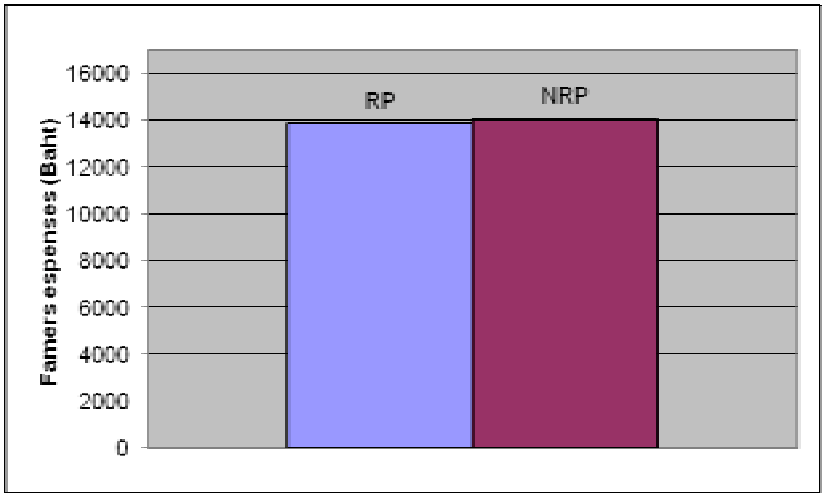


Figure 7: This graph shows the average expenses for the households joining the RP (RP) and those who do not join the RP (NRP). The difference is not significant (p=0.957).
Source: Short questionnaire

The families joining the RP have average expenses of 13,844baht and the families who do not have about 14,061baht. It is surprising that the farmers who join the RP have the same amount of expenses as the other families as the RP farmers have to purchase more seeds, fertilizer and pesticides. The explanation could be that they do not think of the seeds, fertilizer and pesticides for the RP crops as an expense since they do not pay

for them directly, but pay for them as a reduction in their pay when they sell the crops to the RP. However this expense probably has been considered by the farmers saying lower income, which is still much higher than the NRP income.

When the net farm income (farm income less expenses) is compared between the two farmer groups we still see the big difference in their monetary resources (fig. 8).

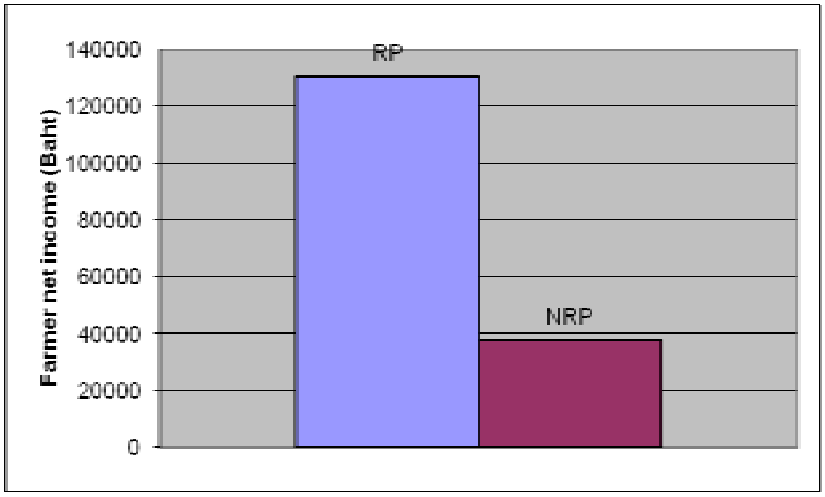


Figure 8: This graph shows the average net income for the households joining the RP (RP) and those who do not join the RP (NRP). The difference is significant (p=0.017).
Source: Short questionnaire

When the off farm incomes are included in the household the picture does not change. The farmers who join the RP still have a much higher income and net income compared to the farmers who do not join the RP (table 11).

Table 11: shows the total income (with off farming income) and total net income for RP farmers and NRP farmers.

	Royal Project	**Non Royal Project**	**Significance**
Total income	140,391	59,605	P=0.034
Net income	131,860	40,005	P=0.016

Source: Short questionnaire

So why do the farmers who join the RP have such a high income compared to the farmer who do not join the RP? If we look closer on the average income the 2 groups of farmers make from the crops we can understand why (fig. 9). The farmers joining the RP and the farmers who do not join the RP all grow the same amount of red onion, cabbage

and Chinese cabbage (there is no significant difference between the groups, red onion (p=0.829), cabbage (p=0.185) and Chinese cabbage (p=0.528). These p values could possible be different if the sample sizes had been bigger.) but the RP farmers grow a lot of additional crops for the RP. The farmers who join the RP all have irrigated fields which allow them to grow 3 crops per year. Compared to the non irrigated fields where the farmer can only grow one crop per year how most of the NRP farmers cultivate.

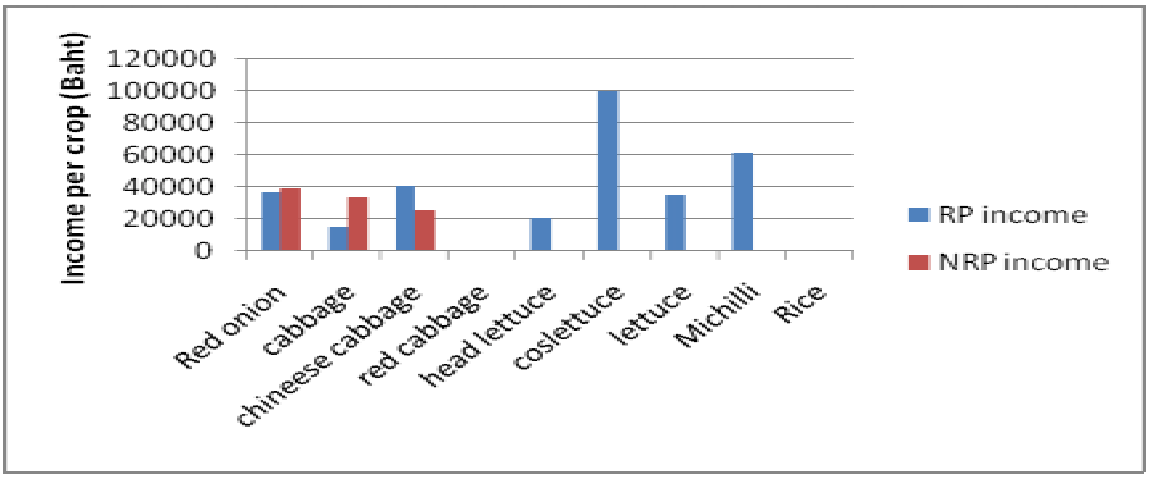


Figure 9: This graph shows the average income from different crops grown by the RP farmers and non RP farmers.
Source: Short questionnaire.

These differences in income between the two farming groups are also visible in the interviews. Every farmer we talked to said he had more money after joining the RP and none of them have ever considered leaving the RP.

The farmers who do not join the RP sell their crops to the middleman or transport it to the market and sell it there. Whether they sell their products depends on how good a price the middleman offers. It does not seem like a big issue for the farmers to bring their products to the market as many households in the village own a pick up. The farmers otherwise pay 1 bat per kg for someone else to transport the crops to the market.

The price the farmers receive from selling their farm product varies between years. Mr. Mareeno for instance explains that the price for cabbage and red onion varies from 2 to 10baht per kg. Mr. Papijor sells lettuce, cos lettuce and herbs for the RP and

his income vary from 2,000 to 30,000baht per season. The same is the case for Mr. Porsoro whose total farm income varies from 20,000 to 140,000baht per season.

Of cause all the information about incomes and expenses has to be taken a little lightly. We do not know how if the farmers are telling the truth, either because they do not know the figure, remember wrongly or because they do not want to share this kind of information with us. There are big variations hidden in the mean values of the incomes and expenses. The lowest net income from a farmer joining the RP is 18,000baht while the highest is 415,000baht. For the farmers who do not join the RP the lowest net income is -15,000 and the highest 130,000. These differences seem big but still we have to remember the large variations of income from one year to another. It is possible that the farmers who had a very little income last year will have a much higher income this year and vice versa.

Conclusively we can say that there is a significant difference between RP and NRP households' economy. The income is much lower for non contract farmers compared to contract farmers while the expenses are the same. This can be explained by the Royal Project farmers' additional crop production.

CONCLUSION

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The main goal of this study was to get some insight in the impacts the Royal Project has on Ban Thon Phung. For this we have been comparing the RP and NRP farmers with respect to their economy and their agricultural and commercial practices.

To do so, three main areas were investigated: the RP advantages and requirements, the sustainability of the agricultural practices and the household economy. The data collected during the ten days makes us draw the following conclusion.

First we can say that one of the main things influencing farmers to join the RP is whether or not they fulfill the requirements based on water accessibility, skills and capital. This brings up the following question "Does the RP support those people who need it less?" Not everyone has access to irrigation, years of farming experience or money in the mattress. But maybe the RP is not a charity organization. The RP has to have requirements in order to function and the farmers need to understand this (Eaton and Shepherd 2001).

The issue of water is particularly important in this area, as all farmers joining the RP have access to irrigation. The access to water might be the main reason explaining the differences in income, more than the contract made with the RP. So it is difficult to prove what most villagers believed, which was a direct link between wealth and the RP.

An other thing that is important to consider in order to understand why farmers join the RP is the social aspect. Since this project belongs to the king, it has become socially important to be part of it, and in some cases this factor comes before rational or economical factors.

The second issue raised in the study was whether the RP has any impacts on the agricultural practices and the sustainability of those practices. Interview results shows

that the soil fertility has been decreasing since the RP arrived and more intensive farming methods were promoted. This was possible due to the development of irrigation facilities. But this intensification does not only concern farmers who join the RP and we noticed that the soil fertility is better in fields belonging to farmers who are part of the RP. We can thereby conclude that the RP do have an impact on the sustainability of fertilizing practice as they advice the farmers in this way.

Looking at the household's economy, we can see a big difference in income when comparing the two groups. The main reason we found for this is that the crops grown for the RP do not substitute the ones that where grown before but are added to them, so it is bringing an extra income. The RP also influences the household economy in term of investment because inputs provided by the RP are cheaper and are paid after marketing.

However, the main economic problem for the villagers is the fluctuation of prices. This problem exists for all farmers but perhaps to a less degree for the contract farmers since the price fluctuation here are smaller.

The main conclusion is that the RP do influence the local economy and farming practices, however this might not have been the case if the irrigation system and the roads had not been developed at the same time. Looking more at the direct activities of the RP, we can conclude - in this case - that contract farming has a good impact on the farmers' economy, but it is difficult to say whether the overall impact from the RP is sustainable in the long term.

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ANNEXES

Annex 1: Short questionnaire

Questionnaire for farmers living in Ban Thon Phung

□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□

Name: □□□□

Gender / □□□ (don't ask):	☐ Male/□□□	☐ Female/□□□□

Number of people in the household? □□□□□□□□□□□□□□□□□□□□□□

How many members of the household lives outside the village? □□□

How much land do you have? / □□□□□□□□□□□□□□□□□□□ ____________rai/□□□

How is the ownership of the land? (□□□) ☐ **None** ☐ □□□□□ / **Bai-Chong** (Authorised temporary occupation of land, after prescribed period and land use.) ☐ □□ **1 / Sor-Kor-Neung** (Claim to ownership based on possession or use of land before the enactment of the land code) ☐ □□ **3 / Nor-Sor-Sarm or Nor-Sor-Sarm Kor** (Secure, enables farmer to sell, transfer, or mortgage land. Ownership rights can be challenged if land lies fallow longer than 5 years) ☐ □□□□ / **Chanod** (Most secure, full unrestricted ownershio title registred with provincial and registrar, Can be sold, rented, sub-divided or mortageged as long as 75% of the land is being used. Ownership rights can be challenged by state or other farmer if land lies fallow longer than 10 years.) ☐ □□ **1 / Nor-Kor-Neung** ☐ □□ **2 / Nor-Kor-Som** (Usufruct) ☐ □□ **3 / Nor-Kor-Sarm** (Can be used legally as loan collateral but can not be sold until 5 years after issue date) ☐ □□□ / **Sor-Tor-Kor** (Usufruct certificate) ☐ □□□ / **Sor-Por-Kor** (Usufruct certificate)

Are you at the moment joining the Royal Project by producing crops for them? □□ ☐ Yes (**□□□**) , if Yes, for how many years? ____________________years

☐ No (□□□□□□□)

Why? (□□□□□□□□□□) / Why not?____
____

If NO, have you joined the Royal Project before but decided to leave?
□□□□□□□ □□□

☐ Yes ☐ No

A. Please list the main crops you grow (maximum 5)
(□□ **5** □□□□□)

B Please indicate whether the crops are grown for the Royal Project (R), For the market (M) or for self consumption (S).
(□□
□□□□□□□□□□□□□□□□□□□ □□□)

C How much fertilizer do you add to your crop per rai for each season?
(□□)

D How much pesticide do you add to your crop per rai per season?
(□□)

A	B	C Chemical, manure, formula. Kg/rai	D
1			
2			
3			
4			
5			

Do you use any soil conservation methods on your fields? (mark as many as necessary)
□□□

☐ Mulching/□□□□□□□□□□□□
☐ Terraces/□□□□□□□□□□□□□□□□□□□□□□□□
☐ Plant grass (vetiver) on contour lines (contour cultivation)/□□□□□□□□□□□□□□□□□□□□□□□□□□□
☐ Strip cropping/□□□□□□□□□□□□□□□□□□□□□□
☐ Hill side ditches/□□□□□□□□□□□□□□□□□□
☐ Drop structure/□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
☐ Other___________________

How do you apply pesticides?
□□

☐ According to the label/□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
☐ More than the label/□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

☐ Less than the label/□□□□□□□□□□□□□□□□□□□□□
☐ The label does not matter/□□□□□□□□□□□□□□□□□□□

How large an amount of each crop did you sell last year?
□□□

A (crop) □□□□□□□□□□□□	B (amount) □□□□□□□□□□□□□□	C (price/kg) □□□□
1		
2		
3		
4		
5		

Last year, how large an amount of the household income comes from off farming activities? □□□□□□□□□□□□□
□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
☐ <3,000
☐ 3,000-5,000 □□□/Baht
☐ 5,001-7,000 □□□/Baht
☐ 7,001-10,000 □□□/Baht
☐ >10,000 □□□/Baht

Farming expenses:
□□□□□□□□□□□□□□□□□□□□
Last year, how much money did you spend on pesticides, fertilizers, seeds
□□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
□□□□□ □□□□□□□□□□□□□□□□□□□□□□
Pesticides ________________ Seeds____________________
□□□□□□□□□□ □□□□□□□□□□□
Fertilizers_________________ Labor____________________
□□□□ □□□□□□

Annex 2: Long questionnaire

A Household Survey on Land Use, Economy and Social Systems, and Resources Management

□□□□□□□□□□□□□□
□□.....
□□□□□□□□□□□___
_____
□□□□□□ /

Ban Ton Phung Village, Tambon Mae Pae, Jom Tong District, Chiang Mai Pr

****

General Information **General Information** □□□□□□□□□□□□□

House No..... Number of families living in this household……..……...

1.1 1.1 Residents and Labors

No.	Name	Gender	Age	Religion	Family Status	Educational Level	Living inside or outside the village	Main Career	Secondary Career	* Labor or Non-Labor (/)
1										
2										
3										
4										
5										
6										
7										
8										
9										

1.1 **(Continued) Labor Information** *** (Labors Only) ***

/No.	Farming			Non-Farming (Except Livestock and Fishery)				Last year non-farming income given to the family (Baht)
	Working for this Household: Working Length (Days/Months)	Other Employers		In-village		นอกอำเภอ / Out-village		
		In-village(days/months)	Out-village (days/months)	Code (1)	Income	Code (2)	Income	

Note * Code (1) and (2) must be specified

(1) Handicraft (4) OTOP (7) Professional (10) Temporary Employees

(2) Vending (5) Transporting (8) Company's employees

(3) Service (6)/ Craftsman (9) Others

Last-Year Numbers of Labor Force Used for Farming Purposes of this Household ***(Including every crop cultivation)***					
In-Household		Hiring		Labor Force Exchange	
/ Labors	/ Days	/ Labors	/ Days	/ Labors	Days

Productive System, Land Use, and Land Ownership Rights

2.1 This household possesses.....plots of land

No.	/Size /Rai, Ngarn)	Land status				Types of Land Ownership				
		Types of Terrain (1)	Terrain Status		/ Types of Ownership (4)	Methods of Obtaining (5)	No. of Possessing Years	/ Land Use (6)	Approx. Prices of Land	Location
			Slope (2)	Water Access (3)						

Note * (1) - (6) must be specified

/ Types of Terrain (1)	Terrain Status		Types of Ownership (4)	Methods of Obtaining (5)	Land Use (6)
	Slope Level (2)	Water Access (3)			
1 –House	1 –Plain	1 –Irrigational Water Supply	0 –None	1 –Pioneering	1 –On their Own
2 –Paddy Fields	2 –Plateau	2 –Near Natural Water Resource	1 –Reserving Document	2 –Getting Heritage	2 –Renting Out
3 –Farm	3 –Mountainous Area	3 –Rain Water	2 –Sor Tor Kor	3 –Buying	3 –Deserted Land
4 –Seasonal Plant	4 –Highland	4- Tap water	3 –Sor Por Kor	4 –Renting	4- Uncertain
5 - 2+3+4	5 –Forest Area		4 - Nor Sor 3		5- Residing Place
6 –Fruit Plantation	6- Terrace		5 –Land Deed		
7 –Animal Cattle			6- Sor Kor 1		
8- Mixed					

2.2 Tables of Farming Production (Plants)

Types of Plant	2.1 / No. from 2.1	Cultivated Seeds	Chemical Fertilizer			Cow Manure		Compost	Pest Control			
			Type(2)	Formula	/ Quantity (1)	□/Type (3)	Quantity (1)	Quantity (1)	Name	/ Quantity (1)	/way of use (□□□□)	/Quantity (1)
Paddy field												
Highland rice												
Other plants												
Fruit												

Note (1) Specify types of unit (2) 1 – seed 2 – water (3) 1 – cow excrement 2 – chicken excrement 3 – pig excrement

Figure of Property

Property	have	None	Others (1)	Installments Rate (capital + interest)
Electric Pan				
Electric cooking rice pot				

Radio, Stereo				
VCD/TV,VCD Player				
Refrigerator				
Electric gas stove				
Bicycle				
Motorcycle				
Car				
Water pump				
Tractor				
Tractor				
□Pesticide ejection				
Warehouse				
Others (Please state) ……. …….				

Note (1) 1-Given by others 2-By Cash 3-By Credit 4-Distributed by others

Figures of Debt Payment and Saving Deposit

4.1Expenses

(1) A whole-year expenses & food gaining

Types	Gaining by (10 □□□□/scale of 10)		Utilization Frequency (1)	Note
	working	Buying		
1 Rice				
2 Vegetables				
3 Meat				
4 Fruits				

5 Soda, Tea, Coffee				
6 Snacks				
7 Seasoning				
8 Beer, whisky				
9 Cigarettes				
10 Relish				
11 Drinking water				

Note (1) 1-everyday 2-every week 3-every month 4-every year

Figure 4.1 (2) A Whole-Year Transportation Expense

เครื่องใช้	ค่าใช้จ่าย (บาท) ตลอดทั้งปี
1 Soap, toothpaste/Shampoo	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า < 4500
2 Detergent	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า < 4500
3 Sanitary Napkins	☐ ต่ำกว่า > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า < 4500

Figure 4.1 (3) A Whole-Year Transportation Expense

รายการใช้จ่าย	ค่าใช้จ่าย (บาท) ตลอดทั้งปี
1 Bus Fare	☐ ต่ำกว่า > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า < 4500
2 Gasoline Fare	☐ ต่ำกว่า > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า< 4500
3 Car Reparation Fare	☐ ต่ำกว่า > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ มากกว่า < 4500

Figure 4.1 (4) A Whole-Year Social Tax Expense

รายการใช้จ่าย	ค่าใช้จ่าย (บาท) ตลอดทั้งปี
1 Religious & traditional festival	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
2 ceremony of tonsure	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
3 Funeral	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
4 Wedding	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500

Figure 4.1 (5) A Whole-Year Child Education & Medicare Expenses

รายการใช้จ่าย	ค่าใช้จ่าย (บาท) ตลอดทั้งปี
1 Child's education	☐ > 500 ☐ 500-1500 ☐ 2501-3500

	☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
2 Medicare	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500

Figure 4.1 (6) A Whole-Year Public Utility Expenses

รายการใช้จ่าย	ค่าใช้จ่าย (บาท) ตลอดทั้งปี
1 Phone	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
2 Electricity	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
3 Tap water	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500
4 Metan gas	☐ > 500 ☐ 500-1500 ☐ 2501-3500 ☐ 1501-2500 ☐ 3501-4500 ☐ < 4500

4.2 Is now the family in debt of anything?

/NO มี/YES An amount of all debt……Baht From

TKS Bank.....บาท/Baht Interest.....% Arrears.....Lot

- กลุ่ม/กองทุน/Fund.....

Interest.....% Arrears...../Lot

-Relatives, Others Interest.....% /Arrears...../Lot

-Educational Loan.....บาท Interest.....% /Arrears...../Lot

4.3Household Saving Deposit

Yes No Methods.....

Cash.....

Animals.....

Resources Problems

*8.1 Figure of Resources Problems (Interviewees must indicate their own problems)

Priority	Problem	Level			Solution		
		1	2	3	None	fixing	fixed

*8.2

Problem			Level			Solution		
	Yes	No	1	2	3	None	solving	solved
1 Resources 1. Lack of ownership documents								
1.2L ack of farming land								
1.3 Lack of water in consumption and production								
1.4 degenerated forest trespassed forest								

2 Production 2.1 Abnormal weather (disaster)								
2.2 Pest & diseases								
Problem	มีปัญหาหรือไม่		Level					
	Yes	/No	1	2	3	None	solving	solved
2.3 Marketing system in supporting products								
2.4 Losing capital in production								
3 Economy 3.1 Debt-Insufficient income compared with expenses								
3.2 High prices of consumer goods								
4 Social 4.1 Drugs in community								
4.2 Broken community								
4.3 Demoralization								
5 Management 5.1 Injustice Law								
5.2 Attitude bet. Officers & Villagers								
5.3 Regulations breaking								

Figure of Income, Expenses, Saving Deposit, and Debt Interviewees must fill this form after the interview

Income	Source		Total amount (whole year)
	Farming	Non-farming	

Expenses	Details		Total amount (whole year)
	Farming	Non-farming	
Saving Deposit	Source		Total amount (whole year)
Prroperties	Lists of properties		Source of obtaining
Debt	Source of debt		Total amount of debt (whole year)

Note

Interviewer..... Date...../……./……

Annex 3 : Interview guide

Semi-structured interview to farmers and farmer's wife,

The interviews will include the following topics:

Introduction questions:
Family members, history? What are they doing?
Household size and composition,
Size of farm

Questions about the farm:
How long have you been a farmer? (story…changes over years → farming strategies change, history) For how long has the farm been intensive cultivated?
Do you do contract farming with RP or do you sell your crop by your own on market or do you do both?
If both how do you divide your field (area proportion, crop)?
Crops grown – cash crops / subsistence crops - when
Farming practices? (input, output, animals)
What are the difficulties in your current farming practices?
Sustainability, do you ever consider it (long term)? Experience any such problems now? (eg. Low productivity, pests)
Do they use fertilizer (chemical, compost…?) How much?
How much does the field yield?

Other income options:
Other income options, which are important?

Livelihood
Has your life become easier, harder or has not changed? Why?
Food security, income? Health?

Market
Why did you choose contract/non-contract farming?
How has your marketing strategies changed over the last 10-20 years? And how does this influence your way of farming?
How have the marketing strategies of the village changed over the last 10-20 years (access to market, significant changes, increasing/decreasing village development) Does it have influence on your way of farming, choice of your farming strategies?
What are the positive/negative impacts of contract/non-contract farming?
How much do you sell your products for?
How is the transportation to the market?

Outro questions

What will the future bring?
What are you wishes for the future?
What are your fears for the future?
What are your plans for the future?

Questions to RP officer

Is there a limit to how many households/farmers you take in?
Who is responsible for the irrigation system?
Can one enter and leave the RP as he wishes?
Why do you not do business with onion here? Do you do with other village?
Why only crops which need lot of water?
Does the office go to the farmer to ask to enter or the farmer wishes to come here?
Does the farmer decide between marketing and fix price systems?
Can the farmer quit from the marketing (or fix price) system for a while but staying still contract?
What will happen with the reservoir(s)? With the broken one??
Do you plan for the future to support also the people who don't have good water accessibility?
In the fix price system does the farmer know in advance in the contract already the price of the crop? or it can change later?
Usually which farmers or why they choose either fix price or marketing systems?
Can you suggest any way t improve RP?
Do you see any problems with the things how they are now?
Does the seed free any time? Fertilizer, pesticide?
Is it always 25%?

Questions to Royal Project farmer

How did it happen that you join to RP? Story? (RP came to you, you came to RP?, what knid of discussions did you have with RP?, RP gave convincing arguments?)
Did you help any else to join, did you suggest to anybody else?
Does RP meet with your expectations?
How does the support system works? (Advise?)
Did you ever consider leaving from RP? In the future?
(Would you consider yourself a poor/middle/rich farmer?)
Has your income increased since you have joint to RP?
Is RP more popular within certain groups of villagers (young, rich, living a certain place)?
Has RP made your life easier, better?
Are there any disadvantages?
Has your farming practices changed since you joined to RP?
Has the amount of work you are doing changed since then?
Would you like to work more with/for RP (maybe 100%)?
What is the biggest problem you have (quality, quantity, price, fertilizer, pest, skills)?

With what products do you join to RP?
What quality is in the dry/wet season? Why (soil quality, water, skills, seeds, pest)?
How much of your income comes from RP?
How much of your labour/times go to RP?
Do you have income from outside farming? What is it? How much?
If you should advise to RP to do sth better what would you advise?
Do you do RP and non RP farming on the same field or on different ones?
What are your main crops? Why those?
Select 2 crops: details about fertiliser (chemical, organic), yield?
Why do you choose marketing or fix price system?
Do you transport your product by yourself or with a middleman?
With your RP joint crops how is the transportation? Is there any difference compare with the nonRP?

Questions to non RP farmer

How long have you been a farmer here?
Has your farming practices changed over time? How and why? Story…
What kind of land and how much do you own?
Would you like to join to RP? If yes: What is the problem?, How do you think RP can help you?
Are there a lot of farmers who would like to join?
Has any of your extended family join?
Is it a certain groups of society who join? (old, amount of land, friends of joint people)
How do you think RP could affect your economy?
Do you have any income from outside farming?
Can RP affect your life even if you are not joint? How? Can cause you bad things?
How much manure do you use? Do you think in the RP they use less manure?
Why don't you use fertilizer for rice?
How much do prices of fertilizer, pesticide, crop prices change over years an…max, min, average?
Where do you buy the seeds, fertilizer, and pesticide?
What kind of crops do you have?
Do you expect from RP to fix the reservoir?
2 crops: fertilizer (chemical, organic), yield

Annex 4: Annual calendar guide

PRA: Annual calendar

The annual calendar will be done with 2 separate groups, one with farmer joining the RP and one with farmer not joining the RP.

The group will be asked to draw an annual calendar including the fallowing information:

- The 1st line will be containing information about the crops (date of sowing and harvest, weeding period, for the different crops…), periods of off farm activities.
- 2nd line: A graph showing the main variation in the work load along the year.
- 3rd line: A graph showing fluctuation of the price of one crop (the crop still have to be chosen according to the questionnaire)
- 4th line: A graph showing the income variation
- 5th line: A graph showing the expenditures variation
- 6th line: A graph showing the variation in the availability of water (two different colour should be used for rainfall and irrigation water)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main on and off farm activities												
Variation of work load												
Price variation of one chosen crop												
Income variation												
Expenditures variation												
Variation of water availability												

Annex 5: Bonferroni Multiple Comparisons test (P<0,05)

Table A5: Bonferroni Multiple Comparisons test for different level of OM, N, P, K and extractable cat ions among forestry, RP and non-RP fields

Dependent Variable	(I) RPpartipa	(J) RPpartipa	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lowe bund	Upper bund
OM	RP	non-RP	2.13333(*)	.49199	.037	.1847	4.0820
		Forestry	-1.48667	.49199	.117	-3.4353	.4620
	non-RP	RP	-2.13333(*)	.49199	.037	-4.0820	-.1847
		Forestry	-3.62000(*)	.53895	.008	-5.7547	-1.4853
	Forestry	RP	1.48667	.49199	.117	-.4620	3.4353
		non-RP	3.62000(*)	.53895	.008	1.4853	5.7547
Nitro	RP	non-RP	.10667(*)	.02460	.037	.0092	.2041
		Forestry	-.07433	.02460	.117	-.1718	.0231
	non-RP	RP	-.10667(*)	.02460	.037	-.2041	-.0092
		Forestry	-.18100(*)	.02695	.008	-.2877	-.0743
	Forestry	RP	.07433	.02460	.117	-.0231	.1718
		non-RP	.18100(*)	.02695	.008	.0743	.2877
AvailableP	RP	non-RP	59.55333	36.68571	.540	-85.7509	204.8576
		Forestry	-176.01667(*)	36.68571	.026	-321.3209	-30.7124
	non-RP	RP	-59.55333	36.68571	.540	-204.8576	85.7509
		Forestry	-235.57000(*)	40.18718	.013	-394.7428	-76.3972
	Forestry	RP	176.01667(*)	36.68571	.026	30.7124	321.3209
		non-RP	235.57000(*)	40.18718	.013	76.3972	394.7428
Ca	RP	non-RP	70.33333	110.19553	1.000	-366.1276	506.7943
		Forestry	98.33333	110.19553	1.000	-338.1276	534.7943
	non-RP	RP	-70.33333	110.19553	1.000	-506.7943	366.1276
		Forestry	28.00000	120.71316	1.000	-450.1190	506.1190
	Forestry	RP	-98.33333	110.19553	1.000	-534.7943	338.1276
		non-RP	-28.00000	120.71316	1.000	-506.1190	450.1190
K	RP	non-RP	425.33333	540.58816	1.000	-1715.8209	2566.4876
		Forestry	733.33333	540.58816	.739	-1407.8209	2874.4876
	non-RP	RP	-425.33333	540.58816	1.000	-2566.4876	1715.8209
		Forestry	308.00000	592.18466	1.000	-2037.5170	2653.5170
	Forestry	RP	-733.33333	540.58816	.739	-2874.4876	1407.8209
		non-RP	-308.00000	592.18466	1.000	-2653.5170	2037.5170
Mg	RP	non-RP	32.66667	38.01498	1.000	-117.9026	183.2359
		Forestry	-113.33333	38.01498	.122	-263.9026	37.2359
	non-RP	RP	-32.66667	38.01498	1.000	-183.2359	117.9026
		Forestry	-146.00000	41.64333	.074	-310.9403	18.9403
	Forestry	RP	113.33333	38.01498	.122	-37.2359	263.9026
		non-RP	146.00000	41.64333	.074	-18.9403	310.9403

* The mean difference is significant at the .05 level.

Annex 6: Procedure for soil fertility index

To get the Fertility Index (FI), the soil analysis data were graded (Mingthipol, 2007). The level of plant nutrition in soil was classified into 5 levels; very high, high, moderate, low and very low (table 2). However, rating of soil pH was different due the effect of pH on plant nutrition in the soil. 5 points were given for neutral (6.6 – 7.0), 4 points for slightly acid (6.0 – 6.5) and mildly alkaline (7.1-7.5), 3 points for medium acid (5.3-5.9) and moderately alkaline (7.6-8.4), 2 points for strongly acid (4.6 – 5.2) and 1 point for extremely acid (<4.5) and strongly alkaline (>8.5). The points among one 1-5 were set to evaluate soil data: 5 points for the best or very high values of parameters and 1 point for the poorest or very low values of soil parameters (table 2).

Table A6: Evaluation of Soil Analytical data for fertility index

Level	**pH**	**Available**			**Exchangeble**		
		OM (%)	**%N**	**P (ppm)**	**K (ppm)**	**Ca (ppm)**	**Mg (ppm)**
Very high (5)	Neutral (6.6 – 7.0)	>3.5	>1	>50	>300	>4000	>850
High (4)	slightly acid (6.0 – 6.5) and mildly alkaline (7.1-7.5	2.5-3.5	0.5-1	40-50	200-300	2000-4000	500-800
Moderate (3)	medium acid (5.3-5.9) and moderately alkaline (7.6-8.4)	1.5-2.5	0.2-0.5	20-40	100-200	1000-2000	60-50
Low (2)	strongly acid (4.6 – 5.2)	0.5-1.5	0.1-0.2	10-20	40-100	400-1000	30-60
Very low (1)	extremely acid (<4.5) strongly alkaline (>8.5).	<0.5	<0.1	<10	<40	<400	<30

Source: Minghipol, O. (2007). Understanding of On-Site Erosion and Soil Fertility. Faculty of Arquitecture and Environmental Design, Maejo University, Thailand

An overview of the soil fertility status from each type of the field investigated is reported in terms of 30 points (the maximum rate). The analyses were done for pH, organic matter content, available phosphorus and exchangeable potassium, and Cat ion exchange (Ca and Mg). The six parameters were included into 30 points and divided into 5 levels of soil fertility index: very poor (<6), poor (7-12), moderate (13-18), good (19-24) and very good (>24).

Annex 7: Manure and crop nutrient content

Table A7.1: Nutrient content of onion

		Nutrient content in g/kg		
		N	P	K
Onion	1999	34,3	2,5	8,5
	2000	33,7	1,6	6,6
	Average	34	2,0	7,5

Source: P.R. Warman

Table A7.2: Nutrient content of lettuce

		N (g/kg)	P (%)	K (%)
Lettuce	test 1	36	0,72	7,47
	test 2	20	0,87	6,14
	test 3	26,8	0,88	6,22
	test 4	22,3	0,87	6,22
	test 5	25,2	0,87	6,14
	test 6	25,6	0,88	5,89
	test 7	25,5	0,84	6,22
	test 8	33,1	0,72	7,39
	test 9	41,1	0,62	7,68
	test 10	38,5	0,62	7,64
	Average	29,4	0,79	6,70

Source: M. Jarvän and P. Põldma

Table A7.3: Nutrient content of cow manure

	N (%)	P (%)	K (%)	
Cattle manure	0,7	0,3	0,67	Lekasi et *al.*, 20011a
	1,63	0,09	1,13	Smaling et *al.*, 1999
	0,57	0,14		FAO, 1980
	0,64	0,06	0,23	Williams et *al.*, 1995
	0,79	0,22	1	Baijukya et *al.*, 1998
	0,29	0,03	0,42	Budelman and Defoer, 2000
	0,7	0,26	0,55	Budelman and Defoer, 2000
Average	**0,76**	**0,15**	**0,67**	

Source: Food and Agricultural Organisation 2005

Annex 8: USLE

- **R-factor:**

The R-factor is calculated with the following equation:
R = 4,23 x P – 21,1 P: annual rainfall in cm

The average of the rainfall of the last 4 years has been used (2003-2006).

Table A8.1: Calculation of R-factor

	Rainfall data (mm) and R-factor												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2003	0	0	18	206,7	219,5	180,4	269,3	341,4	194,8	69,9	0	0	1500
2004	0	0	24,7	57,2	104,7	193,5	179,1	155,2	436,3	192	22,8	27,9	1393,4
2005	2,8	4,9	0	0,5	249,1	178,8	218	115,7	371,4	38,8	28,9	0	1208,9
2006	17,6	0	53,5	41,2	141,4	92	52,4	156,8	315,8	12,8	6,1	0	889,6
Total	20,4	4,9	96,2	305,6	714,7	644,7	718,8	769,1	1318	314	57,8	27,9	4991,9
Average	5,1	1,2	24,1	76,4	178,7	161,2	179,7	192,3	329,6	78,4	14,5	6,98	1248
Average (cm)	0,51	0,1	2,41	7,64	17,87	16,12	17,97	19,23	32,96	7,84	1,45	0,7	124,8
R factor													**506,79**

Source: Personal discussion with Dr. Orothai

- **K-factor:**

The K-factor was calculated for both fields according to the fallowing equation:

$K = 2{,}1M^{1{,}14} . 10^{-6} (12 – OM) + 0{,}0325 (SSC – 2) + 0{,}025 (PPC – 3)$

OM: Soil organic matter
SSC: Soil Structure Code
PPC: Profile Permeability Class
M: Particle size parameter

M = (100 - %Clay) (%Silt + %v.f.Sand*)

*very fine sand: as this data is unavailable, we assume that it is 5% of the total percentage of sand.

Soil structure code (SSC):
1 very fine granular
2 fine granular
3 medium or coarse granular
4 blocky, platy or massive
Source: **Jens Raunsø Jensen** 2006

Table A8.2: Profile permeability classes (PPC):

PPC class	Infiltration rate		Examples
	General	Basic (cm/hr)	
1	Rapid	>12	Sands, loamy sands, gravely sands
2	Mod. Rapid	6 – 12	Sandy loams
3	Moderate	2 – 6	Subsoil structure grade is moderate or strong or texture coarser than silty clay loam
4	Mod. Slow	0,5 – 2	Moderately permeable surface soils underlain by silty clay or silty clay loam with a weak structure
5	Slow	0,1 – 0,5	Permeable surface soils underlain by massive clay or silty clay
6	Very Slow	< 0,1	Fragipan soils

Source: Jens Raunsø Jensen 2006

Table A8.3: Calculation of K-factor

	OM (%)	Clay (%)	Silt (%)	Sand (%)	v.f. Sand (%)	M	SSC	PPC	K
Field 1	2,48	27,76	13,28	58,96	2,95	1172,31	3	3	0,0955
Field 2	3,70	38,76	6,28	54,96	2,75	552,87	3	3	0,0558

Source: Soil analyze (lab results)

- **LS-factor:**

The LS-factor depends the slope and the length of slope, it is calculated according to the fallowing equation:

$LS = (L/22,13)^k \times (0,0065\ S^2 + 0,045\ S + 0,065)$

L: Length of slope S: Slope k: constant

Table A8.4: Calculation of LS-factor

	LS-factor			
	Length of slope (L), m	Slope (S), %	constant k	LS-factor**
Field 1	31	24	0,5	5,77
Field 2	20,5	23	0,5	4,41

Sources: USLE and field measurement.

Table A8.5: Constant k:

Slop (%)	S < 1	1 ≤ S < 3	3 ≤ S < 5	5 ≤ S
Constant k	0,2	0,3	0,4	0,5

Source: Jens Raunsø Jensen 2006

- **C & P-factors:**

The C and P-factors are defined according to the crop cover and to the agricultural practices.

Table A8.6: Classification of the erosion levels for Thailand

Erosion level	**Loss (t/rai)**
Very slight	0.01
Slight	1.01 – 5
Moderate	5.01 – 20
Severe	20.01 – 100
Very severe	100.01 – 966.65

Source: Mads Jules Feer, Troels Høj Nielsen and Andreas Waaben Thulstrup 2005.

Annex 9: Theresia Niba's activity calendar

On arrival on the 6th in the evening of the first day I attended a meeting based on welcome wordings and a general overview of the Royal Project given by the head of the Royal project. In the evening i took part in the visit to the village headman.

On the 7th I participated in the interview with the Royal Project officer. During the day I observe the farmers bringing their products to sell in the office and ask them some few questions.

The 8th started off with carrying out questionnaires in which I took part. In the evening we had a meeting with the villagers.

The whole day I was in the field collecting soil samples and carrying out questionnaires on farmers who were at the field. It was interesting but so exhausting. This was the 9th day

On the 10th and 11th I stayed at the campus uploading information on the computer.

On the 12th I continued entering data unto the computer.

On the 13th in the evening we had the second PRA in which I was present.

The 14th we had a group meeting discussing how to go about with our data

On the last day the ninth I went out in the morning to help in the village community work which was rounded off by a heavy lunch made up pork cooked in various styles. In the evening, we rounded the field work by exchanging words of thanks with the villagers and a farewell party.

Annex 10: Zsuzsanna Sápi's activity calendar.

On 6th in the evening I went with the whole group to have the first visit in the village. We met with the village headman and introduced ourselves.

On 7th I was also asking on the interview with the Royal Project officer held in the morning. We went to walk around the village with the entire group and we could also talk with some villagers. I was helping to choose villagers from the list with the villagers who are joining to the project for the stratified random sampling. I was observing the process when a farmer brought in his crops to the RP office. I was participating in having a comprehensive interview with the assistant of the headman.

On 8th I went to the village also to survey the agricultural areas with a guide and I was asking from one farmer we found on the field. In the afternoon I was entering information to the computer. Then I was doing questionnaires also in the evening.

On 9th I was typing questionnaires in an excel page in the morning. I had done a correction of the map with GPS. I went and participated also to transact the first PRA section in the village.

On 10th I was also there when our group with the water group looked at and tried to analyze and gain information from the community maps together. I went as well to take 4 soil samples from 2 fields. I was entering questionnaires.

On 11th I did power point presentation for the midterm presentation about our work. I was taking part in the group meeting discuss about the next steps.

On 12th I was entering some data in the computer. I spent the afternoon discussing with the group, analyzing some data and preparing the PRA exercises for the evening. Finally the PRA was delayed.

On 13th in the morning I went also to carry out the PRA, and we were waiting there for hours, but it had to be delayed again. I was typing some more data in computer. In the evening we could manage the PRA and I was doing the annual calendar with the villagers.

On 14th I was entering the PRA in computer. In the evening I was asking from the farmer on the interview.

On 15th I went to the forest also to help in preparing the protection against fire, I was sweeping the forest… In the evening we set off a goodbye meeting in the village.

Annex 11: Nina Kirkegaard's activity calendar

The 6th: Evening: Visited the headman

The 7th: Morning: Interviewed an officer from the Royal Project
Walked around in the village
Afternoon: Observed how the farmers delivered their vegetables to the Royal Project and tested the questionnaire on a farmer.
Group meeting where the RP farmers to give questionnaires were selected
Evening: Visited the village headman's assistant who had also invited other farmers. We interviewed and asked the short questionnaire to them.

The 8th: Morning: Went to the field to find farmers to ask questionnaires
Afternoon: Entering data on the computer
Evening: Asking questionnaires and interviewing farmers in the village community hall.

The 9th: Morning: Collected soil samples
Afternoon: Collected soil samples
Evening: Entering data on the computer

The 10thMorning: Discussing last evenings PRA session and planning future activities.
Afternoon: Entering data on the computer
Evening: Entering data on the computer

The 11th Morning:Group meeting – what have we done, what do we need to do
Entering data on the computer
Afternoon: Midterm presentation
Evening: Walked to the top of nearby hill

The 12th Morning:Collected information for USLE
Afternoon:Analysing data and preparing for PRA in the evening
Evening:Went for PRA, but the session was cancelled.

The 13th Morning: Went for PRA, but the session was cancelled.
Afternoon: Entering date to the computer
Evening: Asking questionnaires next to the PRA session.

The 14th Morning: Asked questionnaires in the village
Afternoon: Entering data on the computer
Evening: Interview with one farmer

The 15th Morning: Helping the villagers to do fire prevention in the forest.
Afternoon and evening: Packing and cleaning up.

Annex 12: Joao Bila's activity calendar

6th evening	First visit to the village. Meeting with the village headman to introduce ourselves, our work, aims, topics and activities.
7th morning	Interview with Mr. Kiat, Royal Project officer. Visit to some RP farmer's field, with RP officer. Pilot questionnaire
Evening	Interview with the assistant of the headman.
8th	Carry out questionnaire survey
9th	Carry out soil sampling, and brief interview with owners of the selected plots.
10th morning	Computer data entering and figure out a quick data analyses
11th morning	Group meeting to discuss what kind of information we have and where
Afternoon	Midterm presentation of the results at the village. Group discussion about the plan for the next days
12th morning	Soil sampling and measurement for the USLE
Afternoon	Group discussion, analyzing some data and preparing the PRA exercises for the evening.
13th morning	Computer data entering and figure out a quick data analyses
Evening	Carry out a PRA together with some group six members
14th	Entering questionnaires and the PRA data. Carry out interview
15th	Computer data entering and figure out a quick data analyses. Data sharing with other groups, Meeting with villagers to thank them, and say good bye.

Annex 13: Jonathan Rey's activity calendar

6th of March:
- *Afternoon:* Arrival, welcome meeting with the head of the Royal Project.
- *Evening:* Meeting with the village headmen.

7th of March:
- *Morning:* Interview with Royal Project officer. And visit of the village.
- *Afternoon:* Pilot questionnaire and sampling for questionnaire.
- *Evening:* Interview with the headmen assistant.

8th of March:
- *Morning:* Questionnaire and interview with one RP farmer.
- *Afternoon:* Summary of the morning interview.
- *Evening:* Meeting with some villager for questionnaire.

9th of March:
- *Morning:* Preparation of the PRA exercise.
- *Afternoon:* Discussion about PRA with the other group and GPS correction on maps.
- *Evening:* Mapping PRA.

10th of March:
- *Morning:* Analyzing of PRA maps and group meeting.
- *Afternoon:* Soil sampling and observation of the soil conservation methods.

11th of March:
- *Morning:* Sharing info in the group and preparation of the midterm presentation.
- *Afternoon:* Presentation and planning for the rest of the time to been spent in the field.

12th of March:
- *Morning:* Measurement for USLE.
- *Afternoon:* Data analyzing and preparation of the PRA.
- *Evening:* Failed in doing the PRA.

13th of March:
- *Morning:* The PRA session failed a second time.
- *Afternoon:* Reorganisation of PRA and data analyzing.
- *Evening:* The PRA was finally done.

14th of March:
- *Morning:* Questionnaires.
- *Afternoon:* Sharing information with in the group.
- *Evening:* Interview.

15th of March:
- *Morning:* Help villagers to do a fire protection in the forest.
- *Afternoon:* Preparation of the goodbye meeting with villagers.
- *Evening:* Meeting with villagers to thanks them and share some picture.

Annex 14: Synopsis

Commercial farming and agricultural intensification in Ban Thon Phung village

Synopsis in
”Interdisciplinary land use and natural resource management”
SLUSE
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Introduction

Background:

The Upper northern parts of Thailand cover about 100.474 km^2 of which twelve percent is considered arable land (Chan, 1995). Here agriculture represents about 30% of the regional product and occupies 2/3 of the population (Hansen, 1995).

The population of the upper north is about 5.6 million people (Rerkasem K and Rerkasem B 1994) and the average population density is about 56 persons per km^2 but with a wide variation within the region (Jørgensen and Aagaard, 2001).

The Climate in the mountainous areas falls under the category semi-temperate (Tsutsui-H.; Saiprasert-P., 1994). The average temperature range from 19.3^0C in January to 26.4^0C in April and the annual precipitation is1542.9 mm with a great variation between rainy (from May to October) and dry (from November to April) seasons (FAO database). This climate is good for growing vegetables and fruit trees.

The main agricultural problems in the highland communities are lack of knowledge about farming, lack of credit services, low price for produce and poor roads (Tsutsui-H.; Saiprasert-P., 1994).

The Ban Thon Phung village is found in the Chom Thong district in the upper part of the Pae Mae water-catchment, located in the province of Chiang Mai. It consists of approximately 150 households with a total population of about 800 people. The main religion in this area is Buddhism and the people have a strong belief in spirits. The region has poor access to social amenities such as schools, hospitals, roads, and good drinking water and the literacy rate in this region is very low. A large part of the population depends on commercial agriculture for their living. The main crops grown here include cabbage onion and garlic. (Jørgensen and Aagaard, 2001).

Before the intensification of the farmland began the people lived of traditional and subsistence agriculture (Tsutsui-H.; Saiprasert-P., 1994). Part of their income they also got from growing and selling opium. The Chiang Mai province used to be the largest opium growing province in the country. This production has now ended as other cash crops have been introduced to the area. Cash crops often require more input (fertilisers, pesticides, expensive varieties of seeds) and give a higher output if managed correctly. This more intensively managed farming system can lead to degradation

of soil fertility and pollution of the surrounding environment if not managed properly. This again can lead to a lower productivity and thereby cause poverty for the farmer.

Research question:

As agriculture in this village is one of the main activities, and the practices seem to have faced intensification during the last decades, this study will focus on gaining some insight on the impact of this evolution on population livelihood. To narrow the research area this work will mainly focus on evaluating the sustainability of those new methods. The research question is as follows:

How does Agriculture Intensification influence the sustainability of the livelihood of the Ban Thon Phung farmers?

This research question will be divided into three sub-questions in order to have more direct objectives to refer to. The division will also provide a clearer view of the areas to cover and make it easier to answer the main question. The sub-questions are the fallowing:

- **Is the agriculture intensification sustainable in terms of soil fertility, soil erosion and pest control?**

The term 'sustainability' covers several aspects such as the bio-physical, economic and social aspects. Due to time constraints this study will focus on only biophysical aspects. As agricultural production is important to the village economy we consider it an important field to look in to.

The study will focus on agricultural aspect and in particular on the main natural resource used for agriculture: the soil. Three main indicators which will be used to assess the sustainability of the practices regarding the soil: The nutrient balance, soil erosion and comparison of nutrient content in soil samples from agricultural and non-agricultural land.

The last point to be raised in this question is the aspect of pest management. Changes in pest pressure compared to the degree of intensification and the use of chemicals will give us good indication on how the natural environment have changed due to human activities and how it is affecting the production.

To answer this question, a lot of data about agricultural inputs (fertilizer, green and animal manure, pesticides…), outputs (yields, crops, use of residues…) and pest management will be collected mainly during the interviews but also from questionnaires. Data needed for soil analyse

and soil erosion will be collected trough observation and measurement. Secondary data will also be used.

- **How does agriculture contribute to the household income and food security?**

This question will look in to the economic importance of farming activities for each household. Knowing how much the villagers rely on agriculture for their income and food is essential to answer the main research question because both money and food contribute to livelihood.

This part of the study is also closely linked to the first sub-question as that question becomes more relevant if the households are highly dependent on agriculture for their income.

Most of the information for this question will be collected through questionnaires and interviews. The main data needed is information about the household's income, how much of the income derives from on farm agriculture and off farms activities. Additional information will be obtained during a PRA session where an annual calendar will be made. The annual calendar will cover information on labour activities and intensity, on the food availability and on the variation of incomes through the year.

- **How is the market chain organised and is it beneficial for the farmers?**

As described in the introduction the north of Thailand has experienced changes within their agricultural systems in the past decades. The Thai government has been promoting the development of cash crops to reduce the production of opium poppies and extension services been established to diffuse knowledge about those new crops. However we did not find any documentation mentioning if any commercialisation facilities have been developed and whether farmers have received any guidance on how to cope with the market organisation of this new filière. Market accessibility plays a vital role in the degree of intensification (Pant, Demaine and Edwards, 2004), so understanding the market chain, the transportation facilities and the strengths and weaknesses of those elements will provide a better understanding of the reasons for intensification and it will also help to identify the possibilities and opportunities available for the farmers in this area.

Experience shows that for small farmers to develop, agricultural prices need to be high enough to enable them to make investments. For most small farmers this is not reality (Mazoyer, 2001).

The data will mainly be collected through interviews and questionnaires. The information needed concern selling prices, transportation and eventually on the type of contracts. A visit to the

market is also planned in order to get information about prices and to have conversations with the actors of the vegetable market.

Use of member disciplines:

The group is composed of five members each with a particular field of expertise: agronomy, biology, agro-forestry, geography and landscape management. This discipline diversity within the group gives us a better understanding of the different subjects covered by this study and good communication will allow us to link those subjects and get an understanding of the situation as close to the reality as possible.

The questions regarding soil fertility and pest control will be covered by the two agronomists and the biologist. This will allow us both an agronomical and an ecological point of view on the results. The soil erosion issue will mainly be done by the landscape manager and by the agronomists in order to evaluate at what extend the agricultural practices are responsible for soil erosion.

In the second question mainly geographical skills will be used, when looking into population and household dynamic. Economic issues will be cover by all 5 group members, and details about production economy might be done by both agronomists and the agro-forester.

The last question regarding markets will mainly be demanding geographical skills, but a landscape expertise might also be needed in order to understand the spatial organization of the chain. Questions regarding the impact of the market chain on farmers will be done by everyone.

Even though all group members have particular fields of expertise, the field work activities will be carried out in groups. This will bring different perspectives on each activity carried out and allow us to learn from each other.

Operational definitions of the concepts:

Carefully defined concepts and the consequential constructs helps to eliminate the ambiguity and establishes a basic for insuring construct validity and reliable operational definitions of the variables, making sure that the instruments measures what is supposed to be measured.

Food Security:

University of Kwazulu-Natal define in their homepage food security as a state of assuring physical availability and economic accessibility to enough food (in an environmentally and socially sustainable manner) in terms of quantity (amount, distribution, calories), quality (safe, nutritious, balanced) and cultural acceptability for all people at all times for a healthy and active life.

Intensive farming:

The main goal for any farmer who wishes to intensify his production is to get a higher output per unit area. According to Mortimer (1995) intensive farming is defined as a process where the farmer either increases the inputs of labour or capital on his field, and/or where the farmer cultivates the land more intensively (area intensification), for example decreasing the fallow period in shifting cultivation.

Livelihood:

A livelihood comprises the capabilities, assets (incl. both material and social resources) and activities required for a means of living (Chamber & Conway 1992).

Sustainability:

When it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not understanding the natural resources base (Chamber & Conway 1992).

Sustainable development:

Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs (Brundtland commission 1987).

Methodology

The group chose to apply both qualitative and quantitative methods in order to obtain not merely a knowledge and understanding of the issues of relevance but in addition an impression of how prevailing these issues are. To answer the research questions, triangulation between interview, questionnaires, participatory methods, direct observation and sample collection will be used. Triangulation implies the use of two or more different methods which can be used to check the reliability of one another and thereby improve the validity of the research data (Halkier, 2002).

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Group Discussion [Participatory Rural Appraisal (PRA)]

The term Participatory Rural Appraisal (PRA) covers a range of information gathering techniques which are aimed at learning directly from community members based on how they analyse their own situation. Larsen and Larsen (2006) state that this method facilitates the identification, preparation and design of community projects based on reality and criteria agreed by the inhabitants themselves. The visualisation techniques often make it easier for the participants to pass on information.

The first methods to be used will be the realization of a community map including wealth ranking of the different household as well as information about the farmers and non-farmers. This exercise will be carried out with a group of 5 to 10 key-informants selected by us according to their availability and a previous discussion with the village headmen. The main objective of this method is to gain general information about the village in order to facilitate the next steps.

Another participatory method will be conducted later on; this one will consist in making an annual calendar of production, labour (see annex 3). The PRA exercise will be carried out in two groups divided by gender as we expect them to have different responsibilities.

Interviews

The interviews will be semi-structured and they will be piloted at Ban Thon Phung village with purposefully selected key informants (or non probabilistic). Those informants will be chosen according to the previous information obtained during the community mapping, to their knowledge on the research topics, to their availability and finally a snow ball effect may be used.

These interviews will be done following major guide lines (see annex 1) in order to obtain as much relevant information as possible regarding the different fields of research that this study aims

to cover. The actual interview guide will probably be revised after the first interviews, according to the findings and comments from the interviewee.

Questionnaires

The questionnaire will be piloted at the Ban Thon Phung village with carefully selected farmers. The questionnaire presented in annexe 2 will be revised according to the findings and comments from the pilot, and also according to the first information obtained during the interviews. The questionnaires will be designed to generate quantitative data, and will therefore be standardized and designed to provide data easy to analyse. The majority of questions will be written in a closed format but some open ended questions will also be asked in order to encourage the respondents to express their perceptions in their own words and to elaborate on their answers given if desired. To begin with, easy questions will be asked in order to make the respondent feel at ease thereby enabling him/her to answer the subsequent ones.

The questionnaire will include some of the information covered in the interviews so that a triangulation of results will be possible. The information which requires more precise answers will only be treated in interviews.

The unit of analyse will be the farming households, and 20% of the population will be cover by this questionnaire or with at least 30 respondent. The respondents will be selected using stratified random sampling, with the stratification done according to the wealth ranking obtained during the community mapping.

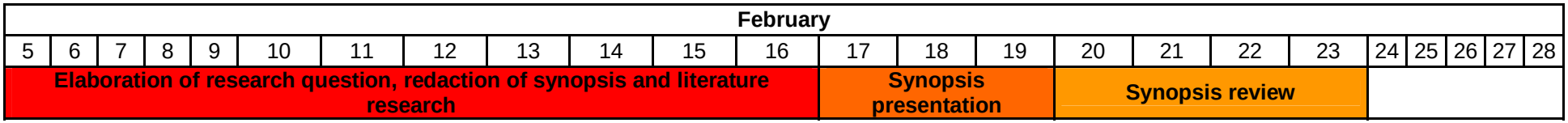
Observation and sample collection

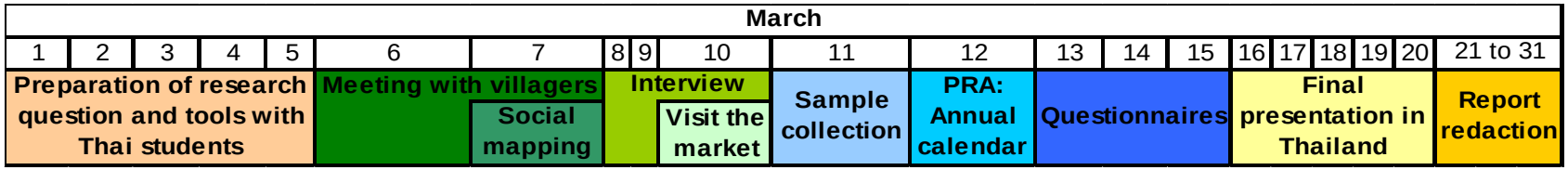
The rest of the needed data will be collected by observation and for some particular subject by measurement of different samples.

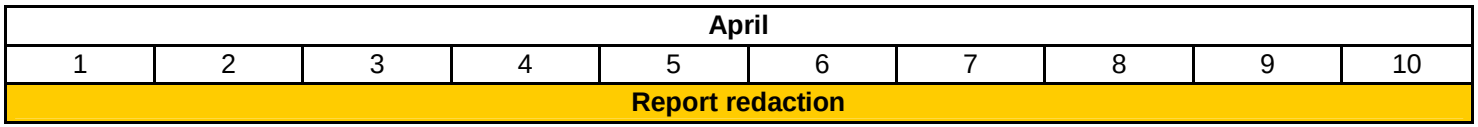
The measurements and analyses of samples will mainly be used to collect the data relating to soil erosion (see annexe 4) and fertility (see annexe 5). Observations and informal conversations will give us information about e.g. market prices and probably also provide us with some unexpected data.

Some soil analyses will be done to measure the impact of agriculture on soil fertility. For this, samples will be collected in 4 different areas: 1) An intensively managed field, 2) a less intensively managed field, 3) a fallow field and 4) a forest area.

Time schedule







Annexe 1: Interview guide

Semi-structured interview with farmers

The interviews will include the following topics:

Introduction questions:
Household size and composition
Family members, What are they doing,
Type of ownership of the land
History of field, changes during years (why), same land use, same crop?

Questions about the farm:
Size of farm
Crops grown
Intensive farming – how intensive and for how long?
What are the main constraints in your farming system? (Land availability, tenure, water, pests and disease, extension service)
Sustainability
Inputs and outputs of the fields

Livelihood
Compare current livelihood with the livelihood before intensive cropping? (Food security, income, health)
Other income options, which are important? (To ask to different household members)

Market
Who buys your products? To which price
At which market are the products sold to the final customer?
Can you get all input (fertiliser and pesticides) you need from the market?
Transportation to the market

Ending questions
What will the future bring?
What are you wishes, fears and plans for the future?

Annexe 2:

Questionnaire for people living in Ban Thon Phung

1. Name:
Gender: (don't ask) □ male □ female

2. Number of people in the household:

3. How many of the people within the household come for dinner (almost) every night?

4. Is the household doing agriculture:

Yes □ No □

5. Would you consider your farm to be producing mainly

□ a) subsistence crops
□ b) cash crops or
□ c) both (proportion?)

6. Do you do anything to conserve the soil on your farm?

□ yes
□ no

If YES, what do you do?

□ Intercropping
□ Using organic manure
□ Mulching
□ Others:_____

7. For how many years have you been producing cash crops?

□ 1-3 years
□ 4-10 years
□ 11- 20 years
□ 21 years or more

8. How large is the harvest now compared to the first years of cash crop production?

- Larger
- The same
- Smaller

What are the reasons for this? (ex. Pest problems, soil fertility, experience)

_____

_____

9. How many Hectares of land are you cultivating?

- 0-0,5 Ha
- 0,51-1 Ha
- 1,1 – 2 Ha
- 2,1- 4 Ha
- 4.1 Ha or more

10. Approximately how large an amount of the household's total yearly income derives from Agriculture?

- 0
- ¼
- ½
- ¾
- all

11. Which other income sources does the household have?

- Work on an other household's farm
- Work in a plantation
- Selling non timber forest products
- Remittance from household members not living on the farm at the moment
- Pension
- Other_____

12. What are the problems/constraints for intensive cash crop production?

Please score the options with a number between 1-5. 1 = no problem - 5 = always a problem

____ Water deficiency

____ Pests problems

____ Bad access to market
____ Bad access to pesticides
____ Bad access to fertiliser
____ Low price for the product
____ Price instability
____ High input costs
____ High variation in output / harvest
____ Difficult to obtain loan
____ Soil erosion
____ Low soil fertility
____ Too labour intensive
____ Lack of knowledge
____ Land availability
____ Other:_____

13. Please list the two most important crops grown for self consumption in your household.

_____ _____

14. Please list the two most important cash crops grown on your farm.

_____ _____

15. Approximately what part of your total home grown crops do you utilize for self-consumption?

□ 0
□ ¼
□ ½
□ ¾
□ All

16. Do you expect your farm to become more intensively managed within the next 5 year?

□ Yes
□ No
□ Do not know

Thank you very much for your time!

Annexe 3:

PRA: Social mapping and Seasonal diagram

Seasonal diagram

Criteria	January	Februar	Marts	April	May	June	July	August	Septem	October	Novemb	Decemb
Food from own production												
Purchased food												
Outside employment												
Cropping calendar												
On farm work												
Other types of work/ activities……												

Annexe 4:

Soil erosion:

The soil loss will be estimated on selected fields and the fields will be selected for their sloopyness, and rate of intensification.

Soil erosion can be estimated using *the Universal Soil Loss Equation (USLE):*

$$\mathbf{A = R} \times \mathbf{K} \times \mathbf{LS} \times \mathbf{C} \times \mathbf{P}$$

Where:

A= soil loss t ha^{-1} yr^{-1}

R= the rainfall factor (ca ½ mean annual rainfall in mm)

K= the soil erodibility factor (range: 0-1)

L= the slope length factor

S= the slope steepness factor

C= the cover factor (range: 0-1)

P= the support practise factor

Annexe 5:

Nutrient balance:

The nutrient balance will be carried out on a few selected fields. The fields will be selected for the following criteria: the degree of intensification and trying to cover a high diversity in the management practices of those fields. The period for which the nutrient balance will be analysed, will be defined according to the length and degree of the rotation (if this is the case) and for certain period of time if cropped as monoculture.

The nutrient balance will be calculated at the field level for N and P with the fallowing equation:

B = Inputs – Outputs

Where:
B = Nutrient gain
Inputs = All the nutrient added to the field (Fertilizer, animal manure, N fixation)
Outputs = All the nutrient exported from the field (Harvest)

The information about applied fertilizer and yields will be obtain during interview and the information concerning the nutrients contend of the different crops, the nutrient content of animal manure, the Nitrogen fixation and atmospheric deposition will be coming from secondary data.

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