# FARMING SYSTEMS RESEARCH AT KHON KAEN UNIVERSITY, THAILAND

Aran Patanothai[1]

Khon Kaen University has been involved in farming systems research since 1975. Work began with the initiation of a Ford Foundation supported Cropping Systems Project aimed at developing cropping systems for rainfed cultivated areas of Northeast Thailand. A multidisciplinary team approach was used, employing the concepts and methodology of farming systems research as they evolved. From 1984, with financial support from the USAID, the project has expanded into a Farming Systems Research (FSR) Project which included the animal subsystem as well. In the FSR Project, the three major components i.e. crop animal, and social science, were integrated into a full scheme farming systems research.

Over the past ten years, we have gained considerable experience and learned a lot of lessons. The concepts and approach have been changed from the beginning of the project. The objectives and activities have also been modified, particularly to fit the role of a university. This paper summarizes the activities and development of farming systems research at Khon Kaen University from the initial phase up to mid-1985.

## 1. Northeast Thailand

Northeast Thailand occupies an area of about 17 million ha with a population of 17 million people, roughly one-third of the country in area and population. Over 80% of the population is engaged in agriculture. Average farm size is about 3.3 ha and supports a family of 7 persons. Per capita income is estimated at only 40 per cent of the national average.

Low income of the people is due primarily to poor agricultural production which, in turn, is a function of poor soils and erratic rainfall. Most of the Northeast soils are light in texture with low moisture holding capacity and fertility. Average annual rainfall is over 1,000 mm, but varies greatly in amount and intensity both within the year and from year to year. The rainy season starts in May and ends in October, with lag periods commonly occurring in June and July. Rainfall occurs occasionally in

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[1]Leader, Crop Section, Farming Systems Research Project, Khon Kaen University, Khon Kaen, Thailand.

the dry season, and crop production is possible only with irrigation. However, irrigation is restricted to less than 5 per cent of the cultivated land.

Rice is a subsistence crop which occupies more than two-thirds of the cultivated land. Field crops are grown on 20% of the cultivated land, and fruit trees and vegetables account for only 0.9% and 0.2%, respectively.

Land topography is mostly undulating. Rice is grown in the depression, while field crops occupy the upper portion of the undulating lands. In certain areas, particularly in the southeastern part of the region, the land are more or less flat, and the cultivated lands are almost entirely paddy. In the undulating land, paddy fields generally spread up to the middle of the terrace. These upper paddy areas are left idle most of the year due to insufficient water for rice transplanting. Even when planted, yield is generally low. In lowland paddy fields, rice could be planted every year but yield varies from year to year depending on the amount and distribution of rainfall.

Rice is grown primarily for consumption. Only the surplus is sold. As rice production is rather unstable, for many farmers, production of rice is intended not only to have stock sufficient for one year but for two years. This is the main reason why paddy fields spread up to the middle terrace where the soils are more suited to upland crops than paddy.

Cassava, kenaf, and corn are the most important field crops occupying the major portion of upland areas. Cassava and kenaf are planted throughout the region, particularly on poor sandy soils. Corn, however, is localized in the fertile soils. Smaller areas are under sugarcane, peanut, cotton, and mungbean. These crops are grown for cash, and cassava is the major source of cash income for a large number of Northeast farmers.

Cropping systems are mainly monocropping. Double cropping is practiced only in irrigated areas or in areas with heavy soils where corn is grown. In certain areas, vegetables are grown in the dry season utilizing water from natural water sources, farm ponds, or shallow dug wells.

The northeast is the most important livestock production area of the country. However, livestock raising is done by small-scale farmers as an integral part of their farming systems. Buffalo and cattle provide the main source of draft power for paddy rice production under prevailing rainfed conditions. Swine and poultry are raised to utilize rice by-products, such as rice bran and broken rice, as well as other home wastes, crop wastes, and weeds such as banana

stems, sweet potato vines and tubers, papaya leaves, water hyacinth, etc. Pigs are generally sold for cash periodically, while chickens provide the current cash needs. Buffalo and cattle, on the other hand, provide a long-term saving for special occasions, for instance, wedding ceremonies, a son entering monkhood, or when severe drought or flood occurs.

Many farmers still make many of their own utensils out of bamboo and rattan, weave some of their own clothes, and produce their own charcoal. Throughout the region, there are some villagers who are able to supplement family income by producing such craft items as silk, rattan mats, and other utensils such as pots. There are also a growing number of villagers who are skilled mechanics, radio repair persons, carpenters, etc., although few such villagers make their primary income from the exercise of these skills. A major source of supplementary income for many farm families are the jobs found in Bangkok and other places outside the region by villagers who become temporary migrants.

## 2. The Cropping Systems Project

### 2.1 Objectives

In 1975, the Faculty of Agriculture of Khon Kaen University initiated a Cropping Systems Project, with financial support from the Ford Foundation and the Government of Thailand. The main objective of the project was to develop cropping systems for rainfed areas of the Northeast. The formal objectives of the project are:

1) To develop cropping systems for rainfed cultivated areas of Northeast Thailand.
2) To identify crop varieties and improved cultural practices suitable for the cropping systems under rainfed conditions.
3) To provide a research framework in which staff members and students can participate in the problem-solving efforts at the farmers' level.

### 2.2 Proposed Cropping Systems

The main target area of the project was the undulating land type in the central part of the Northeast, classified as the mini-watershed agroecosystem of the Korat Triangle (KKU-Ford Cropping Systems Project, 1982). In this land type, rice, cassava, and kenaf are the three main crops grown as monocrops. Rice occupies the lowland, while cassava and kenaf are grown in upland areas. Under the existing practices of monocropping, there appeared to be a good scope for improvement in cropping systems in this type of land.

In designing the cropping systems to be tested, we had taken the three main crops of the region (rice, cassava, and kenaf) into account and attempted to make full use of the growing season. Due to the undulating terrain, we classified the cultivated land into three types - upland, upper (middle-terrace) paddy, and lowland (low-terrace) paddy (Figure 1). Cropping patterns were designed for the three types of land. These are:

Upland area

1. Cassava-field crop intercropping.
2. Kenaf-field crop double cropping.
3. Double cropping of field crops.

Upland paddy area

4. Double cropping of field crops.
5. A field crop before and/or after rice.
6. Late monocropping of field crops.

Lowland paddy area

7. A field crop before and/or after rice.

These cropping patterns are shown diagrammatically, together with the existing cropping patterns, in Figure 2. Rationale behind the design of these cropping patterns are described below.

In the uplands, cassava is generally planted in rows about one meter apart, and it takes about 3-4 months for the canopy to close up the space between rows. Intercropping of cassava with field crops would thus seem to be a logical system, and legumes appear to be most suitable as the intercrop.

Kenaf is normally planted in early April, and cut at the end of the rainy season in October. By cutting the crop earlier than normally practiced, it is theoretically possible to grow early maturing crops on residual moisture after kenaf cutting.

Crops other than kenaf and cassava should be examined in case production of kenaf and cassava becomes unprofitable in the future. Monocropping of several alternative crops has already been evaluated in other projects. In this project, we proposed to examine these crops in double cropping combinations.

There appears to be at least three possible ways of increasing the productivity of the upper paddies. The first is to change completely to field crop production, and double cropping of field crops might be possible, as in the upland

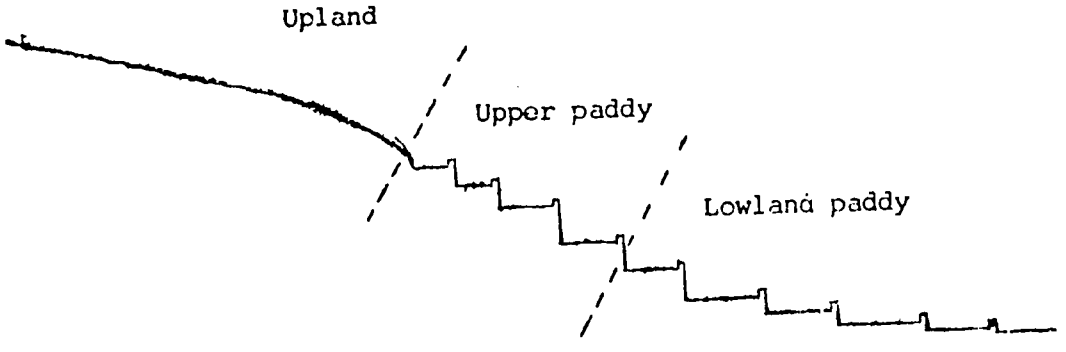


Figure 1. Type of cultivated land in the Northeast Thailand.

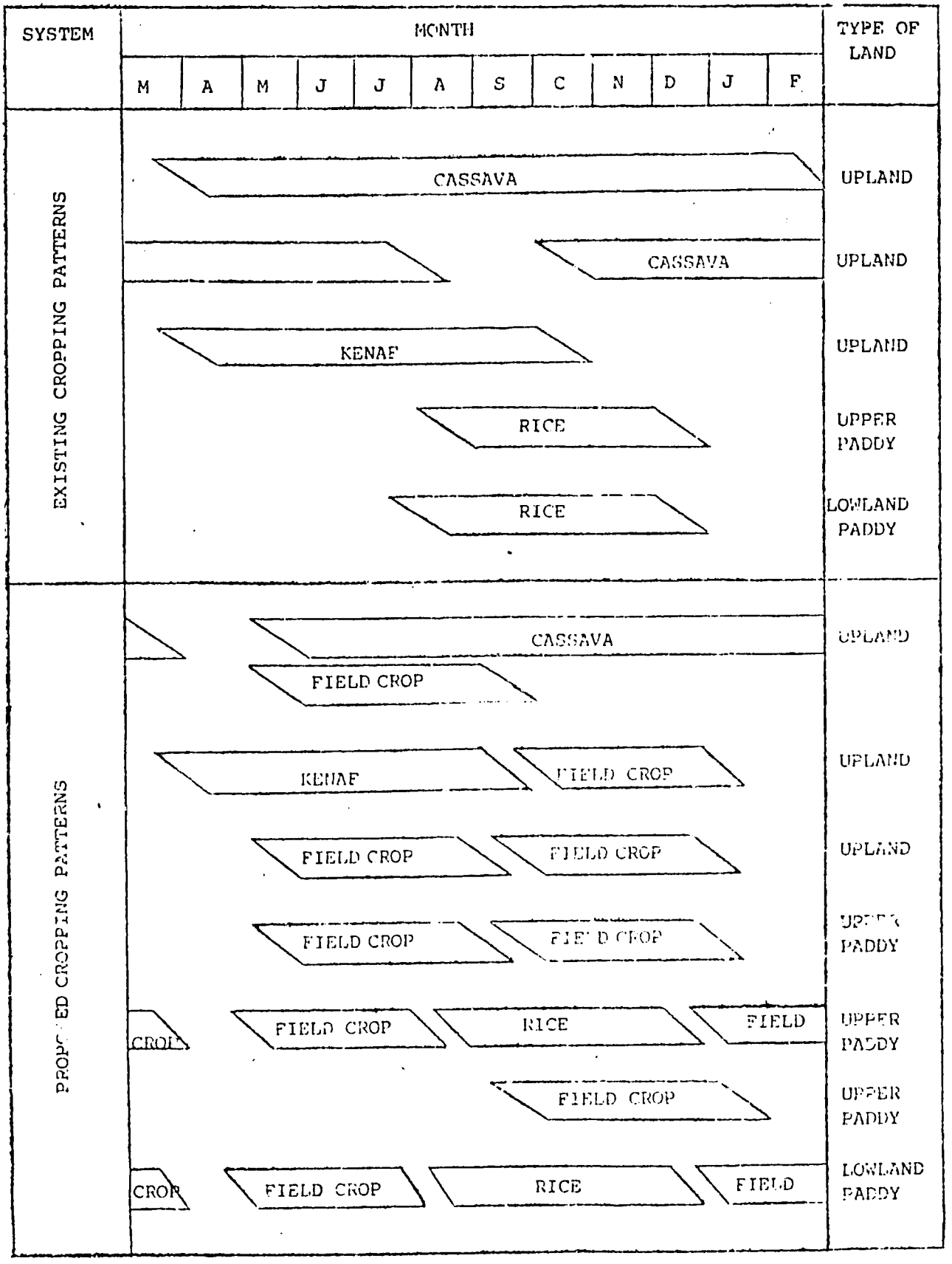


Figure 2. Diagram of existing and proposed cropping systems.

area. Such a practice might not be easily adopted by farmers, since they normally prefer to grow rice for family consumption. However, rice transplanting is late enough to permit growing an early maturing crop. Therefore, the second alternative is double cropping of a field crop with rice.

Growing field crops before rice is perhaps not likely to be accepted by some farmers, since rainfall is unpredictable and they may be afraid that it might interfere with their rice growing. The third alternative is thus to let them wait until very late in the season. If there is not enough water for rice transplanting, and rice production is not possible in that year, field crops might be planted instead of leaving the land idle.

In upper paddies, it might also be possible to grow field crops after rice on residual moisture, using improved soil management.

Lowland paddy generally has sufficient water for rice growing every year, and thus should be used for rice production. We proposed to investigate the possibility of increasing cropping intensity by growing field crops before and/or after rice.

## 1.3 Methodology

We had moved away from the conventional approach in which the experiments are done repeatedly within the research station and the tested cropping patterns go through various stages of improvement before being tested in the farmers' fields. Our approach is to shorten the time frame in screening the proposed cropping patterns by combining testing in the research station and farmer-field testing in the same phase. Field testing conducted by farmers was included very early in the program. It was hoped that this type of approach should enable us to identify some cropping systems or patterns which could be utilized by farmers in a short period of time. Such cropping systems would, by no means, be perfect. However, they could be passed on to the farmers while we work on system improvement utilizing feedback information from the farmers.

Suitability tests were conducted both in the University Farm and in the farmers' fields. Five villages different in socio-economic background were chosen as the test sites. All villages are located in Khon Kaen province and can be reached by car within an hour from Khon Kaen University. Figure 3 illustrates the testing procedure.

Since the experimental farm on campus is an upland area, cropping patterns tested in the university farm were those that had upland crops as the main crops. Standard

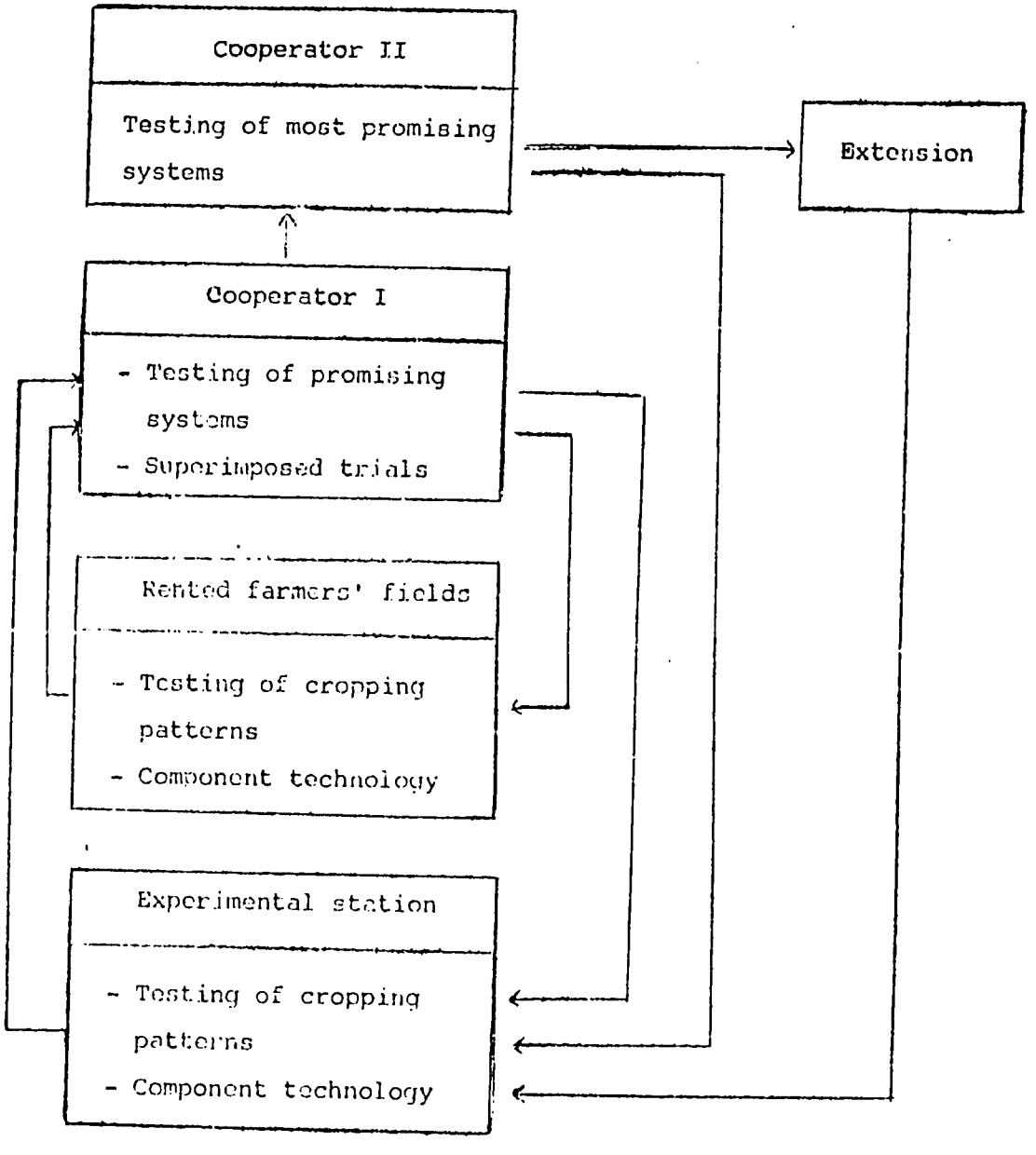


Figure 3. Diagram of the testing procedure.

experimental design with replications was used for testing. Experiments carried out in the villages were classified by the level of management into three types as follows:

1. The trials were conducted by project staff in rented farmers' fields. Treatments were arranged in the usual experimental design with replication.

2. Trials that were conducted by the farmers (called "Cooperator I") in their own fields. These tests were under the close supervision of project personnel. Production inputs like seeds, fertilizer, and other necessary inputs are provided without charge.

3. Trials that were managed by another group of farmers (called "Cooperator II") in their own fields. They tested the most promising patterns on their own farms in demonstration type plots and received technical advice from the project. Production inputs were provided on credit and had to be paid back after harvesting.

Essentially the approach we used is what is now called farming systems research in which on farm trial is the core activity, but the intervention was confined to only the crop subsystem.

### 1.4 Summary of Work during the Early Phase (1975 - 1980)

During the early phase of the project, emphasis was placed on screening the cropping systems for the different types of land previously described, initially in the university farm and/or the rented farmers' fields and later by farmer cooperators in their own land for the promising systems. Component technology research was kept at a minimum during the initial phase but increased over time. Economic evaluation of the cropping systems was done as an integral part of the system evaluation. Other socio-economic studies included base line surveys of the project villages in 1976, a study on marketing system of major crops of the Northeast Thailand, and a resurvey of the project villages in 1980.

During the period 1975-1980, a large number of cropping patterns in the proposed scheme previously described were tested in the different land types. Several field crops were included in those cropping patterns tested. (KKU-Ford Cropping Systems Project, 1975-1980; Limpinantana, et al., 1982; Polthanee, et al., 1982). Results of these cropping patterns testings were summarized in Patanothai (1981 and 1983). The cropping patterns identified as the most promising ones were:

1. Intercropping of cassava with peanut or mungbean.

2. Peanut-mungbean and mungbean-peanut double cropping in upland area.
3. Growing mungbean or peanut before rice in upper paddy field.

Cowpea was also as good, or even better, in performance as mungbean in these cropping patterns, but the market for this crop is very limited.

The promising cropping systems, however, still showed a high degree of instability in production. It was noted that in a certain village, results of several cropping patterns were better and more stable than other villages. In this village, soil moisture appeared to be high in the dry season. Although fluctuations in yields were observed, these promising cropping patterns were considered agronomically profitable. However, these cropping systems were not sufficiently attractive to farmers and their adoption were quite limited. Limited adoption was primarily due to socio-economic factors, particularly the conflict with other farm activities. It became clear that farmers will adopt only the cropping systems that fit their resources and environmental conditions which vary considerably from family to family, place to place, and year to year.

Experiences in working with the farmers has helped us understand the difficulties facing small farmers and the complexity of the system far better than we would have got from working within the research station.

To cite few examples:

(1) Cassava-legume intercropping was found to give better return than solid planting. However the system is hardly practiced by farmers even though there has been a lot of avocation for it. This is mainly because this cropping system would work well when it is planted around May-June in the period of more assured rainfall. Farmers, however, prefer planting cassava at the onset of rainfall (March-April) or after the end of the rainy season (October-November), because weeding is easiest in these periods, and there is less competition for labor with other crops, particularly rice. Planting in May-June requires more labor in weeding, and more importantly weeding time coincides with paddy land preparation and planting which are of higher priority in the farmers' view.

The customary practice of weeding by plowing between rows of cassava with buffaloes presents another complication for intercropping field crops with cassava. Farmers are reluctant to give up this practice in order to interplant field crops, since plowing requires less labor than weeding by hoe.

(2) We noted that farmers who have small paddy land generally took better care of upland crops than those who have large paddy land.

(3) In certain cases, low yields of field crops were not because of poor crop growth, but the farmers missed certain critical operation (for example, did not spray insecticide on mungbean at a critical period). This was due to conflict with other activities of the farmers.

(4) Some farmers did accept some of the systems but accepted only partly and made adjustment to fit other activities and their family resources.

(5) Farmers who practice intensive cropping are generally those with limited land.

(6) In some villages, farmers would not plough their paddy land before a certain festival. This is a constraint to double cropping.

(7) In general, farmers are more concerned with stability of production than maximum return, and those who are likely to take more risk are the better off farmers.

These examples point out the importance of socio-economic factors and the need for better understanding of the interactions of various natural and socio-economic factors in the total system of the farm families, and in particular, with regards to decision making of the farmers.

### 2.5 The Changes in Later Years

With limited adoption of the identified promising cropping patterns, the project began in 1981 to search for new approaches both in terms of practical means and concepts. There were few areas which we found useful and has been incorporated into the present activities. One was the study of the farmers' practices, the others were the concepts and methods of human ecology, agroecosystem analysis, and rural rapid appraisal.

#### 2.5.1 The study of farmers practices

During 1975-1980, we had tested a lot of patterns of growing field crops after rice and after kenaf without any success. We had observed that results from one village were better than the others. This village has high soil moisture during the dry season. However, we learned that, in Surin province, farmers have been growing peanut after rice without irrigation for a long time. In other areas, some of the tested cropping patterns are also being practiced by farmers, e.g. sesame is grown before rice in Burirum

province, and water melon and yam bean are grown at the end of the rainy season in several locations.

In 1981, we began the study of farmers' practices of those cropping systems by visiting the areas where they are used, interviewing farmers, and examining the environmental conditions of the areas. Peanut after rice was the system first chosen for the study. We found that the farmers' techniques differed from the one we had used. The farmers plant peanut very late after the rain ended, make very good land preparations, and plant the peanut very deep. We had attempted to plant the second crops as early as possible, thus, land preparation was done not as good as did the farmers. Field research in 1981 were then concentrated on testing whether the success of growing field crops after rice depends on location or management practices. This was also repeated in later years. The results indicated that the farmers' technique was superior to our previous practice, but location was more important. Good yields of peanut were obtained only in the area with high moisture in the dry season. In those years, we had moved back to largely research managed trials, then expanded to farmers managed trials when we had good success (Jintrawat, et al., 1985). By working with the extension, this cropping system is now being expanded to several locations.

It should be pointed out that studying the farmers' practices was not as easy as one would have thought. The first year of practicing the farmers' technique did not come out the same as the farmers did. We had to go back to the area several times, and finally had to monitor and observe what the farmers did before we could uncover all the details. We also learned that the land preparation technique had to be modified to fit the soil type in Khon Kaen. Study was also conducted later on to examine socio-economic factors related to this cropping system.

Sesame before rice was another existing system studied, but not in great detail as the peanut after rice. To be successful, the crop has to be planted very early (February-March) utilizing early rains. To catch up with depleting soil moisture, land preparation is done poorly, opposite to the peanut after rice system. Farmers realized very well the risk of this cropping system, thus, very low input practices are used.

Case study of well- established existing systems was found to be a short cut approach to identify useful technologies for rainfed farming. In reality, farmers everywhere have been testing several cropping systems and practices over the years by trial and error. Those adopted have passed through the tests of agronomic feasibility, economic viability, and social acceptability. They can readily be transferred to other areas of similar condition. This kind

of study also help us better understand the conditions for which a technology would work and farmers' decision making, which would help guide the direction of future research.

### 2.5.2 Human ecology, agroecosystem analysis, and rural rapid appraisal

In implementation, the project has adopted the farming system research approach. The project has been keeping close touch with the Asian Cropping Systems Network coordinated by IRRI and has closely followed the development of concepts and methodology of farming systems research as they have been developed. However, to use the farming systems research approach successfully and effectively requires more concepts and methods. From 1981, the project began to search for these.

In terms of basic conceptualization, the project team began to learn some of the basic tenets of human ecology. Human ecology is the study of the relations between people and the natural world in which they live. It is intended to help both social scientists, whose ordinary concern is with human affairs, and natural scientists, whose normal focus is on physical and biological phenomena, to better see how their separate subject matter are deeply interrelated. Although there are many different conceptual approaches to the study of human environment interactions, Rambo (1983) suggests that the "system model of human ecology" appears to have particular utility from the standpoint of designing interdisciplinary research projects on human interactions with tropical agroecosystems. The model was designed in recognition that social scientists and natural scientists are professionally equipped to study distinct conceptual entities. Each specialist should continue to work within his area of professional competence but always bearing in mind the need to relate his own research to the overall goals of the whole research project.

While human ecology provides some of the basic outlooks and ideas that can help improve cross-disciplinary understanding, a form of agroecosystem analysis developed by Gordon Conway provides a procedure for analyzing local situations in a manner that can be employed effectively by a multidisciplinary team. The basic procedure is described in detail in Gypmantasiri et al. (1980), Conway (1982), and KKU-Ford Cropping Systems Project (1982).

What this approach provides are organizing concepts or frameworks that encourage scientists from different disciplines to interact with one another in a way that produces insights that significantly transcend those of the individual disciplines. Local systems can be analyzed in a series of steps: statement of objectives, system defini-

tions, pattern analysis and exploration of system properties, identification of key questions, and then research design and implementation. The system properties, which include productivity, stability, sustainability, and equitability, describe how an agroecosystem operates over time.

Agroecosystem analysis procedure allows agricultural, socio-economic and management issues to be raised simultaneously and for a cross-fertilization of ideas to occur. As a consequence, a series of critical questions are raised and collectively recognized. These questions should then be converted into testable hypotheses and serve as the contextual framework for research. The next step is the testing of the hypotheses in laboratory, field research or experiment, or extension trials.

We found that the procedure of agroecosystem analysis is quite useful in the site description (or diagnostic) and designing stages of farming systems research (see Rohrbach, 1981; Shaner, et. al., 1982; or Zandstra, 1982 for detail descriptions of the different stages of farming systems research). Figure 4 shows how, in our view, human ecology, agroecosystem analysis, and farming systems research fit together.

Another technique which we found quite useful is a set of methods known as "rapid rural appraisal (RRA)" (e.g., Beebe, 1985). RRA has several advantages with respect to agroecosystem analysis and in helping to strengthen the operations of interdisciplinary teams. RRA can be used to help generate the data for agroecosystem analysis as well as to begin testing or better understanding some of the hypotheses that result from such analysis. Certain forms of RRA can also be used to assess variation in key factors and constraints over wider areas and groups than a locally focused FSR approach would normally allow. A great deal of RRA experience has recently taken place at KKU (see KKU, 1985). These methods have been proven to be much more effective in beginning to understand rural complexity and variation than many more traditional forms of research method, such as formal survey with questionnaires.

## 3. Strengthening the Interdisciplinary Team - A Preparation for the Rainfed Farming Systems Research Project

By 1982-83, we have gained enough experiences in farming systems research, and, like others, felt that we should go beyond the crop subsystem and take the animal subsystem into account as well. It is well recognized that a key to the success of farming systems research lies in the effectiveness of the multidisciplinary team. Although the Cropping

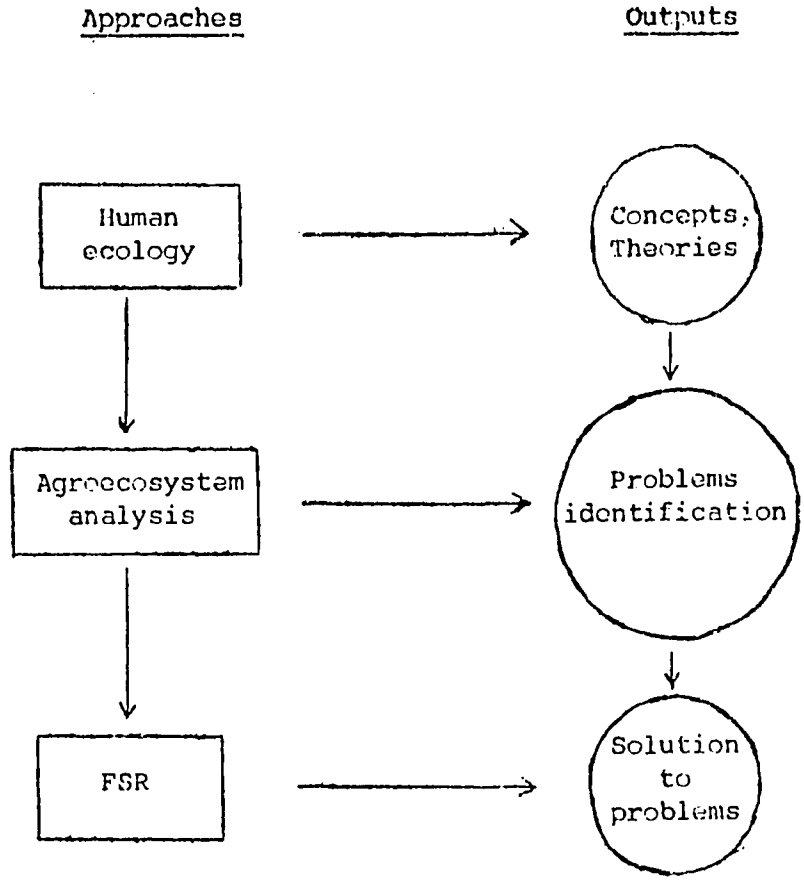


Figure 4. Relationship of human ecology, agroecosystem analysis, and FSR.

System Project was seen as necessarily an interdisciplinary research endeavor from the outset, the social scientists involved were only those in agricultural economics and agricultural extension. Experiences in the past have indicated that we need more disciplines of social scientists in the team. To study the animal sub-system, we also need scientists in the different disciplines of animal science. Therefore, the first step was to broaden the range of disciplinary participation of the team.

But an interdisciplinary team is not just a group of researchers from different disciplines that work together. The team has to view and understand the complexity of the farmer and his environment as a system, not just from some highly specialized aspects. The team should have interdisciplinary "thought" in order that work done would be really integrated. We have utilized the concepts of human ecology, agroecosystem analysis, and rural rapid appraisal in building up system and interdisciplinary thinking of the team (Charoenwatana, 1985). Several workshops on human ecology, agroecosystem analysis, and rural rapid appraisal were held. Some were intended primarily for training, some were done as part of the on going research or assisting other projects of similar nature. We found that these activities were quite useful and effective in improving the system and interdisciplinary thinking of the project staff.

## 4. The Rainfed Farming Systems Research Project

In January 1984, the time the support from the Ford Foundation to the Cropping Systems Project was about to terminate, Khon Haen University started the Rainfed Farming Systems Research (FSR) Project with financial support from the USAID. The Project is essentially a continuation of the Cropping Systems Project, but expanded to include the animal subsystem as well. In the FSR Project, the three major components, i.e. crop, animal, and social science, are integrated into a full scheme farming systems research.

### 4.1 Objectives

In formulating the objectives of the FSR Project, we have considered two major issues - the kind of output technology and the role of the university.

Concerning the kind of output technology, we have experienced that a well defined combination or "package" of technology is of limited use. Farmers adopt technology piece by piece, selecting only those that fit their physical and socio-economic environments. Many times they did not adopt new technology as such, but modified it to fit their environments. Adoption of one technology may lead to adoption of another technology, but generally there is a time lag. Different farmers will adopt different "leading"

technology depending on their resources and interest. Different technologies also differ in their "zone" of applicability, e.g. a crop variety may be suitable for a large area while an agronomic practice will be applicable to smaller area as it is location specific technology, a combination of technologies would be applicable to even smaller area. Even in a particular area, different farmers also differ in their resources, and will make different choices of technology. These considerations led us to believe that, to benefit a large number of farmers, we should aim at generating technology "in pieces" and not in "fix combinations". However conditions suitable for each technology should be specified. We should provide a range of technologies for the farmers to choose. The farmers should be the ones who decide what combination fit their resources and circumstances, and they should be the ones who integrate the technologies or enterprises themselves.

Being an educational and research institute with no direct responsibility for area development, Khon Kaen University has both strength and weakness in conducting farming systems research. The strength lies in the availability of highly trained staff in different disciplines in the same organization. This means we are well fitted to do in depth studies. The weakness is in the teaching and other responsibilities which the staff have to be committed to, and the number of staff and funds are also limited. This means we can operate farming system research in only few sites, and these sites can't be too far from the university. On the other hand, there are several action agencies operating farming systems research in a number of sites, particularly the Farming Systems Research Institute. These action agencies have direct responsibility for area development, and can operate in a larger scale. These considerations lead us to conclude that, to benefit a large number of farmers, the project should aim at action agencies as its immediate clients. Although the target is the rainfed farmers the client is essentially the officers of action agencies. This means the project should generate outputs which can be passed on to farmers through action agencies or can be utilized by action agencies in implementing their programs for improving the well-being of the farmers. The project visualized four kinds of such outputs - technology, methodology, information, and training and communication. These outputs are formulated into the following specific objectives of the project:

(1) To develop and test farming technologies and define the type of farm system and its environments where they will be suitable and beneficial.

(2) To derive classificatory information on agro-

ecosystems and farming systems, their environments, and in terms of types of problems they have and how they allow or constrain various types of technological solutions.

(3) To develop and test methodologies for doing (1) and (2) and put these in a form that can be used by action agencies and applied in the field.

(4) To promote training and communication with action agencies so that (1), (2), and (3) get widely applied in Northeast Thailand and throughout the country.

## 4.2 Coordination of the Project

The project draws staff with different disciplinary backgrounds from the Faculties of Agriculture, Humanities and Social Science, and Public Health. Administratively, the project is sub-divided into three sections - crop, animal, and social science. Apart from the role in policy and financial control above the project level, within the project, a coordinating committee or "core team" was set up to coordinate activities among the three sections for both technical and administrative matters.

Researchers are loosely classified into two types called the "system" researchers and "component technology" researchers. The system researchers refer to those who view the farm as a system. This group of researchers have gone through several seminars or workshops on human ecology and agroecosystems analysis and have gained some system and interdisciplinary perspectives. The component technology researchers are those who are willing to work on special or disciplinary-oriented topics, depending on their training background. However, the topics have to be related to the systems research.

To promote interaction among the scientists, the project holds regular meetings at two levels - the project level and the section level. At the beginning of the project, the group met weekly to discuss research activities and administrative matters. Currently, we meet fortnightly, primarily for discussing research issues.

## 4.3 Research Activities

There are two types of research activities. One is the implementation of full steps of farming systems research in a project village, the second is specific studies outside the project village.

Our experiences in the previous cropping systems project indicated that to develop appropriate technology we must

have a good understanding of the farmers and their decision making, and that a lot could be learned from the farmers. Our emphasis of research in 1984, the first year of the project, was placed on understanding the farmers' existing farming systems, by examining selected existing farming systems in certain areas outside the project village.

In implementing the full procedure of farming systems research, the project has chosen one village, Ban Hinlad, in Amphoe Muang, Khon Kaen, as its base for on farm research and in-depth studies. Site description, the initial step in farming systems research procedure, was carried out using the RRA technique followed by monitoring of farming practices and household record keeping. The latter were also aimed at a better understanding of how the farmers utilize their resources, and defining constraints and opportunities for improvement. Testing of some promising cropping patterns was also continued from the previous cropping systems project.

In 1985, work in the project village are shifting more toward the technology testing stage, but monitoring of farmers' practices is still continued but on specific aspects, and household record keeping is also continued coupled with formal survey to obtain quantitative data for some specific characters of the village. Study is currently being conducted on village history aimed at examining the changes which have occurred in the village, and factors influencing those changes.

Studies of well-established existing farming systems are still a major activity of the project in 1985, as there are several systems and we plan to study them indepth one by one at a time. An approach which we have found useful, particularly in rainfed agriculture, is to transfer existing technology from one location to the others. Such technology could also be further improved. To be able to do this we have to understand the detail practices and conditions suitable for such technology. We also consider the whole process of transferring existing technology from one place to the others as a methodology which will be useful to action agencies. Specific studies, using the RRA technique, are being done on topics significant to the development and transfer of farming systems technology or help improve methodology.

The peanut after rice cropping pattern has gone beyond the testing phase at the research site, and is at the multi-locational testing stage. During the last dry season, we had worked with the extension in testing this cropping pattern at several sites in Khon Kaen. We had one extension worker from the Department of Agricultural Extension working full time with us on this. The aim of this work is not only just technology verification, but also on methodology to conduct this step in the existing government structure.

Below is the list of sub-projects being conducted in 1985. Some of these have been completed at the time this report was prepared.

Crop Section:

C-1 Monitoring of farmers' management practices of existing cropping systems in the project village.

C-2 Studies of the well established existing cropping systems outside the project village.
- sesame before rice in Burirum
- dry season vegetable production by shallow well irrigation in Roi-et
- upland rice in Khon Kaen

C-3 On-farm testing of cropping patterns and component technologies in the project village.
- cowpea and peanut after kenaf
- peanut after rice
- sesame before rice
- vegetables

C-4 Improvement of existing main crops in the project village
- direct seeding for rice
- fertilization of rice

C-5 Research-managed component technologies studies
- yield loss of kenaf due to jassids
- farmers' level storage methods for cowpea seed
- controlling of crop diseases by pre-sowing seed treatment
- dry season moisture regime in the project village
- soil survey and classification in the project village
- identification of nutrient deficiency in the project village soils
- rates and methods of fertilizer application for rice and legumes after rice in the project village

C-6 Multilocation testing of peanut after rice

Animal Section:

A-1 Monitoring of the animal production system in the project village.

A-2 Uses of crop residues as feed stuff
- seasonal surveys and observation of crop residues utilization
- on farm trial

A-3 Small holders dairy farming, competition and complementary to other farm activities
- monitoring and record keeping of resource allocation among seasonal farm activities in three dairy villages.

A-4 Optimum number of backyard chicken to be kept per household in relation to available resources
- topical RRA and monitoring
- on farm trial at later stage

A-5 The role of backyard swine production in farming system
- RRA in four villages

A-6 Small pond and paddy fish culture
- RRA in some selected areas
- monitoring in the project village
- on farm trial in the project village

A-7 Factors affecting number of buffaloes and/or cattle per household
- RRA in some selected areas

Social Science Section

S-1 Household record keeping of selected farmers in the project village.

S-2 Formal survey on certain aspects in the project village.

S-3 Study on project village history.

S-4 Study on nutritional status of children in the project village.

S-5 Topical RRA on specific topics
- labor exchange in the project village
- food habits of farmers in the project village
- farmers' acceptance of crop technology

S-6 RRA methodology development

S-7 In-depth studies of special topics in FSR
- literature review of economic analysis
- economic monitoring of dairy production

Joint Program:

J-1 Communication and training

- distribution of project newsletters, trip reports, occasional papers, and research reports

- providing services to action agencies in the form of consultation, lecturing, committee member, and short-term training as requested
- host the Second National Farming Systems Meeting
- collaborative work with other institutes

J-2 Agroecosystems analysis of Khon Kaen province

4.4 Linkages

Linkages with action agencies and other institutes are considered an important function of the project. As a continuation from the Cropping Systems Project, the FSR project already has strong linkages with action agencies. The key institutes are the Department of Agriculture, especially the Farming Systems Research Institute and the Field Crops Research Institute, the Department of Agricultural Extension, and the Northeast Regional Office for Agriculture and Cooperatives, particularly the NERAD and EEC projects. There has been an increasing demand for contributions of the project by several action agencies to some of their activities. During the past 8 months, the project members were invited to give presentations in the training program or staff meetings held by different agencies 15 times, mainly on cropping systems and concepts of farming systems research. Some project members were also invited to join the committees or working groups established by these agencies. There were also quite a number of visitors visiting the project seeking information on cropping systems and on Northeast agriculture.

An important step in close cooperation with the Department of Agricultural Extension has been made. Apart from giving presentations in their training programs several times, the KKU FSR project has launched a joint program on multilocational testing of peanut after rice without irrigation with the Khon Kaen Provincial Agricultural Extension Office. The Department of Agricultural Extension had sent a staff to work full time with the project on this program, hopefully to examine a better approach in technology transfer and ways to improve linkage between research and extension.

KKU has also played a significant role in assisting the Farming Systems Research Institute in national coordination of farming systems research and development. Two project members represent KKU in the National Farming Systems Working Group. We had helped plan the First National Farming Systems Workshop held at Surat Thani in April 1984, and hosted the Second National Farming Systems Workshop in early 1985. Close linkages with Chiangmai University and Kasetsart University are also maintained.

We have been sending our newsletters to these institutes and the agencies previously mentioned regularly. We also sent trip reports to personnel in other agencies working in the respective topics.

Linkages with foreign institutes are also maintained. The project has been collaborating with IRRI, ICRISAT, East-West Center, and key institutes of Indonesia and the Philippines in the Southeast Asian Universities Agro-ecosystem Network (SUAN). An important collaborative work with ICRISAT is the rainfall analysis of the Northeast. The East-West Center had supported three project members to work on conceptual framework of farming systems and agro-ecosystem. Linkages with other U.S. universities sharing interest in farming systems research are also being established.

## 5. Concluding Remarks

Over the past ten years in which we have been involved in farming systems research, we have gained considerable experiences and have learned a lot of lessons. Our objectives and approach have also been changed from merely generating technologies aiming at farmers as the clients to developing methodology and generating information using technology generation as a tool and targeting at action agencies as the immediate clients. We feel that this approach is more appropriate to the role of a university. Some of our activities may not be appropriate for an action agency to follow, as they are intended primarily for developing methodology which is generally not the major aim of action agencies. But they should be able to utilize such methodology developed. Our work begin to generate a good deal of interest to government agencies, and the requests for our services and assistances keep increasing. However, our new phase of farming systems research is still in an early stage. We still have to go through a series of trials and errors and learn more lessons.

Farming systems research is an attractive approach as its concepts are logically sound. It has gained a lot of popularity in recent years, and its expectation is high. However, farming systems research is a difficult approach to

operate. Although the overall framework is now clearly defined and is well agreed upon, the detail methodology in each step have not been fully developed. Institutional problems are numerous and difficult to overcome. The approach is still in an evolutionary process. We hope that we can contribute some to the development of this approach, particularly in applying the approach to local situations in Thailand.

## DISCUSSION

Q: (Roxas)

Since there is a problem of milk marketing, which is inherent in most programs whose dairy is being introduced, children in the area are possibly benefited by the availability of milk. Have you observed any nutritional improvement in these children, and how much milk is left available to them when the milk is marketed?

A: We asked some farmers on this and were informed that milk is generally given to children, and they look healthy. We don't have the data on quantity of the milk given to children.

Q: (Calub)

What do you mean by "best milking technique"?

A: The word "milking management" may be more appropriate. The farmers in Huai rai village manage activities related to milking well. The milk is good in term of hygienic condition. Milking stalls are kept clean and well looked after.

Q: How much does the farmer have to repay for each value of heifer? (4,000 - 11,000 per animal - interest, amortization,) how many years?

A: Farmers in Huai rai village bought the initial heifers by their own saving money. Thus, no debt to be paid. In the other two villages, when the farmers bring the milk to KKU, they are paid only half the value of the milk. Deduction is done until all the debt is paid. No interest is charged.

Q: What is the "poverty income" level in Thailand?

A: I do not remember the figure.

Q: (Tamang)

In your upland areas of Thailand you have included kenaf fiber crop. Is this kenaf crop brought into use for paper making industries or for some other purposes?

A: Most of the kenaf is used for fiber. However, there is a paper pulp factory located in Khon Kaen which was set up to utilize kenaf in making paper pulp. The factory buy kenaf (dried plants) from the surrounding areas

within the distance that transportation cost is not too high. Apart from kenaf, the factory also buys sunhemp or making paper pulp.

Q: (Dissanayake)

You mentioned that what we should offer to the farmer is not a package but a basket of knowledge as technology. But I disagree with you on this. When a farmer is offered a basket he gets confused. I think at least at the initial stages farmer should be given a package. On the other hand when there are too many variables achievement of the final results would be difficult. Once the farmer is familiar with the system or at later stages he maybe offered a basket to choose from?

A: If you look in detail in the programs where "package of technology" is recommended, you will find that most farmers do not adopt all the components in the package. They select only those that fit their resources and environments. I don't agree that if we offer the farmers several alternatives, they will get confused. As mentioned several times during this workshop, the farmers are smart. They know what are good or not for them. When I say a basket of technologies, I don't mean that we should offer the farmers in a particular area all kinds of technologies. The point I am trying to emphasize is we should provide farmers with alternatives, so that different farmers could choose what is fitted to their different resources and goals.

Q: From what I understand, the farmer plants peanut quite late usually and that your attempts to plant earlier met some problems. But usually, requirement of family labor for harvest may be the limiting factor in the schedule of the second crop especially if the area planted to rice is big enough for the family to handle or just enough to handle. However, in your paper you did not go into the analysis of labor availability and priority. Do you think this is more of a critical issue that farmers do what they are doing rather than moving the schedule of the second crop forward, close to rice harvest?

A: Actually in the area where farmers practice the peanut after rice system, land preparation for peanut is done at the time of rice harvest. Both operations require a lot of labor. If you analyze the labor requirement, you might think that this cropping pattern would not be feasible. But the farmers have a way to manage it. Groundnut is not planted in the entire paddy field, as the pattern is successful only in the upper paddy field where soil moisture is high during the dry season. A family will plant peanut in a certain size of area. In

the field where peanut is to be grown, early rice variety is planted. At rice harvest time, they really work hard. They harvest a few bunded fields. Then very early in the morning they plough those fields until late in the morning when the buffaloes get tired they harvest rice in the next fields. In the evening, they harrow the fields that were ploughed in the morning. The cycle repeats until finished. During that time they probably work more than 10 hours a day, but such period is short. To get a good peanut crop, suitable planting time is a critical factor and the farmers know it. It appears that if there is enough incentive, the farmers are prepared to work hard.