Agricultural Information and Technological Change in Northern Thailand

Edited by

MINGSARN KAOSA-ARD
KANOK RERKASEM
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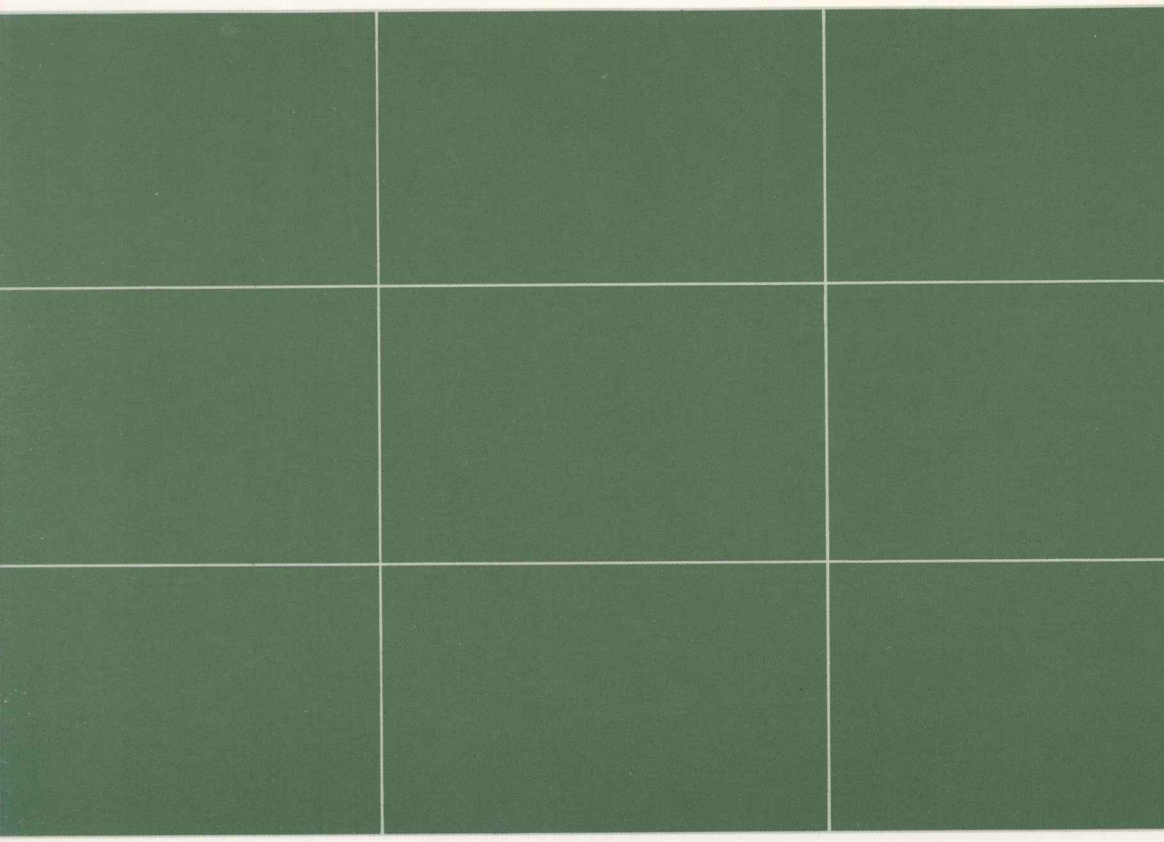

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For the farmers of Northern Thailand.

Contents

Page

List of Tables

Table No. Page

List of Figures

Figure No. Page

Glossary

Amphoe:	district
Baht:	Thai currency, approximately 25 baht to US$1.00
Kaset tambon:	Sub-district extension officer
Rai:	6.25 rai = 1 hectare
Tambon:	Sub-district
Tang:	Volume measurement, 10 kgs of paddy equal one tang

Foreword

Thai agriculture has shown one of the highest growth rates in the world since 1960. Much of that growth, however, has been based on the expansion of traditional inputs, primarily land. As new land areas became increasingly scarce, however, Thai agriculture had to look to other sources for growth – and the introduction of new technology appears to be the most important alternative. The Thai government, under various administrations, has supported the process of generating and disseminating new technology in agriculture. And, in the late 1970s, with the assistance of the World Bank, it increased its extension activities enormously by introducing the Training and Visit System.

Since then it has become clear that the productivity of extension officers could be enhanced if the Department of Agricultural Extension (DOAE) could supplement their work by broadcasting programs and producing audio-visual materials – materials which extension officers could later use in smaller groups. Television channels had, at the time this study was initiated, a slot of one hour of free time every week-day which was not used for broadcasting, a consequence of an earlier energy-saving measure. It was thought that this time could be put to use to promote new agricultural technology.

The Asian Development Bank (ADB) proposed to look into the possibility of financing the DOAE to set up a unit to produce these audio-visual materials, and perhaps also to disseminate them to small farmers' groups as well as to broadcast the programs. This monograph is the outcome of that exploration. The research was directed toward the existing sources of technology information available to farmers, so as to assist in the design of new DOAE extension methods. The Agriculture and Rural Development Program (ARD) of the Thailand Development Research Institute gladly accepted the assignment to conduct this component of the ADB technical assistance project, as the main task of the ARD Program has been to examine and propose policy options to ease the problems of Thai agriculture during the period of transition.

Phaichitr Uathavikul
TDRI President
May 1989

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Chapter One

Introduction

After more than two decades of industrialization, in 1984 agriculture still constituted 24 percent of the GDP, absorbed 70 percent of the work force and generated 45 percent of all export earnings in Thailand. By 1991, it is estimated that the agricultural sector will absorb 68 percent of the total work force (TDRI, 1986).

The future growth of the agricultural sector is expected to be limited as the international demand for major agricultural products will remain weak and the expansion of agricultural frontiers will become increasingly difficult and unproductive. Given present trends, improving agricultural technology will become an important strategy for achieving higher income as a result of improved product quality and crop intensification. Consequently, an efficient agricultural information network is seen as one of the prerequisites for an effective system of technology transfer.

The Thai government has already invested substantially in technology transfer activities, primarily through the National Agricultural Extension Project (under the Department of Agricultural Extension – DOAE) and its use of the Training and Visit (T & V) system. The Department absorbs an annual budget of more than 1,500 million baht and more than 15,000 persons have been employed. Under the present T & V system the *tambon* level extension agent transfers technical assistance through 10 percent of a maximum of 1,000 farming households. These 10 percent are generally known as contact farmers (COF) and it is expected that the remaining 90 percent will obtain agricultural information from them. Apart from public initiatives, the private commercial sector has also been active in transferring new technologies to farmers in order to secure reliable and high-quality supplies as well as to expand the rural chemical-input market.

This study investigated the dynamics of the agricultural information network including its impact on technological patterns in Northern Thailand. In particular, attention was given to informal information networks, especially intra- and intercommunity diffusion. Although the role of the existing transfer media (including the T&V system) is presented by frequency of reception, it was not the purpose of this study to evaluate or to rank the importance and the success of each mechanism.

Another innovative aspect of this study is the emphasis on human resources in agriculture. Most literature related to agricultural development includes elaborate treatment of various inputs. Labor is considered to be the major contribution of farmers. Few acknowledge that investment, field trials, and experiments have

created human capital in agriculture. A sizable proportion of this study is devoted to highlighting the capabilities and heterogeneity of human resources in agriculture. Without a good understanding of the technological ability and the absorptive capacity of farmers, agricultural development would become an impossible task. This study also put special emphasis on television as an additional means of transferring agricultural information. On the basis of the findings, the study also attempts to provide a context within which policy for the future extension of agricultural technology can be considered.

CONCEPTUAL FRAMEWORK

It is apparent that the production of agricultural technology and information are carried out by both public and private organizations (such as agribusinesses and agrochemical firms) as well as scientific communities (such as research agencies and universities). Few recognize that a substantial portion of the existing agricultural information base has been accumulated through the experimentation, learning, and information-search activities of farmers themselves. The information generated by the first sources is more "formal" and is characterized by the following properties:

- the origin of the information can be clearly identified or referenced;
- the information is supported by scientific principles; and
- the information is disseminated by an organized body such as government agencies, private firms, legal foundations.

On the other hand, information generated by farmers themselves may be considered as "informal" information which tends to possess the following characteristics:

- the origin of the information may not be accurately identified;
- the information is handed down through word-of-mouth, for example, through rumors and conversation; and
- the information is largely the fruit of accumulated experience, trial and error.

It is evident that government agencies are the major producers and disseminators of formal information. More recently, commercial firms have participated increasingly in disseminating formal information although they may not produce the information themselves.

This study investigated the dissemination flows of both types of information through various channels via personal communication, group transfer, and mass communication. The major questions are:

1. What are the sources and types of information received by farmers?
2. How does access to information differ among different socioeconomic groups?
3. How is agricultural technology diffused and assimilated in rural areas?
4. How is access to information related to the knowledge and performance of farmers?

It was hypothesized that there is unequal access to information among different socioeconomic groups, e.g. contact farmers and noncontact farmers, male and female farmers, and group and nongroup members.

Unequal access to formal information is not solely a function of the existing economic and social structure but also a result of biases inherent in each of the channels used for dissemination. For example, the present government extension program—the Training and Visit system (T & V) transfers information to selected farmer leaders known as contact farmers (COFs) who are expected to transfer information to their neighbors and friends. Therefore, the government extension program and group transfer approach tend to favor more innovative and sociopolitically better-off farmers, and transfer through television discriminates against those without televisions and so on.

Figure 1.1 is a schematic representation of our assumptions about the information flow within a Thai village. As the most common way for information to flow is through personal contact, e.g. between extension officers and COFs, COFs and non-COFs, farmers and traders and so on, information tends to concentrate within intersections of subsets and tends to diffuse slowly and unevenly. The heavily-shaded areas depict relatively higher concentrations of information. The results of the test of our first hypotheses have important implications for future extension policy. Unequal access prevents potential adoption of better practices and management and, consequently, produces unequal income opportunities.

This study also attempted to examine if farmers with better access to information had more knowledge and better practice and performance. Needless to say, if these two variables are not positively related, the need to improve farmers' access will be difficult to justify.

RESEARCH METHOD

This investigation used two major approaches. The first was a large-scale household survey (1,035 sample households) conducted in advanced and moderately advanced villages in 11 provinces in the Northern Region. In the survey, past and present farming experience, technological need and the access to technological information were identified. The second scheme utilized case studies designed to explore the network required for as well as the process of assimiliation of exogenous (formal) and endogenous (informal) information. Four aspects of an agroecosystem were investigated:

1. Commodity. A case study on soybeans traced the development of this commodity in the Lower North where soybeans are an important field crop. By concentrating on one crop, the network for technology dissemination could be thoroughly explored. In particular, the case study emphasized the spread of on-farm innovations, the integration of informal and formal information, and the importance of the "informal" extension service provided by the business sector.

2. Human resources. Farmer profiles were collected and are discussed in Chapter 4. The underlying hypothesis was that farmers are heterogeneous in their absorptive capacity and have to be dealt with accordingly. Different groups have different information needs depending on their absorptive capacity which is determined by accumulated knowledge, experience, and resources.

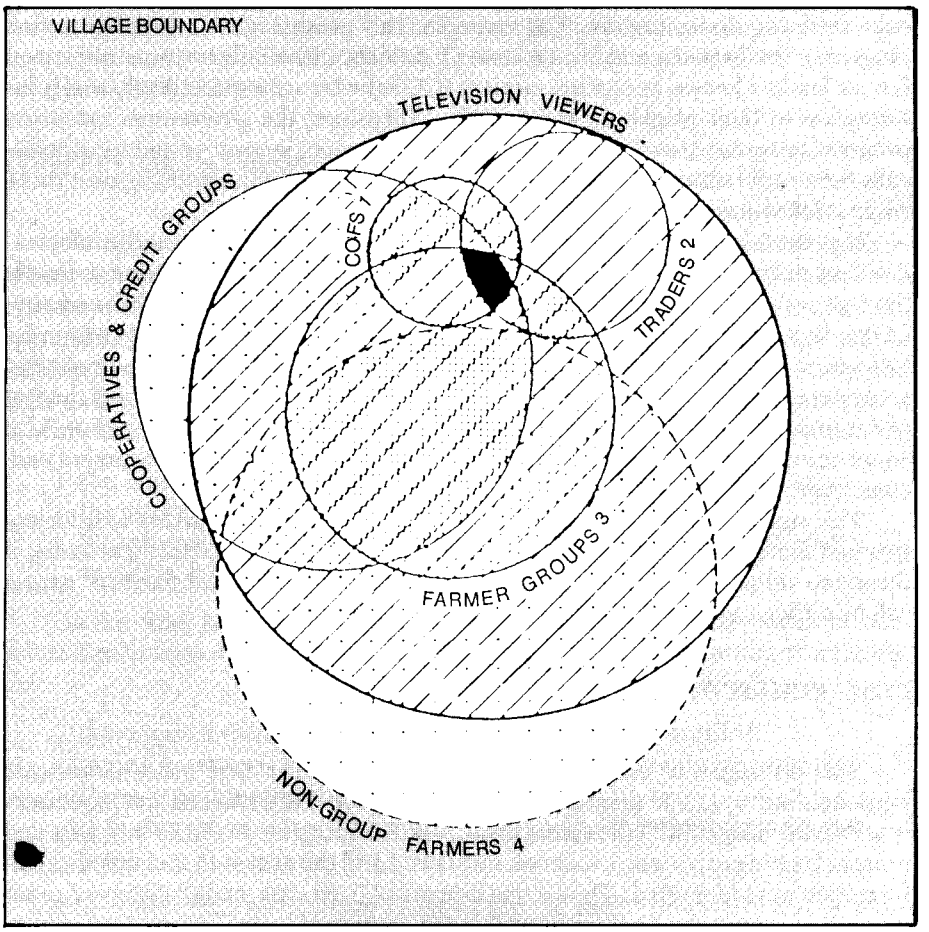

Figure 1.1 Agricultural information exchange between different groups of farmers within a Northern Thai village.

Notes:
(1) Contact farmers;
(2) Traders include local, provincial and regional traders, and representatives from agribusiness;
(3) Farmer groups include both formal and informal groups, i.e. those not set up by the government; and
(4) Nongroup farmers are those who are not members of either farmer or credit groups.

3. Community. The case study of a village in Northern Thailand explores the organizational structure of a village to depict how information is diffused among its members, with special emphasis on the role of a group whose formation is motivated by external forces. The underlying hypothesis was that there is a bias in information reception which is inherent in the village social structure. A cluster of the village elite tends to have better access to information. The study was conducted in Khua Mung village, San Sai District, Chiang Mai province.

4. Dynamics of information transfer. Another case study traces information reception, information processing, and information exchange over time. The study was conducted in a village with a reasonably long history of active technology transfer with external agencies.

SELECTION OF THE SAMPLE

A stratified random sampling procedure was employed in this study using the major cropping system as the primary sampling frame. First the Northern region was divided into major cropping systems. Once dominant cropping patterns were identified, districts for each cropping system were stratified according to the criteria of the National Economic Social and Development Board (NESDB) as advanced, developing, and poverty areas. This classification of advanced, developing, and poverty areas is available from the provincial down to the village level. Since this study emphasized the interaction of various channels for technology and information transfer, the areas defined as poverty districts were excluded from the study. Both public and private extension activities are more commonly found in nonpoverty areas where the potential for agricultural development and available resources is greater. This does not necessarily mean that poverty areas are neglected by the administration. Here the development priority is providing basic needs rather than increasing agricultural productivity.

Districts outside poverty areas which represent major cropping systems were chosen from both advanced and developing areas. Next, a *tambon* was chosen from each district. Within each *tambon* two villages were selected, one to represent advanced villages and the other to represent moderately advanced villages. The districts, *tambon*, and villages were randomly selected from a stratified category and a sample of 55 farmers was drawn from each village. In each village, at least five contact farmers, i.e. 10 percent of all respondents in the village, were interviewed. The remaining respondents were selected randomly and could be male or female; he or she must have been a principal, active farming member but need not have been the head of the household.

A total of 1,035 farmers were selected from 11 provinces in the North (Figure 1.2). Among these farmers, 595 farmers came from five provinces in the Upper North, i.e. Chiang Mai, Lamphun, Chiang Rai, Lampang and Phrae and 440 farmers were from six provinces in the Lower North, i.e. Uttaradit, Phetchabun, Phitsanulok, Sukhothai, Kamphaeng Phet, and Nakhon Sawan. Table 1.1 and Figure 1.2 provide details on the sample areas.

For proximity and cost reasons, San Sai district in Chiang Mai was chosen as the site for an in-depth case study on social infrastructure. For this district, the sample size was 150, distributed over four villages in two *tambons*.

For the case study on information transfer and processing, Mae Kung village, San Sai District, Chiang Mai province, was selected. This village has more than 20 years of experience in receiving technology from traders and Chiang Mai University project personnel.

Table 1.1 Sample areas: Northern Thailand

Cropping system	Amphoe	Tambon	Province
I. Advanced Areas			
– rice-vegetables,	San Sai	Mae Faek Mai	Chiang Mai
(potato, tomato,	San Sai	Mae Faek	
cabbage)	Ban Hong	Si Tia	Lamphun
– rice-garlic-cabbage	Mae Chan	Pa Tan	Chiang Rai
– rice-soybean	Muang	Chomphu	Lampang
	Muang	Tha Kam	Phrae
	San Sai	Mae Faek Mai	Chiang Mai
		Mae Faek	Chiang Rai
	Mae Chan	Pa Tan	Chiang Rai
– rice-tobacco	Muang	Tha Kham	Phrae
– rice-rice-rice	Tron	Wang Daeng	Uttaradit
– corn-mung bean	Muang	Pa Lao	Phetchabun
– rice-rice	Phrom Phiram	Phrom Phiram	Phitsanulok
– rice-soybean-rice	Si Nakhon	Klong Maplub	Sukhothai
	Tron	Wang Daeng	Uttaradit
– corn	Muang	Pa Lao	Phetchabun
II. Developing Areas			
– rice-soybean	Chom Thong	Ban Lueng	Chiang Mai
– rice-garlic-shallot	Chom Thong	Ban Lueng	Chiang Mai
– rice-vegetables	Mae Suai	Si Thoi	Chiang Rai
	Ngao	Ban Pong	Lampang
– rice-groundnut	Chae Hom/	Ban Mai	Lampang
– rice-tobacco	Wang Chin	Mae Pak	Phrae
– rice-peanut			
– corn-mung bean	Nam Pat	Ban Fai	Uttaradit
	Phaisali	Sam Rong Chai	Nakhon Sawan
– soybean-soybean	Phran Kratai	Khui Ban Ong	Kamphaeng Phet
– soybean-mung bean			
– corn	Mae Suai	Si Thoi	Chiang Rai
	Chon Daen	Chon Daen	Phetchabun
– rice	Chae Hom/	Ban Mai/	Lampang
	Ngao	Ban Pong	

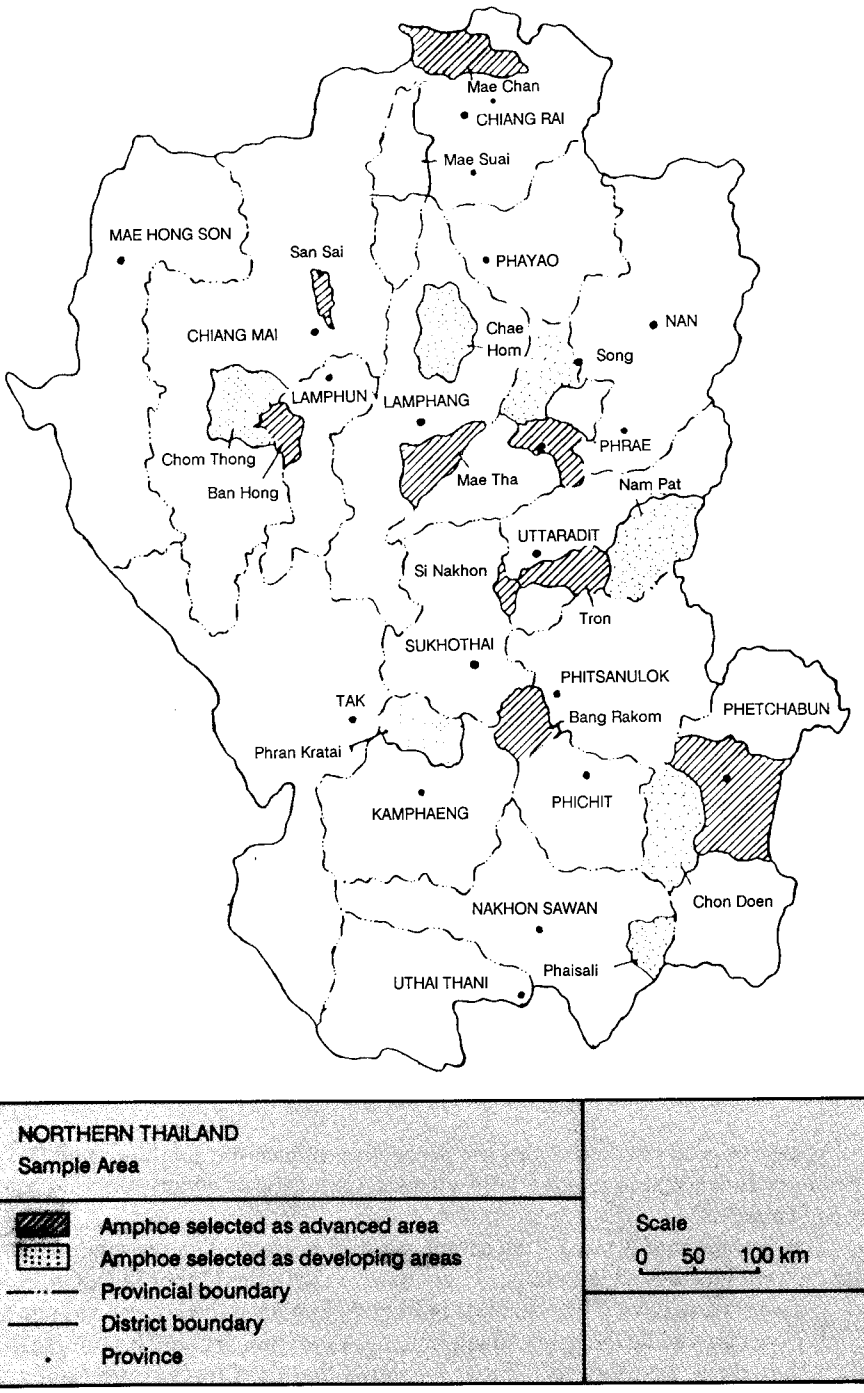

Figure 1.2 Sample areas

SAMPLE CHARACTERISTICS

This section describes the general characteristics of the survey respondents by sub-region and province.

Characteristics of respondents

Seventy-two percent of the total respondents are male farmers (Table 1.2). There is a slightly greater percentage of male respondents in the Upper North, or 75.3 percent compared with 67.7 percent in the Lower sub-region. The percentage of the male respondent sample is highest in Chiang Rai while lowest in Phetchabun.

The average age of the entire sample is 42.09. Most respondents (83.9%) completed four years of compulsory education. Respondents in the Lower North tend to have attained higher education at both the compulsory (86.1%) and higher (10.3%) levels than those in the Upper North (82.4 and 6.0%, respectively). It can be seen that, across provinces, the highest percentage of respondents having no formal education is found in Lamphun while the lowest is found in Uttaradit. For those who have attained formal education beyond the compulsory level, the highest percentage is in Nakhon Sawan (18.2%.)

Table 1.3 shows the percentage distribution of respondent social status and group participation, i.e. contact farmer status (COF), and membership in village groups. Fifteen percent of the respondents are COFs. A higher percentage (19.1%) of COF respondents is found in the Upper North, while the Lower North has 13.6 percent. In all surveyed provinces, the lowest number of COFs included in the sample (1.8%) is in Phitsanulok and the highest is found in Chiang Rai (19.6%).

About one-half of the sample (56.8%) participates in village groups, mainly economic groups, e.g. BAAC groups, cooperatives, or crop-specific groups. There is a higher proportion of group member respondents (60.9%) in the Lower North; the highest percentage is found in Uttaradit (80.9%), and Phetchabun has the second highest with 65.5 percent. Among those in the Upper North, the Chiang Mai and Lamphun samples have a large percentage of group-member respondents—65.4 and 63.6 percent, respectively.

Household characteristics

Some selected characteristics are presented to describe sampled households. These are individual and household characteristics, farm ownership, and major crops (Table 1.4).

The average family size for all samples is 4.78 persons. The respondent family in the Lower North is slightly larger in comparison with the Upper North, 5.19 and 4.47 persons, respectively. Households in Phetchabun have the largest average size with 5.75 persons while those in Chiang Mai and Lamphun are smallest in size (4.19 and 4.18 persons, respectively). Table 1.4 shows that the Lower North family size tends to be larger and there are more family members with a higher level of education (above grade 4) than in the Upper sub-region, 1.66 and 1.39 persons, respectively. This is especially apparent among families in Nakhon Sawan, Phitsanulok, and Kamphaeng Phet.

Table 1.2 Northern Thailand: characteristics of respondents.

	Average Age (year)		Sex (%)		Education (%)			
	Mean	Standard deviation	Male	Female	None	P.1-4	Higher than P4	n =
UPPER NORTH	**42.47**	**11.70**	**75.3**	**24.7**	**11.6**	**82.4**	**6.0**	**595**
Chiang Mai	44.17	12.01	77.6	22.4	6.8	87.3	5.9	205
Lamphun	41.58	11.81	69.1	30.9	18.2	78.2	3.6	55
Chiang Rai	40.90	11.51	85.0	15.0	12.1	81.3	6.6	107
Lampang	43.25	11.40	67.3	32.7	12.4	83.2	4.4	113
Phrae	40.58	11.24	73.0	27.0	15.7	75.7	8.7	115
LOWER NORTH	**41.57**	**1.06**	**67.7**	**32.3**	**3.6**	**86.1**	**10.3**	**440**
Uttaradit	44.00	10.12	69.1	30.9	.9	90.9	8.2	110
Phetchabun	40.27	12.81	59.1	40.9	1.8	88.1	10.1	110
Phitsanulok	41.47	9.97	69.1	30.9	7.3	85.5	7.3	55
Sukhothai	42.23	11.09	74.5	25.5	1.9	83.3	14.8	55
Kamphaeng Phet	40.83	9.99	70.9	29.1	9.1	85.5	5.4	55
Nakhon Sawan	39.52	10.64	70.9	29.1	5.4	76.4	18.2	55
AVERAGE	42.09	11.44	72.1	27.9	8.2	83.9	7.9	1035

Source: Field survey, 1986.

Table 1.3 Northern Thailand: contact farmer status (COF) and group membership of respondents

	COF Status		Group Membership		n =
	COF	Non-COF	Member	Non-Member	
UPPER NORTH	**19.1**	**80.9**	**53.8**	**46.2**	**595**
Chiang Mai	15.1	84.9	65.4	34.6	205
Lamphun	12.7	87.3	63.6	36.4	55
Chiang Rai	19.6	80.4	40.2	59.8	107
Lampang	14.2	85.8	48.7	51.3	113
Phrae	19.1	80.9	46.1	53.9	115
LOWER NORTH	**13.6**	**86.4**	**60.9**	**39.1**	**440**
Uttaradit	18.2	81.8	80.9	19.1	110
Phetchabun	16.4	83.6	65.5	34.5	110
Phitsanulok	1.8	98.2	40.0	60.0	55
Sukhothai	10.9	89.1	58.2	41.8	55
Kamphaeng Phet	14.5	85.5	56.4	43.6	55
Nakhon Sawan	12.7	87.3	40.0	60.0	55
AVERAGE	**15.2**	**84.8**	**56.8**	**43.2**	**1035**

Source: Field survey, 1986.

Table 1.4 Northern Thailand: characteristics of sample households

Province	Persons in household	No. of pers. received educ. > P.4	Household labor (persons)		
			Nonfarm	Male	Female
UPPER	**4.47 (1.50)**	**1.39 (.69)**	**1.73 (.90)**	**1.58 (.84)**	**1.38 (.62)**
n =	**595**	**218**	**287**	**577**	**519**
Chiang Mai	4.19 (1.44)	1.26 (.57)	1.90 (.88)	1.53 (.80)	1.34 (.55)
n =	205	60	82	199	167
Lamphun	4.18 (1.40)	1.40 (.69)	2.13 (1.13)	1.52 (.66)	1.51 (.68)
n =	55	27	30	53	47
Chiang Rai	4.53 (1.60)	1.72 (.93)	1.90 (1.18)	1.80 (1.07)	1.36 (.60)
n =	107	43	42	104	94
Lampang	4.79 (1.45)	1.35 (.66)	1.46 (.61	1.45 (.73)	1.27 (.49)
n =	113	31	65	109	102
Phrae	4.73 (1.50)	1.31 (.53)	1.50 (.72)	1.60 (.82)	1.52 (.77)
n =	115	57	68	112	109
LOWER	**5.19 (1.85)**	**1.66 (.87)**	**1.89 (1.11)**	**1.66 (.84)**	**1.61 (.87)**
n =	**440**	**203**	**142**	**427**	**422**
Uttaradit	4.72 (1.68)	1.50 (.75)	2.00 (1.29)	1.50 (.68)	1.45 (.70)
n =	110	40	37	102	106
Phetchabun	5.75 (1.84)	1.63 (.83)	1.73 (.89)	1.89 (.87)	1.65 (4.86)
n =	110	44	41	110	105
Phitsanulok	5.47 (2.08)	1.79 (.81)	2.38 (1.02)	1.71 (.79)	1.69 (.91)
n =	55	29	26	53	53
Sukhothai	5.07 (1.80)	1.60 (.95)	1.75 (1.38)	1.58 (.99)	1.54 (.84)
n =	55	28	8	55	48
Kamphaeng Phet	5.23 (2.00)	1.70 (.74)	1.66 (1.11)	1.81 (1.01)	1.83 (.93)
n =	55	30	9	54	55
Nakhon Sawan	4.81 (1.59)	1.81 (1.14)	1.57 (1.07)	1.37 (.56)	1.63 (1.09)
n =	55	32	21	53	55
AVERAGE	**4.78 (1.69)**	**1.52 (.79)**	**1.78 (.98)**	**1.61 (.84)**	**1.48 (.75)**
n =	**1035**	**421**	**429**	**1004**	**941**

Note: Number in parenthesis represents standard deviation.

Source: Field survey, 1986.

The nonfarm members of the respondent family average 1.78 persons. Again, the Lower sub-region has a slightly higher number of family members employed in nonfarm activities than the Upper North. This trend is shown in Phitsanulok and Uttaradit which show 2.38 and 2 persons, respectively. Among provinces in the Upper North respondent families in Lamphun, Chiang Mai, and Chiang Rai have high nonfarm member averages (2.13, 1.9, and 1.9 persons, respectively).

The average size of the male labor force is larger than the female work force (Table 1.4) for all interviewed families (1.61 for males and 1.48 for females). The Lower sub-region sample shows a relatively equal male and female labor size. Unlike the Lower North, there is observably more male than female labor in the Upper North samples, especially in Chiang Rai (1.8 males and 1.36 females). There are only two (among 11) provinces having more female labor than male, i.e., Nakhon Sawan and Kamphaeng Phet.

The farm ownership characteristic (Table 1.5) indicates that the majority of respondent families own lowland rice fields (68.5%) and that 19.5 percent are tenants. Upper Northern families, however, show a higher percentage of both owned (70.3%) and rented (23.7%) rice farms. The percentage distribution pattern of Upper sub-region ownership is similar to that of Lower Northern rice-farming families. It is important to note, however, that the meaning of the term "other land" differs in the two sub-regions. In the Lower North, it generally refers to farming unclaimed land (the case in Phetchabun, Sukhothai, Phitsanulok and Nakhon Sawan). In the Upper North, "other land" refers to farming parents' land, the pattern predominant in Chiang Mai, Chiang Rai and Phrae. About one half of the sample farmers (47.5%) own rainfed upland farms and the Lower North has a higher percentage of upland farms (53.9%) than does the Upper North (42.9%). Chiang Rai is the only province in the Upper North where most people own rainfed upland farms; however, there is a remarkably high percentage of rainfed upland farm ownership in three provinces in the Lower sub-region – Kamphaeng Phet, Phetchabun, and Uttaradit with 83.6, 71.8, and 67.3 percent, respectively. However, the case of Phitsanulok differs markedly from the rest of the sub-region, as, here, only 1.8 percent of the respondents own rainfed upland farms.

Table 1.6 indicates the type of farm ownership and major crops grown by the sample households. The majority of the respondents practice lowland rice farming (89.7%); all respondents in Phitsanulok and Sukhothai are rice farmers. Kamphaeng Phet is unique and differs from the other ten provinces in that it has the lowest percentage of lowland rice farmers (41.8%). A higher percentage of rice farmers (93.1%) is found in the Upper North than the Lower North (85%).

Upland farming is more prevalent in the Lower North (63.2%) and is especially high in Kamphaeng Phet (96.4%) and in Phetchabun (94.5%). Chiang Rai province shows a particularly high percentage of upland farming respondents (82.2%). There is a noticeably low percentage of orchard farmers (23%) in the sample. In the wet season, corn is the second major crop after rice. Other major crops are vegetables and soybeans and in the dry season soybeans and rice are the major crops.

The following chapter presents an overview of agricultural technology in Northern Thailand. Secondary and field survey data as well as information obtained from appraisal trips are used to describe the evolution of agricultural systems in the region.

Table 1.5 Northern Thailand: percentage of household farm ownership by type of farm land and province.

	Lowland farm (%)				Upland farm (%)				n=
	Owner	Leaser	Tenant	Other	Owner	Leaser	Tenant	Other	
UPPER NORTH	**70.3**	**4.2**	**23.7**	**6.9**	**42.9**	**0.3**	**7.1**	**2.7**	**595**
Chiang Mai	65.9	4.4	24.0	10.2	21.0	-	10.2	3.9	205
Lamphun	2.7	5.5	16.4	1.8	16.4	-	16.4	1.8	55
Chiang Rai	69.2	3.7	26.2	8.4	87.9	0.9	2.8	2.8	107
Lampang	61.9	6.2	40.7	-	47.8	0.9	3.5	-	113
Phrae	86.1	1.7	6.1	8.7	47.8	-	4.3	3.5	115
LOWER NORTH	**66.1**	**3.2**	**19.5**	**15.5**	**53.9**	**2.3**	**7.7**	**7.7**	**440**
Uttaradit	85.5	1.8	15.5	7.3	67.3	0.9	5.5	3.6	110
Phetchabun	42.7	-	7.3	28.2	71.8	2.7	10.9	21.8	110
Phitsanulok	78.2	3.6	25.5	18.2	1.8	-	-	1.8	55
Sukhothai	85.5	16.4	5.5	21.8	23.6	3.6	5.5	-	55
Kamphaeng Phet	29.1	1.8	12.7	1.8	83.6	3.6	21.8	5.5	55
Nakhon Sawan	80.0	-	21.8	10.9	43.6	3.6	1.8	3.6	55
North	**68.5**	**3.8**	**19.5**	**10.5**	**47.5**	**1.2**	**7.3**	**4.8**	**1035**

Note: One household may belong to more than one classification.

Source: Field survey, 1986.

Table 1.6 Northern Thailand: percentage of household farming system (farm and crop patterns) by province.

Percent, (N = 1035)

	Type of farm			Wet season crop					Dry season crop		
	Low land	Up land	Or-chard	Rice	Corn	Soy bean	Veget-able	Pea nut	Rice	Corn	Soy bean
UPPER (n = 595)	**93.1**	**48.9**	**28.2**	**93.6**	**20.2**	**1.3**	**15.3**	**11.3**	**6.6**	**-**	**46.2**
Chiang Mai	92.2	34.1	47.3	93.2	-	1.5	4.9	4.9	14.1	-	59.0
Lamphun	81.8	30.9	38.2	81.8	-	-	74.5	-	-	-	-
Chiang Rai	96.3	82.2	6.5	96.3	66.4	3.7	35.5	0.9	2.8	-	43.9
Lampang	93.8	48.7	24.8	94.7	12.4	-	1.8	28.3	6.2	-	69.0
Phrae	96.5	53.0	13.0	96.5	30.4	0.9	-	20.9	-	-	25.2
LOWER (n = 440)	**85.0**	**63.2**	**15.9**	**84.8**	**38.2**	**16.8**	**3.9**	**.5**	**15.9**	**.7**	**29.5**
Uttaradit	98.2	71.8	20.0	97.3	46.4	11.8	11.8	-	17.3	.9	30.0
Phetchabun	72.7	94.5	29.1	72.7	87.3	0.9	2.7	0.8	-	-	-
Phitsanulok	100.0	3.6	14.5	100.0	-	-	-	-	92.7	1.8	-
Sukhothai	100.0	29.1	9.1	100.0	1.8	12.7	-	-	-	1.8	80.0
Kamphaeng Phet	41.8	96.4	5.5	41.8	-	96.4	-	-	-	-	96.4
Nakhon Sawan	96.4	43.6	-	96.4	36.4	-	1.8	-	-	-	-
North	**89.7**	**55.0**	**23.0**	**89.6**	**27.8**	**7.9**	**10.4**	**6.7**	**10.5**	**0.3**	**39.1**

Note: One household may belong to more than one classification.

Source: Field survey, 1986.

Chapter Two

Technological Bases for Agricultural Systems of NorthernThailand

BENJAVAN RERKASEM
KANOK RERKASEM

This section briefly outlines the system of agricultural production in Northern Thailand and the changes that have taken place in the last 20 years. Technological bases for this change and farmers' competence in utilizing these technological innovations are examined to allow analyses (in later chapters) of the flow of this information and the channels and conditions for its effective flow.

PROFILE OF AGRICULTURE

Agricultural systems

Agriculture is a major source of income in the North, accounting for almost 40 percent of the gross regional product in 1980 and 80 percent of regional employment (unpublished data, National Account Division, National Economic and Social Development Board). Within the agricultural sector, crop production is the most important income generator; 90 percent of the average regional cash income on the farm comes from crop production (OAE, 1985). Livestock, forestry, and fisheries make up the balance.

The North accounts for a quarter of the country's annual rice production, one half of maize, 40 percent of sorghum and almost all of the soybean and green and black gram production. Other significant crops planted over extensive areas in the region include cassava, sugarcane, cotton, and groundnuts (Table 2.1 and Figure 2.1). Tobacco, chilies, garlic, shallots, and several kinds of vegetables and fruits are planted in specific locations, contributing to a significant portion of farm income in those areas.

Table 2.1 Production of rice and upland crops in Northern Thailand, 1984/85

(Tons)

Province	Rice			Upland Crop	
	Main crop	Second crop	Total	Corn	Sorghum
Upper North	**1795475**	**56708**	**1852183**	**329317**	**-**
Chiang Mai*	389521	21389	410910	3983	-
Chiang Rai*	621099	15089	636188	95204	-
Lampang*	131692	7599	139291	7439	-
Lamphun*	120590	2965	123555	-	-
Mae Hong Son	40531	321	40852	-	-
Nan	63799	3619	67418	83125	-
Phayao	270406	1451	271857	20007	-
Phrae*	111598	-	111598	39901	-
Tak	46239	4275	50514	79658	-
Lower North	**3299564**	**301072**	**3600636**	**1768606**	**158173**
Kamphaeng Phet*	426615	26151	452766	115005	1118
Nakhon Sawan*	721771	82516	804287	404244	101281
Petchabun*	548877	1431	550308	795470	45693
Phichit	494570	31636	526206	28737	193
Phitsanulok*	485341	107047	592388	105533	-
Sukhothai*	258329	20371	278700	28022	1299
Uthai Thani	133499	8835	142334	221458	8589
Uttaradit*	230562	23085	253647	70137	-
North	**5095039**	**357780**	**5452819**	**2097923**	**158173**
Country	**17274803**	**2630008**	**19904811**	**4225572**	**374281**

Note: * indicates provinces where samples were taken.

Source: OAE, 1985.

There are two major systems of production: rice and rice-based cropping systems and, upland rainfed systems.

Rice and rice-based cropping systems. Almost all of the flood plains and some of the lower terraces in the region have been bounded and leveled for the cultivation of wetland rice (Figure 2.1). In these bounded paddy fields, rice is virtually the only crop grown in the wet season when the soil is under 30 to 50 cm of water most of the time. In the dry season, where irrigation is available, one crop (or occasionally two or more crops) follows rice. Crops grown after rice include soybeans, especially in Chiang Mai, green gram in the Lower North, garlic and shallots in Chiang Mai valley, or another crop of rice. Many vegetables, including chilies, tomatoes, potatoes, onions, and cabbages, are also grown. Virginia tobacco follows rice in some areas of the Upper North and Burley tobacco follows rice in Sukhothai and Phetchabun in the Lower North (Figures 2.2 and 2.3).

Table 2.1 (Continued)

(Tons)

Upland Crops Cont'd					
Cassava	Sugar cane	Cotton	Mung beans	Soybeans	Ground nuts
179810	**344391**	**2624**	**24963**	**78052**	**77736**
-	21093	-	218	45518	12669
179810	-	-	1000	5562	6075
-	309132	36	1090	2874	17640
-	6831	-	204	1942	4484
-	-	-	-	3220	2938
-	-	1736	12665	350	15774
-	-	-	934	949	6154
-	-	823	6633	8800	9186
-	6335	29	2219	8837	2816
892629	**4241738**	**20544**	**259490**	**128635**	**19300**
290290	2280551	978	28207	19897	1371
210883	539701	2342	41350	11569	4048
5618	-	8366	79495	8160	2710
-	-	468	21895	-	453
205672	233796	15	26280	2706	2522
-	386112	6968	37480	67270	3071
180166	242335	1076	10088	2561	1359
-	559243	331	14695	16472	3766
1072439	**4586129**	**23168**	**284453**	**206687**	**97036**
19262639	**25055026**	**79425**	**352354**	**246448**	**172084**

Upland rainfed systems. On the rolling uplands, (and often on steep mountain slopes), where there is good surface drainage, one finds wet-season rainfed cropping of upland crops (Figure 2.4). Corn is the most extensive crop, often grown in association with green gram or sometimes sorghum. Wet season soybean followed by black gram and, more recently, soybean/soybean, are commonly found cropping patterns in Sukhothai and neighboring districts, or *the amphoe* of Kamphaeng Phet and Phitsanulok. In the remote district of Phitsanulok, Uttaradit, Kamphaeng Phet, and Phetchabun corn is sometimes intercropped with black seeded cowpea or rice beans. Other upland crops found in the rainfed areas of Northern Thailand are peanuts, cotton, sesame, tobacco, and cassava. These crops may be grown as a sole crop on one piece of land in the wet season, but they are often found in sequence with other crops (Figure 2.5). For example, peanuts may be followed by mung beans, sesame may follow corn, and in dry years when soybean growth is markedly restricted, cotton may be relayed into stands of soybean some four to five weeks before harvest.

NORTHERN THAILAND
Agricultural Area

Paddy 16.9 mil. rai
Upland Crops 8.5
Forests 54.1 and Others 25.6
Housing 0.7
Total 106 mil. rai

Scale
0 50 100 km

Sources:
LDD 8 OAE (1985)

Figure 2.1 Agricultural areas in Northern Thailand

Note: Others include fruit tree, grassland and unclassified areas.

Change

The current system of agricultural production in Northern Thailand is relatively recent. A most remarkable change has taken place in the last 20 years, the planted area having increased from just 10 million *rai* in 1962 to some 27 million *rai* in 1984 (Figure 2.6). There has also been a marked diversification of the crops grown; rice production increased from 8 million *rai* to 13 million *rai* in this period, but the dominance of rice over the whole system greatly declined. In 1962 rice accounted for 80 percent of the total planted area in the region; by 1984 only 48 percent of the land was planted to rice.

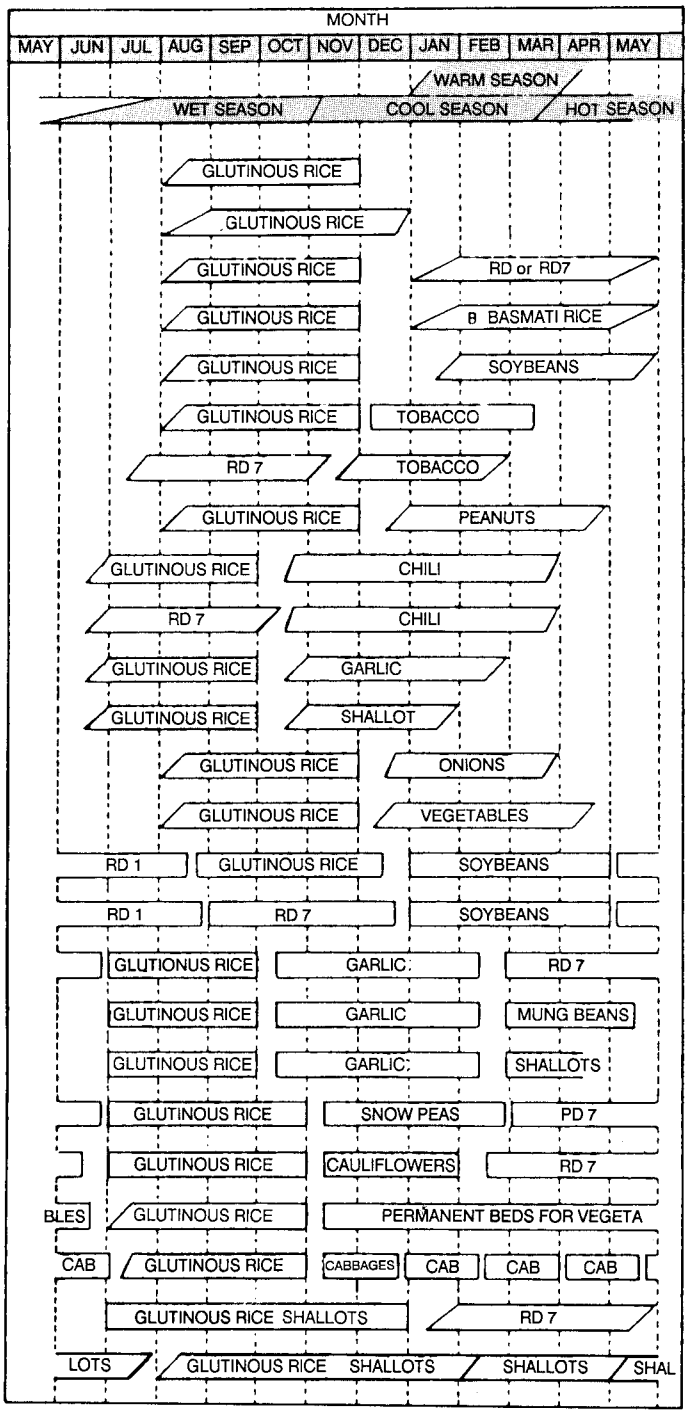

Figure 2.2 Rice-based multiple cropping systems in irrigated areas of the Upper North sub-region

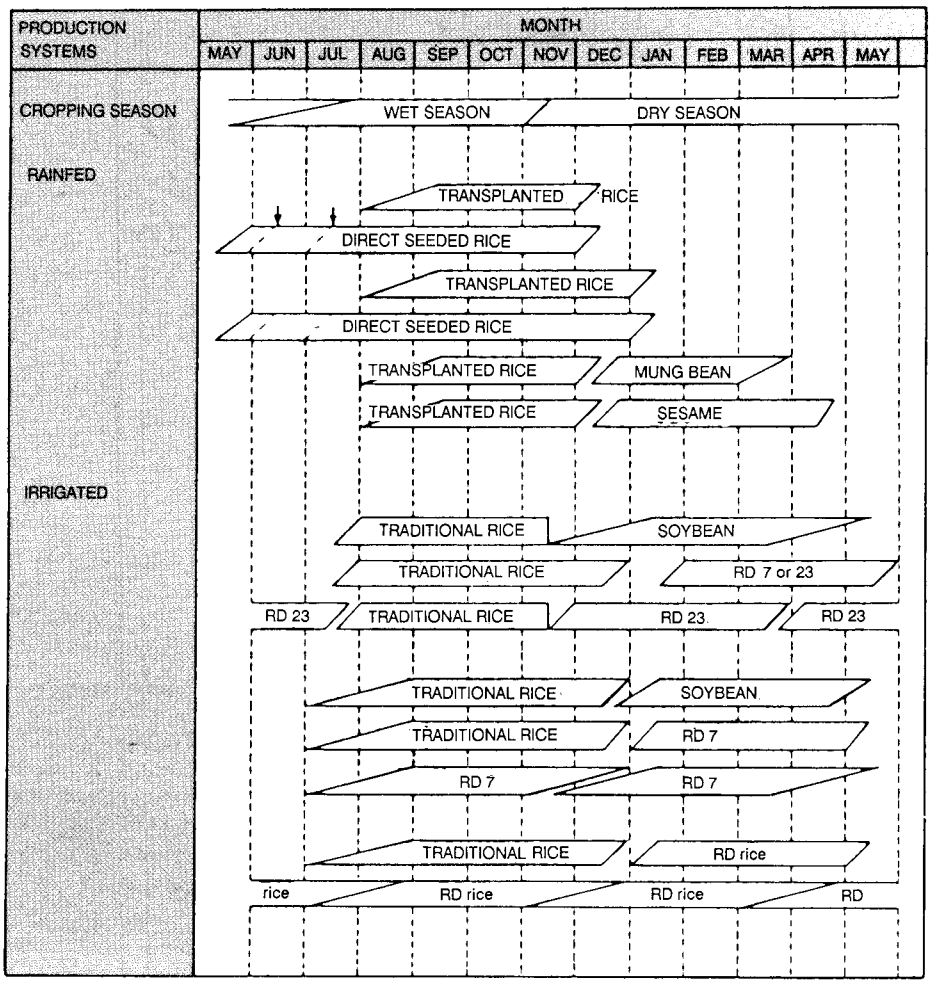

Figure 2.3 Rice-based cropping systems in the Lower North sub-region

In this period, the greatest change occurred in the Lower North, in which there has been an almost two-fold increase of planted area as well as a most drastic decline in the relative importance of rice, from 88 percent to less than half of the total rice planted in the sub-region. To a large extent this expansion has taken place through the opening up of cultivated land through the depletion of the national forests in Kamphaeng Phet, Phetchabun, Uthai Thani and Phitsanulok. The Upper North, with its limited potential for expansion, saw much more limited growth over the same period (Figure 2.7).

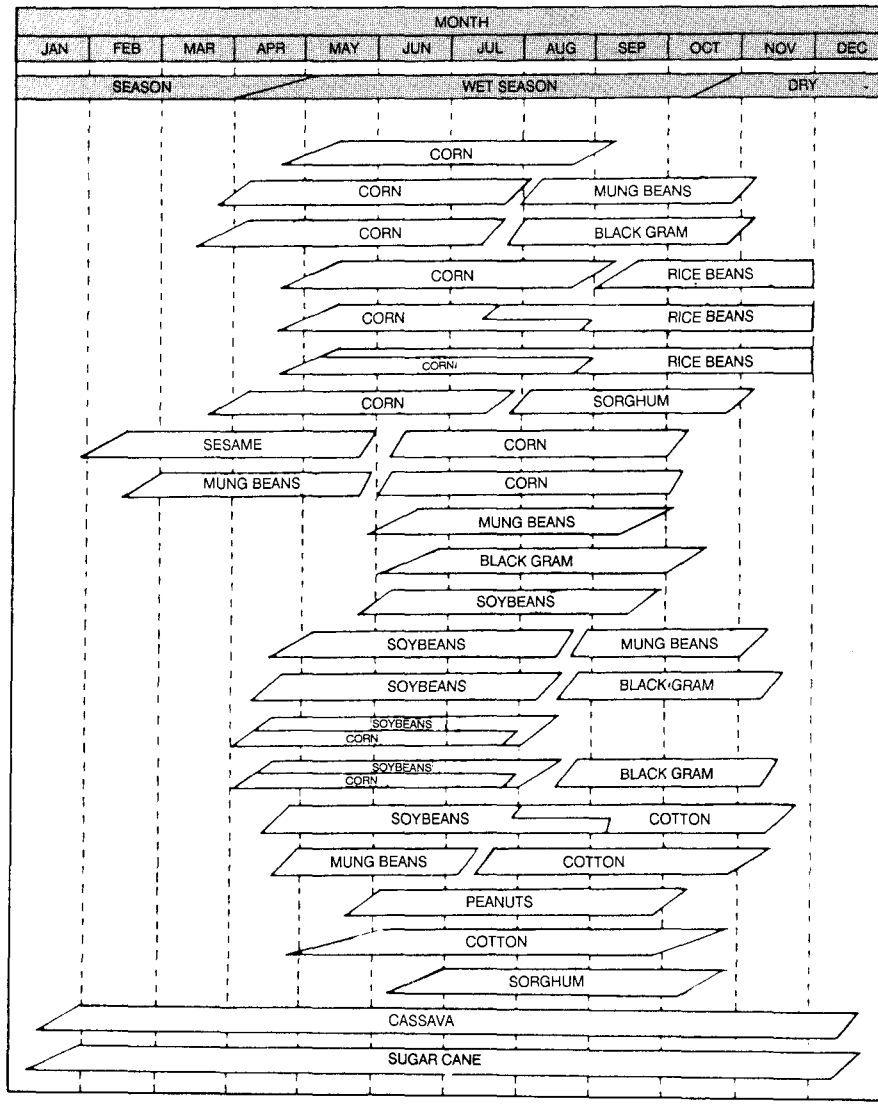

Figure 2.4 Rainfed cropping patterns in the Lower North sub-region

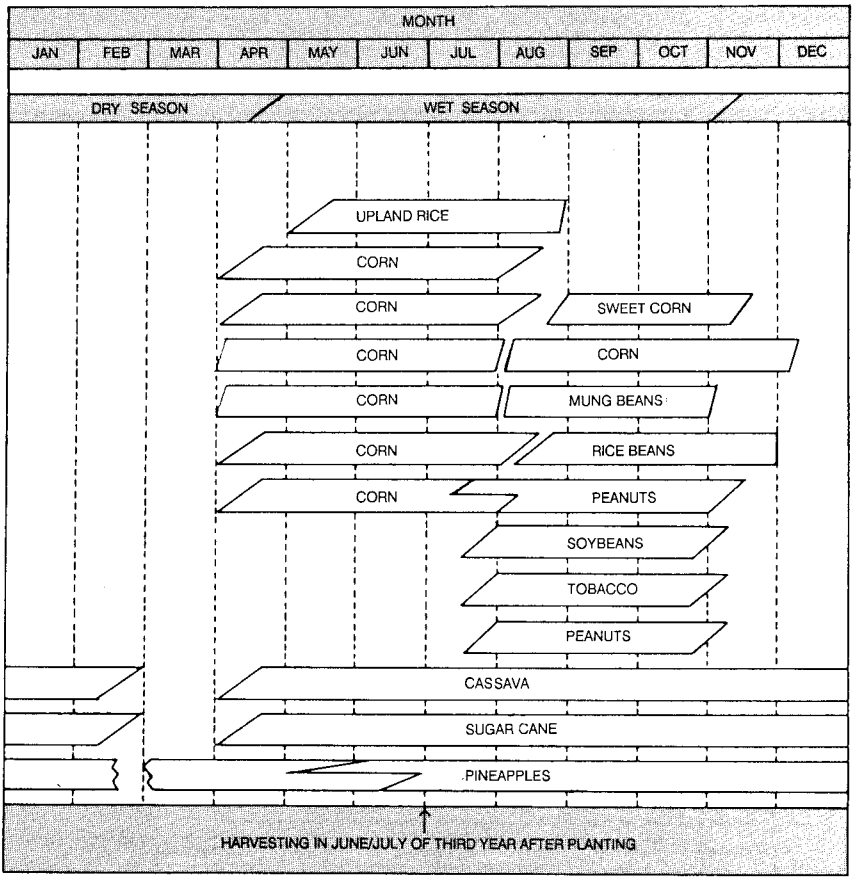

Figure 2.5 The dominant rainfed cropping systems in the Upper North sub-region

New crops that have gained importance in the last 20 years are corn, green gram, soybean, black gram, Burley tobacco, cassava and sugarcane. The introduction of new rice cultivars, which are day-length insensitive, has resulted in a marked expansion of dry season rice in many areas. Peanuts, sesame and castor beans have seen very little or no growth in this period.

Despite its decline in importance at the regional level, rice remains the most important crop to most farmers. Therefore, expansion in the production of all these new crops has taken place through diversification at the farm level. That is, most farmers in Northern Thailand now grow more than one crop – but rice is almost always one of the crops. A typical cropping system may involve the farmer growing rice and upland crops on a separate parcel of land, and growing more than one crop on one piece of land at different times, or at the same time. In addition to other innovations (including new crops and new cultivars for traditional crops), an increase in the utilization of chemical inputs (fertilizers and pesticides), and farm machinery, the development of cropping system technology, described next, has been an important factor in making this expansion in crop production possible in the region.

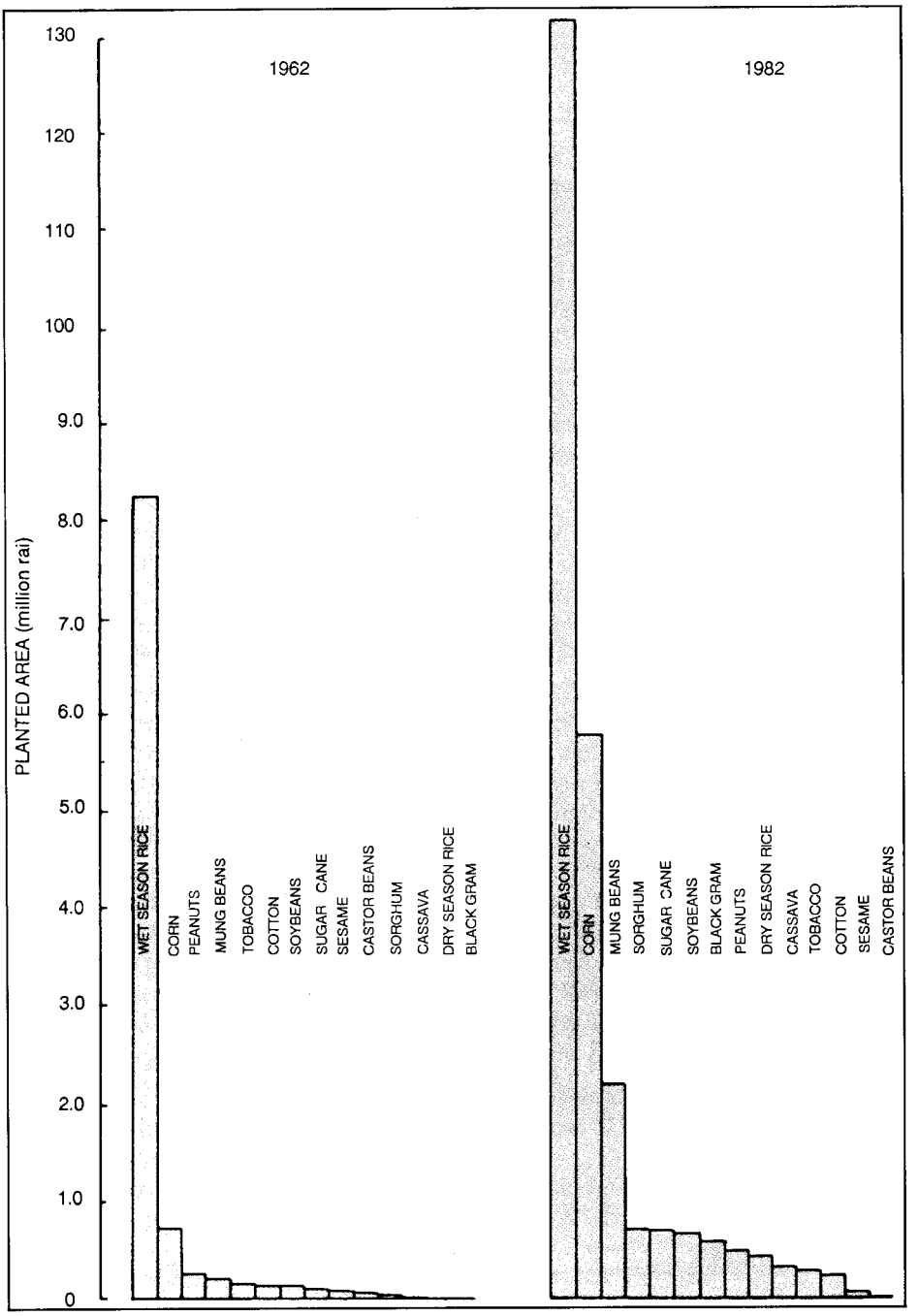

Figure 2.6 Changes in area under important crops in the North

Sources: DOAE (1963, 1983), Thodey (1972) and OAE (1985).

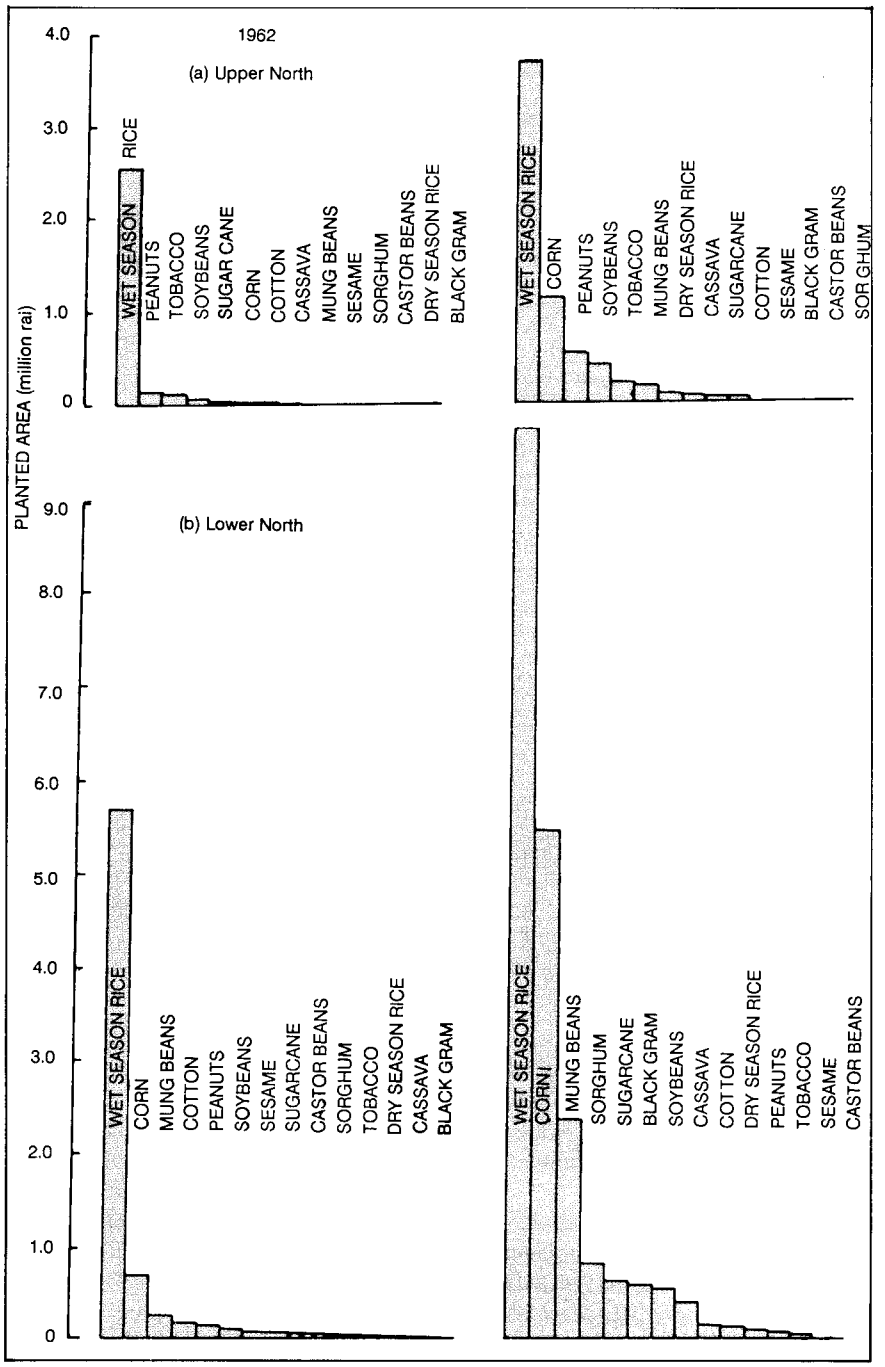

Figure 2.7 Changes in area under important crops in the North: Upper (a) and Lower (b) North sub-regions.

Sources: DOAE (1963, 1983), Thodey (1972), and OAE (1985)

TECHNOLOGICAL BASES FOR CHANGE

New crops and cultivars.

Rice. The rice technology generated by the Rice Institute of the Department of Agriculture (formerly the Rice Department) in the form of new rice cultivars (Table 2.2) have brought about improved rice production through: (1) selection, purification, improvement, and dissemination of good local rice cultivars – for Northern Thailand this includes cultivars such as *Niaw San Pa Tong*, *Leuang Yai*, *Khao Dawk Mali*, *Gam Pai 15*, RD6 and RD15; and (2) breeding and introduction of new high yielding cultivars which are responsive to nitrogen fertilizer, thus providing potentially higher yields and early maturing due to their day-length insensitivity – these include RD1, RD2, RD7, RD10 and, recently, RD 23.

These new rice cultivars have influenced cropping systems of the North as well as rice production in one or more of the following ways:

- increasing yield potential;
- improving yield stability through reduction of susceptibility of pests and diseases,
- improving values through better grain quality;
- increasing cropping intensity through shorter growing seasons; and
- intensifying off-season cropping through day-length insensitivity.

In the 1981/82 growing season, a survey by the Office of Agricultural Economics (OAE) showed that, in Northern Thailand, 25 percent of the rice crop was of the RD types, 30 percent was of improved local cultivars and 45 percent was the farmers' own cultivar (Rotchanaritpichet and Srinives, 1986). Field surveys of the current study (1986) show 56.7 percent of the rice farmers in the North using new RD rice varieties and 15.5 percent using other improved cultivars (Table 2.3). Most of these changes occurred within the last five years. Of the remaining 22.3 percent designated as traditional local cultivars, a fair proportion has been selected and perpetuated by farmers themselves for some particular location-specific purpose. In this study we will call such innovations "farmer technology." Examples of these farmer cultivars with special characteristics which fit certain specific agronomic and/or socioeconomic needs, certain conditions, or the so-called agroecological niche, are:

- *Khao Kluoi*, a traditional glutinous cultivar, which is preferred by farmers in Chiang Mai valley for low lying areas because of its adaptability to a water depth greater than 30 to 45 cm;
- some of the late maturing cultivars, e.g., *Khao Kaew* and *Khao Phah*, which are still preferred by poorer farm families who must supplement their income with wages from harvesting the rice of other village farms; using these varieties, their own rice can be harvested after the peak period for employment;
- traditional tall varieties which are preferred by farmers who earn additional income from the sale of rice straw to garlic farmers, especially in Lamphun and Chiang Mai, for the high yield and quality of the straw for garlic mulching;

- early maturing traditional cultivars, known as a group as *Khao Dor*, which are sometimes preferred in rice-garlic or rice-shallot system which require an early rice harvest because of their superior eating quality; and
- *Khao Ta Haeng*, a cultivar adapted to broadcasting, which is preferred in certain areas of the Lower North because of its recognized superior quality for processing into parboiled rice, despite its susceptibility to some of common diseases.

Thus, in addition to modern improved cultivars, good traditional rice cultivars have made a considerable contribution to agricultural development in the last 20 years.

Table 2.2 List of some improved rice varieties from the Rice Division, Department of Agriculture for Northern Thailand

Variety	Source/Pedigree	Year
Glutinous Type		
Pha 23	local selection	1956
Lai Luang	local selection	1956
Khao Kaew 11	local selection	1956
Muey Nawng 62M	selection	1959
Niaw San Pa Tong	selection	1959
RD2	TN/Gam Pai15	1969
RD4	Leuang Thong/IR8/W1252	1973
RD6	Khao Dawk Mali 105	1969
RD8	IR262/Niaw San Pa Tong	1978
RD10	RDI (Radiation)	1981
Non-glutinous Type		
Khao Ta Haeng 17	local selection	1956
Khao Dawk Mali 105	local selection	1959
Leuang Yai 148	local selection	1968
RD1	Leuang Thong/IR8	1969
RD3	Leuang Thong/IR8	1969
RD5	Puang Nahk16/Sigadis	1973
RD7	C4-63/Gow Ruang 88//Sigadis	1975
RD9	Leuang Yai 34/TN1//N1256/RE2	1975
RD11	IR 661/Khao Dawk Mali (KDML) 105	1977
RD13	Nang Phaya 132/Pak Sien 39	1978
RD15	Khao Dawk Mali 105 (Radiation)	1978
RD21	KDML 105/NMS-4//IR26	1981
RD23	RD7/IR32//RDI	1981
RD25	KDML 105/IR 2061-214-2-3-3// KDML105/IR26	1981
RD27	Khao Ta U/Khao Ta Haeng 17	1981

Source: Bhusapraves, 1982.

Table 2.3 Characteristics of rice farming in Northern Thailand

(% of respondents)

Category			Upper North (582)	Lower North (437)	North (1015)
1. Varieties					
1.1	RD varieties		52.1	63.8	56.7
1.2	Other promoted varieties		17.5	12.6	15.5
1.3	RD & other promoted varieties		5.8	4.8	5.4
1.4	Local and unknown varieties		24.7	18.7	22.3
	Total		**100.0**	**100.0**	**100.0**
2. Adoption of RD and promoted varieties (years)					
2.1	More than 5 years		26.4	39.3	31.8
2.2	Within 5 years		73.6	60.7	68.2
	Total		**100.0**	**100.0**	**100.0**
3. Seed source					
3.1	On-farm collection only		53.2	61.3	56.5
3.2	Exchange		20.0	10.8	16.3
3.3	Purchases		11.5	4.0	8.5
3.4	Combinations of the above methods		5.4	15.3	9.4
3.5	Others		9.7	8.6	9.3
	Total		**100.0**	**100.0**	**100.0**
4. Practice					
4.1	Broadcast		-	5.4	2.2
4.2	Transplanting		100.0	67.7	87.1
	Total		**100.0**	**100.0**	**100.0**
5. Mechanized rice threshing			**4.9**	**33.0**	**21.3**
6. Yield per rai (kg)					
6.1	First rice	- mean	583.4	545.2	567.9
		- standard deviation	178.5	231.3	202.2
		- maximum yield	1250.0	1250.0	1250.0
6.2	Second rice	- mean	524.5	648.4	595.5
		- standard deviation	228.0	146.9	124.4
		- maximum yield	980.0	969.0	980.0
			(n=29)	(n=39)	(n=68)

Source: Field survey, 1986.

Corn. *Suwan 1*, an open pollinated cultivar of corn, was released in 1974, from a joint effort between Kasetsart University and the Field Crop Department (now the Department of Agriculture) supported by the Rockefeller Foundation and the International Center for Maize and Wheat Improvement (CIMMYT). Except for the very small amount of hybrid and some traditional varieties planted in remote areas, most of the corn crop in the North, as in the rest of the country, is currently planted to *Suwan* (Table 2.4). *Suwan 1* has exhibited a most remarkable range of adaptability to growing conditions in corn production areas in the region, and has thus enabled the expansion of corn production into Phetchabun and its surrounding areas in the Lower North and up to Chiang Rai in the extreme North. One outstanding characteristic of *Suwan 1* is its significant tolerance to downy mildew, a disease that can cause devastating yield losses. *Suwan 2*, another result of the same program, has an even higher degree of tolerance to downy mildew, but it has not been as widely accepted as *Suwan 1*. The field survey indicated that the *Suwan* varieties are used by 69.3 percent of the corn farmers in the North.

The success of *Suwan 1* has contributed to the most remarkable growth of the corn seed industry, which has grown from nothing ten years ago to some 10,000 tons – one-quarter of the annual national requirement in 1984. Almost all of this was *Suwan 1*, some of whose seed production areas are in the North.

Table 2.4 Characteristics of corn farming in Northern Thailand (%)

Category	Upper North (70)	Lower North (168)	North (238)
1. **Size of operations (rai)**	5.2	22.5	15.3
2. **Varieties (% of respondents)**			
2.1 native varieties	15.7	11.0	13.0
2.2 Suwan	77.7	61.6	68.3
2.3 Suwan and other varieties	-	1.8	1.0
2.4 other	6.6	25.6	17.7
Total	100.0	100.0	100.0
3. **Adoption of Suwan (% of respondents)**			
3.1 more than 5 years	27.7	28.4	28.1
3.2 within 5 years	72.3	71.6	71.9
4. **Yield (kg/rai)**			
4.1 mean	306.3	473.2	406.3
4.2 standard deviation	156.8	178.3	188.5
4.3 maximum yield	833.0	975.0	975.0

Source: Field survey, 1986.

With the growth of the seed industry there has also been concerted effort to develop hybrid corn varieties for Thailand by private companies and Kasetsart University. There are now several corn hybrids on the market, e.g., *Suwan 2301*, *Pacific 9*, and those marketed by Pioneer, Cargill, etc. The estimated total volume of hybrid seed sold in the whole country in 1984 was 600 tons. Trial yields from these hybrids were not significantly different from *Suwan 1*, the seed of which retailed for one-quarter to one-fifth of the cost for the hybrids. In the North some hybrids are grown in Uthai Thani and Phetchabun.

Green gram. Among field crops of the North, green gram is second only to corn in terms of planted area. Farmers who grow green gram are less specific about the exact cultivar used; very few recognize *Uthong 1*, the recommended variety released by the Department of Agriculture in 1976. The field survey showed that 60.5 percent of the farmers who regularly grow mung bean have no knowledge of the cultivar they used and, only 39.5 percent recognize *Uthong 1* or just the name *Uthong*. Nevertheless, although the types now widely grown include some of the old, small-seeded type with a dull seed color, the majority are the larger, shiny-seeded kind. These lines, often rather mixed, are the result of a green gram improvement program which began in 1950 to select better types from local mixed materials and, which later introduced more germ plasm from overseas. Improvements that have been achieved include a shorter growing season, more concentrated pod set and larger seeds with a shiny seed coat. These desirable characteristics are now found in the majority of farmers' green gram crops in the North.

Black gram. Black gram is one of the new crops that has become important in the North over the last 20 years. In the North, its growth from nothing in 1960 to some 500,000 *rai* a year now can be attributed almost entirely to a private-sector introduction effort. It is believed that the first collection of lines were brought into the Sawankhalok, Sukhothai area from India and Burma by grain exporters in contact with the Japanese Bean Sprout Importers Association in the early 1970s. In 1978 the Department of Agriculture released *Uthong 2* as the recommended cultivar. Farmers and buyers, however, make very little distinction between *Uthong 2* and other available lines.

Soybeans. Soybeans have been grown in the Upper North for a long time. Land races or traditional lines can sometimes be discovered in remote villages, especially among those ethnic Thais who are related to the Shan in Burma for whom salt-free fermented soybean has long been an important traditional food. Since the growth of soybean production in the North began in the 1960s, however, these traditional soybeans have been largely replaced by more recent introductions. In 1936 types of soybean available in the country already included the small-seeded and low-oil local type and those of Chinese and Japanese origin. Systematic introduction and selection began in 1951. Lines were brought into the country from the United States, Indonesia, Japan, Taiwan and other places and the first recommended modern cultivars, SJ1 and SJ2, were released by the Department of Agriculture in 1965 because their yield potential was higher than traditional local lines. SJ4 and, later, SJ5 were later released in the 1970s having even higher yield potential then traditional local lines. SJ4, and SJ5, were later released in the 1970s having both higher yield potential and better tolerance to rust. In 1985 it was estimated that almost all of the irrigated soybeans in Chiang Mai were planted to SJ4 and SJ5 (Sunantha and Sanga, 1985). By contrast, in the rainfed soybean area in Sukhothai in the

Lower North, SJ4 and SJ5 were less popular. Our 1986 field survey statistics confirmed this observation. Of Upper Northern soybean farmers, 86.7 percent used SJ4 or SJ5, whereas only 48.2 percent use was found in the Lower North. SJ1 is still favored in some areas of the Lower North, along with some black seeded types, such as *Yod Son*, *Dum Taek* and *Ton Tia*. And, recently named *Sukhothai 1*, formerly *Phak Bung*, has become extremely popular in the Sukhothai, Sawankhalok, Phrankratai area (see Chapter 5).

Cropping systems and farming systems

In addition to the new crops and cultivars described above another factor which has contributed significantly to the growth of agriculture in the North in the last 20 years is the way in which these crops have been utilized on the farm. As mentioned previously, the majority of farmers in the North grow more than one crop, as indicated by the cropping diversity index of 1.92 (average number of crops grown by a farmer) measured in the field survey. This farm-level crop diversification is achieved through the skilled management of limited farm resources in space and time, under the constraints of the prevailing growing season; it is largely developed and transferred among farmers themselves. The majority of farmers who grow corn in the uplands always grow some rice in the lowlands as already illustrated in Figure 2.4. In the Lower North this involves the temporary migration of farm workers into upland areas during the early wet season to plant corn; they go back to the lowlands in August to plant rice; they return again to the uplands for the corn harvest in September and the sowing of mung beans afterwards; and they finally go back to the lowlands again to harvest rice toward the end of the year. Other cropping system practices include the sowing of upland crops such as soybean, mung bean, chilies, garlic, tobacco and other vegetables in the paddy fields after the rice harvest. In some remote corn areas black-seeded cowpea (black bean) and rice beans are intercropped with corn.

Other agronomic practices

The agronomic practices designed to improve crop production that are available in the North are often highly specific to certain locations. Practices such as precise spacing in transplanting rice and direct and dry seeding of rice have been introduced by the research and extension services of the Ministry of Agriculture and Cooperatives. The practice of precisely spacing rice transplants is widely adopted in Chiang Mai, but direct and dry seeding is practiced by only five percent of the rice farmers in the field survey. There are also some farmer technologies which have been transferred by farmers in certain areas. Examples of these (to be elaborated in later sections) include the double transplanting of rice, stubble sowing of soybeans and mung beans, a soybean seeding implement, and corn/cowpea and corn/rice bean intercropping. A method for applying the contact herbicide Grammoxone to an established crop is also spreading rapidly among soybean farmers.

The use of farm chemicals and machinery

The Office of Agricultural Economics estimated that in the 1982/83 crop season, a Northern farmer spent 1,171 baht a year on fertilizers, chemical and farmyard manure; 275 baht on pesticides; and 18 baht on farm equipment rental (OAE, 1985). This survey reported that 35 percent of the rice farmers used fertilizer. Indeed, very little fertilizer is used on rice and the major field crops such as corn, soybeans, and mung beans. Most of the fertilizer used in the North goes to high-value crops such as cotton, sugarcane, tobacco, garlic, shallots, and other vegetables.

The Rhizobium Unit of the Department of Agriculture produces bacterial inoculants recommended for use on all grain legumes. The products are available commercially in major centers such as Chiang Mai and Sawankhalok, but very few farmers who grow soybeans, mung beans, or peanuts are aware of this technology.

The use of chemical pest control is more widespread. Sixty-five percent of the farmers interviewed in the field used herbicides and 76.8 percent used insecticides. Some 20 percent reported using some form of chemical, usually a mixture of plant nutrients, including macro and micro elements and sometimes some hormonal and vitamin compounds marketed as "hormones." Fertilizer mixes for foliar applications containing water soluble compounds of most essential elements are also commonly marketed and widely used by farmers—especially for soybeans—around Sukhothai and Kamphaeng Phet.

The use of farm chemicals, fertilizers, and pesticides has increased sharply in the last few years. An average farm in the North spent only 355 baht/year on fertilizers and 119 baht on pest control in 1978/79; by 1982/83 the amount rose almost fourfold (to 1,170 baht) for fertilizer and 2.3 times (to 275 baht) for pesticides (OAE 1985). Their contribution to total farm expenditures rose from 7.2 percent to 16.6 percent in this period.

The use of labor saving machinery has become widespread in the North, especially in the last five years (Table 2.5). Of the farmers interviewed in the field survey, 62.6 percent responded that they had used walking tractors for the last five years, half of these stating that they had rented the machine from others in the village. The use of large four-wheel tractors is less common; they were used by only 21.3 percent of the farmers. Water pumps were used by 33.7 percent of the farmers interviewed, mostly in Chiang Mai and Phetchabun. Pumps are usually owned rather than rented. Crop threshing by machine for rice, soybean, and corn is now very common and rice threshing machines, which are usually rented, are now used by 23.4 percent of rice farmers.

KNOWLEDGE AND EFFICIENCY OF TECHNOLOGICAL USE

The recent expansion of crop production in the North would seem to be indisputable proof that the new technology that was made available to farmers in the region has born fruit. Nevertheless, for the purposes of future development, an examination of how these innovations are perceived and used on the farm is needed so that weaknesses can be identified. Remedies and the delivery of appropriate innovations are being improved. The technology categories described above will now be examined for this purpose.

Table 2.5 Number of years walking tractors have been in use

Province	Classification of Village		Average years	No. of cases
	Advanced	Developing		
UPPER NORTH	**3.97 (193)**	**3.15 (97)**	**3.69**	**290**
Chiang Mai	3.67 (67)	3.09 (52)	3.42	119
Lamphun	5.15 (32)	-	5.15	32
Chiang Rai	3.00 (17)	3.71 (28)	3.44	45
Lampang	4.25 (24)	2.50 (12)	3.67	36
Phrae	3.81 (53)	2.20 (5)	3.67	58
LOWER NORTH	**6.67 (200)**	**4.58 (158)**	**5.75**	**358**
Uttaradit	7.00 (55)	3.32 (50)	5.25	105
Phetchabun	5.60 (35)	3.50 (34)	4.57	69
Phitsanulok	6.89 (55)	-	6.89	55
Sukhothai	6.80 (55)	-	6.80	55
Kamphaeng Phet	-	6.44 (55)	6.44	55
Nakhon Sawan	-	4.68 (22)	4.68	22
Average	**5.34 (393)**	**4.04 (255)**	**4.83**	**648**

Source: Field survey, 1986.

New crops and cultivars

The rapid spread of new cultivars (such as the RD rice varieties, *Suwan 1* corn, SJ4, SJ5 and *Sukhothai 1* soybeans) and new crops (such as black gram and Burley tobacco) is evidence that farmers in the North are extremely receptive to innovations in the form of new crops and cultivars. There are numerous examples of farmer knowledge of cultivars and species adaptability to a particular locale. For example, SJ4 and SJ5 are recommended for all soybean areas of the North, but they are accepted more widely in Chiang Mai's Upper North irrigated areas; whereas recommended cultivars in Sukhothai's Lower North rainfed crops have been largely used along with an old cultivar, SJ1, some black seeded types and, more recently, *Sukhothai 1*. That *Sukhothai 1* (*Phak Bung*) has been selected by farmers is evidence of the exceptional ability of some very good Northern farmers.

Local knowledge of the desirable characteristics of rice cultivars and their hereditability has been well documented for the Chiang Mai valley but is less evident in the Lower North. The practice of conscientious and systematic selection of rice seed is widespread. Most farmers know exactly what rice cultivars they are growing. Among the rice farmers interviewed in the present study only 0.5 percent did not know the rice cultivars they were using. In the Chiang Mai valley, farmer

rice cultivars knowledge is so well developed that several cultivars can be found growing on one farm, each one for a particular purpose. An early maturing *Dor* type may be grown on a few *rai*, its early harvest enabling a timely planting of garlic or chilies. Increasingly, modern cultivars which are photoperiod insensitive, RD7 or RD10, are also used for this purpose and may occasionally be sold for cash to finance the dry season crop. The majority of the paddy land will be planted to one of the main season glutinous cultivars, RD6 or *Niaw San Pa Tong*, for the family's yearly home consumption. A late maturing traditional variety or specially adapted variety may occupy low-lying land which is under deeper water and does not drain until the end of the year. In the above cases on an average-size farm, a few *rai* of a high quality non-glutinous cultivar, i.e., *Khao Dawk Mali*, may be grown for cash. This use of multiple cultivars which mature at different times on a farm also helps to even out the harvest season's peak labor requirement periods.

A large number of farmers are able to recognize standard rice cultivars from plant and grain types. The recognition of a cultivar's sensitivity to traditional photoperiods, which is crucial in distinguishing modern improved rice from traditional varieties, is also becoming widespread. It is common knowledge to most farmers that modern cultivars with their photoperiod insensitivity can be planted in the dry season when days are longer. The selection of desirable characteristics in rice cultivars among locally available germ plasm is commonly practiced by farmers.

Nevertheless, on the farm there are some knowledge gaps with respect to rice cultivars. Information regarding cultivars for special purposes (such as *Khao Dawk Mali* for quality rice markets, *Leuang Yai* for noodle factories and *Khao Ta Haeng* for parboiled rice markets,) together with their market potentials could be useful on the farm.

Farmers' knowledge of more recent crops such as corn, mung beans and soybeans is somewhat less impressive; nevertheless, much progress has been made in the last five years.

For example, as mentioned earlier (Table 2.4), 68.3 percent of the corn farmers interviewed used *Suwan 1* while most of the rest did not know the cultivar they use. Most of those using *Suwan 1* have been doing so only in the last five years; only 19.8 percent responded that they had used *Suwan 1* for longer than five years.

Only three percent of the soybean farmers interviewed responded that they did not know what soybean cultivar they grew. In the Chiang Mai valley there appears to be some preference for SJ4 or SJ5 in certain areas; farmers claim that one or the other is not adapted to their particular conditions. Soybean cultivars are generally more difficult to differentiate than rice cultivars. Farmers were able to distinguish between the old SJ1 and SJ2 because their hilum colors differed (black, and red-dish-brown – respectively, hence, they were more familiarly known as "black-eyed" and "red-eyed" instead. SJ4 and SJ5 are more difficult to differentiate; the plant types are very similar and there is little difference between hilum color. However, farmers seem to be able to recognize distinct soybean cultivars by plant type and earliness, although they might not get the official names correct. For example, in the Chiang Mai Valley, there are currently two quite commonly recognized lines, *Ta Dum* (*Or Tor Kor*) and *SJ5 Tia*, which are preferred for certain conditions. Their origin has not been identified.

The rainfed soybean varieties are much easier to differentiate. *Sukhothai* 1 is unmistakable with its distinctive narrow leaves. Other popular cultivars had been named for their easily recognizable growth habits. Thus, *Yod Son* is an indeter-

minate plant type; *Dum Taek* is black-seeded, with easily shattered pods and *Ton Tia* is a relatively short plant type.

Mung bean farmers seem to pay less attention to the cultivar they grow; only 39.5 percent reported using the recommended *Uthong 1* and the proportion of peanut farmers who grow the recommended *Tainan 9* is even smaller (17.4%). However, the remainder splits equally between those who do not care which cultivar they use and those who conscientiously choose some unnamed traditional variety with more kernels per pod which fetch a better price in the market for boiled peanuts.

On the subject of new crops, Burley tobacco has been restricted to certain areas in the Lower North according to Excise Department regulations. In areas where buyers had production contracts, such as Phetchabun and Si Samrong, farmers have been most ready to adapt their traditional technology to produce native tobacco for Burley production.

Likewise, black gram has been restricted to the areas in the Lower North close to Sawankhalok where major buyers and exporters are located. The reasons for this black and green gram concentration in the Lower North and lack of expansion into the Upper North may be physical as well as market-related – limited land for expansion could be one reason and the deficiency of the plant micronutrient boron could be another. Indeed, the levels of boron in many of the major soils of the Upper North are considered below sufficiency for good growth and yield for most crops (Hiranburana and Chawachati, 1986). Black gram and green gram, on the other hand, are among the crops more sensitive to a boron deficiency than soybeans, rice, or peanuts (Rerkasem , 1986 and Rerkasem, *et al.*, 1986). Without yield reduction, peanuts show the typical "hollow heart," symptom which has been used to identify boron deficiency over a wide area in the Chiang Mai valley (Netsangtip, *et al.*, 1986). This is a simple diagnosis tool that can very well be used by farmers on the farm.

Agronomic practices, cropping systems, and farming systems

The development of cropping and farming systems by farmers in the North is evidence of their ability to utilize available technology. Likewise, the development and spread of traditional practices, (such as the stubble sowing of soybeans and mung beans) is another example of the farmers' capability to accept new farming methods. However, examination of farm yields and farm practices reveals that there is much room for improvement in agronomic practices – improvements that would involve a small additional cost to farmers, in cash or labor, but could significantly increase returns. Some examples of agronomic practices that could be improved on the farm will now be considered.

Seed germination rate test. A few soybean farmers in Sukhothai, according to field observations, routinely test their seed for germination. Poor quality seed is a common problem, especially for oil seeds such as soybeans. As a result, farmers generally tend to use high seeding rates in anticipation of the problem of poor germination. For example, a 1985 survey of wet season soybeans in Sukhothai showed that 75 percent of the farmers used a seeding rate of 11 kg/*rai* or higher and 42 percent used 16 kg/*rai* or more (Northern Region Agricultural Extension Office, 1985), whereas the recommended seed rate is less than 10 kg/*rai* (DOA, 1980). A simple germination test would enable farmers to make sure of the quality of the seed they bought and to reject it if the percent of germination was poor.

The use of rhizobial seed inoculation. During the survey, very few farmers interviewed knew about rhizobium inoculation. We even found a package of rhizobium on a farm where the farmer had no idea what it was. A 1985 survey by the Northern Region Agricultural Extension Office showed that only 19 percent of the farmers in Sukhothai used rhizobium inoculation technique as it is such a foreign concept for most farmers that they cannot readily appreciate its use. And, being a living organism, it also needs careful handling to be effective.

On-farm water management. Data on on-farm water management in Northern Thailand is scarce. Observations from the Chiang Mai valley, where irrigated dry-season cropping is the most widespread in all of the North, indicate that there is much room for improvement. Although traditional communal irrigation system management and the regular repairing of weirs and canals are well established, water management at the field level is often a problem. Irrigation in the North has been built around rice; now, with dry season upland crops, having too much water or too little causes problems. The concept of drainage is also little understood. There are water conflicts between farmers along the same irrigation ditch: for farmers at the top end of the ditch, the problem is too much water leaking into their fields because farmers at the far end of the ditch are irrigating; and for those at the far end, water often runs out before it is their turn to irrigate.

The use of chemicals

As discussed previously, farmers are now using more chemicals in crop production. For some pest control chemicals, (such as Grammoxone) the effect of abuse can be very drastic, so farmers have very quickly learned to use it properly. For most chemicals, however, the results of misuse are largely unseen. The problems of pesticide toxicity have not been stressed often enough. The field survey showed that 54.3 percent of the farmers interviewed have witnessed cases of insecticide toxicity in neighbors and others in the same or nearby villages. Cases of pesticide resistance were known to 60 percent of the farmers. Of these, 47 percent had difficulty in overcoming the problem (Table 2.6). Some 18 percent did not know how to deal with the problem, another 18.3 percent tried to overcome it by repeated spraying or increasing the concentration, and another 10.9 percent resorted to the "cocktail" method, i.e., using a mixture of several chemicals – both strategies which would only aggravate the problem. Extension programs that would educate farmers on the effects of pesticides on the environment, (including pesticide resistance and the decimation of predators), and the long-term effects of selective herbicides would be very helpful. Our interviews with farmers showed that these rather complicated pest ecology concepts could be appreciated by farmers if explained to them in their terms. Another complaint that farmers often have, especially in Upper North areas where the farm size is smaller, is that insects escape into neighbors' fields when they spray. Large fields or village scale pest management is something that could be encouraged by building upon the tradition of communal collaboration that exists in the North.

Fertilizer use for major field crops such as rice, corn, and soybeans has been rather minor and farmer knowledge of fertilizers is accordingly limited. Table 2.7 indicates that approximately 25 percent of the farmers interviewed had no knowledge of any of the four major fertilizers commonly sold in the region: 46-0-0 (urea), 21-0-0 (ammonium sulfate), 15-15-15 and 16-20-0. Another 25.6 percent

knew of only one of these. Some 12.9 percent had knowledge of fertilizers by brand name, e.g., "ox head" brand or "plough" brand.

Table 2.6 Farmer practices to overcome pesticide resistance problems

Practices	Percentage of Total
Do not have knowledge of pesticide	**47.1**
No solution	17.9
Repeat spraying	12.2
Increased concentration	6.1
Cocktail method (mixed pesticides)	10.9
Have knowledge of pesticide	**52.9**
Rotating pesticides	41.3
Integrated methods	7.4
Other	4.2
Total	**100.0**
Number of respondents	476

Source: Field survey, 1986.

Table 2.7 Farmer knowledge of chemical fertilizers: urea (46-0-0), ammonium sulfate (21-0-0), and complete fertilizers (15-15-15 and 16-20-0) in the North

Knowledge	Percentage of Total
No knowledge of fertilizer	25.5
Recognizing brands or trademarks	12.9
Identifying nutrient composition	61.6
- one formula	25.6
- two formulae	22.8
- three formulae	10.5
- all formulae	2.7
Total	**100.0**
Number of respondents	1035

Source: Field survey, 1986.

Fertilizers have not previously been essential. Most upland crops have expanded into land claimed from the forest in the last 20 years. Upgrading farmer knowledge of fertilizers, what to use, when to use it and how much, may be crucial to the next stage of agricultural development.

CONCLUSION

Agriculture in Northern Thailand has gone through a substantial transformation in the last two decades – from a subsistence economy to (partially and sometimes fully) commercialized agriculture. Today a large number of farmers, including those in rainfed areas, grow more than one crop a year. In the Upper North many farmers work on different pieces of land of differing topographies during different seasons. Thai farmers have adopted modern technologies, adapted them to their needs, and integrated them into increasingly complex farming systems.

How this new information gets to farmers is an important part of the process. Thus, the next chapter will investigate the channels responsible for disseminating technological information as well as the levels of the technology acquired by different groups of farmers.

Chapter Three

Farmers' Access to Information

MINGSARN KAOSA-ARD
CHAIWAT ROONGRUANGSEE

This chapter highlights the major results of the household survey. The first subsection presents findings on knowledge, practice, and performance by groups of farmers as surveyed and is followed by a subsection on farmer exposure to the media. Next, the importance of each source of information (measured in terms of frequency of farmer contact and access to information of different social groups) is identified. The final subsection combines these different components – knowledge, practice, performance, and access to information – into indices and performs statistical tests of the main hypotheses which are:

- There is differential access to agricultural information among different social groups in favor of male, contact, and group member farmers; and
- Better access tends to associate positively with better knowledge, practice, and performance.

KNOWLEDGE, PERFORMANCE, AND PRACTICE

Owing to the diversity of cropping patterns and environmental conditions, it is not possible to compare the agronomic knowledge of farmers; however, it is possible to assess their agrochemical knowledge. Table 3.1 indicates that, in general, male farmers tend to have better knowledge than female farmers; farmers belonging to an economic or agricultural group also appear to be better informed; and, finally, among those without agrochemical knowledge (item 1, Table 3.1), the difference is most obvious between group and nongroup farmers. And among those with some agrochemical knowledge, the difference seems the most marked between contact farmers and noncontact farmers. Both Tables (3.1 and 3.2) show that the level of knowledge is lowest for those falling in category 1 and highest for those in categories 5 and 6, respectively. However, it is worth noting that among those with some agrochemical knowledge, only 5.7 percent of the COFs recognized chemical fertilizers by brand name or trademark against 14.2 percent of non COFs; 10.3 per-

cent of male against 19.7 percent of female farmers and 12.1 percent of group against 14.1 percent of nongroup members (Table 3.1).

The figures in Table 3.2 indicate the performance and practice of different groups of farmers. Group members and COFs tend to be more diversified and more innovative with respect to the adoption of chemical inputs. However, it is not apparent that they are superior to the opposite group in terms of yield performance, nor are they more innovative in terms of mechanization and the adoption of varieties.

As for solutions to pesticide problems (Table 3.3), the data are inconclusive. For instance, although, in comparison to female farmers, more male farmers follow the relatively acceptable technique of changing the type of insecticide when they encounter pesticide resistance, they also favor other questionable techniques such as repeated sprays and increased concentration. From these data, it may be concluded that farmers' agrochemical knowledge is incomplete; however, a comparison of performance will be dealt with again in a later section.

Table 3.1 Northern Thailand: knowledge of chemical fertilizers and pesticides (% of respondents)

Knowledge	Sex		Membership		COF status		North Sample
	Male	Female	Group	Non-group	COF	Non-COF	
Knowledge of chemical fertilizers							
1. No knowledge	23.6	30.4	18.0	35.3	21.7	26.2	25.5
2. Brands and trademarks	10.3	19.7	12.1	14.1	5.7	14.2	12.9
3. One formula	26.2	23.5	25.4	25.8	21.0	26.3	25.6
4. Two formulae	25.4	15.9	27.1	17.3	32.5	21.1	22.8
5. Three formulae	11.5	8.0	13.6	6.5	15.3	9.7	10.5
6. Four formulae	2.8	2.4	3.9	1.1	3.8	2.5	2.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
(No. of respondents)	(746)	(289)	(588)	(447)	(157)	(878)	(1035)
Knowledge of pesticides							
1. Non users/no knowledge	23.0	35.3	23.0	30.8	25.5	26.5	26.4
2. Trademarks or company names	1.7	3.5	1.9	2.7	0.6	2.5	2.2
3. Trade names	72.8	59.2	72.6	64.2	70.7	68.6	69.0
4. Combinations	2.4	2.1	2.6	2.0	5.1	5.8	2.3
5. Generic names	0.1	-	-	0.2	-	0.1	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
(No. of respondents)	(745)	(289)	(587)	(447)	(157)	(877)	(1034)

Source: Field survey, 1986.

Table 3.2 Northern Thailand: performance and practice

Category	Membership		COF status		Total
	Group	Non-group	COF	Non-COF	Sample
1. Number of wet-season crops	1.70	1.63	1.76	1.65	1.67
2. Mechanization (% of respondents)					
- no mechanization	5.8	16.6	10.2	15.5	10.4
- two-wheel tractors	71.6	56.3	62.3	65.5	65.1
- four-wheel tractors	21.6	20.8	23.7	20.8	21.3
- water pumps	41.3	23.7	32.5	33.9	33.7
3. Adoption of promoted varieties (% of respondents)					
- rice	80.1	74.4	79.7	78.0	77.7
- corn	66.7	72.9	75.0	68.1	69.3
- soybeans	83.8	79.1	87.8	80.3	81.8
mung beans	38.4	41.4	38.4	39.7	39.5
4. Yield per rai (kg.)					
- rice	572.5	562.0	571.3	567.4	568.0
- corn	399.3	416.5	407.5	406.1	406.3
soybeans	228.2	208.3	219.2	220.3	220.1
5. Percentage of agrochemical non-users:					
- fertilizers	18.0	35.3	21.7	26.2	25.5
- pesticides	21.0	25.7	23.6	22.9	23.0
- herbicides	26.9	45.2	32.9	35.1	34.8
- hormones	38.0	48.2	41.0	42.8	42.5

Source: Field survey, 1986.

Table 3.3 Northern Thailand: solutions to pesticide resistance

(% of respondents)

	Sex		Membership		COF status		Total
	Male	Female	Group	Non-group	COF	Non-COF	Sample
Change of pesticide	44.2	35.5	44.7	36.8	40.3	41.6	41.4
Integrated methods	6.9	8.4	7.3	7.5	5.2	7.8	7.4
Mixed (cocktail)	10.0	12.9	12.4	9.0	10.4	11.0	10.9
Increased concentration	6.2	5.8	5.1	7.5	10.4	5.3	6.1
Repeated spraying	14.3	7.7	9.8	15.4	9.1	12.8	12.2
Nó solution	15.6	22.6	16.0	20.4	18.2	17.8	17.9
Other	2.8	7.1	4.7	3.5	6.5	3.8	4.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
(No. of respondents)	(321)	(155)	(275)	(201)	(77)	(399)	(476)

Source: Field survey, 1986.

EXPOSURE TO MASS MEDIA

Radio

About three-quarters to one-fourth of the respondents listen to the radio (Table 3.4) and slightly less than 20 percent listen to the radio every day. Most respondents do not follow any specific radio program and only 38.3 percent (291 respondents) of those who indicated that they listened to the radio (760 respondents) could indicate a favorite program – either by the title of the program or by the name of the announcer. The most popular listening times were before 0700 hours (38%), from 1200 to 1259 hours (20.3%) and from 2000 to 2100 hours (17.0%). One of the reasons why the period after 2000 hours did not turn out to be the most popular time could be competition with television. On the basis of the information presented in Table 3.4, the pattern of exposure to radio and the listening habits of male and female farmers are quite similar. It is useful to note that if radio broadcasting is to be used to advertise or relay information to farmers, any announcement should be made before 0700 hours or between 1200 to 1259 hours.

Television

The figures in Table 3.5 indicate that almost 90 percent of the respondents watch television and 35 percent are regular viewers. Of those farmers who do not own a television set, only 20 percent were nonviewers; 8 percent watched television regularly, and 72 percent watched television from time to time. Male and female viewing patterns did not seem to be dissimilar.

Table 3.4 Northern Thailand: exposure to the radio (%)

	Male	Female	Total Sample
1. Radio-listening habits			
- every day	18.0	19.0	18.4
- not every day	56.3	52.0	55.1
- never listen	25.7	29.0	26.6
Total	**72.1**	**27.9**	**100.0**
(No. of respondents	(746)	(289)	(1035)
2. Radio listening time (favorite programs only)			
- Before 0700 hrs	36.7	2.9	38.0
- 0700 - 0859 hrs	9.5	8.6	9.2
- 0900 - 1159 hrs	8.7	5.6	7.8
- 1200 - 1259 hrs	18.1	27.2	20.3
- 1300 - 1759 hrs	3.0	2.8	2.7
- 1800 - 1959 hrs	5.1	1.4	4.0
- 2000 hrs. onward	19.4	11.4	17.0
Total	**100.0**	**100.0**	**100.0**
(No. of respondents)	(22)	(70)	(291)

Source: Field survey, 1986.

News and boxing were the most popular programs. Entertainment programs came next with women farmers tending to follow entertainment programs more regularly than male farmers. In contrast to the general belief that most farmers watch boxing programs, the survey results indicate that only 5 percent of the respondents watched only boxing programs and 31.5 percent watched a combination of boxing and other programs.

The most popular television channel reported was Channel 7 which has national coverage (Table 3.5). The government's regional network (Channel 8) is the least popular channel owing (partly) to poor reception and its restricted network. Therefore an agricultural information system via television should not be limited to public-sector participation if extensive coverage is to be achieved.

Table 3.5 Northern Thailand: exposure to TV

(N = 1035, %)

		Male	Female	Total Sample
I. TV viewers				
(a) Regular	- own TV	30.3	30.8	30.4
	- no TV	4.7	2.4	4.1
	Sub total	35.0	33.2	35.5
(b) Sometimes	- own TV	18.8	21.1	19.4
	- no TV	37.7	31.8	36.0
	Sub total	56.5	52.9	55.4
(c) Non TV viewers	- own TV	0.1	0.3	0.2
	- no TV	8.4	13.5	9.9
	Sub total	8.5	13.8	10.1
	Total	**100.0**	**100.0**	**100.0**
II. TV programs				
News only		34.9	20.2	30.9
Boxing only		6.6	0.4	5.0
Entertainment only		2.1	14.5	5.4
News and boxing		27.8	3.2	21.2
News and entertainment		16.5	56.9	27.3
Boxing and entertainment		2.4	1.6	2.2
All programs		9.9	3.2	8.1
	Total	**73.3**	**26.7**	**100.0**
III. Popular TV channels				
Channel 5		0.4	0.4	0.5
Channel 7		72.2	69.8	71.5
Channel 8		7.1	10.5	8.0
Channel 5 & 7		5.4	4.8	5.3
Channel 5 & 8		0.3	0.4	0.3
Channel 7 & 8		11.5	10.1	11.1
Channel 5, 7, & 8		3.1	4.0	3.3
	Total	**100.0**	**100.0**	**100.0**

Source: Field survey, 1986.

AGRICULTURAL INFORMATION THROUGH MASS MEDIA

It was mentioned earlier that 291 respondents could specify their favorite radio programs. Of these 291 respondents, 206 (71%) could specify a favorite agricultural program. The figures in Table 3.6 indicate that the more popular programs are those between the hours of 0500 to 0530, 2100 to 2200 and 1600 to 1630. It should be noted that programs between 2000 to 2059 hours received less-than-expected interest. This could be the result of competition with television programs.

"Farmers' News," which is a three-minute agricultural documentary broadcast by Channel 7, received the widest viewing interest. Almost 80 percent of the 897 respondents (710 viewers) reported that they watched this program and 25 percent the respondents (220 viewers) followed the program regularly. Other agricultural programs are much less well-known owing to restricted networks and less popular broadcast times. At the time of our survey, while Channel 7's "Farmers' News" was broadcast every day around 2050 hours, between the domestic and the foreign news, *Haa Kin Thin Nua* (Channel 8) was shown only once a week on Tuesday at 1600 hours and *Samun Phrai*, also on Channel 8, was broadcast every Wednesday, also at 1600 hours.

Table 3.6 Northern Thailand: agricultural information through mass media

(a) Popular agricultural radio programs

Hours	Male (%)	Female (%)	Total (%)
0500 - 0530	25.1	25.8	25.3
1600 - 1630	12.6	6.5	11.6
2000 - 2059	4.0	9.6	5.0
2100 - 2200	19.4	25.8	20.4
	(n = 175)	(n = 31)	(n = 206)

(b) Viewership of agricultural TV programs

	No. of respondents	% of viewers
Farmers' News (Channel 7)	897	79.2
Haa Kin Thin Nua (Channel 8)	869	3.7
Samun Phrai (Channel 8)	969	3.1

(c) Viewership of Farmers' News (n = 897)

	% of respondents
- regular	24.6
- irregular	54.6
- non viewers	
- heard of the program	14.6
- never heard of the program	6.1

Source: Field survey, 1986.

Comments from respondents about Channel 7's "Farmers' News" were sought from viewers and are presented in Table 3.7. About half of the viewers found the program very interesting. Most viewers (60-70%) thought that the length and the presentation of the program were quite appropriate. About one-third of the viewers considered the program too short and one-quarter of the respondents considered the presentation too fast. In-depth interviews revealed that some of the respondents who said that the program was not interesting were the best farmers. They indicated that the program was too short and the narration was too fast to be useful. They preferred reading materials as they could read them repeatedly. In addition, the figures in Table 3.7 also indicate that male farmers, contact farmers (COFs), and members of economic and agricultural groups appear to be more interested in the program than others. Interestingly, 34.9 percent of the viewers stated that they would like to see the program cover a longer period. This shows the eagerness and enthusiasm on the part of farmers to receive agricultural information through television, a dissemination approach which has become increasingly common in the rural areas of Northern Thailand.

Table 3.7 Comments on "Farmers' News", Channel 7

(% distribution within a sub group)

	Sex		Membership		COF status		All
	Male	Female	Group	Non-group	COF	Non-COF	Respondents
Interesting Content							
very	50.3	4.4	50.2	46.7	59.2	46.7	48.8
moderately	48.6	53.9	48.3	52.2	40.2	52.0	49.9
not	1.1	1.7	1.4	1.0	0.8	1.4	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Length							
appropriate	59.9	63.6	59.9	61.6	59.9	60.9	60.6
too long	3.1	9.1	3.4	6.2	1.6	5.2	4.6
too short	37.4	27.3	36.7	32.2	39.3	33.9	34.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Presentation							
appropriate	72.0	75.4	72.9	72.8	71.3	73.2	72.9
too slow	2.3	2.3	1.5	3.4	0.8	2.6	2.3
too fast	25.7	22.3	25.6	23.8	27.9	24.2	24.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
n =	(525)	(175)	(410)	(290)	(122)	(578)	(700)

Source: Field survey, 1986.

SIGNIFICANCE OF DIFFERENT MEDIA DISSEMINATION APPROACHES

In the survey questionnaire, respondents were asked if they had ever received "agricultural information and knowledge" from the ten sources (which appear in Table 3.8) and, if so, how often, and what type of information was received. Respondents were asked to judge whether the frequency of contact was "often" or "sometimes." We took a "sometimes" response to indicate a willingness to obtain more agricultural information from that particular source.

Of the ten sources of agricultural information listed in the questionnaire extension officers and television were cited as the most frequent sources of information (Table 3.8), about 18 percent reported that they often received agricultural knowledge from extension officers and 17 percent reported that they most often received agricultural knowledge from television. However, when those who "sometimes" received agricultural information are included, television turned out to be the most popular source. A total of 65.5 percent of 1,035 respondents received agricultural information from television. Under this broader definition, extension officers became the second most important source of information (59.6%), followed by local traders (46.8%), groups (46.1%), and contact farmers (44.9%). The least significant sources were field trips and exhibitions (20.6%), and reading (22.9%). It is interesting to note that almost two-thirds of the respondents reported that they never received agricultural knowledge from the radio.

Table 3.8 Northern region: frequencies of agricultural information reception by source

(n = 1035, % of respondents)

Information source	Receivers			Non-receivers
	Often	Sometimes	Total	
Local traders	6.1	40.7	46.8	53.2
Agrochemical companies	0.8	19.2	20.0	80.0
COFs	11.9	33.1	44.9	55.1
Banks	2.9	27.1	30.0	70.0
Television	17.3	48.2	65.5	34.5
Radio	7.1	27.4	34.8	65.2
Reading	2.2	20.7	22.9	77.1
Field trips/exhibitions	0.5	20.1	20.6	79.4
Groups	10.4	35.7	46.1	53.9
Extension officers	17.5	42.1	59.6	40.4

Source: Field survey, 1986.

It should be noted that the word "importance" here does not refer to "superiority." It simply refers to the opportunity for or the frequency with which farmers have had contact with a particular medium. As different media have different advantages and disadvantages, it is not appropriate to judge one medium on the basis of another's advantage. As television is a mass medium and penetrates into the homes of farmers, it is bound to be the most important source of information measured in terms of contact frequency. What is interesting about this finding is that television – more than radio – has become the more popular means for diffusing information in Northern Thailand.

Secondly, it is not the aim of this study to judge the influence of different media on adoption decisions. Here, the media are assessed only in terms of the inability to bring a message to a receiver. It is believed that an adoption decision is a complex procedure and more than one medium plays a major role at each different stage leading to adoption, i.e., awareness, search, assessment, experiment, action, and, finally, adoption. A large-scale field survey can only emphasize the impact of media on farmer awareness. The other stages are better explored using the case-study approach.

Table 3.9 indicates the type of agricultural knowledge provided by the ten sources. The most frequently received information from television involved agricultural practices, followed by new crop/variety, chemical input and seeds. Television appears to be a minor source of information on prices. Extension officers are an important source of knowledge regarding chemical input, practice, seeds, new crop varieties and tend to provide packaged technology. Local traders are a major source of price information and agrochemical firms provide more information on chemical inputs and, to a minor extent, also provide information on varieties. The information provided by COFs follows the same pattern as that of extension officers, i.e., packaged technology, but at a lower level of frequency.

Table 3.9 Northern Thailand: frequency of agricultural information reception by type of knowledge

(% of respondents)

Information Source	New crop/ variety	Seed input	Chemical	Practice	Price	Other
Local traders	5.8	8.7	8.5	2.4	38.4	3.9
Agrochemical companies	4.0	1.5	19.0	2.2	0.5	1.7
COFs	21.8	23.2	25.9	22.7	6.9	4.7
Banks	7.7	9.0	15.1	7.7	3.6	19.1
Television	36.9	23.2	26.7	48.3	5.6	11.5
Radio	17.2	13.2	18.5	19.5	9.1	5.8
Reading	12.2	10.0	13.5	14.1	2.9	3.1
Field trips/ exhibitions	10.9	7.6	6.9	10.6	0.6	7.1
Groups	21.1	18.8	27.7	19.4	9.8	19.5
Extension officers	33.5	33.6	40.1	35.1	8.0	10.2

Source: Field survey, 1986

ACCESS TO INFORMATION AMONG DIFFERENT GROUPS

It is hypothesized that members of different groups have different access to agricultural information. For example, in the Thai society, men traditionally deal with the political and external aspects of family business. They are often selected as contact farmers, tend to be the family's representative at village meetings, and travel more often into town to buy inputs. Thus, men are expected to have better access to information.

Those belonging to an economic or an agronomic group also tend to have better access to information. In fact, the establishment of farmers' groups facilitates information dissemination. Thus, farmers who belong to an economic group such as the BAAC group, a cooperative or a crop-specific group, tend to have more opportunities to interact with technology transfer agents and receive technology supplied by the organizers of the group. Finally, under the current agricultural extension system, contact farmers who are selected as the informal sources of local information dissemination should have prior access to official information.

The figures in Table 3.10 indicate the proportion of respondents in each group reporting access to agricultural information. It is evident that male respondents consistently had better access to agricultural information. For each source, more male respondents indicated having access to agricultural knowledge. Similarly, group members tend to have better access than nonmembers and contact farmers have better access than noncontact farmers. Most contact farmers obtained agricultural information from extension officers and fellow contact farmers. As expected, the media (i.e., television and radio) turned out to be a relatively equitable source of information. In a later section, the result of a test of the statistical significance of these differences will be discussed.

Table 3.10 Comparison of access to agricultural knowledge by source and by group (% of respondents)

Information Source	Sex		Membership		COF status		Total Sample
	Male	Female	Group	Non-group	COF	Non-COF	
Local traders	48.5	42.6	52.0	40.0	55.8	45.2	46.8
Agrochemical companies	21.2	17.0	24.3	14.3	25.5	19.0	20.0
COFs	50.1	31.9	51.8	35.9	78.9	39.5	45.0
Banks	34.8	17.8	48.8	5.4	44.8	27.4	30.0
Television	68.4	58.1	68.4	61.8	76.3	63.6	65.6
Radio	37.1	27.8	37.1	31.0	40.1	33.5	34.5
Reading	24.7	18.3	26.3	18.4	40.8	19.7	22.9
Field trips/exhibitions	22.1	16.7	23.5	16.7	39.6	17.2	20.6
Groups	48.8	39.2	77.0	5.7	66.7	42.5	46.1
Extension officers	63.8	48.9	65.9	51.5	85.7	55.0	69.6
n =	746	289	588	447	157	878	1035

Source: Field survey, 1986.

For all groups, television is the most important source of information on variety and practice. The extension officer is the next most important source for all groups in providing knowledge about seeds and chemical inputs. In the Upper North, contact farmers are relatively more important for transmitting various kinds of agricultural information to both male and female farmers than they are in the Lower North. The role of agricultural groups is more pronounced in the Lower North than in the Upper North. It is interesting to note that, in general, women rely more on television as an important source of agricultural information than do men who tend to obtain their information from contact farmers (COFs) and agricultural groups as much as from television and extension officers. This finding is consistent with Thai tradition where men deal with the social and political aspects of family business. It is also noteworthy that COFs frequently obtain information from their own social class.

TEST OF HYPOTHESES

This section reports the results of statistical tests of the following:

- whether different groups have different access to information;
- whether different groups have different agrochemical knowledge, practice, and performance;
- whether access to information and agrochemical knowledge move in the same direction; and
- whether access to information, practices, and performance have positive correlations.

Computation of indices

To answer these questions, a number of indices were computed.

1. The Contact Frequency Index (CFI) measuring farmers' actual access to agricultural information.
2. The Contact/Information Index (CII) which is the CFI weighed by types of information received.
3. The Practice and Performance Index (PPI) measuring agronomic practices and achievements.
4. The Agrochemical Knowledge Index (KLI), primarily measuring farmer knowledge regarding agrochemicals.

The four indices were derived as follows:

1. The Contact Frequency Index (CFI). In the questionnaire, respondents were asked if they had received agricultural information from the following sources: local traders, agrochemical companies, contact farmers, banks, television, radio, reading, exhibitions and field trips, economic, social or agricultural groups, and extension officers. A score of two was given to a farmer who indicated that he "often received" agricultural information from a particular source, a score of one was given for "sometimes," and no score was given for "never."

The Contact Frequency Index (CFI) was obtained by summing frequency scores of all sources. The maximum CFI score is 20. CFI is expressed as a percentage as follows:

Let f_i = scores for the ith channel of agricultural information, i = 1.... 10
f_i takes only 3 values : 0, 1, 2.

$$CFI = \frac{\sum_{j=1}^{10} f_i \times 100}{20}$$

2. *The Contact Information Index (CII).* *The CII* was obtained by weighing CFI by the number of types of information received. In the questionnaire, respondents were asked which type of agricultural information was received: new crop/variety, seed, agrochemical, cultivating method, price, and other. More than one answer for one channel was allowed. The sum of the number of information types was used as weights which were applied as follows:

Let t_j = jth type of information for channel, j = 1.... 6; t = 1 or 0
f_i = scores for the ith channel of agricultural information i = 1.....10

$$CII = \frac{\sum_{i=1}^{10}(f_i \sum_{j=1}^{6} t_j) \times 100}{120}$$

3. The Practice and Performance Index (PPI). The PPI for each respondent was obtained by summing the following: A farmer received one point for:

- growing more than one wet season crop;
- using a promoted variety of any major crop (rice, corn, soybeans, mung beans, and peanuts);
- having adopted a promoted variety for more than five years;
- using any mechanized equipment;
- a yield of any major crop that was greater than the sample mean for that crop;
- resorting to various sources of seed supply other than permanent on-farm collection;
- applying any of the four major chemical fertilizers (16-20-0, 15-15-15, 21-0-0 and 46-0-0) (one score was given for each correct use);
- being able to distinguish weed killers from weed controllers;
- recognizing pesticides by common or generic name; and
- solving pesticide resistance by changing pesticide type rather than mixing or increasing concentration.

The maximum number of points in the PPI index is 13.

4. The Agrochemical Knowledge Index (KLI). The knowledge of respondents regarding agrochemicals was measured whether they actually used agrochemicals or not. Scores were given as follows:

	Item	Score
(a)	**Recognition of chemical fertilizers**	
	- no knowledge of any chemical fertilizer	0
	- brand names or trademarks	1
	- one formula	2
	- more than 2 formulae	3
(b)	**Application of 16-20-0**	
	- no knowledge	0
	- top-dressing	1
	- top-dressing or basal application	2
	- basal application	3
(c)	**Application of 15-15-15**	
	- no knowledge	0
	- top-dressing	1
	- top-dressing or basal application	2
	- basal application	3
(d)	**Application of 21-0-0**	
	- no knowledge	0
	- basal application	1
	- basal application or top-dressing	2
	- top-dressing	3
(e)	**Application of 46-0-0**	
	- no knowledge	0
	- basal application	1
	- basal application or top-dressing	2
	- top-dressing	3
(f)	**Distinction of weed killers from weed controllers**	3
(g)	**Recognition of pesticides**	
	- no knowledge	0
	- trademarks or company names	1
	- trade names or combination of trade names and trademarks	2
	- generic names	3

The maximum KLI score is 21. Scores for respondents were transformed into percentage points.

Statistical results

Mean scores for different groups were computed. The groups considered consist of the following:

- male/female;
- contact farmers/farmers; and
- those belonging to any kind of economic and social group, e.g., a BAAC group, a cooperative, etc. *vis-a-vis* those who do not belong to any such group.

The null hypotheses used for the one-tailed t-tests are that the mean values of the score of the opposite group listed above are not different. The alternative hypotheses are that the means for male, contact, and group-member farmers are larger than those of the opposite group. The results of the t-tests are summarized and presented in Table 3.11. It is apparent that all of the null hypotheses can be rejected and the alternative hypotheses accepted. Therefore, it is possible to conclude that statistical tests suggest inequality of access to information between groups in the direction that is more favorable for males, group members, and contact farmers. It should be noted that the PPIs of male and female farmers were not compared as such a comparison is meaningful only if all female respondents came from woman-headed households. At the same time, it is observed that the performance and practice of group members and contact farmers, i.e., those with better access to information, are superior. The difference is more noticeable between contact farmers and noncontact farmers.

Table 3.12 presents the correlations of the above indices and it is evident that there is a positive relationship between indices for access to information and indices for knowledge, practice, and performance.

INFORMATION NEEDS

During the survey, respondents were asked to indicate the types of information they would like to have. Some of the respondents could identify their needs spontaneously and immediately; other farmers who could not identify their needs by themselves were asked to go through a list of information types and indicate their needs. Respondents were allowed to give more than one answer but not more than three. The results are shown in Table 3.13.

The ranking of information needs by spontaneous request is very similar regardless of group (Table 3.13). They are, in order of importance: planting methods, pest control, new crops, fertilizer application, and new varieties. It should be noted that farmers' felt needs (i.e. spontaneous requests) are concentrated in planting methods (on-farm practices) and on-farm practices are particularly suited to dissemination by audio-visual mass media.

It is interesting to note that those providing spontaneous requests showed a similar need pattern and those choosing answers from a suggested list showed another similar pattern. The pattern for each group is consistent across social subgroups. Relatively passive farmers considered pest control as their priority, followed by fertilizer application, new varieties, planting methods, compost production, and new crops.

Table 3.11 Summary of the comparisons of means

Variable/ Group	No. of cases	Mean	Standard deviation	t-test of identical means t value	d. f.
1. Contact Frequency Index (Grand mean = 23.13; sd = 14.3800)					
- Male	746	24.9866	14.675	7.33*	614
Female	289	18.3391	12.424		
- Group membership	588	28.0187	14.745	14.14*	1033
Nongroup	447	16.7002	10.999		
- Contact farmers	157	34.1083	15.080	10.07*	202
Farmers	878	21.1674	13.351		
2. Contact/info Index (Grand mean = 9.2568; sd = 14.3898)					
- Male	746	9.9665	9.387	4.60*	663
Female	289	7.4250	7.361		
- Group membership	588	11.6383	10.007	11.01*	984
Nongroup	447	6.1242	6.007		
- Contact farmers	157	14.1454	11.011	6.25*	188
Farmers	878	8.3827	8.220		
3. Practice and Performance Index (Grand mean = 5.0106; sd = 1.7053)					
- Group membership	588	5.3129	1.604	6.60*	913
Nongroup	447	4.6130	1.754		
- Contact farmers	157	5.3631	1.729	2.82*	1033
Farmers	878	4.9476	1.694		
4. Agrochemical Knowledge Index (Grand mean = 6.1575; sd = 3.7519)					
- Male	746	6.5992	3.677	6.19*	1033
Female	289	5.0173	3.708		
- Group membership	588	6.8656	3.787	7.13*	1033
Nongroup	447	5.2260	3.498		
- Contact farmers	157	7.2102	3.853	3.84*	1033
Farmers	878	5.9692	3.704		

Notes: Significance level
* = 0.5%
sd = standard deviation

Table 3.12 Correlation of access to information and knowledge, practice, and performance

	CFI	CII
KLI	.2328*	.0982*
PPI	.2408*	.1805*

Note: Significance level * = 1%

Table 3.13 Northern Thailand: ranking of information needs[1]

Information Need	Sex		COF Status		Membership	
	Male	Female	COF	Non	Group	Non
Spontaneous requests						
planting methods	1	1	1	1	1	1
pest control	2	2	2	2	3	2
new crops	2	3	3	4	4	4
fertilizer application	3	5	4	4	4	3
new varieties	4	4	5	5	5	5
fishery	5	-	-	-	-	-
Suggested requests						
planting methods	4	3	4	4	4	4
pest control	1	1	1	1	1	1
new crops	-	5	-	5	-	5
fertilizer application	2	2	3	2	2	2
new varieties	3	4	2	3	3	2
fishery	-	-	5	-	-	-
manure production	5	-	3	-	5	5

Source: Field survey, 1986.
Note: [1] indicates highest priority

That "new varieties" is not high on the list of priorities may be the result of extensive current extension program efforts supplemented by very active private-sector dissemination, especially in the area of new commercial crop varieties.

In the suggested list, food preparation and food preservation were also included. However only one female out of 289 farmers (0.3%) expressed a need for such information. A similar proportion, i.e., 3 out of 746 male farmers (0.4%), was also found. Thus, the survey results seem to suggest that there is no need to create a special home economics program for women. If there is to be one, male farmers should be given the same option.

CONCLUSION

The analysis of information obtained from our household survey clearly indicates that farmers have different access to information depending on their socioeconomic status. Our hypothesis that male, contact, and group-oriented farmers have better access to information than their corresponding, opposite group (i.e. female, noncontact, and nongroup farmers) is supported by the empirical evidence. Findings also show that those having better access tend to perform better agronomically.

The information most frequently cited as needed by farmers includes planting methods and pest control. As later chapters will show, these on-farm technologies have been the subject of much experimentation and positive results have been adopted by many innovative farmers in different locales. These achievements would be better exploited by disseminating findings more widely into other farm communities.

The following chapters present information obtained from interviews and case studies which were intended to probe more deeply into the interaction between information networks and the process of technological change at the village level.

Chapter Four

Farmers in Northern Thailand

MINGSARN KAOSA-ARD
BENJAVAN RERKASEM
BENCHAPHUN SHINAWATRA

Studies of agricultural development tend to focus upon how productivity can be improved without giving due recognition to the most crucial agent of change – the farmer. This chapter attempts to reveal the background, knowledge, experience, and access to information of both male and female farmers in Northern Thailand who have diverse characteristics and different origins. Some are community leaders and contact farmers. Some were considered dynamic, competent, and successful by the researchers and others were considered passive and ignorant. Together they form the resource base for agricultural development. Their real names, however, are disguised.

The case studies presented in this chapter were not drawn randomly. They are the farmers who researchers interviewed intensively. They were selected to present a picture of the different degrees and the different dimensions of the human resources quality in agriculture. They were chosen to represent the wide spectrum and variation of the farming community. These case studies were designed and written in the hope that farmers will be better understood as individuals involved in a complex investment decision-making process and not merely as another input to agricultural production. Given this purpose, no conclusions or generalizations are attempted in this chapter. Readers are invited to explore, reflect, and arrive at their own conclusions.

CASE STUDIES

Arb

Background. *Arb* was elected the village headman nine years ago when his nephew resigned from the post. Today he leads a village of 170 households. The village is one of the most advanced villages in Chiang Mai. He is generally called *Phaw Luang*, meaning headman.

Current practices. *Phaw Luang* knows about the correct application of all fertilizers contained in the survey questionnaire and more. He recognizes that alluvium deposits from the river cause the very fertile soil on his farm. He also knows that traditional tall rice varieties respond negatively to fertilizer on soils as fertile as his own. Therefore, although he has knowledge of 16-20-0 as a fertilizer recommended for rice, he would use it only on the semi-dwarf varieties such as RD1, RD7, or RD10, and never on any of the traditional tall varieties. He provides maximum labor and minimum cash input for non-cash crops such as rice, and optimum cash input for high-return crops such as tomatoes. His 1985/86 rice yield was 700 kg per *rai,* which is 100 percent above the national average. His tomato yield of 4,500 kg per *rai* was much above the experimental tomato plots' yield at Chiang Mai University.

Innovations. *Phaw Luang* is the community's leading innovator. Before he became headman, he introduced a new rice variety, *San Pa Tong,* in 1971. In one of his trips to purchase timber in a neighboring village, he heard of the superior yield potential and cooking quality of a new rice. So, he bought some seed and grew the variety on a 5-*rai* plot. The following year, a few relatives followed. After three years, other farmers followed. Apart from its superior cooking quality, *San Pa Tong* rice can be harvested ten days earlier than the traditional variety, *Lai Daw.* This allows for earlier sowing of the dry-season crop following rice.

At present, *Phaw Luang* obtains *San Pa Tong* seed from the district extension officer. He claims that seed can be collected on the farm for three years, after which new seed must be purchased.

In 1981, *Phaw Luang* was among a few innovators who adopted regular spacing for transplanting rice. *Phaw Luang* started growing high quality, scented rice for sale for the first time in 1985 obtaining the seed from his neighbor. The fact that he recognized immediately upon planting that the seed was rather mixed is testimony to his competence and excellent knowledge of rice variety characteristics.

Despite only four years of education, *Phaw Luang* is a scientific man. He was willing to try regular spacing of rice by reasoning that evenly spaced hills allow for even distribution of plant nutrients. During the interview, when it was explained to him that spraying of insecticides can kill predators which pray on pests as well as kill the pests, he showed a ready appreciation of this basic concept of pest ecology. He remarked, "No wonder we seem to be getting more pests now even when we keep spraying, while there did not seem to be as many pests when we did not spray." He can differentiate trade names and common names for agrochemicals. He applies hormones in tomato production and recognizes fertilizers by formulae. He does not attach much importance to trademarks. For insecticides, although *Phaw Luang* may not fully understand the chemical mechanisms behind each product, he reads the label and can identify similar chemicals for the same type of pest. This ability allows him to select the lowest-cost products and to negotiate with agrochemical agents.

Phaw Luang is also an economic man. He heads the local soybean production group. Agrochemical firms generally contact him and the group to promote their products. The decision to select the supplier is generally an economic decision. The company that offers the lowest prices and provides the longest credit will be selected. Similarly when he purchases fertilizers, he compares fertilizer prices with the same formula and selects the cheapest one.

Access to information and evaluation. The fact that *Phaw Luang* is a leader in his own right does not prevent him from seeking information from other farmer-leaders. At the time of the interview, he was also growing potatoes, getting advice from his sons and a well-known innovative family in a nearby village. He constantly seeks additional agricultural information from various sources: reading, television, radio, extension officers, exhibitions, and field trips. He feels that technical information from district extension officers is most accurate, but values the exchange of knowledge and experience with his fellow contact farmers (COFs).

Boon

Background. *Boon* moved into the village at the age of 25 in 1961. Five years later, he was elected headman and had served continuously for nine years. At the time of the interview, *Boon*, 47 years old, was the chairman of the district agricultural cooperative and held several village offices.

Boon owns 20 *rai* of rice land, plus one *rai* of residential land and a two-*rai* orchard. Apart from farming, *Boon* is also an entrepreneur engaging in the advanced purchase of *longan*, a local fruit, during the flowering period. As such, he gets higher returns from bearing the burden of yield and market risks.

Current practices. Like other leading farmers *Boon* has sufficient knowledge of chemicals for his trade. He uses fertilizers correctly and distinguishes them by formulae although he does not understand the scientific properties of each ingredient. As for insecticides and herbicides, *Boon* cannot distinguish between trade names and common names but he applies them according to the label. *Boon,* however, observes very strict safety rules when using the chemicals. He indicated that those who became sick from insecticides did not pay attention to the safety rules: they consumed liquids without washing themselves after spraying; they neglected to protect their nose and mouth when spraying tall plants; and they ignored the rule of not spraying under windy conditions.

Innovations. Apart from his relative wealth and position, *Boon* remains active in farming and is still a leading innovator. In 1978, he attended a meeting organized by the district cooperative. A resource person from Mae Jo Institute of Agricultural Technology came to promote the practice of regular spacing. *Boon* decided to adopt the practice immediately and started regular spacing on 15 *rai*. The increase in yield was more than 40 percent for the RD variety and about 15 percent for the recommended native variety. A few of his relatives then followed his lead. Within three years, almost everybody in the village was practicing regular spacing.

Last year *Boon* passed by a neighboring district and came across regular spacing of soybeans. He immediately experimented. Yield increased from between 270 to 300 kg per *rai* to 360 kg per *rai*, an extremely high yield in the Upper North. This year, more than ten farmers have followed this practice and *Boon* is considered an authority in soybean production.

Evaluation of information sources. *Boon* has an intense interest in improving his agricultural knowledge. He regularly watches "Farmers' News" (an agricultural documentary shown daily on Channel 7). He even watches when the programs show practices or crops which cannot be adopted in his village. He accepts the fact that the government is an important channel for many new technologies, notably crop

varieties and seed technology, but feels that, as far as cultivating practices are concerned, what other farmers do tends to be more relevant and practical. He regularly discusses and exchanges ideas with COFs and extension officers.

Chan

Background. *Chan* is the vice-chairman of the Young Farmers' Group in a village in an Upper Northern province. She is 21 years old and has graduated from an agricultural college. Her father was a contact farmer (COF) and her eldest brother is a COF. *Chan* won second prize in a regional agricultural quiz held in Nakhon Sawan last year and is often a candidate in major farm-related contests.

Chan grew up in a very enterprising family. Her father, *Pun*, was the first man to grow potatoes in this district. In 1973, *Pun* heard from a Chinese trader that potatoes could be grown in Chiang Mai. He immediately traveled to town to see the Provincial Agricultural Extension Officer to try to get more information and was provided with a booklet on how to grow potatoes. He then started growing potatoes according to the instructions. After growing the Bintje variety for five to six years, her father saw a new potato variety, Spunta, which had a much bigger head, in a neighboring village. He began to produce Spunta and became the leader of the potato farming community. In 1984, the family adopted a new variety, Russet Burbank, to supply the Royal project.

The family is run like an enterprise with a clear-cut division of labor. *Chan's* father has retired from active farm work and assumes an advisory role. Her eldest brother has become family leader and assumes the role of financial and general manager. As the leader of the Potato Growers' Group, the eldest son travels regularly to the provincial town as well as to other provinces. He also started a new ginger farm this year.

The second elder brother is a field manager and looks after a newly acquired 60 *rai* farm in a neighboring district, 60 kilometers from the family residence. The third elder brother is the pest and weed control expert of the family. *Chan*, who is the youngest child and the only daughter, supervises day-to-day field operations.

Current practices. *Chan's* family employs good agronomic practices. Their rice yield was 1,160 kg per *rai* for RD varieties and 830 kg per *rai* for the promoted *San Pa Tong* variety. Potatoes yield an output of 2,500 to 3,000 kg per *rai*.

Despite her education, *Chan* was not knowledgeable about agrochemicals. This could be because, as has been noted, in the Upper North where farm size is small, women are not given the task of spraying.

Innovations. The family invests a great deal on experiments and has tried cantaloupes and Japanese cucumbers. *Chan* is interested in tissue culture as a means of potato propagation. When asked if this was not too far-fetched and uneconomic, her reply was, "We always have to look to the future." Her father sounded a little more conservative, but even though he does not feel enthusiastic about it he lets his daughter experiment with potato plantlets as a means of propagation. The family's grasp of knowledge on potato production is demonstrated by their expansion into the highlands for wet-season production. After their March lowland harvest, some of the smaller tubers are sold to hill tribe farmers as seeds to be planted in the coming wet season. Some of the smaller tubers again become seed for the subsequent lowland cool-season crop. This local recycling of potato seeds helps to alleviate the

problem of the high cost and late arrival of seeds imported from Holland. Also, the family is well aware of the problem of seed-borne diseases. *Chan*, as field supervisor, is knowledgeable about insect-transmitted diseases in the field. She complained, however, that it was not always easy to get farmers in their potato group to remove the plants showing symptoms of infection.

Access to information and evaluation. The family is known for its expertise and has experimental field plots for at least three firms—Union Carbide, FMC, and Zuellig. According to *Chan*'s father, the village extension officer stops by their house three times a day. Overwhelmed with this information, although they feel it is relevant to their needs, they rarely depend on radio or television or information, but both *Chan* and her father consider reading an important source of knowledge.

Dee

Background. *Dee* may be called the average farmer of the Chiang Mai valley. He has five *rai* of paddy land which is well irrigated in the dry as well as the wet season. He lives in a village with a long tradition of irrigated agriculture and thus there is a rich background of traditional farming technology. In the last 20 years, the village has often been a site for the introduction of new technology, namely, the introduction of chilies (in the mid 1960s) by a contract buyer hoping to produce dried chilies; the Multiple Cropping Project of Chiang Mai University which introduced intensive rice-based cropping systems (from 1975 to 1979); and the introduction of Basmati rice on a contract basis (in 1982) by a company aiming to export the rice to the Middle East.

Current practices. *Dee* now grows two kinds of rice—three *rai* of the glutinous RD8 for home consumption and two *rai* of nonglutinous RD7 for sale. RD7, the semi-dwarf, high yielding rice, is grown with modern rice technology, i.e., regular spacing and fertilizer application. The fertilizer used is the recommended 16-20-0. *Dee* knows that more fertilizer means better yield, but the amount varies and depends upon his current purchasing power. RD8, a traditional improved variety, is grown traditionally, i.e., with little fertilizer and rough spacing.

RD7 is harvested in November, the rice is sold immediately, and the cash it earns helps to finance (50% of the cash input in this case) the chili crop that follows. About one month before RD7 is harvested, chili seed is sown in a nursery. After RD7 is harvested, the land is ploughed by a hired tractor and bedded up, and the chilies are transplanted to the beds. Chili management is standard village practice. Fertilizer, originally prepared and sold for tobacco (which contains N.P.K., as well as Mg and, occasionally, B) is believed to be best also for chilies. It is applied at the rate of a scant spoon to individual plants after the transplanted seedlings have been established. The crop receives splash irrigation each time water is allocated to the field and, starting in December, the green chilies are picked regularly for fresh market produce. *Dee* knows that during periods when prices for green chili are low, the crop can be left to ripen and made into dried chilies; but he also knows, as does everybody in the village, that the setting of new fruit will be reduced if the picking of green chili stops. The RD8 harvest is kept for home consumption. After its harvest the field is planted to another crop of RD7.

Innovations. Before the adoption of the current cropping systems, *Dee* grew the staple glutinous rice, *Niaw San Pa Tong*, followed by soybean in the dry season. RD7 was adopted in 1982 and RD8 in 1984; RD7 was first adopted in the village in 1975 and RD8 in 1981. The adoption of RD7 was accompanied by the change from soybean to chilies in 1982, although information on how to grow chilies had been available in the village since the mid 1960s. All of *Dee*'s technological information has come from the village. He obtained RD7 and RD8 seed from village neighbors. There was no experimental phase to his adoption process. Ten kilograms of RD7 were obtained from a neighbor and planted onto two *rai* in the first instance and, similarly, 20 kg of RD8 was planted onto three *rai*; these are the total planted areas for each cultivar he grows. Similarly, with regular spacing, the practice was adopted over the whole field in the first instance. Perhaps, with such a small holding, he cannot afford an experimental plot. It is worth noting that *Dee* still grows glutinous rice for family consumption, although the most recent trend among the more progressive farmers in the village is to convert completely to cash cropping as it is more economical to buy glutinous rice from neighboring villages.

Access to information. *Dee* had heard of the Multiple Cropping Project but, although he had a neighbor who took part, he was not interested in participating. He has also not been involved in the contract production of Basmati rice; however, the buyer specified that contracts would only be given to farmers with more than five *rai*, which would have excluded *Dee* anyway. Similar to the rest of the village, *Dee* is a member of the village temple group, which is organized for religious and other public service purposes. Meetings of this group and other social occasions within and outside of the village are used by other, more progressive, farmers to exchange agricultural information. *Dee* is, however, not the type of farmer who actively seeks agricultural technological information and knowledge. This is perhaps understandable because of his inability or unwillingness to experiment. Indeed, most new ideas and knowledge often require an experimental and adaptation phase not affordable by every farmer. All of the information that led to adoption on *Dee*'s farm came from the proven successes of other farmers in the village.

It seems that *Dee*, and many in his position, limit their ability to adopt new technology by using information acquired by others rather than by accessing information themselves. Information delivered by the media that expect to reach this group of farmers must suggest practices within the farmers' economic and technical capability. In this respect, information on how to do certain things a little better, e.g., how to count insects coupled with knowledge on damage threshold (how many insects before damage is significant enough to warrant spraying), hunger signs in crops, and symptoms that could help diagnose diseases, are some examples of helpful methods.

Ek

Background. *Ek* has six *rai* of rice land. His farm is in an irrigated area, but he experiences some of the problems associated with irrigation that are common in irrigated areas of the Upper North. Some of his fields are low lying and the water level in the wet season can be rather deep. In the dry season, scarce irrigation water may run out before reaching these fields, which are at the end of the irrigation ditch. *Ek* heard about the Multiple Cropping Project of Chiang Mai University through

some relatives who took part in it, but he did not participate. *Ek* entered into a contract to grow Basmati rice in 1985, but had to abandon this effort in 1986.

Current practices. In the 1986 growing season, *Ek* planted four *rai* of RD15 and two *rai* of *Khao Kluoi* (a traditional variety) to be followed by soybeans in all six *rai* in the coming dry season. All of his rice was transplanted using regular spacing. *Ek* chose *Khao Kluoi* for his low-lying fields; RD15 had been chosen with less definite information. It had been seen on neighbors' fields, but *Ek* chose it more in the absence of any alternative, and less on its proven superior performance.

In 1985, *Ek* was contracted to grow Basmati rice. In his four *rai* field *Ek* planted the Basmati rice on contract. It was to be followed by soybean in the dry season and then another crop of rice using the new glutinous rice RD10. However, the third crop, RD10 variety, was still not harvested when farmers contracted to grow the Basmati rice were required to plant. So he had to abandon Basmati production in 1986. This is an example of the cost of on-farm innovation due to lack of technological information. Information on crop duration and cropping systems could have been very useful to *Ek* and others like him.

Innovations. The fact that *Ek* was growing RD10 in 1986 soon after it was introduced into the village shows that he is fairly innovative. He has also been active in changing rice cultivars; however, he seems often to have made the wrong choice. In addition to the problem with RD10 above, he had difficulty with his low-lying fields in that photosensitive and relatively tall rice varieties (such as RD8) lodged badly; indeed, a switch to *Khao Kluoi* may have effectively solved this problem. The majority of farmers who are successful innovators usually try out a new idea on a small scale to see how it fits into their other farming or cropping systems; they see whether any modification of the practice, the environment, or both, is necessary. By contrast, *Ek* does not generally carry out trials. He adopts new rice varieties or new practices right away.

Access to information. All of *Ek*'s technological information has come from within the village. He frequently observes neighbors' fields and identifies practices that may have potential for his own farm. The quality or completeness of the information received seems to be *Ek*'s problem. In other words, he has difficulty in adapting new practices to fit the particular condition of his own farm. For example, when he saw that RD8 and RD10 performed well in neighbors' fields, he just adopted it without verifying how it would fit into his own farming and cropping system. Once in a while he is lucky and the new technology just happens to fit, like *Khao Kluoi*, but other times the results end in failure. A program which will direct information toward this group of farmers would be most helpful if the information is as complete as possible. As important would be a general education program to raise the level of understanding of present farming and cropping systems so that when farmers attempt to fit new practices into existing ones, the process is more systematic and less random than is currently the case of *Ek* and others like him.

Fah Khum

Background. *Fah Khum* is a rice farmer in a village in an Upper Northern province. He has 15.25 *rai* of paddy land which is all planted to rice in the wet season. His farm is well irrigated in the wet season, but there are some water-shortage problems in the dry season. He was among the first farmers to start to grow chilies when they were introduced into the village in the mid 1960s. He did not participate in the Multiple Cropping Project, but was aware that some neighbors were participating. He was among the first farmers in the village to sign a contract to produce Basmati rice in 1983, the first year it was introduced. *Fah Khum* is also a contact farmer (COF).

Current practices. Currently, *Fah Khum* is growing four kinds of rice, four *rai* of Basmati, four *rai* of RD7, four *rai* of RD15 and 3 1/4 *rai* of RD8. Each of the rice varieties is followed by soybeans in the dry season, except RD15 which is followed by chilies. RD8 is kept for home consumption. RD7 and RD15 are sold immediately after the harvest; 40 percent of the income earned goes toward financing the planting of the soybean crop.

Fah Khum knows about modern rice technology, but does not feel it worthwhile to use the whole management package on his crop, except for Basmati rice. In this case he uses new practices because the company insists that he use regular spacing and recommended fertilizer application techniques. And, rather than do what the crops require, RD7 and RD15 receive fertilizer, only to the extent that the farmer feels he can afford in that particular season. His yields of RD7 and RD8 in 1985 were in the range of 800 to 850 kg/*rai*. RD8 is grown without fertilizer and regular spacing is not practiced on these three cultivars.

Lack of water is considered to be an important obstacle to improved soybean management. The farmer was embarrassed by apparently low yields and refused to give information on the yield level he obtained. He kept repeating that he could do a lot better if his dry-season water supply could be assured. However, he became vague when pressed about exact management practices that could significantly improve his yields.

Innovations. Judging from his adoption of new rice cultivars, *Fah Khum* is a relatively innovative farmer. He was among the first in the village to try out these new rice cultivars. Having heard about a delicious rice variety from a local merchant, he made a journey to the San Pa Tong Rice Station some 15 km away to obtain the new seed as soon as it arrived. However, his active search for new technology is restricted to rice. He is at a loss on what to do about other problems, such as his poor performance with soybeans.

Access to information. The San Pa Tong Rice Station has been the major source of information for *Fah Khum*. He did not know that there was a Center for Field Crop Research at Mae Jo which could give him some advice on soybean management. He also has much less interaction with traders and input suppliers (who greatly contribute to the transfer of information about soybeans) than do his counterparts in Sukhothai. It could be argued that *Fah Khum* would be more active about finding out how to improve his soybean crop if his water supply were secure. Nevertheless, in many cases such as this, farmers would benefit if they were exposed to information about alternatives to soybeans that might be better adapted to the water shortages of February onward.

Gait

Background. *Gait* owns a four *rai* rainfed rice field which can be cropped only once. Therefore he has become a part-time farmer. He was lucky to find employment as a laborer in a local government office. Like most other farmers in his village, he has only four years of education. Also hiring out his labor seems to be the only way to supplement his farm income. His other part-time farmer friends are less fortunate, they live by illegal logging and collecting of forest products.

Current practices. *Gait* has been growing RD8 for two years. He used to grow native varieties such as *Khao Khao* and *Khao Kaew* but shifted to RD8 when he saw better yields on another farm when he was traveling to work. He exchanged his seed with the owner of that farm. This is normal practice for him; whenever he believes that his output is declining he exchanges seed with a neighbor. Now he collects RD8 seed from his own farm, but will exchange it again when it is necessary. He observed that his rice yield has increased with the adoption of RD8. Previously, he only obtained about 200 *kg/rai* in a bad year and 300 *kg/rai* of rice in a good year. Now he can get about 300 *kg/rai* of rice from RD8 in a bad year and 450 *kg/rai* in a good year. Nevertheless, the rice he grows is only sufficient for his family's consumption (wife, two children, and father-in-law) for half a year.

Gait has seen people in other villages practicing regular spacing using string lining. He does not understand why this is done and thinks that it is a waste of time as he can only give one day a week to his farm.

Gait does not use any chemical fertilizer and does not understand fertilizer formulae. In the dry season, he generally dumps cow manure in his field in preparation for the wet season. He claimed that he does not have many problems with pests, except rats, so there is no need to apply pesticides. As for rats, *Gait* said that the more that were killed, the more came from other fields. His strategy is to leave rat control to nature, i.e., snakes and fellow rats.

Gait does not use buffaloes anymore. He hires a tractor for 200 baht per *rai* once a year and saves his labor for his regular employment.

Access to information. *Gait* never attends village meetings organized by extension officers. Such meetings have been rare anyway, because the village is considered to have relatively low agricultural potential. He does not know any contact farmers. Actually he does not know what the term means. *Gait* does not own a television and is a nonviewer. He listens to radio every day, mostly to music programs, and does not pay any attention to agricultural commercials. When asked whether he listened to agricultural programs and needed any further agricultural information, he was obviously surprised and simply said, "Without water, knowing more is not useful."

Harn

Background. *Harn* is a 37 year old farmer in a rainfed area. His village is relatively new and consists mainly of migrants. He had four years of primary education, but his wife did not go to school. The two of them make up the farm's entire labor force as their two children are still too young. Together they grow six *rai* of rice and 1.2 *rai* of peanuts.

Current practice. On his six *rai* of rice land *Ham* grows glutinous rice using a traditional cultivar called *Daw Len*, which is common is this area. The peanut variety is also a traditional, unnamed cultivar. He has no knowledge of any fertilizers or herbicides. Similar to several other farmers in this area, *Ham* uses DDT to control insects, which he identified as gall midge, by applying it soon after transplanting. He reported an insecticide resistance problem and said he tried to cope with it by repeated sprayings. His rice yield is about 400 kg/*rai*, and his peanut yield is 40 tang/*rai*, reasonable yields for rainfed crops.

Innovations. *Ham* identified some farm problems which are shared by farmers in the area. These problems largely concern gall midge and other insects and the use of insecticides. He also wants to know more about other agronomic practices such as the use of fertilizers and new crop cultivars. In his village, a relatively undynamic farming area, there seem to be no innovative farmers to introduce and try out new ideas and technology and act as a sources of information for *Ham*.

Access to information. Residing in a rather remote village, *Ham* has very little access to information—even about rice. He has had contact with some COFs and *tambon* extension officers about rice cultivars, but not specifically about cultivars resistant to gall midge. His neighbors are in the same position. His other contact with the outside world is through the radio which has not transmitted any programs on the farm problems he would like to solve. *Ham* had no information about Phrae Rice Station in the same province; nor did he know that it had been upgraded into the Rice Research Center for the whole Upper North.

Itti

Background. *Itti* won first prize in the soybean yield contest in Kamphaeng Phet for the 1984/85 season and won second prize in 1985/86.

Itti is only 29 years old. He moved with his parents from Phitsanulok to Kamphaeng Phet when he was 18. The family started farming corn. After two years, the family experimented with growing black gram on 10 *rai* of land as they noticed that it provided better income and reduced land preparation requirements for the dry-season crop. The following year, the family switched completely to soybeans.

Current activities. *Itti* grows two soybean crops a year. As a normal practice he seeks to improve soybean varieties by exchanging seed with his neighbors and purchasing seed from government seed centers. In the year when the interview was conducted, he planted 20 *rai* of SJ5 soybeans and 25 *rai* of *Phak Bung* (Sukhothai 1) and *Khlong Lan* soybeans.

Itti uses machinery for land preparation, although he does not use a sowing machine. His brother had one that he could have used but he explained that the machine was not well constructed. He added that one could not see whether the soybean seeds were dropped properly and sometimes the machine was clogged by weeds, preventing good and regular spacing.

Like most farmers, *Itti* has only a four-year compulsory education. However, he understands the need for germination tests and would reject the entire seed lot if germination were less than 80 percent.

Itti generally grows several varieties of soybeans. In this way he continues to search for the best varieties and spreads his risk. At the time of the interview he was

growing three varieties; *Khlong Lan*, *Phak Bung*, and SJ5, and achieving yields of 410, 450 and 330 kgs per *rai*, respectively. He uses different land-preparation methods for wet and dry-season crops and he uses rhizobium, hormones, fertilizers, herbicides, and insecticides properly.

Itti is a self-taught scientist. He reads widely and recognizes agrochemicals by generic names. Although he is aware of the method of brewing homemade herbicides from an initial small stock of Paraquat, he is not at ease with the method as he does not understand what makes the homemade recipe work and hence does not know the side effects.

Innovations. Despite his youth and short career, his life history is filled with technical change and innovation. He was one of the first farmers to plant the *Phak Bung* soybean variety before it was officially recognized by government research and extension officers. This variety gives relatively high yields compared to others and its output is sold for the same price. He has been planting this variety for three years and, on average, can obtain about 400 to 500 kg per *rai*. He once tried to intensify input, care, and management on a *rai* of *Phak Bung* soybean and obtained 600 kg of output. However, he did not think it worthwhile to make such an effort to obtain this yield since it required such heavy investment and management.

For *Itti*, experiments and innovations are simply routine tasks. For example, he was the first farmer in the subdistrict to know about and actually use the weed killer, Paraquat, on a soybean farm. Six years ago, he heard that in Sawankhalok market there was a new chemical that eliminated weeds. Within a week, he went to Sukhothai to buy this herbicide (branded Grammoxone) to use on his farm. After successful application he asked a local shop owner to get hold of this herbicide for other farmers. It was only then that Grammoxone was introduced to the village.

To get to know how to use Grammoxone appropriately was the result of trial and error. The shop owner had told him to be careful not to let the herbicide contact the crop. At first, *Itti* used bundles or racks of Imperata grass to prevent Grammoxone and soybean leaf contact. However, within a few hours, the leaves began to show signs of burning and before he realized it, he had damaged a *rai* of growing soybean.

He then tried a new method. This time he used a corrugated iron plate to cover the soybean plants while spraying Grammoxone. However, this approach needed three persons working together to do the job – one person spraying, the other two holding the plate. Clearly a better way was needed to handle this operation.

He finally developed a new method – this time he invented a tube mounted above the nozzle that would control and channel the spray in the desired direction. The tube was simply cut from an old Grammoxone bottle. This method only required one person and accomplished the job.

Access to information. *Itti* has now established himself as one of the most – if not the most – advanced farmer or farmer-leader in the district. He is in close contact with the village headman who is also a major local supplier of agricultural inputs and purchaser of soybeans. The village headman always sends salespeople or visitors to meet *Itti*. He said he no longer had to go to salespeople from different companies, these people came to him. In fact, he has become a field experiment researcher for a number of private companies. A new chemical or variety that he tests and approves is accepted by the village headman who then recommends it to other farmers.

Having relatives in other provinces is an important source of information. *Itti* has relatives in Phitsanulok and in Si Nakhon district, Sukhothai province and he occasionally receives agricultural information from them. For example, information on the use of fertilizers was obtained from his relatives in Si Nakhon district.

As a rule, innovative farmers actively search for new technologies. A good deal of knowledge was passed to *Itti* through his contacts with agrochemical suppliers at various town centers. Although he has a good relationship with the local store, he reported that he visited, bought inputs, and obtained information from suppliers in Sukhothai and Phitsanulok provinces as well.

Active and articulate, he is therefore a focal point for agricultural research and extension officers from various government offices. He is often invited to attend training courses, to visit exhibitions, and to be a panelist.

Jom

Background. At only 36 years of age, *Jom* has already achieved remarkable financial success. Starting off with an initial investment of 30,000 baht several years ago, *Jom* now owns two Massey-Ferguson tractors, a pickup truck, a motorcycle, a bicycle, a water pump, a soybean thresher, and a five-bin sowing machine.

Jom is a native of a village in Sukhothai province. He has been living in his present village since he was born. He recalled that, in this area, soybeans had been intercropped with cotton for a long time. He added that in recent years, cotton has suffered from insect and disease build-up and has thus incurred high chemical input costs.

Jom is a knowledgeable farmer. He understands fertilizer formulae and knows a variety of chemicals by trade name as well as by common name. He often wins prizes in farmer meetings organized by agrochemical firms to promote their products.

Innovations. *Jom* intercrops soybeans and cotton and grows hybrid sorghum. He got the idea to substitute an open-pollinated sorghum with hybrid sorghum from watching Pacific Seed Co., Ltd. commercials on television. He learned to use hormones after obtaining free samples from agrochemical firms. He adopted spray fertilizers following information he heard on the radio.

Jom owns 30 *rai* of farmland but derives his income mainly from his tractor hire service, a piece of equipment which not many farmers can afford. However, his fellow farmers increasingly see the need to mechanize at least some farm operations. He uses his tractor-hire income to pay the monthly installments required by the shop owner to whom he still owes money for the tractor. *Jom* has expanded his service to nearby provinces. At first, he drove the tractor and worked by himself; later on, he hired an assistant to drive the tractor. He personally supervises this assistant and travels with him to collect the money and look after his tractor.

Access to information. *Jom* travels extensively because of the nature of his tractor-hire business. He talks to a lot of people—salespeople, extension officers, farmers. Moreover, he listens to the radio and reads newspapers, newsletters, pamphlets, and other agricultural publications. He considers reading the most essential path to knowledge. He is usually too tired to watch Channel 7's "Agricultural News."

Although he can now afford to buy agricultural inputs for cash, he continues to buy them on credit, which, of course, is more expensive. He reported that he did this in order to maintain a good relationship with the shop owner who is his *thao kae* (patron). Nearly all of the farmers in the area have their *thao kae* who gives them agricultural inputs on credit and who buys their output at the end of the cropping season. In addition to the high implicit interest rates for the agricultural input loans, these *thao kae* provide farmers with short-term loans in times of difficulty. They also provide farmers with a variety of agricultural information necessary for farm operations. *Jom* considers his relationship with his *thao kae* essential to his operations.

Kaew

Background. *Kaew* lost her husband several years ago. She now farms with the assistance of three children. Her fourth and youngest son (a student at an agricultural college) lends additional help only during summer vacation. She owns 11 *rai* of rice farmland and 16 *rai* of field crop land.

Like most farmers in soybean country, *Kaew* grows two soybean crops a year and intercrops soybeans and cotton. Last year, she grew two soybean varieties, five *rai* of *Phak Bung* and seven to eight *rai* of SJ5. *Kaew* grows rice—mainly for household consumption. The year of the interview she intended to expand her production of *Phak Bung* soybeans as yields were substantially higher.

Current practices. *Kaew* follows the standard agronomic soybean production practices of the region. Land preparation and sowing are mechanized. She can distinguish between the applications of Grammoxone (weed killer) and Dual (weed controller) properly. She uses fertilizer on her cash crops, but does not apply fertilizer to rice as she does not use RD varieties, her rice farm is too deeply flooded for input-responsive varieties. She applies insecticide according to need but has not used or heard of rhizobium or hormones. She recognized all agrochemicals by trademark and brand name.

Kaew grows and selects her own seed supplies. Part of the output from the dry-season crop is stored and used as seed for the wet season. To make sure that her investment will have worthwhile results, she regularly performs germination tests. She takes a sample of five seeds from each sack and places them in different holes, one hole per one sack. If germination is less than 80 percent, i.e., fewer than four seedlings turn up, that particular bag will be sold and she buys seed from the shop. She also sun dries the seed from the wet season crop twice before sowing. She grew SJ1 for three years before converting to SJ5 and adopted *Phak Bung* or *Sukhothai 1* two years ago. She believes that *Sukhothai 1* provides a higher yield but cannot totally convert because of lack of seed.

Innovations and access to information. As the head of the household, *Kaew* joins village meetings from time to time. Most of her knowledge about agrochemicals is obtained from her *thao kae*. Practical cultivating techniques are obtained from conversations with friends and neighbors. Her yield performance is on par with the average male farmer in the Sukhothai region but is higher than the national average. She adopts innovations only after visual inspection results. For example, *Kaew* adopted both SJ5 and *Phak Bung* varieties after she had seen the yields when she went to help harvest. She also adopted foliar fertilizers following the recommendation of the Tha Chai extension officer.

Being a woman, long-distance travel is rare for her and she travels as far as Phrae and Phitsanulok. As a consequence, television has become a very important source of information for her.

Ladda

Background. *Ladda* is a timid, young girl of 20 and a native of Sawankhalok, Sukhothai province. She accompanied her father to farm soybeans on a sloping hill in the northern part of Si Satchanalai. The other members of the family, her mother and sisters, still live in Sawankhalok. *Ladda* and her father live in a temporary shack and grow SJ4 soybeans and black gram on a 20 *rai* farm. Since her father is not healthy, *Ladda* is the principal farmer of the family.

Current practices and access to information. *Ladda* uses the Sawankhalok package of soybean technology, including rhizobium, fertilizers, insecticides, herbicides, and hormones. The additional inputs were recommended by her brother-in-law who got them and the information about them from a local extension officer. *Ladda* did not really know what rhizobium was for. She thought it was a kind of insecticide. She used a spray mask to prevent spray drift as recommended by her *thao kae*. However, she could not recall the trade names of those agrochemicals and has never carried out germination tests of her seed. In fact, when her soybeans showed a peculiar symptom of nutrient deficiency, i.e. yellowing of growing leaves, she applied a fungicide instead. As they are migrants, neither her father nor she attends village meetings or contacts extension officers. She achieved a 247 kg soybean yield per *rai* in the wet season.

Radio is the only constant source of agricultural information for *Ladda*. She sometimes watches Channel 7 and has seen "Farmers' News" at a neighbor's place. However, media access cannot be a routine event for a young girl residing under these circumstances in a lonely valley.

FINAL REMARKS

Although generalizations from a few case studies should not be made, some observations are notable. First, the case studies show that on-farm experiments of innovations are continuously performed by farmers. This aspect of farmer investment in technology is often overlooked and hence is not effectively utilized by formal transfer channels. Secondly, individual discovery and production of knowledge are slow and sporadic processes, often depending on chance and rumor. Incomplete knowledge needs to be tried, and readjusted – from farm to farm. Hence the private cost of knowledge production and dissemination could be high. Lastly, the traditional extension worker's description of late adopters as "incorrigible" tends to overlook both the personal and environmental constraints of farmers of varying capacities and endowments. For these farmers, rejecting exogenous technology and information may be a rational attempt to minimize losses.

While this chapter examined individual efforts to obtain technology, the next explores the informal process of information delivery from farm to farm.

Chapter Five

Agricultural Information Dissemination: A Case Study of Soybean Technology in the Lower North

BENCHAPHUN SHINAWATRA
BENJAVAN RERKASEM

Agriculture in Northern Thailand has undergone remarkable change in the last 20 years. The public research and extension service as well as commercial concerns have been partly responsible for the evoluion and dissemination of crop production technology, the basis of this change. Indeed, the pivotal role of farmers, often in cooperation with others in the community, has not previously been given sufficient recognition. In the North, many innovations were introduced through these conventional channels, but technology adoption appears to have been possible only after passing through the village information network.

In this section, an example of Lower North soybean technology was chosen to illustrate how successful innovations may pass from one farmer to another, then from village to village, and finally disperse on a larger scale – over a subregion and then across the region. In the following subsections of the case study, we describe:

- the current situation of soybean production in the context of the Northern region as a whole;
- changes in soybean production technology;
- information structure and exchange systems; and
- implications for agricultural extension and development in Thailand.

The case study draws information from the field survey undertaken for the Northern region, followed by an in-depth case study in the major soybean production area in the Lower North subregion (Figure 5.1). A rapid rural appraisal or RRA (KKU, 1985) was adopted as an approach to extract information from farmers and

local traders in districts of Tron, Lap-lae and Phichai of Uttaradit province; Si Nakhon, Sawankhalok and Si Satchanalai districts of Sukhothai province; and Phran Kratai district of Kamphaeng Phet province.

This appraisal was followed by interviewing key farmers and traders. Technological practices were traced back to original sources. Visits to origins were made to complete the information-delivery process. Hence, the case study was expected to achieve the following objectives:

- to provide a description of current soybean production technology in the Northern region;
- to identify technological changes in a major soybean production area; and
- to explore information channels and exchange systems at different rural community levels – farm, village, district, province.

These objectives should assist in our understanding of farmers' knowledge about existing technological information and innovations which otherwise could not be fully explained by other research approaches as described in previous chapters.

SOYBEAN PRODUCTION IN THE NORTH

In Thailand's 1985/86 growing season a total of 1.5 million *rai* of soybeans was planted which produced 206,687 tons. Northern Thailand accounts for about 80 percent of national production. During this time, domestic livestock industry demand for soybean meal was about 357,000 tons, 38 percent of which could be supplied by domestic production. Thus, this left the import requirement at around 216,000 tons. A government regulation concerning soybean meal imports required that for every two tons of soybean meal imported, one ton of soybean meal had to be purchased from domestic producers. Consequently, this regulation restricted the use of imported soybean meal. In early 1986, owing to some difficulties in importing soybean from China, less soybean meal was imported than was actually allowed by the Ministry of Commerce and the situation led to a temporary shortage of soybean meal in the country. Indeed, this regulation has benefited soybean farmers and domestic soybean traders. As an import substitution product, soybeans are a high-demand product enjoying relatively stable prices and markets.

In Thailand there are two distinct soybean production areas, the Upper North and the Lower North, which, in 1985/86, accounted for 35 and 65 percent of the area planted and 33 and 67 percent of production, respectively (Figure 5.2).

Soybeans have long been grown on a small scale in the North for local consumption. For example, a total area of 60,000 *rai* was reported planted in Sukhothai, Nakhon Sawan, Chiang Mai, and Lamphun in 1949 (Tongpan, *et al.*, 1974). A gradual increase took place from that time until there were about 700,000 *rai* in the early 1970s. From 1971 to 1982, the planted area fluctuated between 500,000 to 800,000 *rai* a year (Table 5.1 and Figure 5.3). However, from 1983/84 onward there has been sustained expansion of soybean production in Thailand. Between 1982/83 and 1985/86 the planted area increased by 746,196 *rai*, i.e., almost doubling, with production increasing from 113,392 to 309,000 tons. Most of this increase has taken place in the North. Some expansion has occurred in the main centers of Chiang Mai and Sukhothai; but, significantly, much of the growth occurred through the spread of

soybean from these centers into neighboring provinces (Figure 5.2 and Table 5.2). In Sukhothai, soybeans have been grown with what may be called "Sukhothai technology," expanding into Kamphaeng Phet, Phetchabun, Uttaradit, Nakhon Sawan and, to some extent, into Tak and Phrae in the Upper North. This new Lower North soybean area accounted for 25 percent of the crop planted in 1984/85, and more in the 1985/86 growing season. The spread of "Chiang Mai soybean technology" is more restricted: Chiang Rai is the only new major area.

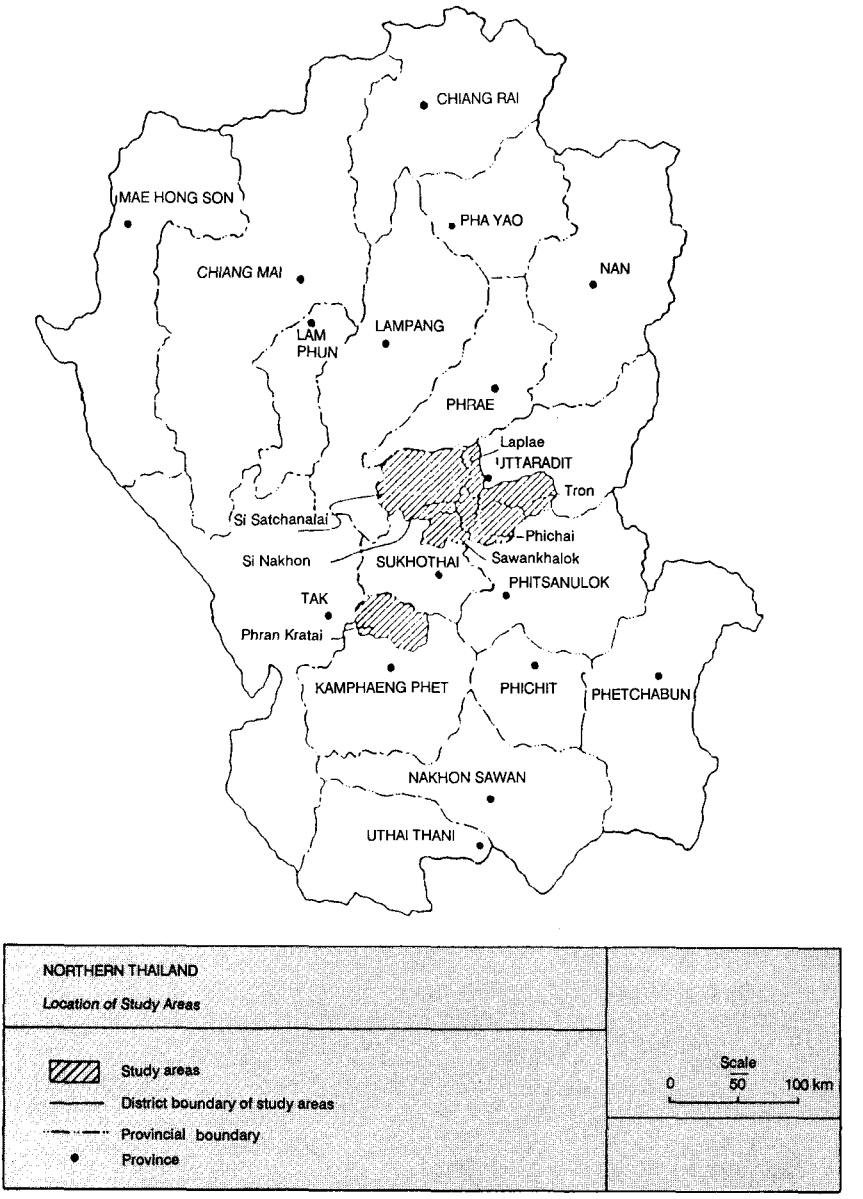

Figure 5.1 Map showing locations of the soybean technology study areas

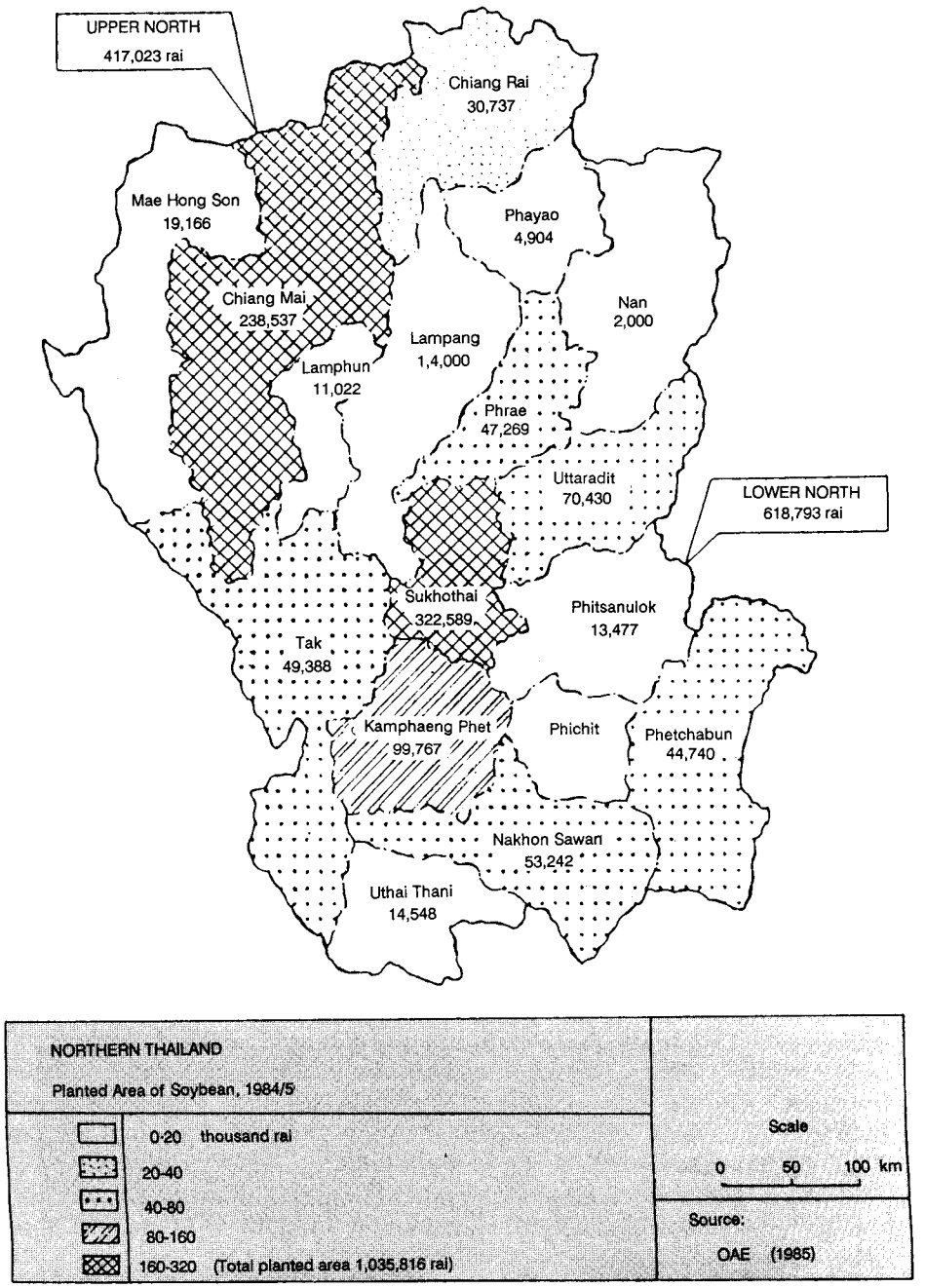

Figure 5.2 Planted areas of soybeans in Northern Thailand

Table 5.1 Growth of soybean production areas in Northern Thailand and the two major centers of Chiang Mai and Sukhothai, 1974/75 to 1984/85

(*rai*)

Year	Chiang Mai	Sukhothai	North
1974/75	151,931	298,196	686,992
1975/76	143,263	385,863	674,264
1976/77	64,037	247,138	558,037
1977/78	118,780	228,321	795,965
1978/79	154,688	228,321	837,406
1979/80	137,379	236,802	567,054
1980/81	183,722	290,833	683,209
1981/82	152,750	267,878	673,634
1982/83	118,709	250,187	777,804
1983/84	241,058	294,634	857,395
1984/85	238,537	322,549	1,035,816

Sources: DAE 1978, OAE 1981, and OAE 1985.

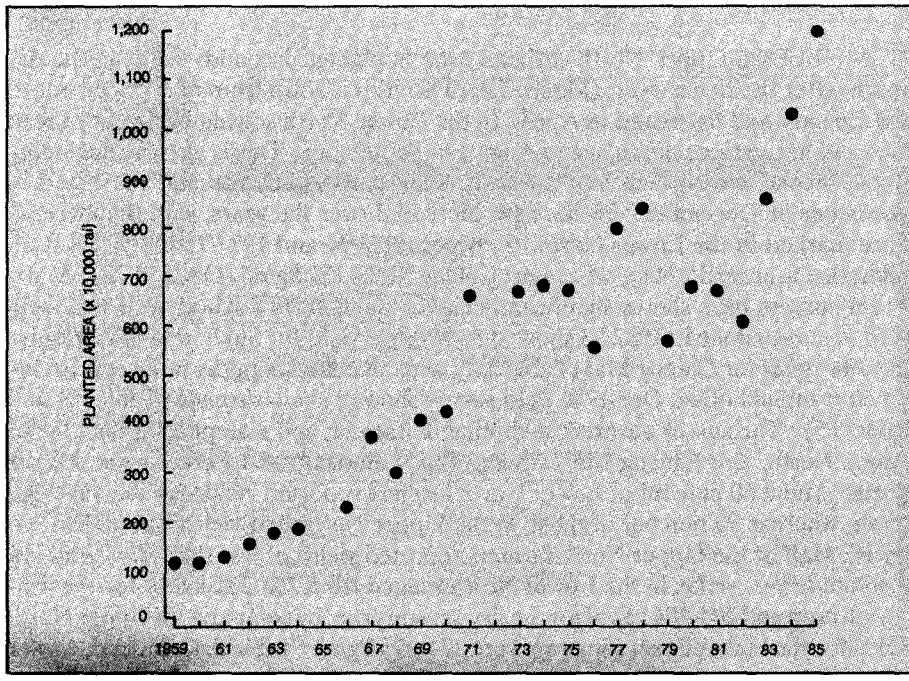

Figure 5.3 Changes in planted area to soybean in Northern Thailand from 1959 to 1985

Sources: 1959-1971: Department of Agricultural Extension 1972-1985; Office of Agricultural Economics.

Table 5.2 Changes in soybean production area in some new growing sites in Northern Thailand between 1982/83 and 1984/85 (*rai*)

Province	1979/80	1982/83	1984/85
Chiang Mai	137,379	118,709	238,537
Chiang Rai	4,524	10,231	30,737
Tak	19,887	32,259	49,388
Phrae	16,959	33,826	47,269
Mae Hong Son	21,938	16,655	19,166
Sukhothai	236,802	250,187	322,589
Kamphaeng Phet	9,280	68,741	99,767
Nakhon Sawan	5,009	3,676	53,242
Phetchabun	77,258	20,689	44,740
Uttaradit	22,777	11,994	70,430

Sources: OAE 1981 and OAE 1985.

Most of the Upper North soybean crop is planted in paddy fields in the dry season after the rice harvest (Figure 5.4). The crop is sown from mid December to mid January and harvested in April. In the Lower North sowing begins in May to June and harvesting takes place in August or September. This is also the beginning of the second crop which is planted in August or September and harvested in November or December. Yields have increased over the years, with the increase more marked in the Lower North. Between 1973/74 and 1977/78 the yields from Sukhothai averaged 134 kg/*rai* against Chiang Mai's 139 kg/*rai* (OAE, 1978). Many recent surveys have shown significantly higher yields from Sukhothai than Chiang Mai. A survey done in 1982/83 showed an average yield for Sukhothai of 220 kg/*rai* and 184 kg/*rai* for Chiang Mai (Table 5.3), with all cultivars performing consistently better in Sukhothai. Our 1986 field survey showed similar trends (Table 5.4 and Table 5.5). The survey covered Sukhothai, Uttaradit, and Kamphaeng Phet in the Lower North, and Chiang Mai, Chiang Rai, Lampang, and Phrae in the Upper North. About 60 percent of Lower North farmers reported yields greater than 300 kg/*rai*; whereas 90 percent of those in the Upper North had yields lower than 300 kg/*rai*. Half of the Upper North farmers reported yields of less than 200 kg/*rai*. In absolute terms, yields in the Lower North ranged from 233-331 kg/*rai* for the wet-season crop and 204-284 kg/*rai* for the dry-season crop; by comparison, Upper North yields for the main dry-season crop were 184-195 kg/*rai* (Table 5.4). Indeed, Lower North yields are beginning to compare favorably with soybean yields in major exporting countries such as the U.S. and Brazil, which had average yields of 315 and 259 kg/*rai*, respectively, over the 1979 to 1983 period (OAE, 1985).

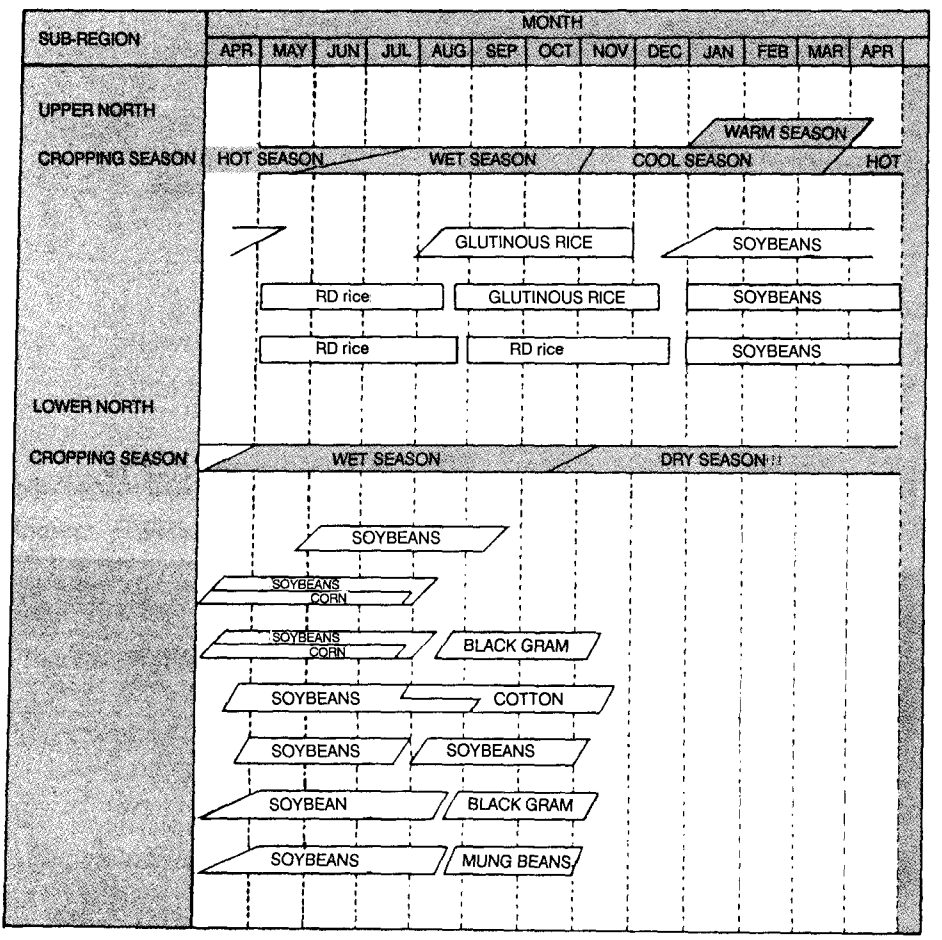

Figure 5.4 Soybeans in the dominant cropping systems of the North

Source: Field survey, 1986.

Table 5.3 Soybean yields from Chiang Mai and Sukhothai 1982/83

(kg/*rai*)

Province	Cultivar					Average
District/Sub-district	SJ5	SJ4	SJ2	16-4*	Local	
CHIANG MAI (mean)	**184**	**188**	**144**	**-**	**189**	**184**
San Pa Tong	153	174	-	-	-	155
Chom Thong	-	182	110	-	196	166
Mae Rim	261	198	-	-	182	218
San Sai	212	178	210	-	-	197
SUKHOTHAI (mean)	**273**	**206**	**-**	**287**	**198**	**220**
Si Satchanalai						
- Tha Chai	364	224	-	281	217	251
- Nong Or	228	189	-	293	283	217
Sawankhalok						
- Par Kumkor	-	-	-	-	222	222
- Nai Muang	-	205	-	-	172	188

Sources: Vesurai, S. and S. Duangrat, 1985.

* Presently named *Sukhothai 1.*

Table 5.4 Distribution of yields of main-season soybean in Northern Thailand, 1986

Yield Range (kg/*rai*)	Distribution	
	Upper North (Dry season)	Lower North (Wet season)
Less than 100	8.9	1.5
101 - 200	42.2	6.0
201 - 300	38.0	31.3
301 - 400	8.9	53.7
More than 400	2.0	7.5
Total	100.0	100.0
Mean (kg/*rai*)	210.3 (n = 255)	243.9 (n = 71)

Source: Field survey, 1986.

Table 5.5 Soybean yields in Northern Thailand by season and area, 1986 (kg/*rai*)

Province	Village		Average
	Developed	Developing	
WET SEASON			
Lower North	237	331	284
Uttaradit	240	-	240
Sukhothai	233	-	233
Kamphaeng Phet	-	331	331
DRY SEASON			
Upper North	215	181	198
Chiang Mai	241	188	230
Chiang Rai	204	150	-
Lampang	189	176	184
Phrae	195	-	195
Lower North	250	228	-
Uttaradit	204	-	-
Sukhothai	284	-	284
Kamphaeng Phet	-	228	228
AVERAGE	**225**	**206**	**220**

Source: Field survey, 1986.

TECHNOLOGICAL BASE

As mentioned above, soybeans have long been grown on a small scale for local consumption in the North. Traditional technology can still be encountered in the form of local cultivars and agronomic practices such as stubble sowing. There are two distinct soybean production systems in the North – Chiang Mai technology and Sukhothai technology – which roughly form the basis for Upper North and Lower North production, respectively (Figure 5.5).

The origins and major distribution areas of these technologies are shown in Figure 5.5. Operation size is much smaller in the Upper North, at 2.9 *rai* for the wet-season crop and at 4.4 *rai* for the dry season crop. This may be compared with 20.3 *rai* and 17.0 *rai* for the wet and dry season, respectively, in the Lower North (Table 5.6).

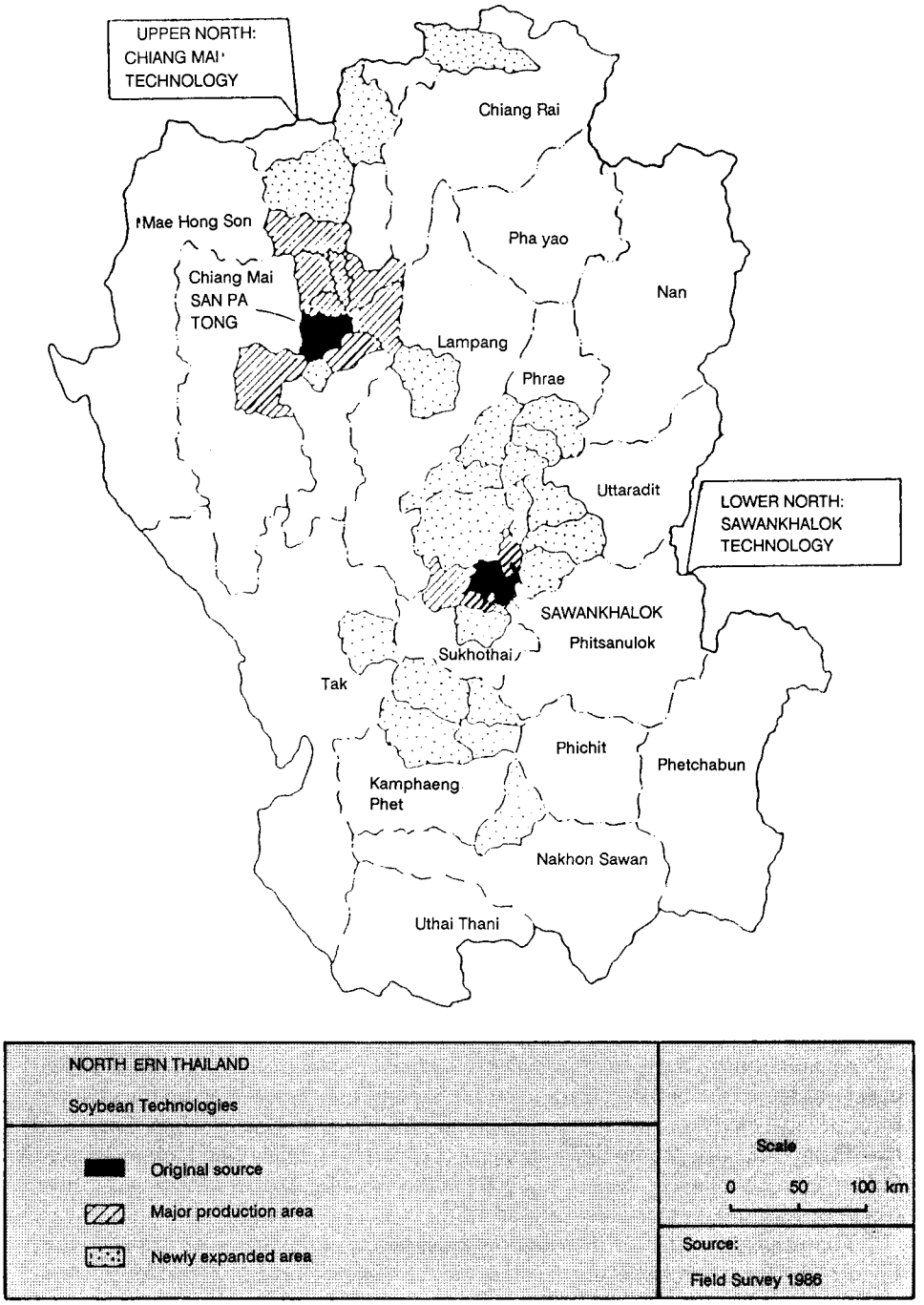

Figure 5.5 Traditional soybean production technologies, Chiang Mai and Sawankhalok technologies, in Northern Thailand.

Table 5.6 Comparison of soybean technology in the Lower and Upper North (1986)

Soybean Technology	Northern Region		North
	Upper	Lower	
Size of operation (*rai*)			
Wet season	2.9	20.3	18.6
Dry season	4.4	17.0	8.3
Cultivars (% of respondents)			
SJ1	2.1	3.6	2.6
SJ2	1.0	-	0.7
SJ4, SJ5	85.8	48.6	73.6
Phak Bung or Sukhothai 1	1.4	24.6	9.0
Local	5.0	2.2	4.0
Mixed varieties	4.6	21.0	10.0
SJ adoption (% of respondents)			
Within 5 years	66.0	45.7	59.3
More than 5 years	23.0	19.6	21.9
Seed source (% of respondents)			
On-farm collection	23.7	44.1	30.5
Exchange with neighbors	4.0	1.5	3.2
Purchases from government office	45.6	10.3	33.9
Purchase from private business	22.6	20.0	22.9
Other/mixed sources	4.0	22.1	22.4
Hormone application (% of users)	33.3 (n=282)	87.0 (n=138)	51.2 (n=420)
Average yield (all varieties)			32.9
Wet season mean (kg/*rai*)	291.0	311.8	309.8
Sd.	109.4 (n=7)	71.0 (n=67)	44.7 (n=74)
Dry season mean (kg/*rai*)	211.5	241.5	221.5
Sd.	90.7 (n=259)	75.4 (n=129)	86.5 (n=388)
Maximum yield			
Wet season (kg/*rai*)	431.0 (SJ)	440.0 (Phak Bung)	440.0
Dry season (kg/*rai*)	632.0 (SJ)	564.0 (SJ)	632.0

Source: Field survey, 1986.

Chiang Mai technology

Using the Chiang Mai system, soybeans are planted with irrigation in the paddy field from mid December to mid January, following the rice harvest. SJ4 and SJ5 account for some 90 percent of the cultivars used. Some 24 percent of the farmers in the Upper North collect their own seed from the preceding crop. This is usually done by growing a small off-season crop in the uplands. About 68 percent of the farmers buy their seed from village traders. Credit is often provided for the purchase of seed, and the seed is generally sown into rice stubble. Land preparation varies considerably, with two major categories – with tillage, and minimum or non-tillage. With minimum or non-tillage, the rice stubble is cut to ground level after the rice harvest, and straw is spread over the field and burned. In some areas the straw is cut to a few inches above the ground and left unburned. Small ditches are dug in the field to provide drainage. Pre-irrigation is always practiced with minimum or non-tillage. To the north of the town of Chiang Mai ploughing is more common, and the crop is sown on raised beds. Very little fertilizer is used, except in Hang Dong, where the application of pig manure is believed to be essential for good growth and yield.

The crop is irrigated five to six times during the season, and the shortage of water is a common problem from the end of February. Other common problems encountered in the field are water logging, heavy weed infestation, and poor stand, in addition to the terminal drought mentioned above. The crop is harvested by hand in April and May. Machine threshing is becoming popular. The cost of threshing in Chiang Mai in the 1985/86 dry season was 7 to 9 baht per *tang*.

The field survey found that the maximum yield of an Upper North crop can be high, 413 kg/*rai* for the wet-season crop and 632 kg/*rai* for the main dry-season crop. However, there is a large discrepancy between these potential yields and the average yields of 291 and 212 kg/*rai*. With respect to the problem of poor stand, the Chiang Mai system must rely on wet-season grown seed which is generally of poorer quality than the dry-season grown seed used in the Sukhothai system. Germination testing is a simple technology that may ensure a better stand establishment and can be easily performed by farmers.

Sukhothai technology

Sukhothai technology is an upland rainfed system. Soybeans are planted in May or June and harvested in August or September. The crop may be followed by a crop of black gram, or cotton may be relayed into a standing soybean crop up to one month before harvesting. One soybean crop followed by another toward the end of the wet season is becoming quite common. Sukhothai data for the 1985 growing season showed that about one-quarter of Sukhothai's wet-season soybean was planted as the last wet season crop (Northern Region Agricultural Extension Center, 1985). The improved cultivars SJ4 and SJ5 are less widely used in this system than in the Chiang Mai system: about 52 percent of the soybean-planted area in Sukhothai was reported sown to cultivars other than SJ4 and SJ5. *Sukhothai 1*, formerly *Phak Bung*, is one popular cultivar. Black seeded types are also common in this system and earlier releases, SJ1 and SJ2, are still used. Seeds used in this system come from the preceding dry season crop grown in the Lower North or are im-

ported from the Upper North. These dry-season grown seeds are often of better quality than the wet-season grown seeds used in the Chiang Mai system.

Land preparation involves double cultivation, which offers good weed control as well as well prepared seedbeds. Sowing is done by hand, and increasingly by machine, in 50 cm rows with 10 to 15 plants per meter within a row. Post-emergence cultivation is carried out about 30 days after germination with a two-wheel tractor. Additional weed control may be effected by spraying with the contact weed killer Grammoxone, a kind of Paraquat. Chemical control of insects is widely and, apparently – based on field survey observations – competently practiced. SJ4 and SJ5 are harvested in 95 to 100 days. Some of the local, shorter-duration cultivars may be harvested as early as 85 to 90 days; these may then be followed by another soybean crop. In this system, since the harvest season of the first soybean crop occurs in the middle of the wet season, a wet harvest and resultant poor seed quality are the biggest complaints.

TECHNOLOGICAL CHANGE IN THE SUKHOTHAI SYSTEM

In 1949 there were 4,658 *rai* of soybeans in Sukhothai. Planted area in the province and neighboring districts has increased markedly since then, with two major periods of expansion (Figure 5.6). The first period of expansion was during the 1960s and coincided with the decline of cotton in the area; and the second phase of growth was from early 1980 to the present. Expansion in this second phase was accompanied by a significant increase in yield per *rai*. It is difficult to pinpoint the variable responsible for this recent growth, however, as many technological changes took place in this same period.

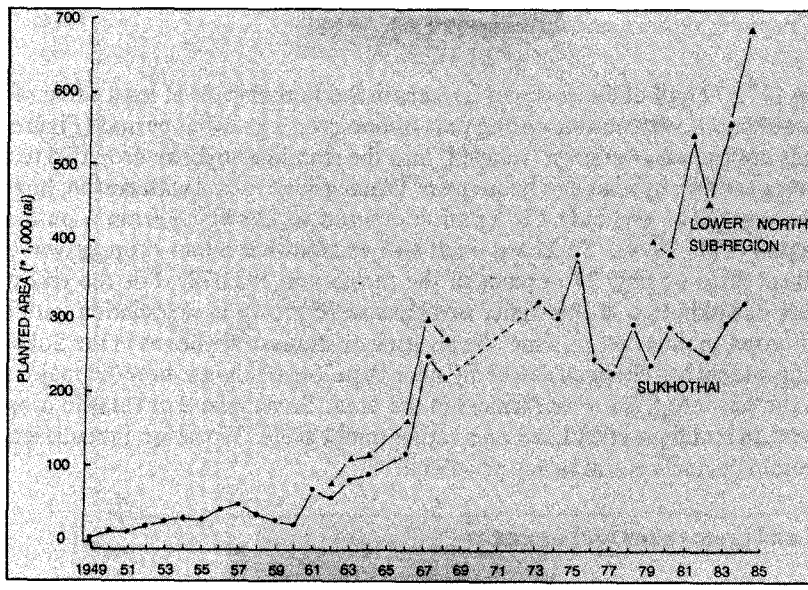

Figure 5.6 Changes in planted area to soybean in Sukhothai province and the Lower North sub-region from 1949 to 1984

Sources: 1949-1968: Tongpan *et al.* (1974) and Thodey (1972).
1973-1984, Office of Agricultural Economics

Cultivars

The release of the first two modern soybean cultivars, SJ1 and SJ2, in 1966 greatly transformed soybean production in many areas of the Lower North. For example, in Wang Daeng, a sub-district of Uttaradit, soybean production expanded in pace with the introduction of each new cultivar of the yellow seeded type (Figure 5.7). However, as recently as 1980/81, black seeded type cultivars accounted for half of the soybeans grown in Sukhothai (Table 5.7). Farmers indicated a preference for these cultivars because of their apparent tolerance to weathering (damage caused by wet weather during harvest), although their selling price was usually slightly lower than the normal, yellow-seeded type. SJ4 was introduced in 1976 and SJ5 in 1980. Our field survey (1986) showed that these recommended cultivars are now used by 48 percent of soybean farmers in the Lower North. In Sukhothai province, the Northern Region Center for Agricultural Extension reported that SJ4 is the more popular of these two cultivars: only one in five farmers uses SJ5 against four in five using SJ4 (NRAEC, 1985). Most interesting was the most rapid adoption of *Sukhothai 1*, by 33 percent of the farmers interviewed, since its discovery in Tha Chai in 1982 (Figure 5.8). The popularity of the black seeded type seems to have declined. For example in the Sawankhalok and Si Nakhon districts of Sukhothai, the black-seeded type has been largely replaced by *Sukhothai 1* (Table 5.8). Many farmers who had been growing SJ varieties have now shifted to *Sukhothai 1* (Table 5.9).

Seed cycling between Chiang Mai and Sukhothai has improved greatly since the early 1970s when major roads between major towns in the North were completed. Now only 44.5 percent of the farmers grow their own seed during the preceding dry season, compared to 60 percent 15 years ago.

Cropping systems and farming systems

In 1971/72 half of the soybean farmers in Sukhothai grew at least some of their soybeans mixed with cotton during part of one crop's growing period (Figure 5.4). Usually cotton was oversown (relayed) into the standing soybean crop two to three months after the soybean had been sown. When grown mixed with cotton, however, the soybean yield was only 171 kg/*rai* compared to 214 kg/*rai* from a pure stand (Tongpan *et al.*, 1974). Soybeans were also a somewhat minor crop, grown as the sole farm crop by only 27 percent of the farmers in 1971/72. For the rest of the farmers in Sukhothai at that time, soybeans were grown in association with other major crops, mainly cotton. Thus the position or status of soybeans in the Sukhothai farming system has changed markedly since then. Soybeans are now the major crop, often the only crop, for most farmers in the area. Some mixed or relayed cropping with cotton is still practiced, but on a rather minor scale. However, inoculation with rhizobium bacteria is still rarely practiced.

Land preparation and sowing

Ploughing is mostly done in April before the rain begins. Most farmers now plough twice, to control weeds as well as to prepare seedbeds. Fifteen years ago only half of the farmers practiced double cultivation and 41 percent ploughed only once before sowing (Tongpan, *et al.*, 1974). Before sowing, a furrow is opened either

by hand, or with the aid of an animal-drawn implement, or with a tractor. The seeds are placed in the furrow by hand. A locally designed and manufactured seeder, mounted behind a two-wheel tractor is becoming increasingly popular. The seeder, which costs only 2,000 baht, greatly improves germination and stand establishment as it ensures precise and constant sowing depth as well as offers the farmer significant savings on the labor cost of sowing.

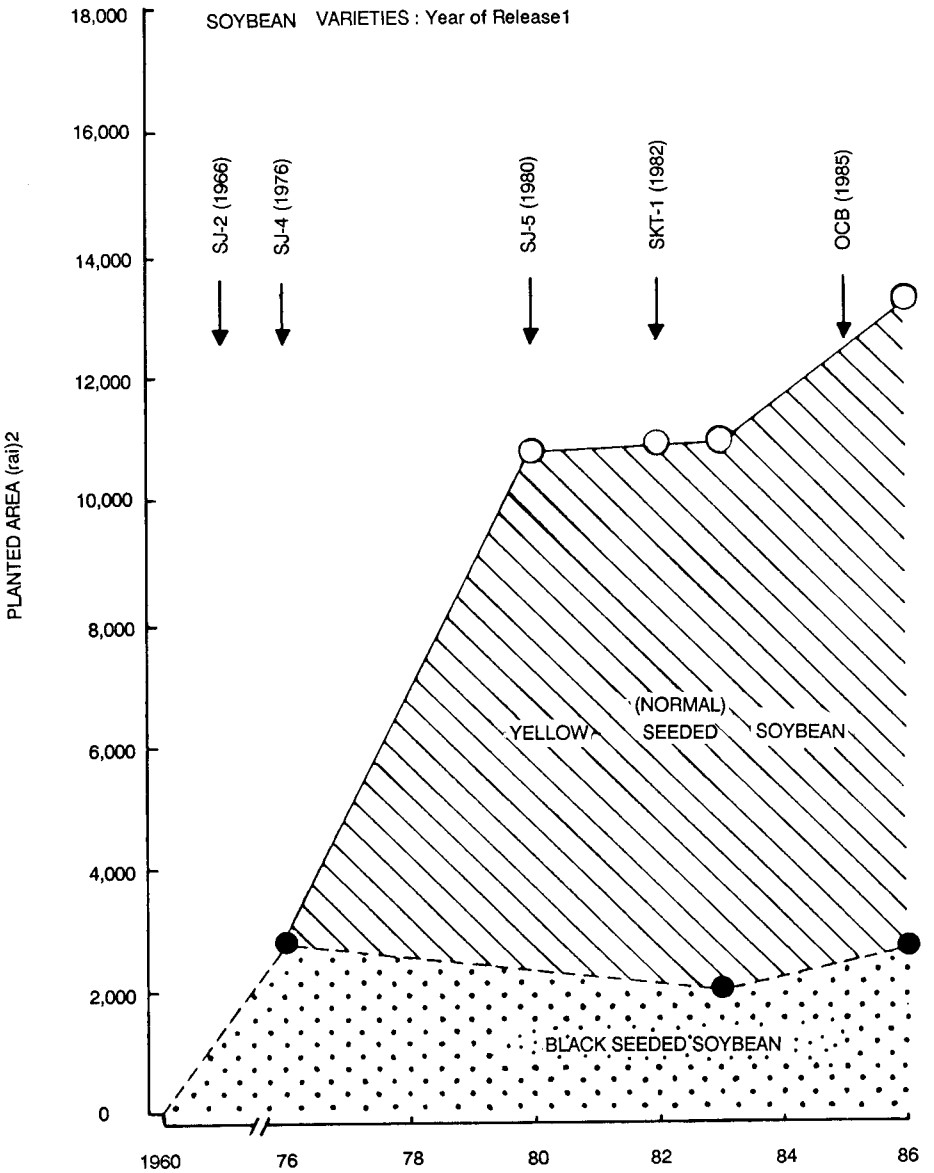

Figure 5.7 Changes in planted area of soybean in *tambon* Wang Daeng of Uttaradit Province in the Lower North sub-region.

Sources: (1) DOA (1980), Soybean Monograph, DOA (1982); (2) Tron Agricultural Extension Office

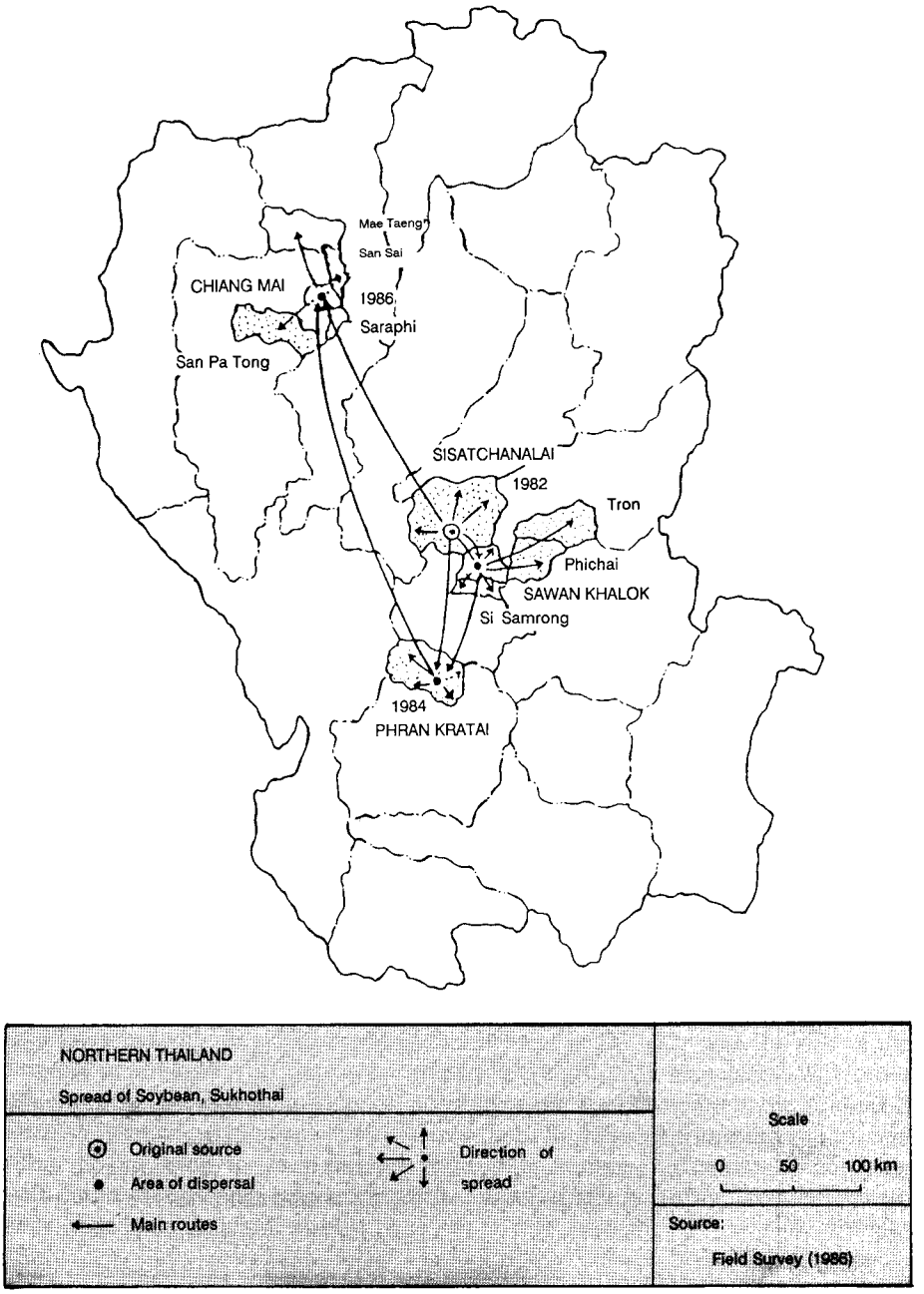

Figure 5.8 Spread of soybean variety *Sukhothai 1* in *tambon* Tha Chai of Si Satchanalai district in 1982

Table 5.7 Soybean types planted in Sukhothai, 1978/79 to 1980/81

(*rai*)

Soybean types	1978/79	1979/80	1980/81
Normal Yellow Seeded	279,249	202,518	201,221
Black Seeded	193,402	229,259	204,043
Sukhothai Total	472,651	431,777	409,064

Source: Crop Promotion Division, Department of Agricultural Extension, MOAC.

Table 5.8 Changes in soybean types in selected locations in the Sukhothai soybean technology areas of the Lower North

(*rai*)

Location/ Type of soybean	Planted Area 1981	1982	1983	1984	1985	1986
Sawankhalok						
Black Seeded	48,256	50,560	22,925	na	na	13,327
Normal Yellow	33,549	73,549	79,366	na	na	155,468
Total	**81,805**	**124,109**	**102,219**	**na**	**na**	**168,795**
Si Nakhon						
Black Seeded	8,500	na	na	2,744	na	3,711
Normal Yellow	5,090	na	na	14,438	na	18,484
Total	**13,590**	**na**	**na**	**17,182**	**na**	**22,195**
Phran Kratai, *Tambon* Khui Ban Ong						
Black Seeded	na	na	na	29,700	35,090	2,450
Normal Yellow	na	na	na	2,914	8,280	37,120
Total	**na**	**na**	**na**	**32,614**	**43,370**	**39,570**

Sources: District Agricultural Extension Offices in Sawankhalok, Si Nakhon, and Phran Kratai

Another advantage of the seeder is that sowing, for the average soybean farm of 20 *rai* or more, can be completed during the time that soil moisture is at the level best suited for sowing. Most farmers claim the seeder pays for itself within a year. Soybeans are currently sown in rows which are 50 cm apart with 10 to 15 plants per meter within each row. This is much narrower than was practiced earlier in 1970 (Tongpan, *et al.*, 1974) when there were 75 to 100 cm rows for monoculture soybeans or 150 to 200 cm rows for a mixed-culture with cotton. Now many farmers in the Lower North also prepare land and seed soybeans by contracting with the owner of a four-wheel tractor, who charges a fee for his services (see examples in Chapter 4).

Table 5.9 Shifting soybean variety patterns among 62 current users of the SKT1 variety in Northern Thailand

Variety	No. of Respondents	Percentage
Previous soybean varieties		
Black seeded	21	38.9
Traditional	11	20.4
Black seeded/traditional	2	3.7
S1/SJ5	11	20.4
SJ1/SJ4 or SJ5	7	12.9
Not applicable	2	3.7
Total	**54**	**100.0**
Current soybean varieties		
Sukhothai 1 (SKT 1)	38	61.3
SKT1 and SJ4 or 5	14	22.6
SKT1 and Black seeded	7	11.3
SKT1 and Traditional	2	3.2
SKT1 and SJ1	1	1.6
Total	**62**	**100.0**

Source: Field survey, 1986.

Weed and pest control

Weed control has always been essential for Sukhothai soybeans. Post emergence cultivation is a long-established practice which is still commonly used. Previously, animal-drawn implements were used; now the task is performed with the aid of two-wheel tractors. Most farmers now use a contact weed killer, Paraquat (commercially known as Grammoxone) to improve their weed control. Although the chemical is non-selective and is identified as a contact weed killer, innovative farmers have been able to overcome problems of non-selectivity by developing their own application methods, mainly through trial and error. Successful methods have largely contributed to the expansion of the use of Paraquat as a major method of weed control for soybean in the North.

In 1971/72 only ten percent of the soybean farmers in Sukhothai reported using insecticides on their soybean crops (Tongpan, *et al.*, 1974). Now, chemical insect control is an essential activity on virtually all rainfed soybean farms. This technology has been transferred from cotton which requires heavy use of insecticides. Spraying is now often done on a contract basis. Most farmers have reasonably good knowledge of the important soybean insect pests and the need to use different chemicals for certain types of insects. However, spraying is based mostly on the farmer's judgment about the extent of the damage and infestation. Only a few farmers actually determine the number of insects, since none of them knows insect/pest threshold levels. This aspect of insect control has not changed since the days of cotton.

The application of fertilizer to soil is still very rarely done. However, foliar spraying of plant nutrients is a common practice, especially during dry spells. The composition of available foliar fertilizers varies a great deal. Some brands clearly state the concentrations of the macronutrients and the microelements on the package; others contain only micronutrients; many claim to contain certain hormones which enhance growth, pods and seed sets, and yields.

Harvest

Wet harvesting is still a common problem and has always been a problem for soybeans in this system. Harvesting is still done by hand. Before the introduction of machine threshers, soybean threshing was done by hand or by using a tractor to tread on the crops. This was one of the reasons why Sukhothai soybeans were fetching lower prices than Chiang Mai soybeans. However, now, use of the threshing machine is widespread among soybean growers. Compared to traditional hand-threshing methods, the advantages of the machine include seed cleaning and time saving during the drying periods between cutting and threshing. To a certain extent the machine has helped alleviate the wet-harvest problem.

FARMER INNOVATIONS

In the course of the case study, the research team found numerous cases where farmers were very innovative and did several on-farm experiments on new varieties, chemical inputs, practices, and etc. This section briefly outlines these innovations.

Development of new varieties. Almost all farmers who were interviewed indicated their interest in new varieties. In fact, many farmers are using new varieties which they found through various informal sources such as local traders and neighbors. Small plot trials, ranging from 20 to 100 square meters, are often seen on an average farm of 20 *rai*. Using this process, the search for information and seed sources prior to "on-farm" testing is important.

These farmers use a combination of varieties during one season. During the field survey an innovative farmer was found experimenting with a new variety which, he was convinced, was different from SJ5. He called this variety *Khlong Lan* although government extension officers called it SJ5. A female farmer in Si Satchanalai used *Phak Bung*, SJ4, and SJ5 at the same time.

Seed germination tests. At the farm and village levels, crop seeds are poorly kept and this can create seed viability problems in some crops, particularly soybeans. We came across a few farmers in Si Satchanalai, a district of Sukhothai province, who routinely tested soybean germination rates before sowing. Simple, but realistic, methods were developed for the farm environment. For example, 20 soybean seeds from each sack are sampled and germination tests are carried out by space sowing of individual seeds into the soil in 1.0 m rows. Each row is marked by a number corresponding to the sack. Seedling counts are made at about two weeks from sowing to determine the germination rate. Although the main purpose of the trial is to determine the germination rate of the seeds (seed viability), farmers also gain knowledge of seedling vigor.

Development of soybean seeders. Soybean seeder technology was recently introduced into the soybean areas of Uttaradit province. The machine is a modified model of the corn seeder used in the corn-growing areas of Saraburi province. Modifications were made to fit a two-wheel tractor by adjusting seed delivery and installing a new marker. However, in the first season that the first machine was introduced to farmers they had many complaints and suggestions. Some of the problems included the delivery tube's clogging up and the fact that a solid seed tube directly connected to the shoe prevented farmers from actually seeing the seeds which dropped into the soil. Other minor problems were the position of the wheel and the attachment system. This information was directly fed back to local mechanics who made modifications. Many problems have been solved and some fine-tuning modifications have been made. At present, more attempts are being made to improve the planter, e.g., to make it compatible with tractors of different sizes and to make it more versatile and able to sow different upland crop seed species.

Reducing costs of chemical inputs. Chemicals are one of the most expensive soybean production inputs and reducing the cost of production is always in the back of a farmer's mind. Some farmers observed that after spraying soybean fields with Grammoxone the washing water from the sprayer could damage the weeds. These farmers learned that reducing herbicide concentrations in connection with weed growth stages could be economical, i.e., less concentration during stages of early growth (2- to 3-leaf stage).

In other cases farmers experiment with various kinds of mixtures to reduce Paraquat spray doses. For example, farmers in Tron district, Uttaradit province, reported that they produced a Grammoxone-based herbicide by boiling Grammoxone with a few less expensive chemical ingredients. They obtained a Grammoxone-based herbicide which is more or less as effective as Grammoxone but costs much less, as one gallon of Grammoxone can produce five gallons of this special mixture (Table 5.10). However, without knowledge of pesticides and toxicology this method may be harmful. Information should be available to correct the situation if there is a negative impact.

Techniques for spraying contact herbicides. As mentioned earlier after many experiments, advanced farmers in Phran Kratai, discovered a method to use Grammoxone (Paraquat) efficiently. In San Sai District, soybean farmers applied Paraquat to soybeans by spraying close to the ground and avoiding contact with the soybean leaves. Regular spacing of soybeans, a method adapted from regular spacing of rice, facilitates the spraying of contact herbicides.

Other adaptations. Farmers perform on-farm experiments on new chemicals, new varieties, and fertilizers, more than most people realize. The use of rhizobium, for example, was on-farm tested in many instances. And, if the incremental gains do not exceed incremental costs in terms of management, labor or capital, then the new technology is not adopted. For farmers in Uttaradit who used soybean planters, the use of rhizobium was found to increase the incidence of planter clogging and, for this reason, they chose not to use rhizobium. A contact farmer once experimentally intensified *Sukhothai 1* production on a *rai* of land and obtained some 600 kg per *rai*. He, however, decided it was not worth his attention, labor, management, and capital to intensify to such an extent. With 45 *rai* to care for, he was satisfied with an average yield of 400 kg per *rai*.

Table 5.10 A recipe for Grammoxone (Paraquat) - based herbicide

Items	Amount
Materials	
1. Grammoxone	1 liter
2. Sodium Chloride	1 kg
3 Potassium Nitrate	1 kg
4. Detergent	1 liter
5. Cold water	20 liter
Procedure	
1. Mix sodium chloride and potassium nitrate thoroughly	
2. Add Grammoxone, water, and detergent	
3. Mix thoroughly and boil	
Storage	
Store in container. The mixture should be used within 30 days after preparation	
Rate of Application	
80-100 cc per 20 liter of water	

Source: Field interviews, 1986.

These cases should illustrate how farmers, especially advanced farmers, are creative and innovative in their operations. After a new technology is tested by certain farmers, the spread of such technology to nearby households, villages or districts is very rapid via the informal village information network.

INFORMATION STRUCTURE AND EXCHANGE SYSTEMS

This section describes how information and technology were transmitted using the adoption and distribution of soybean variety *Sukhothai 1* as an example of how rapid technological change may be induced by commercial interests.

The Sawankhalok credit system

The center of soybean production and trade in the Lower North (and perhaps in all of Thailand) is in Sawankhalok district, Sukhothai province. In Sawankhalok, there are a number of soybean traders who may or may not be engaged in the trade of other commodities as well who have direct links to vegetable oil factories which buy and process soybeans into soybean oil and soybean meal. Some buyers from large factories have their offices in Sawankhalok for speedy transactions. However, it is the soybean traders, known as "*thao kae*," in Sawankhalok, not the buyers from factories, who have direct contact with farmers.

Soybean *thao kae* (traders or merchants) have developed a system of "*luk rai*" (informal contract farmers) to guarantee themselves a soybean supply. These traders operate on a fixed-margin per kilogram basis; therefore, the more soybeans they buy and sell, the higher their profit. This system of *luk rai* is similar to a patron-client relationship although it operates on a more businesslike basis. Farmers obtain seed, fertilizer, chemical inputs as well as some cash for their soybean operations (if they so want) from their *thao kae* (patron) on credit. They are obligated after the soybean harvest to sell the output to the trader at market prices. Outstanding debts are settled at the time of the final sale. Farmers reported that the traders make a profit both when supplying inputs and when buying and selling the output. Inputs supplied to farmers on credit were priced at levels higher than those bought and paid in cash. However, farmers hesitate to be completely independent of their *thao kae* even when they have money to buy the inputs for cash. They reported that these patron traders help them when they are short of money—for whatever purpose, production or household consumption. Indeed, most farmers are usually short of money, especially at the beginning a farming operation and soybean production costs vary from 600 to 1,000 baht per *rai* depending on the amount of pesticide, herbicide, and hired labor used. An average farmer in the Lower North who farms 20 *rai* of soybeans would incur about a 12,000 to 20,000 baht investment in his/her farm during the three-month soybean operation. Such an amount is large for an average farm household. Besides, a farmer's not being part of the *luk rai* system can introduce uncertainty as to where the farmer will sell the output. The farmer might also have to incur additional costs to transport the output to the provincial market while *luk rai* farmers get their trader to haul their output from their farms—without having to pay cash for transport. Moreover, to sell output to new traders who may happen to pass though the village is a practice subject to fraud and risk (of default in payment and faulty scales). Most of the soybean farmers in the Lower North, consequently, function as part of the *luk rai* system. In other nearby provinces, such as Uttaradit or Kamphaeng Phet, the credit system is similar to that described above.

Information exchange among traders, farmers, and extension officers

Given the above credit system for soybean production and trade, information exchange among traders and farmers is frequent and mutually beneficial. Farmers convey their demand with respect to seeds, herbicide, pesticide and, to a lesser extent, fertilizer to their *thao kae*. These *thao kae*, in turn, seek inputs for their farmers. For those farmers who are seeking more information about technical matters, a good source of information for them is, of course, their *thao kae*, who obtain information from farmer innovators or advanced farmers and relay this information to their farmers. The *thao kae*, having a wider contact circle, also communicate with other *thao kae* in other locations and, through such channels, information exchange takes place.

In the case of the *Phak Bung* variety, it was found that, farmers first sought and obtained variety and seed information from fellow farmers. *Phak Bung* (*Sukhothai 1*) seeds were originally grown for soybean varietal trials in Tha Chai, Si Satchanalai district, Sukhothai province. Farmers from a nearby village who came across this trial plot were impressed by this variety because of its very prolific pod setting. At maturity, *Phak Bung* plots were harvested and the yield stolen one night by these farmers.

In the 1982 wet season the *Phak Bung* variety was grown in Si Satchanalai. The output was sold as seed at a premium price. Later, a village headman in Phran Kratai district, Kamphaeng Phet province, heard of this variety and went to buy some seeds from Si Satchanalai. The first crop was planted on an area of eight *rai*, giving yields in the order of 3,600 kg, an average of 450 kg per *rai*. All was sold as seed to other farmers in Phran Kratai. Two years later, most farmers shifted from SJ1 to *Phak Bung* in Phran Kratai because it is an unquestionably high yielding variety which does not need additional inputs or management.

It has been a few years since the introduction of *Phak Bung* and there are now some 70,000 *rai* of *Phak Bung* soybean grown in the Lower North. Local *thao kae* who learned of *Phak Bung* variety from their *luk rai* farmers, now buy and sell *Phak Bung* soybeans widely. This soybean variety gets the same price as SJ5 and vegetable oil factories do not discriminate against it. The information network outlined earlier is illustrated by Figure 5.9.

Despite the dominant role that soybean *thao kae* play in terms of information exchange, one must not forget the role of government extension officers. In *Phak Bung* soybean areas, the role of extension officers may not be as important as that of the private sector with respect to soybean seeds. However, extension officers have been able to introduce other inputs such as rhizobium, chemical inputs, and related application techniques. In other areas, especially in dry-season soybean producing areas, such as Uttaradit and Sukhothai, extension officers were found to be very active in supplying useful information to farmers. Indeed, seed exchange programs, in particular, seem to be one of the activities for which farmers appreciate extension officers. Farmers also use extension officers as sources of information on other production techniques.

Local *thao kae* as well as extension officers supply farmers with price information. Prices quoted by local *thao kae* are, however, more relevant to farmers because they are the actual buyers of soybean output.

Private and public information systems

Contrasting private and public information systems of Lower North soybean production, it was observed that, generally, public information systems are biased toward production-related matters, i.e., supply-side information, while private information systems are more demand-oriented. In the case of soybeans, the private information network has also been production-oriented as there is a substantial amount of technical expertise transferred through local *thao kae*. When a private business has an interest in selling farm inputs, e.g., soybeans, it can be very active in promoting both production and market information. Indeed, how soybean production and trade work in the Lower North clearly illustrates how powerful the private system can be in transmitting information.

In the past, the public information system has been relatively slow to react to changing market situations. It is only able to transmit information on production-related matters or on technical matters gradually. The resulting impact on farmers depends on frequency of visits, means of transferring information and, of course, the quality of the information. Thus, sudden and mass impact on farmers in relation to new information is not likely without the private and informal information networks. To speed up the transfer of information as delivered by the public information system, the process needs to be more powerful and effective and, at the same

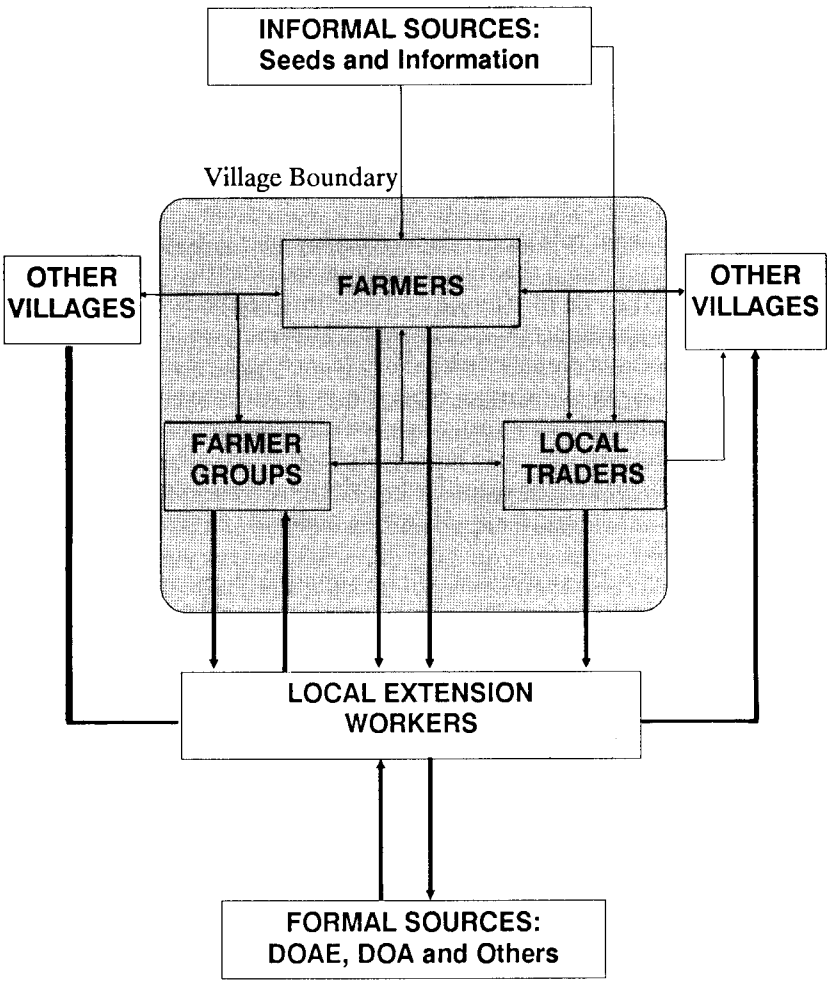

Figure 5.9 The Information network for spreading the *Phak Bung* soybean variety in the Lower North sub-region.

Source: Field survey, 1986.

time, the information to be transmitted needs to be more relevant, timely, appropriate, and useful to farmers.

IMPLICATIONS FOR INFORMATION TRANSFER MECHANISMS

This soybean production case study raises several issues which have implications with respect to agricultural information transfer mechanisms. Thus, current approaches to agricultural extension may be re-examined from the following perspectives. The case study clearly shows:

1. Examples of powerful information transfer mechanisms operating through the business sector. Both production and market-related information can be rapidly transferred through private merchants and private individuals. It shows that when there is a clear case of new, high pay-off inputs, farmers actually do seek those inputs actively. The case of the *Phak Bung* soybean variety shows how information was transferred rapidly outside public information channel mechanisms. The speed and efficiency of the private sector's information transfer mechanisms might be positive in a number of cases while it could be potentially harmful to the public in other cases. Private merchants and business leaders could, if they chose, promote technologies whose benefits are uncertain. This points to the need for public follow-up and more speedy and up-to-date monitoring mechanisms within the public sector.

2. How creative and eager farmers are to adopt and adapt new technology, especially advanced farmers. These innovators are suppliers of new practices and knowledge to others in the village. Such enthusiasm toward potentially useful information among these advanced farmers suggests that there is a need to provide farmers with continuing education to a greater extent than is currently provided by the agricultural extension structure.

3. That the current public information network has been rather production-oriented while farmers' information needs are both production and market-related. In the case of soybeans, the market structure, government policy, the world demand and supply situation, are very important kinds of information needed at the local level. Although to transmit too much information related to the market situation can be confusing to the average farmer, the need for information on important issues (such as updated government policies, prices, and market situations – supplied in simple, understandable language) cannot be overlooked. The use of television and radio for this purpose can be further explored and strengthened. However, a one-way flow of agricultural information transmitted through the media is hardly adequate for effective agricultural extension.

4. The significance of the "informal" agricultural extension service provided by the business sector; it also shows that, in many cases, the relationship between farmers and their *thao kae* is more intricate than one would realize. The assumption that farmers are individual agents acting entirely on their own may be questioned.

5. That sensitivity to physical, biological, environmental, agronomic, and socioeconomic differences will be key to the success of any agricultural information transfer program for Thailand.

Chapter Six

Social Infrastructure and Information Flow

CHAIWAT ROONGRUANGSEE

The classical sociological paradigm for explaining the adoption of farm technologies (Wilkening 1953, Rogers and Shoemaker 1971, Rogers and Burdge 1972) argues that exposure to information sources accelerates the adoption process. It is also assumes that, regardless of sources, information is disseminated or distributed without bias. This basic assumption, however, becomes a focal question in the agricultural development strategy of developing countries (Havens and Flinn 1976, Heim, Rabibhadana and Pinthong 1980, Hoare, Crouch and Lamrock 1982, Newby 1983, Hooks, Napier and Carter 1983). This chapter closely examines the structural constraints hampering the information diffusion process among farmers in Northern Thai villages. It is, therefore, hypothesized that the social organizational structure in Northern Thai villages impedes the equitable dissemination of information. Group leaders, who usually are members of the village elite, strongly influence the flow of agricultural information and assistance.

VILLAGE GROUPS AND AGRICULTURAL INFORMATION

Khua Mung village

An in-depth study was conducted in Khua Mung village which is in a sub-district (*tambon*) called Mae Faek Mai, San Sai district. The village is located 22 kilometers on Highway Number 1001 northeast of the city of Chiang Mai and two kilometers west on the village road. The physical setting of the village is a long strip along the East side of the Mae Ping River. The village remains an agricultural society like typical villages in Northern Thailand and, during the dry season, its farmland is sufficiently irrigated from two main sources. One source is the Mae Faek irrigation dam, the other is the Mae Ngad dam irrigation canal about ten kilometers north of the village, a dam recently constructed by the Royal Irrigation Department.

About 30 to 40 years ago, a large group of villagers from the Saraphi district, which is 12 kilometers south of the city of Chiang Mai, migrated to the area to seek better opportunities. The village, therefore, was named after the place where these people had previously lived. The present abbot of the village temple, for example, is one of the prominent immigrants. He moved into the village about 30 years ago.

At the time of the survey (1986) there were 179 households in the village. However, 1984 statistics show that the village ranks fifth among the nine villages in the *tambon* (Table 6.1) in terms of number of households.

Glutinous rice remains the traditional major crop grown in Khua Mung village. In the past, during the dry season, tobacco was a major crop; however, in the past few years, other dry-season crops, namely potatoes and tomatoes, have become the major cash crops.

New crops, varieties, and chemical inputs in Khua Mung village have been gradually introduced by a combination of sources. About ten years ago tobacco, which was introduced by a local tobacco curing factory, was the main dry-season cash crop. Factory field representatives trained tobacco growers to use chemical inputs and modern techniques. These skills acquired from tobacco growing have become a technological base for non-rice diversification. As will be seen later, other formal and informal information sources were (and continue to be) passed word-of-mouth by friends, relatives, neighbors and acquaintances; the media; demonstrations; exhibitions; government officials, and private agricultural input representatives. For example, a new variety of rice (*San Pa Tong*) was brought in by the present headman. The former headman introduced the method of regular spacing for rice transplanting through string lining. The district agricultural extension officer recommended a new soybean variety (SJ 4) about two years ago. After the tomato processing factory was opened in the nearby district, local agricultural traders in a neighboring village initiated contract farming practices with Khua Mung farmers.

Table 6.1 Characteristics of villages in *tambon* Mae Faek Mai in 1984

Village	Households		Population		Areas	Density
	Number	%	Number	%	rai	person/rai
Mae Faek	192	12.22	714	9.69	1,191	0.6
Sob Faek	152	9.68	614	8.70	1,006	0.6
Jedi Maekhrua	234	14.89	948	12.86	1,616	0.6
Khua Mung	166	10.57	700	9.50	1,434	0.5
Huay Bong	132	8.40	618	8.39	718	0.9
Phae Jedi	262	16.68	1,097	14.88	10,945	0.1
Phae Mae Faek	251	15.98	1,892	25.67	15,417	0.1
Phae Huay Bong	86	5.47	390	5.29	3,978	0.1
Ban Klang	96	6.11	371	5.03	417	1.0
Total	1,571	100.00	7,370	100.00	36,722	-

Source: Bureau of City Planning, Ministry of Interior

Villages and village groups

Village groups consist of collections of individual villagers who interact regularly and identify with one another in sharing common goals. The village is usually viewed as an undifferentiated entity comprising all villagers who share a livelihood within the boundary of a geographical setting. A Thai village is often reflected in the bond of temple membership (Moerman 1966), person-to-person (Hanks 1975), and "older-younger" (Kaufman 1977) relationships. Politically, it is recognized as the smallest regional administrative unit and is headed by a *phaw luang* (the village headman).

The village social structure, on the contrary, comprises micro units of individuals or groups categorizing the gradation of socioeconomic differentiation. Individual villager preferences, specializations, and role differentiations singly or jointly influence the formation of "groups" in the village.

Group membership is generally based on voluntary participation; it can be motivated by the villagers' individual and psychological needs or can be influenced by determinants outside the village. Naturally, grouping patterns vary. They range from nonstructured sociocultural groupings such as kin, clique, and neighborhood to politically and economically organized groups such as sanitary, development, and crop-specific groupings.

The formation of a group is commonly influenced by external motivations and forces (Wolf 1969, Ingram 1971, Scott 1976, Turton 1978, Popkin 1979, Kuwinpant 1984). Furthermore, it is apparent that group establishment has become more common in the village during the last two decades. This is mainly because national development strategy has shifted toward integrated development at the village level. The scheme aims at alleviating rural poverty through the concerted efforts of four core government agencies: the Ministries of Interior, Health, Education, and Agriculture and Cooperatives. As group formation facilitates information diffusion, forming groups has become the primary activity of these agencies in implementing their projects. Consequently the variety of groups in a village has mushroomed, while drawing membership from the same pool of potential participants.

Formal group establishment in the village is usually initiated by outsiders, especially government officers from various departments. Groups therefore vary from village to village in number and quality, mainly depending on the leadership characteristics of the village headman. If the headman is responsive to government initiation, the village tends to accommodate a larger number of groups. However, only the types of groups which are relevant to the immediate needs of villagers will be formed. Groups which are oriented to income generation tend to form quickly in comparison with those oriented to general community development, security, health, or sanitation.

It has been observed that most village groups usually relate to farming activities. These groups are "formal" in relation to organizational structure – recruitment of members, obligation to rules and regulations, planning and scheduling of meetings, and bureaucratic administration. Some groups are officially registered with government agencies. Others not officially registered as legal entities are classified by the Department of Agricultural Extension (DOAE) as "natural groups" (groups that have not been initiated by the DOAE). These so-called natural groups are, however, regarded as formal groups in sociological terminology.

Community leaders and the elite

It has been argued that local leadership plays a very important role in mediating the changing agricultural structure of Thai villages (Moerman 1969, Keyes 1970, Vesarach 1977). In terms of this study, these leaders consisted of a sub-district head (*kamnan*), headmen (*phaw luang*), monks, teachers, traders, and sub-district health officers who served as important linkages between villagers and external information sources. They were selected because their socioeconomic well-being enables them to better interact on the villagers' behalf with outside authorities; they also act as patrons. *Kamnan* and headmen were thought to be potentially better agents for transferring agricultural information at the village level as they are usually highly respected by villagers. The *kamnan* also serves as an official information channel and is willing to participate in government programs and activities (Neher 1974). These factors were claimed to be essential for bringing about technological change in agricultural work. A study of the Training and Visit system in Indonesia, where the active role of local leadership was relied upon, indicated that villagers benefited from the system (Vesarach, 1977). The study proposed that the Thai sub-district heads and headmen as well as advanced farmers in the village could be utilized as agents in the process of agricultural technology transfer.

The following outlines the role of important community leaders in Khua Mung village.

The headman. A village is headed by an elected person who is usually a senior and respected citizen. He (or rarely, she) assumes the secular leadership role while the Buddhist abbot takes an important role in the sacred sphere.

The present headman of Khua Mung village was elected in 1977 to fill the position which was vacated by his nephew. He is also a paid government village administrator under the Ministry of Interior. Two more years remain before he reaches official retirement age. His seniority and successful farming experience have given him substantial credibility for maintaining his administrative role in the village. More importantly, he can fully serve his office since most of his (eight *rai*) farm activities are handled by his in-laws.

New knowledge and information is abundantly provided to him through official meetings and regular administrative circulars. Private firms also approach him first to select farmers for experimental plots or to supply inputs. Thus he has ample access to new information through his position.

Village committee members. The Village Committee is a formal village administrative body initiated by the Ministry of Interior to strengthen the role of traditional village authority. The committee is chaired by the headman who consequently hand-picks assistants and committee members who are usually relatively better-off socially and economically than the rest of the village. Unlike the headman and his assistants, Village Committee members hold office without pay. Instead, they earn prestige and recognition as well as gain greater access to information and opportunities made available to the village. Some of them are also selected to represent the headman at meetings, exhibitions, and other official functions. Additional organizational offices set up in the village are usually distributed among these members. This practice does not apparently generate conflict with other villagers since these positions are not seen as tasks for which there is monetary reward. Instead, holding community office is seen as a communal responsibility and a sacrifice.

Khua Mung is not an exception to the above norm. The headman is the chairman of the Village Committee which comprises 36 personally hand-picked members. They represent 20 percent of all households in the village. There are two assistant headmen, seven division heads (each has four division members), and one secretary. These divisions are: (1) administration; (2) development and vocational promotion; (3) welfare; (4) security; (5) education and culture; (6) health; and (7) treasury. The headmen and his assistants are in charge of three divisions. The advisory members consist of ten persons: the village temple abbot, an honorary village member, four village school teachers, two elder women, the sub-district agricultural extension officer, an assistant district officer assigned to the sub-district, the police chief, a sub-district health officer, and a sub-district community development officer. This structure was set up in the village in 1984 and no member has been replaced for any reason other than death.

Six out of the seven division chiefs serving on the Village Committee are contact farmers (COFs). There are 16 contact farmers in Khua Mung over whom the headman is also the chief. The chief of Education and Cultural Affairs was selected chairman of the Potato Growers' Group (the group is structured at the sub-district level) while the headman holds chairmanship of both the Tomato Growers' Group and the Soybean Growers' Group. The honorary Village Committee member is a previous headman. He is also the chairman of the District Cooperative and the village health volunteer.

The village temple abbot. A native of Saraphi district (about 12 kilometers immediately south of Chiang Mai city) the abbot migrated along with many other villagers to Khua Mung village when he was 17 years old. He was then a novice. Now at the age of 51, he commands a high degree of respect from village members. His prestige has been heightened by his success in raising two million baht, mostly from external sources, for the monks' residence.

He often watches agricultural programs on television and even constructed a test pit for compost in the temple compound following instructions seen on a television program.

The abbot has been very supportive of village social and development activities. He is always present at action programs to contribute moral support. As an advisory member of the Village Committee, he approves the time and date set by the headman for any proposed village meeting. The village monthly meeting usually takes place at the temple pavilion where the abbot gives the opening address and provides a closing summary speech to endorse meeting resolutions.

AGRICULTURAL INFORMATION THROUGH GROUPS

Contact farmer groups

The present agricultural extension approach is the Training and Visit system (T&V) which was initially implemented by the Department of Agricultural Extension (DOAE), Ministry of Agriculture and Cooperatives, in four provinces in the northeast of Thailand in 1977. Nationwide implementation followed in 1979. The T&V system employed the sociological implications of "informal group" village behavior as the catalytic mechanism for technology transfer. As mentioned earlier,

under this scheme agricultural extension officers transfer technical information to selected farmers who are known as contact farmers (COFs). A COF will, by design, spread particular information to a group of ten neighboring farmers. The group is, therefore, called the "Contact Farmer Group."

Structure and leadership. Members of a COF group in a village usually live in geographically clustered residences. The COF is expected to disseminate knowledge received from the agricultural extension officer to the cluster members. The selection of COFs is accomplished through sociometric preference techniques or appointment by a respectable village officer such as the village headman. The sociometric preference technique helps identify the most trusted and accepted farmers in terms of interpersonal relationships. In practice, however, the appointment method is commonly exercised in selecting COFs. A selected COF does not have to own a large amount of land or be wealthy.

In principle, the agricultural extension officer makes regular, scheduled visits to these COFs and, if time permits, to other individual farmers and groups. The COF is very dependent on the agricultural extension officer, the contact farmer's main source of information.

There are 155 COFs (from the nine villages of 1,550 farm households) in the Mae Faek Mai sub-district. In Khua Mung village alone, there are 16 COFs all of whom are male. The selection of the COFs was made at one village meeting in which COF candidates were nominated by the headman and approved by the members.

Behavior and function. A COF is expected to carry out the information dissemination task by mediating between the agricultural extension officer (source) and the group members (end-receivers). Contact farmers in Khua Mung are visited once a week, on Friday for half a day. However, the schedule can be flexible in practice. This is because the extension officer responsible for Khua Mung is a native of and lives in a neighboring village. He, therefore, prefers to make himself available any time—including being stopped on the road. He also makes frequent, unplanned visits to meet particular COFs and farmers.

Agricultural information flow and distribution. The questionnaire survey conducted in Khua Mung, a sub-sample of the regional survey, shows that 76.5 percent (Table 6.2) of the farm households (which includes all COF respondents or 21.6 percent) received agricultural information from the *tambon* officer (agricultural extension officer). This suggests that 70 percent of non-COF farmers received information through the agricultural extension officer. The importance of this source of information, however, ranks third (76.5%) after the sources of COFs (82.3%) and television (78.4%). The importance in terms of the percentage of response for the agricultural extension officer source is much higher here than in the other three villages in San Sai district and in the overall Northern sample (59.6 percent).

The survey also shows that the role of COFs in Khua Mung village is highly expressive (82.3%) in the diffusion of agricultural information among farmers. About 80 percent of those who are not contact farmers in Khua Mung village reported receiving information from COFs. This explains how COFs represent the most accessible channel of information, mainly due to the importance of person-to-person relationships in the village social structure. This situation is in sharp contrast to other three villages from the survey in the same district (Nong Majab, Huay Kaew and Phae Huay Bong) where COFs are less effective.

The kind of information received from COFs is mostly related to crop varieties and chemical inputs. Both report an equal percentage of response (60.8%). Only 3.9 percent of Khua Mung respondents reported that they received price information from COFs.

The contact farmer approach to the transfer of agricultural technology has been questioned in relation to cultural constraints (Heim, Rabibhadana and Pinthong 1980) and the underutilization of dynamic group techniques (Hoare, Crouch, and Lamrock 1982). The cultural critique argues that the contact farmer approach may not work in Thailand where the society does not admire high-profile members. Furthermore, less well-to-do COFs may find it difficult to carry out their tasks as their limited economic resources prevent them from fulfilling their expected role as patrons. Thus, the leadership of such a COF is expected to be weak. The latter critique charges that the contact farmer approach may not be appropriate in dealing with the problems of behavioral change for the majority of farmers and the group of nonadopters. The process does not allow the entire group to participate in expressing its felt need for technological assistance.

In Khua Mung, the contact farmer approach appears to have been very efficient. However, the same degree of success does not seem to prevail across the region. In many villages, especially those with relatively less agricultural potential, many respondents do not even know their COF – nor do they know what the term means. This implies that the dissemination process is not only uneven within a village but also among villages.

Table 6.2 Percentage of frequencies of agricultural information sources received by farmers in Khua Mung village, San Sai district and the Northern region.

Sources of information	Percentage of Information Reception		
	Khua Mung*	San Sai**	Northern***
	(n=51)	(n=150)	(n=1035)
Contact farmers	82.3	64.0	45.0
Television	78.4	75.3	65.6
Tambon officer	76.5	56.0	59.6
Groups	74.5	60.0	46.1
Radio	66.7	46.0	34.5
Reading	43.2	26.7	22.9
Study trips and exhibitions	21.6	28.6	20.6
Agrochemical companies	19.6	20.7	20.0
Local traders	9.8	10.7	46.8
Banks	2.0	10.0	30.0

Source: Field survey, 1986.

* Khua Mung village sample.

** Four villages in San Sai district, Chiang Mai (including Khua Mung).

*** All Northern region samples from 11 provinces.

Farmer groups

In the village, a farmers' group refers to a collection of farmers who are bound together by motivations related to the farming livelihood. There are two types of established groups: the non-legal arrangement, and the legal entity groups formed under an association or special legislation.

The establishment of a farmers' group is basically a response or an adjustment to the commercialization process. Government officials and private business people play an important role in the initial organization of these groups as well as their ongoing administration because group formation facilitates information dissemination.

Two types of groups will be discussed, those with and those without legal status. For instance, the Farmers' Group, which is an agribusiness group of at least 30 farmers, is a joint effort of members responsible for organizational operation as a registered legal entity. The rationale behind the Farmers' Group is to implant cooperative philosophy to farmers with the hope that the group will become an Agricultural Cooperative. The Group is set up at the sub-district level and its members are recruited from villages in the respective sub-district. In *tambon* Mae Faek Mai, this group is called the Orchard Farmers' Group of Mae Faek Mai. However, there is no member from Khua Mung village.

Another group of a similar nature is the Agricultural Cooperative. The group is organized at the district level and there is a subgroup at the village level. There are 92 members in Khua Mung village. The chairman of the village subgroup is also the chairman of the district-level operation.

The objectives of these two groups focus on raising the standard of farmers' livelihood through the provision of agricultural credit. Almost all members are credit beneficiaries. Therefore, the major activities of both of these groups involve loan processing, administration, and collection.

The second type of farmers' group is a group which bears no official registration status. Sometimes called "natural groups," these are mainly groups of people which have no legal obligation and in which members are formally recruited to facilitate specific operations. The nature of these groups, therefore, varies according to the collective interest – i.e., social, cultural, economic, and political ties. Natural groups are characterized by a nonstructured (informal, primary groups) grouping such as clique, kin, and neighborhood to the more organized (formal, secondary) groups such as crop-specific or water-users' groups. The latter groups are commonly understood in the discussion of village groups since their structure is distinctively defined. Essentially, the analysis of group behavior in relation to information diffusion will focus on the first type of group, formal groups.

Crop-specific groups and natural-resource management groups are frequently observed in the Upper North. In each group a committee serves as the group's coordinating body. Group members are expected to adhere to a set of practices in exchange for benefits obtained – agricultural inputs, infrastructure, farm information, credit, and marketing outlets. Most group activities are seasonal, according to crops. The social relationships among members are generally formal at the village level. However, primary relationships (small, intimate groups of people who relate to one another in direct, personal ways) exist in subgroups which sometimes enhance group strength and activities.

There are four crop-specific groups in Khua Mung village – the Potato Growers' Group, the Tomato Growers' Group, the Soybean Growers' Group – and the fourth is made up of "other groups" related to farm activities.

The Tomato Growers' Group (TGG). The TGG was established in 1985 in response to a new market opportunity provided by a food processing company located in a nearby district. The company only obtains its raw materials from contracted suppliers at a guaranteed price, quality, and volume. The suppliers are usually local agricultural traders who, in turn, subcontract the supply quota to individual farmers. In the past, tomato farmers in Khua Mung subcontracted from traders residing outside the village. In order to increase benefits through direct contact with the company, the district agricultural extension officer formed TGG in anticipation that the group effort could replace the role of local traders as well as stabilize the price of tomatoes.

There are currently 42 members of the TGG. These members were voluntarily recruited at a village meeting which was jointly chaired by the headman, the sub-district agricultural extension officer, and the district agricultural extension officer. The administrative body, which was formed later, is headed by the present village headman. This committee body acts on behalf of the members in negotiating their production quota and prices with the company.

The total tomato growing quota allotted to farmers in Khua Mung village is 60 *rai*. The company agreed to buy tomatoes from the group – not more than 8,000 kilograms per day – with a guaranteed factory-gate price of 1.20 baht per kilogram. It also provides farmer members with inputs (such as seed, fertilizer, and other chemical products) on credit from the company and elsewhere. When harvest time comes, the committee organizes the delivery of the produce to the factory. The total produce sold by the group this year amounted to 130,000 kilograms.

Some tomato farmers were hesitant to participate in the TGG this year since the group is a recent endeavor in Khua Mung village and it has not been ascertained whether or not it will succeed. As they have done in the past few years, farmers eschewed risk-taking by retaining their contracts with outside traders. Besides, these people were provided with earlier quota allocations than TGG members which further reduces their confidence in the TGG.

At the end of the group's inaugural season the TGG proved to be very successful in relation to the guaranteed price. The net price (excluding delivery) for TGG members remained at 1 baht per kilo while nonmembers received only 0.40 baht per kilo. Due to an oversupply local traders, registered with the company, cut down their buying price while the factory-guaranteed price for the TGG remained stable. All in all the TGG made about 3,000 baht net operating profit on a commission of .05 baht/kg after the season.

Because of the success of the TGG, it is expected that more farmers will join the group for the next growing season. The founding members will have their first choice in the group's allotted planting area quota (60 *rai)* and acceptance of new members will be confined to the remaining balance.

The Potato Growers' Group (PGG). While TGG members enjoy the group's guaranteed price, PGG members are provided access to and may buy imported potato seed. Potatoes have been grown in the village for about six years (since 1980) but the village PGG was only established in 1983. Total sub-district membership amounts to about 1,100 farmer growers and there are 50 members in Khua Mung.

Since the demand of farmers for growing potatoes is high and potato seed imports are limited, the group helps bargain for the fair allocation of seed by household instead of by farmland size. This allocation system eliminates those who have a large amount of land from making money on the resale of the unused portion of their potato seed share.

There are three varieties of potato acquired by the group. They are Kenebec, Russet Burbank, and Spunta. Those who accept the first two varieties are offered price guarantee coverage. The first variety was introduced by a company in Fang district (about 150 kilometers North of the village) and the Russet Burbank was introduced by the Royal Project. But there were no general allotments of these two varieties for members in Khua Mung. Only three members, including the headman, were given some Kenebec seed to perform a small trial this year. Group members were provided with Spunta seed.

The Soybean Growers' Group (SGG). This group was initially motivated by the office of the San Sai District Agricultural Extension to implement national policy to reduce the rice farming area, especially during the dry season. The implementation of this policy is carried out by the agricultural extension officer through village level SGGs by providing inputs and market outlets. The district office provides the SGG with seed at a lower price (although it is limited), rhizobium, herbicide, and insecticide. Purchases are also organized by the office—with the cooperation of local district cooperatives and a large soybean trader in Chiang Mai city—to absorb all farm produce at the prevailing district market price. Last year soybean farmers could sell their produce to the seed exchange program at a guaranteed price. In addition, the agricultural extension officer also assists in acquiring chemical products on credit. It is reported that no farmer was interested in selling produce through the district market channel in 1986 because the local trader's price was more attractive. The SGG is presently composed of 72 farmer members and is headed by the present village headman.

Other groups. There are other groups in the village whose tasks relate to farming activities. These are the Farmer's Housewife Group (FHG) and the Young Farmers Group (YFG). The FHG in Khua Mung village has about 30 members and was observed to be mostly active in food preparation and preservation activities, mainly involving own-family consumption. The YFG is still in its infancy in Khua Mung as the district and the sub-district agricultural extension officers have only just called a meeting in the village early in the year to propose establishing the group.

INFORMATION DIFFUSION DYNAMICS WITHIN THE GROUP

Access to group membership

When a group is initiated, membership is publicly invited at a general meeting. Some, especially natural groups, do not require much commitment but there are obvious potential benefits, such as those found through the Soybean Growers' Group and the Potato Growers' Group, for instance. Signing up is sufficient for joining some natural village groups. The objectives and scope of the group are announced at the meeting. These, plus the farmers' experience, form the basis on which they decide whether or not it would benefit them to join the group. Those who have never

had any experience with tomato farming before may not feel comfortable in applying for group membership until they have experience. Membership in some groups may also require ownership of farm land and this factor contributes to the restriction of access to some farmers.

As the group becomes established and begins to show positive benefits, nonmember farmers may request membership. The Tomato Growers' Group is an example. If demand exceeds supply, i.e., requested membership exceeds allotted quota, a first-come-first-served principle is enforced. This principle implies that those with close connections to the village elite will tend to get information first (most probably before the meeting) and will have time to ponder their choices and be the first to get the quota. The lag between the time when the headman receives information from external sources and the village meeting, also provides the top echelon with more opportunity for assessment.

Farming group leadership is normally held by the headman, but the option is passed on to the headman's administrators if the headman is not available. The headman in Khua Mung leads both the Tomato and the Soybean Growers' Groups. Part of the reason for his not leading the Potato Growers' Group is that the soil on his farm is not suitable for potatoes.

If groups are stimulated by outsiders, (which is usually the case) – either the government or the private sector – the headman is the first person to know. He is, therefore, in a position to make an initial response. If he agrees with the proposal of the group, he can pass it on to the villagers at a general meeting in which they participate. If, on the contrary, he does not agree with it, he can set the matter aside at the outset.

The selection of group leaders is not competitive mainly because potential leaders are limited and normally belong to the village elite – village office holders, local farm traders, or advanced farmers. It is, therefore, normal to observe that group leadership in the village passes to a few local leaders. Rich farmers or villagers are in a better economic position to interact with government officials. Consequently, the rich farmers and members of the village elite have prior access to village political office and have greater access to external information; this, in turn, further enhances their wealth and opportunities. The existing leaders and potential leaders in the village have direct impact on the establishment of new groups or on the strength of existing groups. The role of these leaders can be summarized as "gate-keepers" of the flow of information, the "regulators" of information. This headman behavior has been illustrated by the so-called "synaptic leader" (Moerman 1969).

Flow and distribution of agricultural information within farmer groups

Members of formal groups (such as crop-specific groups) receive new information and practices mainly through compulsory requirements because they have to abide by farming contract specifications. Farmers have to use specific crop varieties, chemical inputs, and management techniques. Some farming inputs are directly supplied by the company, while technical knowledge is usually obtained from consultations with the agricultural extension officer. Crop-specific groups have been in Khua Mung village for a long time. The earlier groups resulted from contract farming with local tobacco curers. The more recent groups involve the growers of tomatoes, potatoes, and soybeans.

Farm information and assistance from government and private agencies are usually passed on, at the village level, to group leaders and group officials – in person. This is done either in the village or outside the village, such as at official meetings and at training programs. Within the village, groups serve as units of first contact. Meetings and training sessions organized outside the village are accessible mostly to group leaders or senior committee group members. These people, therefore, have prior access and act as "gatekeepers" by evaluating and making decisions whether or not to further relate information to other members or group leaders.

Information diffusion processes at the village level are occasionally performed through group meetings. A village meeting is organized to disperse government information which the headman receives at a regular district level monthly meeting. Again, the headman decides whether or not a village meeting is needed. It has been observed that the village meeting is set up very formally, resembling an official government meeting. In-depth discussions of topics that follow up issues on the agenda are often undertaken later in "informal groups" or cliques with kin and intimate neighbors. This kind of discussion is observed to critically pursue details and may influence evaluation as well as adoption.

Word-of-mouth distinctively characterizes the informal flow of information within village circles. Casual conversations among informal group members can help assess and confirm newly received information. It also is an informal source of information such as "rumors" as well as a source of detailed information.

The interaction among members of informal groups is not predetermined. Issues discussed are mostly to reconfirm and reassess information spread by formal channels. These groups do not schedule regular meetings because casual and informal discussions can be held among smaller group members during leisure gatherings. This furthermore helps generate a larger flow of information within the village. Casual conversation often stimulates the sharing of information provided either through groups or by word-of-mouth among members and nonmembers.

The survey sample of 51 farm households in Khua Mung village (see Table 6.2) indicates that 74.5 percent of the farmers interviewed reported having received agricultural information from groups. This brings group membership to the fourth most important ranking among the ten selected information channels. Again, the role of groups in this village tends to be relatively exceptional compared with the total San Sai district sample as well as the whole Northern region (60% and 46.1%, respectively). This is partly due to the high rate of group membership (78.4% in Khua Mung) compared with San Sai district (63.3%) and that of the whole region (56.8%). The most reported group in Khua Mung to which respondents belong is the Cooperative Group, 62.5 percent, followed by crop-specific groups, with 25 percent. It was observed that no membership in the COF group was mentioned. This is probably due to the casualness of the group structure and activities which may not be substantially perceived by most farmers.

Information diffused through groups in Khua Mung involves chemical inputs (64.7%), crop varieties (62.7%), and farming practices (31.4%). Table 6.3 shows the unequal roles of groups in spreading various kinds of agricultural information among four villages in the San Sai district. Both Khua Mung and Nong Majab villages share similar patterns through their village groups on crop variety information spread and chemical inputs. They, however, differ in the degree of reception – despite the similarity in group membership (78.4% in Khua Mung and 77.3% in

Nong Majab village). Compared with the responses of the regional samples, the diffusion impact of Khua Mung groups tended to be more widespread.

Within the formal village group structure there are, however, small "informal" groups consisting of people who share informal and primary relationships. They are closely and sentimentally formed among kin, neighbors (by residence or by farming plot), and cliques. Their function, in terms of information, is to further spread and facilitate the evaluation of information received from formal channels.

Table 6.3 Percentage of information received by type of information channeled through groups in villages in the San Sai district

Type of information from groups	Villages				San Sai district
	Nong Majab	Huay Kaew	Khua Mung	Phae Huay Bong	
Crop variety	54.5	19.4	62.7	-	41.3
Seeds	13.6	-	7.8	-	6.7
Chemical inputs	40.9	3.2	64.7	4.2	35.3
Farm practices	6.8	12.9	31.4	4.2	16.0
Price	9.1	6.5	11.8	-	8.0
Other	15.9	29.0	11.8	12.5	16.7

Source: Field survey, 1986.

CONCLUSION

The study of Khua Mung village and the Northern region indicates that information is not disseminated into a vacuum and, the manner in which the information is absorbed depends on the social infrastructure which determines who gets information first. Under the current mode of communication where person-to-person contacts predominate, the members of the village elite, who are intended by public authorities to act as a bridge between the village and the outside world, have become, through their offices and expected roles, the "regulators" of information flow.

Groups are formed by government agencies and commercial concerns to facilitate information and technology transfer. However, the fact that groups are found to be relatively successful (as in the case of Khua Mung) does not imply that information is evenly spread within the village. There are nongroup members who are left out of the diffusion process. Moreover, the first-come-first-served principle applied to group membership and recruitment provides better opportunities to those close to the village elite.

This chapter has revealed an inherent bias in the current information absorption system. Therefore there is an apparent need for a more equitable means of transfer.

Chapter Seven

Technology Transfer and Adoption in Irrigated Agriculture: A Case Study of Mae Kung Village in the Chiang Mai Valley

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In comparison to the long history of agriculture in the Chiang Mai valley that dates back more than 1,000 years (Gorman 1969), modern agricultural technology here is relatively recent. Elsewhere in this report, concern with the transfer of modern technology to farmers has been emphasized – especially how information is transmitted to farmers from external sources. Looking at the process from a different perspective, this section deals with how technical information is diffused among farmers.

Following the study described in Chapter five (which outlines the social infrastructure into which information is received) this section traces farmer contact and interaction with external sources of information. It also examines the role of the village information network through which exogenous and endogenous information is processed, assimilated, and exchanged among farmers in rural communities. Mae Kung village was chosen to represent a village with a history of active introduction of new technology over the past two decades and where technology has largely contributed to increased agricultural intensification and diversification.

Mae Kung is a village in the San Pa Tong district of the Chiang Mai valley (Figure 7.1). Its agricultural land consists almost entirely of paddy fields, which are planted to wetland rice in the wet season and upland crops in the dry season. The village paddy fields are located at the end of a traditional irrigation system. Community participation in the Water Users' Association is minimal, even though the availability of irrigation has improved markedly since the large Mae Taeng Project of the Royal

Irrigation Department was completed in the early 1970s. This radical improvement in irrigation has led to a high degree of intensification in rice-based cropping systems. The village may also serve as a model on how to develop information systems for the newly irrigated areas in the North which are currently being underutilized for dry season cropping (CMU/CUSRI 1985).

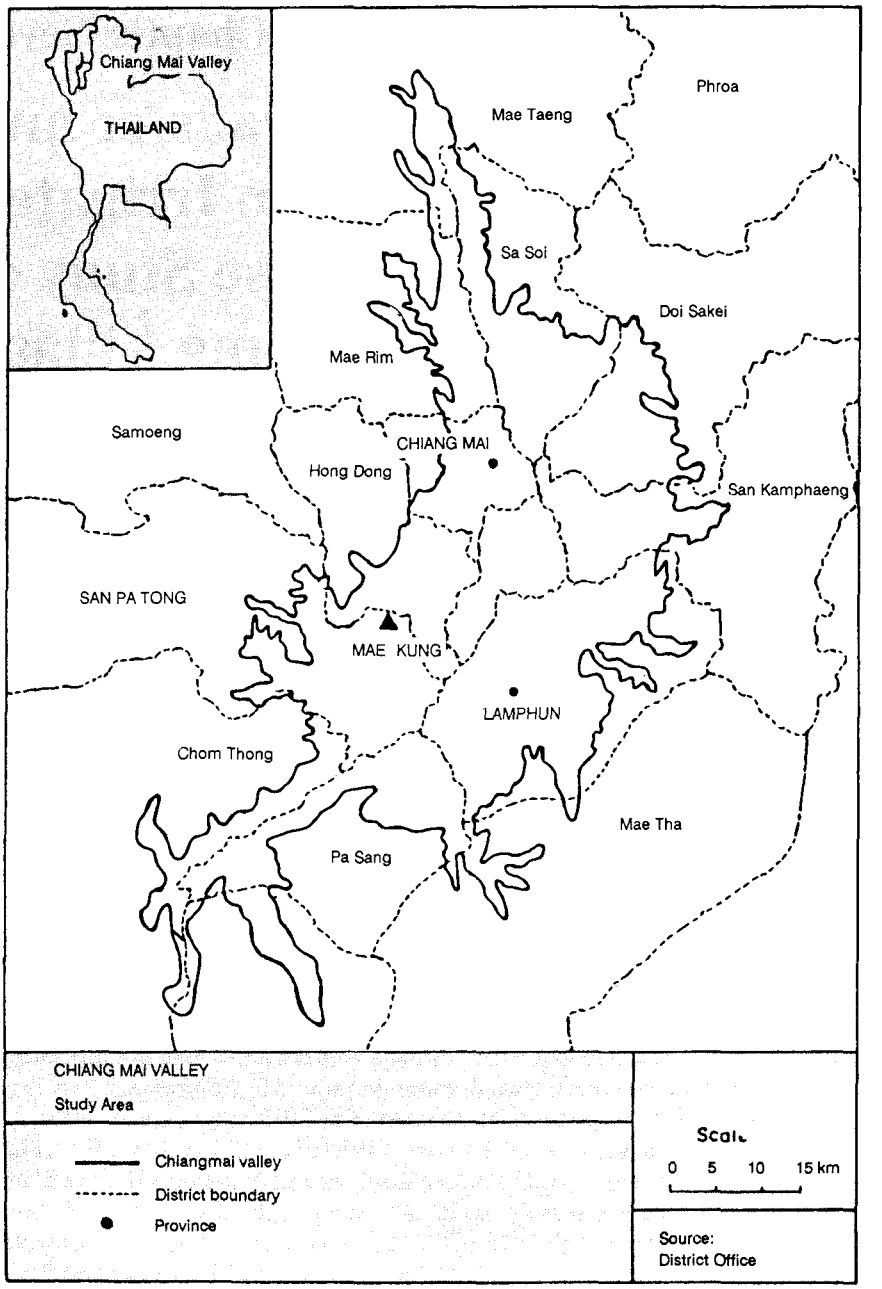


Figure 7.1 Map showing Mae Kung village study area, in the Chiang Mai valley.

In this study a standard questionnaire was developed and used to interview 100 farmers in the 199-household village. The sample was categorized into three groups depending on the degree of a farmer's involvement in the on-farm cropping system testing program introduced during 1975 - 1979 by the Multiple Cropping Project of Chiang Mai University. The categories included direct participation, 33 farmers; participation of relatives or close neighbors, 18 farmers; and those not involved, 49 farmers. Key informants were identified and interviewed. They included the village headman and his assistants, early adopters, and late adopters.

VILLAGE INFORMATION FLOW ORGANIZATION

Mae Kung is a typical village of the Upper North sub-region; its social life is tightly structured with intricate links between members (Moerman, 1968; Potter 1976; and Calavan 1977). The village has both a relatively recent, administrative body – set up with the encouragement of and instruction by the central government (Figure 7.2) – and the more informal traditional structure common to villages of the North.

The formal structure

Similar to Khua Mung and other villages, the village headman in Mae Kung acts as the intermediary between the village and district and sub-district officers. The headman and his staff form a village council (Figure 7.3) which runs the general and social affairs in the village. Apart from carrying out the administrative tasks entrusted to it by the district office and because of its frequent contact with official authorities and people outside the village, the village council serves as a bridge for information reception in the village.

Informal groups

In Mae Kung there are numerous informal, traditional groups which act as forums for interaction among farmers, i.e. kin, temple, and funeral groups and the practice of helping each other, called *chuai kan*. Many of these groupings have social objectives. Membership in an informal group is not necessarily limited to members of the village. For example, labor-exchange groups – which existed before the more recent official village boundaries were established – may involve people from more than one village. Membership in the temple at Mae Kung also includes farmers from nearby Ban Nai of Klang Nua as well. There is a high percentage of endogenous marriages in Mae Kung; thus, the sense that everyone is related to everyone else is very strong.

Leadership of all these informal groups is generally drawn from the elite of the formal administrative structure. Social transactions within the village and with neighboring villages (such as within the labor-exchange group as well as though the common custom of *chuai kan*) appear to form a village information network in which exchange and transfer of technical agricultural information is one important feature. Village leaders are often also the leading and most innovative farmers and are an important source of technical information for the village.

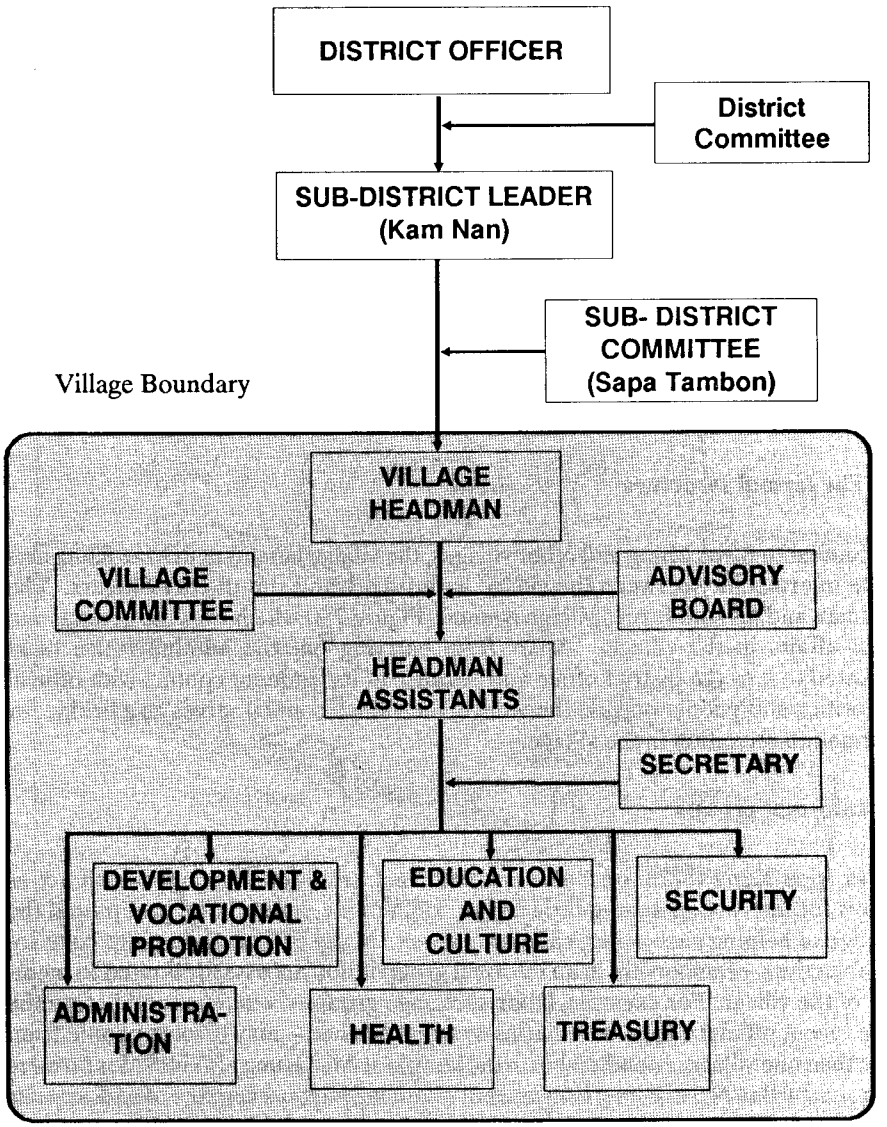
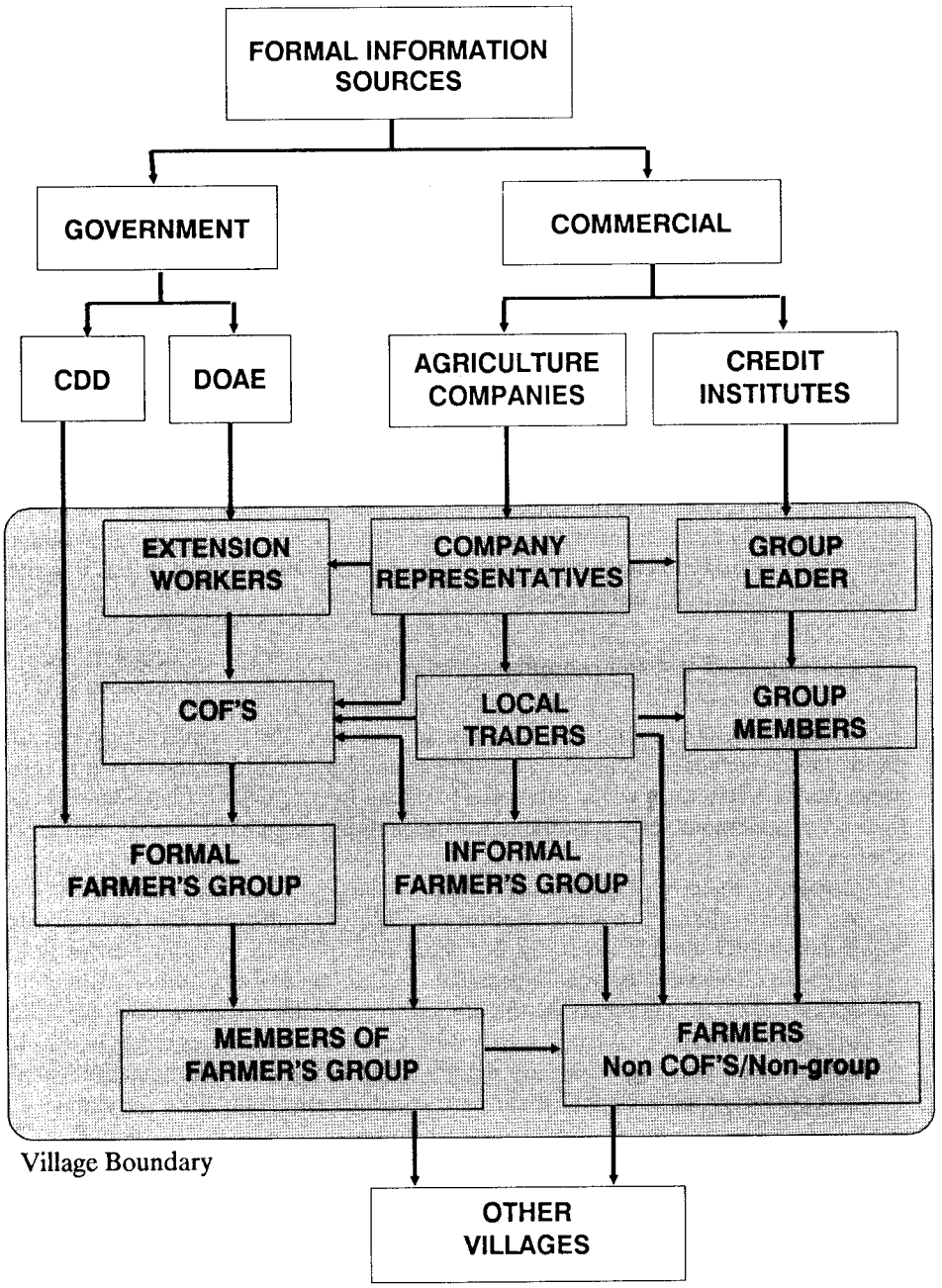


Figure 7.2 Hierarchical structure of village administration and organization in Mae Kung village



Notes: CDD - Community Development Department
DOAE - Department of Agricultural Extension
COFs - Contact Farmers

Figure 7.3 Information channels in a rural village of Northern Thailand

FARMING CONDITIONS

Farming structure

Mae Kung is situated just off the sealed road 23 km south of Chiang Mai city. It is served by an irrigation canal of the Mae Taeng Project designated "Lateral 23." Prior to 1971 and before the completion of the RID irrigation system, the village used traditional irrigation practices called *Fai Kor Bor Ton*. At that time, during the dry season, the irrigated area was limited to some low-lying fields and fields adjacent to the main canals. However, irrigation water was relatively abundant during the wet season when a subsistent crop (glutinous rice) was grown. Today these ditches and dikes built for the traditional irrigation system, have, in effect, become the basic infrastructure for distributing irrigation water from the Mae Taeng irrigation project on a year-round basis.

The soil in this area is mostly coarse loamy mixed isohyperthermic, Typic Ochraqualfs, of the San Sai series. According to the Department of Land Development (1976) the soil is deep with the texture varying from sandy loam to sandy clay loam, generally poorly drained and with a pH below 7.0. However, farmers classified their land according to field elevation, water availability, and crop response (e.g. lodging traditional rice in light, fertile soils).

Existing land-use and cropping systems

Village houses are clustered together in one area. Each is surrounded by its paddy land which can be classified into upper and lower paddy – lower paddy is in areas where wet-season water levels are too deep for the rice and late drainage at the end of season makes it unsuitable for the planting of an early cool-season crop after rice.

Currently, the cropping intensity for the whole village is more than two crops a year which relates closely to irrigation and different land types. The lower paddy is suitable for double rice cropping while rice followed by upland crops (e.g. soybeans, tobacco) or vegetables (e.g. chilies, cucumbers, tomatoes, watermelon, etc.) is cultivated in the upper paddy. Drainage is obviously the predominant factor. Access to irrigation water also influences crop choice. It may be seen that vegetables are mainly found along the main irrigation canal and upland crops such as soybeans are grown relatively far from the canal.

Farm households

In Mae Kung the average holding is about 4 *rai*. One-third of the farm families are pure tenants and 45 percent farm on their own land (Table 7.1). Delivery of irrigation water is a problem to many in the village. More than half of the farmers do not have direct access to the irrigation channel, and must get the water only after it has passed through others' land. One-quarter of the farmers have their fields more than half a kilometer from an irrigation ditch.

Table 7.1 A profile of Mae Kung, a village in San Pa Tong district, Chiang Mai valley.

Population	Total = 988		
		% male	% females
	Adults	35	43
	Children (>15 yrs)	15	9
	Number of households	199	
	Agricultural households	90 percent	
Family size	5 persons/family		
Education		% of respondents	
	at least P4	82	
	< P4	9	
	no schooling	9	
Irrigated area	91 percent of total farm land		
Land ownership		% of households	
	Own farm	45	
	Rent	34	
	Own and rent	21	
	Farm on more than one parcel	41	
Farm size	4.1 *rai*		
Cropping intensity index	2 (number of crops grown on same land in one year)		
Debts		% of families	
	Families with some debts	52	
	Sources of credit: BAAC	59	
	Coops.	31	
	relatives	10	
	Investment in agriculture accounts for 90 percent of debts incurred		

Source: Field survey, 1986 and Srimongkol *et al*, 1985.

TECHNOLOGICAL INPUT

Over the past two decades many different innovations and farming practices have been introduced into Mae Kung; however, our research team concentrated on only three major innovations and those practices which have been extensively adopted in the village, as follows:

Chilies in the mid 1960s

Chilies were introduced into the village by a trader who expected to produce dried chilies on a contract basis. The trader introduced the seeds and demonstrated to farmers how to grow the crop – from raising the seedlings in the nursery, to transplanting, and general crop management.

The multiple cropping system in the mid 1970s

Chiang Mai University's Multiple Cropping Project (MCP) initiated a program in Mae Kung in 1975 to verify, under farm conditions, the feasibility of intensive rice-based cropping systems designed at the university's experimental station. At the heart of this intensive cropping system was "modern" rice technology, based on the new semi-dwarf cultivars of RD1 and RD7. Also introduced were accompanying practices such as the use of chemical fertilizers and regular spacing.

Basmati rice in the mid 1980s

In 1984 a private foreign firm introduced Basmati rice into the village on a contract farming basis. The company provided technological inputs including seed, fertilizers, and pest control chemicals on credit. Farmers contracted to sell the rice to the company at a guaranteed price normally higher than the prevailing market price of other varieties. Crop management instructions provided by the company were similar to those of modern rice technology, except that less fertilizer was used.

Other technologies and sources

Another source of information is the San Pa Tong Rice Experiment Station about five kilometers south of the village. Every year some farmers, individually or in groups, visit the station to buy rice seed and obtain the most recent information on new rice cultivars released by the Department of Agriculture.

In addition to these formal channels for introducing information, the village also received other agricultural technology through the informal village information network, e.g. traditional rice cultivars such as *Khao Kluoi*; crops such as cucumbers and watermelons; and mushroom cultivation using rice straw.

THE INTRODUCTION OF TECHNOLOGY

Chilies

Technology available before introduction. When chilies were introduced, farmers who had experience with tobacco growing found no difficulty in cultivating the crop because, to a large extent, the agronomic management of tobacco and chilies is almost interchangeable, e.g. seed-bed preparation, transplanting methods, and fertilizer application. However, chilies are a long growing season crop; flowering and fruit set are spread over a long period. In the years since adoption, many modifications have been made and these will be dealt with in a subsequent section.

Technology introduced. Chilies represented a new alternative cash crop for farmers and conditions under contract were the same as tobacco, i.e. provision of seedlings, fertilizers, and other necessary chemicals under credit. The origin of the crop is unknown but the early adopters noticed a wide variation between plant type, fruit size, and development pattern. This suggests that the introduced variety was possibly a varietal mixture.

Farmer participation. In the days before the completion of the Mae Taeng irrigation project, only a few farmers could grow a second crop after main season rice; however, the exact number of farmers actually contracted to grow chilies was unknown. After the completion of the Mae Taeng irrigation project the chili crop was recognized as one of the most important cash crops after main season rice. Trial plots were repeatedly seen in the village. Indeed, many late adopters simply copied skills from early adopters. Thus, in this case, technology transfer depended upon the interest of and relationship between farmers in the village.

The multiple cropping system

Technology available before the project. Cropping system technology practiced by farmers in Mae Kung prior to 1975 (Figure 7.4) included the use of traditional rice cultivars, such as the early maturing "three-month rice" (in rice-tobacco and rice-chilies systems in the upper paddy) and traditional mid season cultivars such as *Niaw San Pa Tong, Khao Kaew* and *Khao Pah* (in rice-soybean systems, in the lower paddies). The traditional practice of double transplanting was used to cope with the deep-water problem.

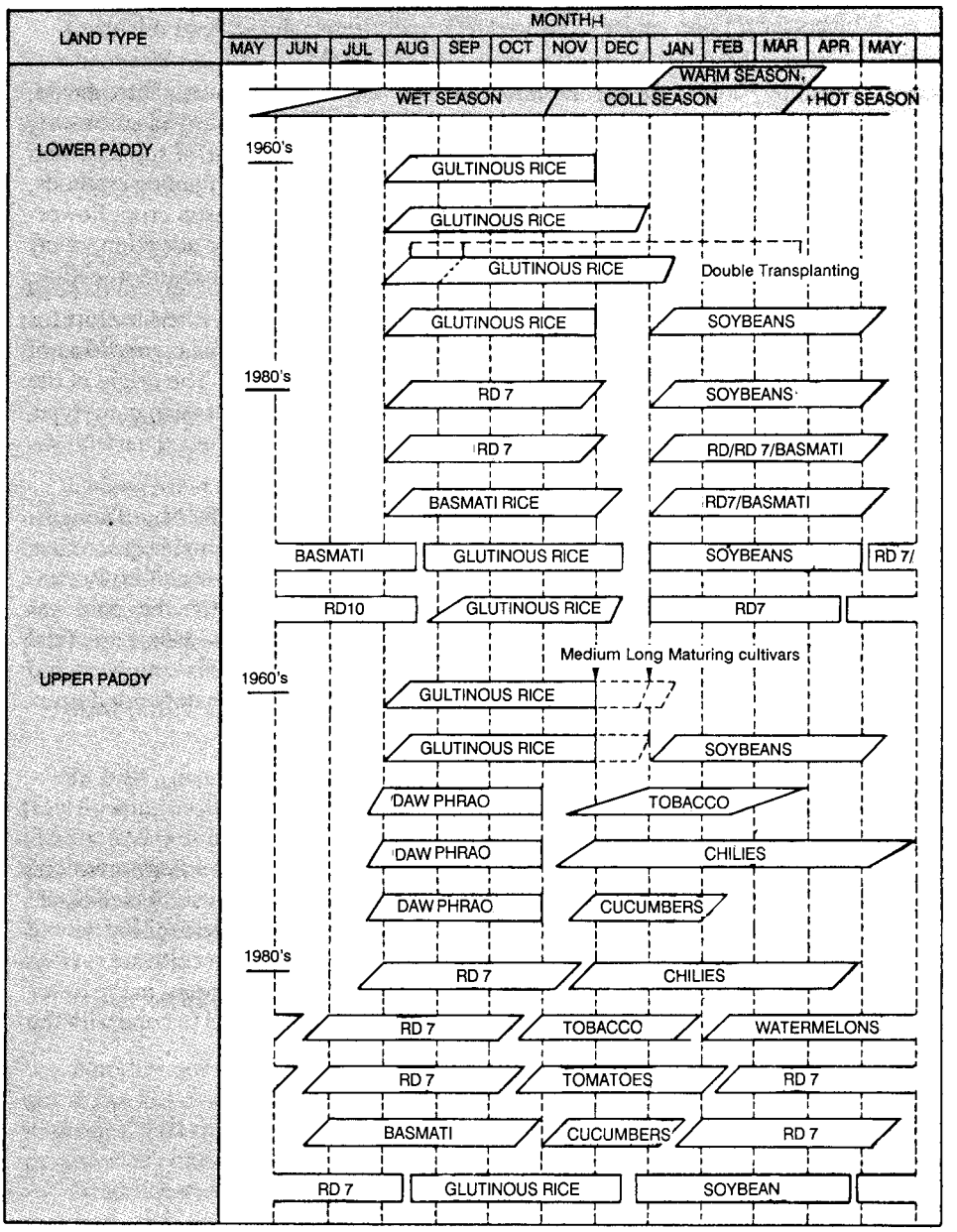


Figure 7.4 Changes in cropping technologies in Ban Mae Kung from the 1960s to 1980s

Source: Field survey and interviews

Technology introduced. The technology introduced by the MCP to Mae Kung mainly involved intensive, rice-based cropping systems. The adopted cropping systems are as follows:

1975/76	**Cropping systems (28 farmers)**
	RD1 rice-peanuts-tomatoes
	RD1 rice-tobacco-Chinese cabbage
	RD1 rice-soybeans-cabbage
	RD1 rice-tomatoes-RD1 rice
1986/77	**Cropping systems (26 farmers)**
	RD7 rice-peanuts-tomatoes
	RD7 rice-tobacco-peanuts
	RD7 rice-garlic-corn
1977/78	**Cropping systems (25 farmers)**
	RD7 rice-peanuts-tomatoes
	RD7 rice-tobacco-peanuts
	RD7 rice-soybean-sweet corn
	RD7 rice-garlic-mung beans
1978/79	**Cropping systems (20 farmers)**
	RD7 rice-peanuts-tomatoes
	RD7 rice-soybeans-sweet corn
	RD7 rice-garlic-mung beans
	RD7 rice-tomatoes-stringbeans
	Kao Dor-peanuts-tomatoes
	Kao Dor-tomatoes-stringbeans
	Kao Dor-chilies

Central to these cropping systems were the RD1 and (later) RD7 rice varieties, the newly released semi-dwarf rice varieties from the Department of Agriculture. Their major attributes include:

- insensitivity to photoperiods in Northern Thailand;
- a rather short crop duration of 110 days; and
- responsiveness to nitrogen fertilizer, which means, with proper management, high yielding ability.

Other practices (such as fertilizer management, regular spacing, and pest control measures) were also introduced along with the new rice cultivars .

Method of information transfer. Farmers were selected to participate in the project on the basis of their access to year-round rice field cropping—which included their right to use land and water availability. On each farm a selected cropping system was tested on an area of about half a *rai*. Training for farmers was provided by university staff before and during each cropping season. Inputs, (including seed, fertilizer, and pesticide) were provided on credit. An extension officer with a B.Sc. degree in agriculture who was assigned to the program visited the village at least three days a week to provide additional advice and information on the management of introduced crops. The management of various other aspects of these cropping systems was also backed up by Chiang Mai University's Faculty of Agriculture staff and the university also rented a piece of village land on which staff carried out their own experiments.

Farmers' participation. Out of the total 144 farms in the whole village, 28 farmers participated in the program during the first year and 26, 25, and 20 participated over the following three years, respectively. Individual farmers who participated changed from year to year; however, a total of 33 farmers in the village were exposed to the program at one time or another. Many farmers were in the project for the entire four years. The distribution of farmers who participated in the MCP program is shown in Figure 7.5. Some seven farmers who participated actually lived in the next village, San Klang, but their paddy fields were in Mae Kung.

Basmati rice

Technology available before introduction. When Basmati rice was introduced into Mae Kung in 1984, intensive cropping based on RD7 was widely practiced. In 1982 RD cultivars were grown by 47 percent of the farmers, while 39 percent used RD7 (Table 7.2): modern rice technology, which uses fertilizer and regular spacing was also widely practiced.

Table 7.2 Changes in rice cultivars grown in the wet season in Mae Kung, a village in San Pa Tong district of Chiang Mai province.

Cultivar	Cultivars(%) 1982 (1)	Counted(%) 1986 (2)	Remarks
Traditional local	**50.0**	**25.3**	
Kao Dor	12.0	1.2	early maturing
Niaw San Pa Tong	27.0	14.7	standard mid-season
Others	11.0	9.4	medium to late
Improved	**47.0**	**74.7**	
RD7	39.0	12.4	introduced in 1975 by MCP
Other RD non-glutinous	-	12.9	excluding RD7 glutinous*
RD glutinous	8.0	27.0	RD6, RD8, RD10
Basmati	-	22.3	introduced in 1983
Non-rice	3.0	-	
Total count	100	170	
No. of sample farms	76	100	

* including the recently introduced RD15 and RD23

Sources: (1) Srimongkol *et al.* (1985)

(2) Field survey, 1986.

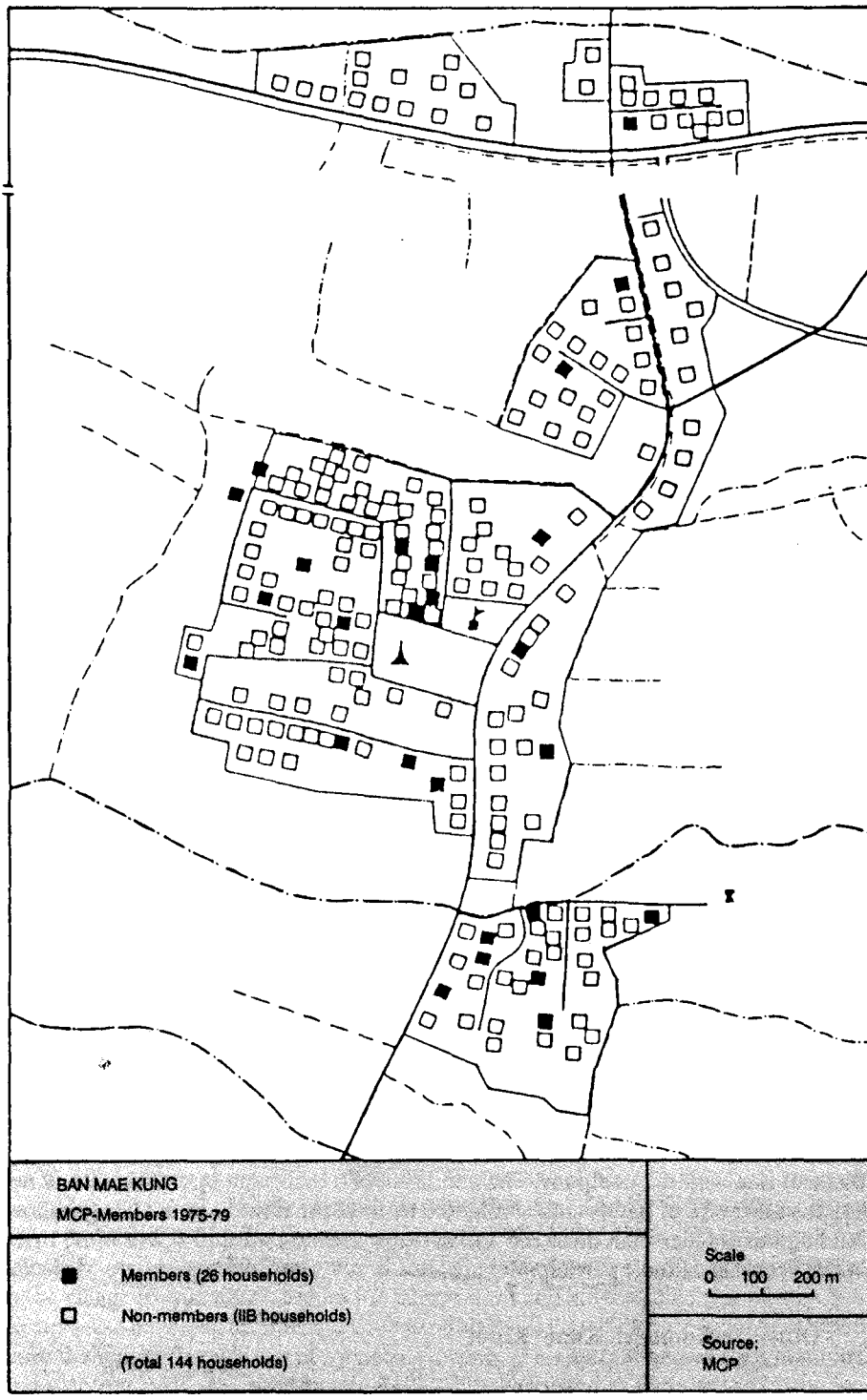


Figure 7.5 Map of Mae Kung village showing participating households in the Multiple Cropping Project (MCP) from 1975-79

Technology introduced. The new cultivars, BS1 and BS2, were about the only completely new system introduced. Farmers participating in this program were required to put more than three *rai* into Basmati production. Management practices recommended were mainly derived from the packages previously introduced for the RD rice varieties, as follows :

Recommendations for Basmati rice in Mae Kung

Agronomic practice	Recommendation
Planted area	> 3 *rai*
Rice cultivar	BS1 or BS2 (120 days)
Seedling age at transplanting	30 days
Spacing	25 x 25 cm
Seedlings/hill	3
Density (plants/*rai*)	76,800
Fertilizer application	5.5-3-0 (N-P-K) kg/*rai*
15 days from transplanting	15 kg/*rai* of 16-20-0
30 days from transplanting	15 kg/*rai* of 21-0-0
Weed control	Butachlor at 3-4 kg/*rai* three days after transplanting
Insect control	Furadan at 4 kg/*rai* 17 days after transplanting
Expected yield	500-700 kg/*rai*

Fertilizer application was recommended at 15 kg/*rai* of 16-20-0 and 21-0-0 at 15 and 30 days from transplanting, respectively. Furadan was recommended for the control of stem borers at 4 kg/*rai*. Transplanting was recommended for 30-day-old seedlings. BS1 requires 120 days from transplanting to mature.

Method of information transfer. A Basmati rice company set up an office in the village. The staff occupied the office which originally served as the MCP's Mae Kung headquarters. The company loaned the farmers original BS1 rice seed, which was to be returned at harvest time. Fertilizers and pesticides were supplied on credit. The company guaranteed, that it would buy all of the BS1 rice produced, at guaranteed prices of between 38 - 40 baht per *tang*, in the 1985 wet season. The company also provided an extension service through its office in Mae Kung and carried out some research and demonstrations on its own land in Mae Kung.

Farmer participation. In the first year 37 farmers signed contracts to produce Basmati rice with the company. The condition of a minimum operation size of not less than three *rai* of paddy land eliminated many of the farmers in the village whose holding was smaller than three *rai*. On average, farmers planted 5.5 *rai* of BS1 rice in the first year of their participation.

Other technology: Khao Kluoi

Technology available prior to introduction. *Khao Kluoi* is a mid-season cultivar long grown in the village, a traditional variety with resistance to early monsoon season flash flooding. Four farmers out of the 100 interviewed in Mae Kung reported that they had previously grown this kind of rice. However, without the pressure for

intensification, its desirable, flood resistant trait had apparently not been recognized. In Mae Kung's lowland areas, the water depth can be, at times, as deep as 50 cm; the traditional practice for coping with this was double transplanting. This method, however, used some of the older, late maturing rice varieties; thus, in these low lying fields, late harvesting became a constraint to increased crop intensity, and to double or triple cropping.

Technology introduced. *Khao Kluoi* is one of the traditional rice cultivars grown in the flood-prone areas of the Saraphi district in the Chiang Mai valley (Figure 7.6). During the village's rapid intensification of cropping systems over the last ten years farmers traveled frequently to San Pa Tong. On one of their visits some farmers from Mae Kung learned from Saraphi farmers about the potential of *Khao Kluoi* as an alternative to double transplanting. They learned that *Khao Kluoi* might enable them to increase the cropping intensity of the lower paddies despite deep-water problems, as well as save on the labor of transplanting.

Farmer participation. In 1986 seven out of the 100 farmers interviewed used *Khao Kluoi* in the manner described above. Most of them used double rice- soybean cropping systems. For two farmers this enabled them to triple crop – with rice-soybean-rice. They used *Khao Kluoi* as the first crop and the newly introduced glutinous RD10 for the third crop in the sequence.

ADOPTION AND INFORMATION FLOW

Adoption and adaptations

In 1986 all of the following new technologies were commonly practiced in the village, but most involved a number of modifications.

Chilies. Instructions were issued to participating farmers to leave the chilies until they ripened, but most farmers soon learned about the demand and good price for green chilies in Chiang Mai city and they harvested them green. Thus, the scheme to produce dried chilies failed badly and most farmers breached their contract. However, chili technology remained and farmers primarily produce chilies for the green chili market. Occasionally, when the green chili price is down, the crop may be allowed to ripen and to be processed into dried chilies. However, it is common knowledge that there will be fewer new pods set if the picking of green chilies is discontinued.

A 1985 survey showed that after rice, 50 percent of Mae Kung's farmers grew an average of 1.4 *rai* of chilies in their paddy fields. One farmer in Mae Kung, *Lung Kum*, is considered to be the master or "*guru*" of chilies. His skill includes seed selection, seed collection, and general management of the crop. Other chili growers in the village frequently go to him for information and advice. The rest of the Chili farmers also have well established Chili production skills which have been developed from their prior knowledge of tobacco growing. This system begins with planning and planting early rice, now mostly RD7, to be harvested as early as the beginning of October. Three types of fertilizer are then used. At transplanting 15-15-15 is applied with some chicken manure; this is followed by a top dressing with another formula, 14-14-21, at about the time of the first picking; then the crop has another top

dressing of urea at about six weeks. This complicated fertilizer management technique is continued between pickings throughout the long life of the crop – which might stretch to April or May. Control of certain wilt diseases is practiced by destroying affected plants before they become a source of further infestation, a practice learned from controlling tobacco and tomato viruses and introduced by the tobacco buyers and the MCP program, respectively.

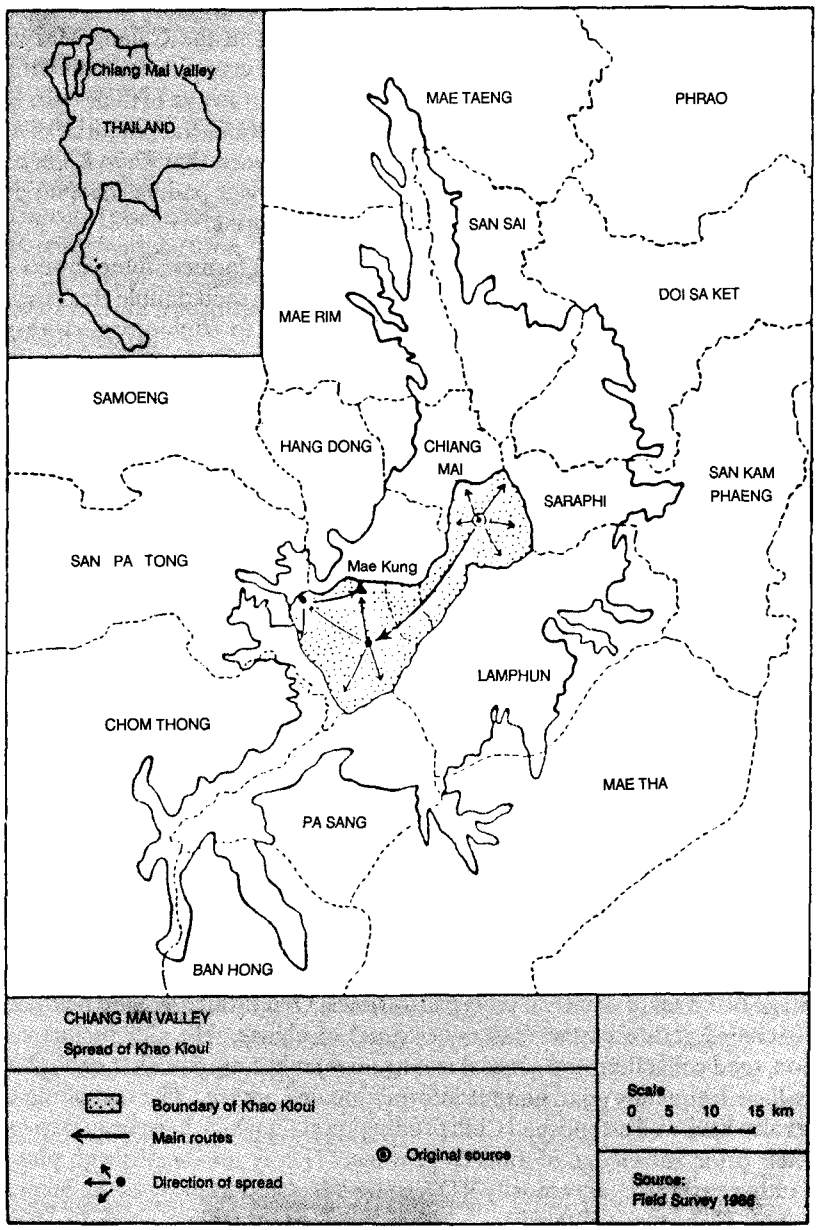


Figure 7.6 Spread of *Khao Kluoi* in the Chiang Mai valley

The MCP. In 1979 the MCP project was evaluated. Results showed that virtually all of the introduced cropping systems had not been adapted to farm conditions; that the farmers' need to grow the staple glutinous rice for home consumption; and, the lack of semi-dwarf glutinous cultivars with an acceptable eating quality were the major constraints to acceptance (Gypmantasiri *et al.* 1980). More recent visits to the village, however, have shown that, although the whole package of cropping systems was not accepted, many intensive rice-based cropping system components were adopted, some after modification. The most outstanding among the new practices adopted was "modern" rice technology, which has radically changed farmers' overall attitude toward rice production. Changes include the ready adoption of new RD rice varieties and the use of production technology that resulted in average yields of 800 - 900 kg/*rai* for RD7 and similar semi-dwarf cultivars (the average yield for Chiang Mai is some 500 kg/*rai*).

Even in 1982, before the contract production of Basmati rice, cash cropping of wet-season rice had become very common. In fact, RD7 was reported grown by 39 percent of Mae Kung farmers in 1982 (Table 7.2). Some 50 percent of the cash return from the sale of the rice goes towards financing the planting of chilies and other high-value, cool-season crops (such as cucumbers and tomatoes). The other learned advantage of RD7 is its earliness; by planting early enough, the first green chilies are harvested while prices are still high. Regular spacing of rice is another technique that is now practiced by 78 percent of the farmers in the village (Table 7.3).

Table 7.3 Adoption of regular spacing in rice in Mae Kung village, San Pa Tong district of Chiang Mai province, comparing different levels of involvement with the MCP.

Number of farmers (%)

Use of rice	Participation with MCP			
Transplanting method	Self	Relative or neighbor	No formal contact	Total
regular spacing	28 (85)	17 (94)	33 (67)	78
irregular	5 (15)	1 (6)	16 (33)	22
Total	**33 (100)**	**18 (100)**	**49 (100)**	**100**

Source: Field survey, 1986.

Basmati rice. The number of farmers growing Basmati rice had increased from 37 (in 1984) to 67 by 1986, while the average area planted by each farmer was slightly lower, at 5.0 *rai* compared with 5.5 *rai* in 1984. Between 1984 and 1986 some 16 percent of the farmers made drastic reductions in the area planted to the Basmati cash crop, from an average of 11.5 *rai* to 6.2 *rai*. A few farmers found that their desire to intensify to triple cropping was in direct conflict with the need for the early planting of Basmati rice required by the company, and some farmers found the delayed payment for their Basmati rice an obstacle to the financing of cool-season crops.

Khao Kluoi. Currently *Khao Kluoi* is grown by some ten farmers in Mae Kung on a total area of 35 *rai*. This is less than half of the estimated 80 *rai* of lower paddy in the village. The adoption of *Khao Kluoi* into intensive cropping systems has been quite recent, only in the last year or so. Thus, it is possible that planting of this crop may spread more into the lower paddy area in the next few years. In all cases, however, farmers have been able to intensify their cropping systems to at least double crop – rice-rice or rice-soybean. In two cases out of the one hundred interviewed the farmers were able to triple crop with rice-soybean-rice.

Adoption process

Farmer experimentation and adaptation are the main features of the Mae Kung adoption process. During the time lag between the MCP's introduction of intensive cropping systems based on semi-dwarf RD rice and their incorporation into farming systems, several modifications and adjustments were made. Results indicate that the experimental phase is usually carried out by a few innovative farmers, and proven practices are then picked up by neighbors, as illustrated by the adoption of regular spacing (Table 7.4). Almost half of those who were indirectly informed of the practice by the MCP tried out the practice on a small plot before large-scale adoption. By contrast, those who had seen the practice working (on a neighbor's or another's village field) adopted the practice right away. Similarly, new rice cultivars were also first tested on a small scale by a few farmers. (Table 7.5).

Spread of information to other farmers. The sources of information and seed for new rice varieties in Mae Kung are many (Table 7.6), but for the majority of farmers, other village farmers are by far the most important source of information and of seeds. However, different sources are seen as having different levels of importance. The MCP, *kaset tambon*, and the San Pa Tong Rice Station sources are crucial because they introduced the new technology into the village for the first time. Those farmers who obtained their information and new seeds from these sources were the first adopters; it was they who acted as secondary sources for the rest of the village. A similar flow of information – from the first adopters to other farmers – can also be seen in the case of regular spacing (Table 7.4).

Table 7.4 Experimentation and adoption of regular spacing of rice in Mae Kung.

(Number of farmers (%)

First adoption scale	Types of Farmers Participating in MCP			Total
	MCP participation	Relative or neighbor in MCP	No direct contact	
small*	12 (43)	4 (27)	3 (10)	19 (26)
whole area	16 (57)	11 (73)	27 (90)	54 (74)
Total	28 (100)	15 (100)	30 (100)	73 (100)

* trial plot of usually 0.5 - 1 *rai*, smaller than eventual area of adoption.

Source: Field survey, 1986.

Table 7.5 Scale of first adoption of new rice cultivars and subsequent practice in Mae Kung.

Farmer Group	Planted Area (rai)		Total Number of cases
	Year of first adoption	Current year	
small trial in first year	2.1	5.0	14
full adoption first year	3.4	3.4	63
unsatisfactory first year trial	6.1	3.7	14

Source: Field survey, 1986.

Table 7.6 Sources of information and seed for new rice cultivars in Mae Kung (% of respondents)

Source	Information	Seed
Multiple Cropping Project	6.1	6.1
Kaset Tambon	8.6	-
Tobacco contractors*	3.7	3.7
San Pa Tong Rice Station	7.4	25.9**
Neighbors and others in village	71.6	61.7

Notes: * a traditional early rice called three-month rice
** many farmers went to San Pa Tong Rice Station to obtain seed after having seen it on other village fields or after having been informed about it by *the kaset tambon.*

Source: Field survey 1986

CONCLUSIONS AND IMPLICATIONS

This study illustrates how a village information network can be responsible for all stages of technology introduction and transfer. Further, the key to the success of the network appears to be related to existing farmer knowledge and experience as well as information flow conditions.

Farmer knowledge

Through trial-and-error, farmers gain and accumulate considerable farming system perspective for their own village. As the Mae Kung case shows, land-use and cropping system patterns have been tailored to specific farms and indeed, even to

individual fields. This enables individual farmers to fit new technology into well-defined multidimensional space. For example, fitting *Khao Kluoi* into a system for a low lying field does not merely enable the traditional practice of double transplanting, it also allows multiple cropping to be practiced. As cropping intensity increases, RD7, a nonphotosensitive rice, has a role as a dry-season, cash crop. As soon as the price of non-glutinous rice drops, RD10, which is a glutinous nonphotoperiod rice can be used as an alternative.

It took Mae Kung farmers at least 15 years, i.e. after the completion of the Mae Taeng irrigation project, to effectively handle new technology and/or innovation under such diverse (physical, biological, social, and economic) conditions. At present, the village is classified as one of the most advanced villages in the district (San Pa Tong Agricultural Extension Office: personal communication).

Information flow

There are many sources of information and new technology available to the village, but they do not all have the same effect on information flow and transfer of technology. Two distinct groups of farmers may be identified in this village information network: (1) those innovative, leading farmers who are actively seeking new information and carry out trials on their own; and (2) the rest of the villagers who readily adopt an innovation after they have seen how it works. Figure 7.7 shows the different stages of information flow and the transfer of technology in which village information networks predominate.

Stage 1: Introduction. At this stage, the group of leading farmers in the village who are always searching for new ideas and technology obtains new information from various sources.

Stage 2: Trial and adoption. Next, the leading farmers conduct on-farm experiments and often make modifications to fit local conditions. This is almost always a condition for their adoption of the new technology. New practices are often first tried out on a small scale and adopted over the whole farm if found successful.

Stage 3: Diffusion. The next stage, adoption by emulators in the village, goes much faster. Relatives and neighbors who have actually seen the performance of the innovation in the field, take it up more readily. Unlike trial adoption of innovators, the adoption by emulators usually takes place over the whole farm.

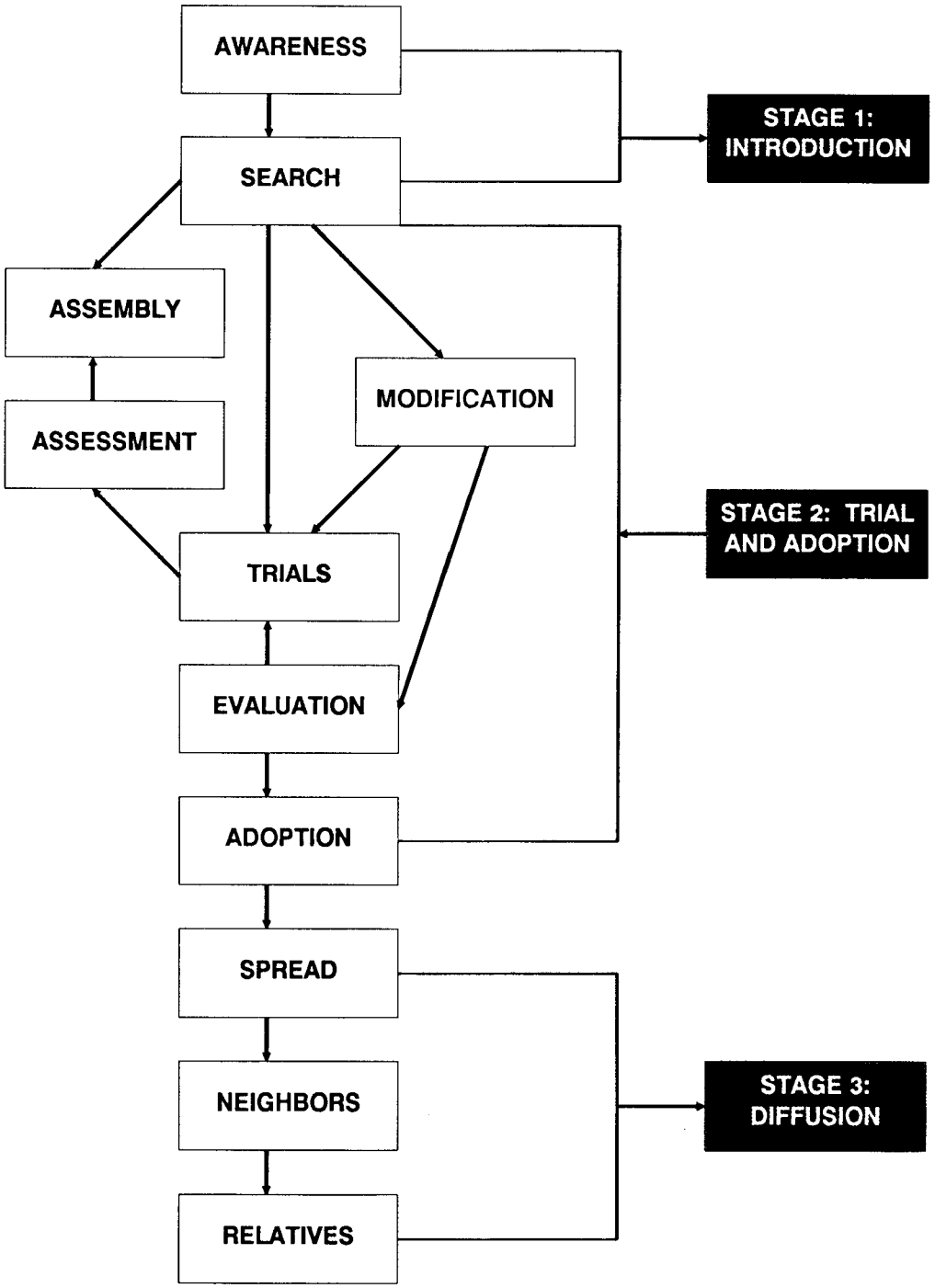


Figure 7.7 The process of farmer adoption and spread of new (improved) technology in a Northern village.

Chapter Eight

Conclusions and Considerations

Technological change in agriculture in Northern Thailand is portrayed in this study as a gradual process that relies on the incorporation of one type of technology into another. In some cases this is achieved by modifying and integrating modern technologies into conventional practices. In others, traditional technology is incorporated into modern farming systems. On-farm innovations and adaptations of technology to local conditions are found to be important components of technological progress in Northern Thailand.

CONCLUSIONS

This study has shown that farmers received two types of technological information – formal and informal information – from various sources through various means. Table 8.1 summarizes the significance of different media used as disseminating agencies.

Table 8.1 A Summary of the current use of disseminating media in agricultural extension.

Disseminating Agency	Media					
	Verbal	Printed	Radio	TV	Video	Other
1. extension service	***	**	**	-	-	*
2. private firms	***	**	***	*	*	*
3. local traders	***	-	-	-	-	-

Notes: *** most commonly used
** commonly used
* rarely used

It is evident that government agencies are the major producers and channels for the dissemination of formal information. However, the field survey also indicates that in nonpoverty areas, television has become the most important source of agricultural information (including technological information) measured in terms of frequency of reception. Radio turns out to be a less popular source of all types of information, except price information.

Although the current extension system is not the most frequent source of agricultural information, it remains the second most frequent source. However, the system relies heavily on the (officially recruited) human resource component – not only in terms of skills but also in terms of personal motivation and aspiration. In the areas where district and *tambon* officers are highly competent and efficient, the impact is still locality-specific.

In view of the fact that the tasks required of extension workers under the Sixth National Economic and Social Development Plan will be increasingly demanding, extension services will have to become multidimensional, not limited to promoting yield increases of a few major crops. Given this new scenario, the extension system which relies primarily on personal and group communication, may need to include more powerful supplementary means.

Recently, commercial firms have increasingly participated in disseminating formal information although they may not produce the information themselves. These private firms have direct access to technical information from the public sector, including universities and research communities, and from foreign parent firms. These private firms, through their business practices, have established a commercial network at the regional and, in some cases, national level through local district and village traders.

Assessments have been made with respect to the equity of agricultural information transferred through the Training and Visit system. The 1,035 sample survey revealed that technical information is unevenly disseminated among various socioeconomic and gender groups. Farmers in the less-advantaged groups, e.g. those not belonging to economic or financial groups, noncontact farmers, and female farmers, tend to have less access to agricultural information. The difference is most marked between contact farmers and noncontact farmers. For these less-advantaged groups, television, in terms of frequency of reception, is also the most important source of information. Field studies also suggest that farmers who have less access to information tend to have less knowledge of agrochemicals and agronomic practices, as well as a relatively lower level of agronomic performance.

A village case study further indicates that information is not disseminated into a vacuum. How the information is absorbed depends on the social infrastructure which determines who will get the information first. Under the current mode of communication where person-to-person contact predominates, the village elite (who are assigned by public authorities to act as bridges between the village and the outside world) have become, through their office and expected role, "regulators" or "gatekeepers" of the information flow.

Our study on social infrastructure further reveals that groups in the village are generally formed by government agencies and commercial firms to disseminate information and facilitate technology transfer. The leaders of the groups tend to circulate among the village elite. Moreover, the first-come-first-served principle applied to group membership and recruitment provides better opportunities to those who have close relations with the village elite. However, the fact that groups

are found to be relatively successful does not imply that information is evenly spread within the village. There are nongroup members who are left out of the group-diffusion process.

The last three chapters indicate that the bulk of informal information is generated and disseminated by farmers themselves through the "village information network." The network encompasses various interlinking relationships, e.g., kinship, patron and client, neighborhood, labor exchange group, and so on. These relationships may expand beyond one village, one province, and sometimes beyond one region.

Since a village information network is a natural phenomenon, its speed of information delivery is gradual. Yet, the soybean study indicates that the speed of delivery of information through a village community network can be accelerated if a clear monetary gain is perceived. In addition, the local commercial information system, which is closely linked to the village information network, has proved that it reacts quickly to changes in both market and supply potential while the current public information network is geared mainly toward production matters.

In Chapter 5, the soybean case study, which is an important cash crop in the Lower North, clearly illustrates how a new seed variety spread over 70,000 *rai* (to cover four provinces in the Lower Northern region) in three years without the need for government support. The seeds were originally stolen from a government research station before they were officially released and transferred from one village to another through the informal network and finally reached other provinces through commercial and informal contractee networks.

Under the informal soybean production and trade credit system which prevails in the Lower North, information exchange among traders and farmers is frequent and mutually beneficial. Farmers convey their demand for physical inputs and technical information to their traders. The traders, having a wider circle of contacts, communicate with other traders in other locations. And, by such channels, information exchange takes place.

The farmer profile and another village study (described in the last chapter) trace the dynamics of the technology adoption process of individual farmers and of the community. The farmer profile reveals a remarkable heterogeneity in the absorptive capacity of farmers. Leading farmers who often seek out new ideas and technology can be found in villages in advanced, rainfed areas. These farmers obtain new information from various sources and are often engaged in on-farm experiments and modification of new technologies. They are hard-working, innovative farmers with Schumpeterian entrepreneurship tendencies. Some of these farmers exceed the achievements of their peers and are considered "masters" or *gurus* of a specific skill.

These early-adopters or leading farmers understand basic scientific principles in simplified terms. They have a common quality, i.e. understanding both *how* and *why* a cultivating practice is done. These farmers constantly search for technologies through listening, traveling, and, (even) pirating. We found that many of them read voraciously and repeatedly, (pamphlets, brochures, booklets, and newspapers) regarding agricultural techniques – despite the fact that they only have a few years of education. These leading farmers are not always wealthy because they have invested a great deal in farm experiments, some of which are risky.

General or average farmers obtain their knowledge from ancestors, neighbors, and their own experience. They are the emulators, adopting a technology only after

it is commercially proven. They usually know how things should be done although they often do not know exactly why. However, this group of farmers is not as aggressive as the first in their search for technology.

The last group of farmers, the passive farmers, is found to be constrained in technological search and adoption activities by its lack of resources. These passive farmers include those in less advantaged areas, and the part-time and migrant farmers who have moved into newly opened, hilly land. The kind of eagerness and alertness found among the leading farmers is absent in this last group. However, this lack of motivation has a valid economic explanation. As one farmer in a rainfed backward village succinctly put it, "Without water, knowing more is not useful." For these farmers, knowing more will only increase their level of frustration, not their productivity.

The village study in the Upper Northern region shows that farmers successfully incorporate one type of information and technology into another. Illustrations of adapted knowledge were provided by examples of farmers' ability to multiply the cropping of a traditional rice variety, and various methods using local or waste materials to handle contact herbicides.

Farmers do not adopt a new technology on a full scale as soon as they have come across it. Innovative farmers generally experiment with the new technology on a small plot first. If incremental gains do not exceed incremental costs in terms of management, labor, or capital, then this new technology is not adopted.

Adoption is a gradual process. A technology may be adopted, discarded and later readopted as physical and market environments change. A period of fifteen years was required for villagers to incorporate introduced intensive cropping systems based on semi-dwarf nonphotosensitive rice into local farming systems. And during this period numerous modifications and adjustments were continuously made.

The speed of information delivery through an informal network is generally slow. Regular spacing through string lining was adopted in a province located in the soybean belt in the Lower North about ten years ago. Also, mechanized sowing has recently made regular spacing by means of string lining unnecessary. However, it was found that in 1986, an innovative farmer in a village in the Upper Northern province adopted regular spacing for soybean for the first time after having seen the practice in a nearby village.

CONSIDERATIONS

Overall considerations

This study was done as preparatory research prior to the design of policy. As such, no specific recommendations were proposed on policies to be implemented. What the research has shown are certain considerations that should be borne in mind. These are:

- Firstly, a large pool of useful traditional technologies and modern technologies adapted by farmers exist in different locations in the region. In addition to the more formal sources of technology such as government agencies, research communities, and commercial enterprises, knowledge and experience of the leading farmers should be screened, compiled, and disseminated widely.
- Secondly, more attention should be paid to the private dissemination system. The private information network should be recognized and employed for speedy diffusion. However, it is important to note that there could be misleading information generated by private agents. Therefore, their activities should also be monitored to prevent inaccuracy and commercial exploitation.
- Lastly, as watching television has become a part of rural life (especially for those residing in irrigated and advanced rainfed areas), television and audio-visual materials could be used to support current extension activities. Currently, agricultural programs account for less than one percent of the total television airing time in all regions of Thailand.

Television could be a very useful medium in a number of ways. It is an efficient means to disseminate policy issues as it reaches a large audience simultaneously. As the current public information system relies heavily on the personal mode of transfer, the scale of impact cannot be expected to be substantial and instantaneous as it depends on frequency of visits and, most importantly, on the quality and aspirations of extension officers. Television could also be used to activate commercial and village information networks into operation. Indeed, television may be used to stimulate farmers' demand for extension services.

Specific considerations

- A program of technology transfer needs to distinguish target farmers. The effects on the further flow of information would differ markedly for those aiming at the leading and more innovative farmers as well as other intermediate farmers. Information disseminated through the media (such as radio and television) would reduce the search costs of innovative farmers. While the major sources of information for the majority of farmers in the village is their neighbors and other farmers in the village, it is important to recognize that the introduction stage is important for the subsequent spread of the technology to reach the bulk of the village population.
- There is an inherent bias in the current information absorption system through elite village groups. Therefore there is an apparent need for a more equitable means of transfer. However it is also important to note that mass communication will render the role of the "gatekeeper" or "regulator" redundant only in the area of general information. Information and technology that are crop specific and require binding commitments from farmers still need the support of a group.

- Television is more popular than radio as a means of diffusing information in Northern Thailand. The most popular television channel reported was Channel 7, which has national coverage. The government's regional network (Channel 8) is the least popular channel owing (partly) to poor reception and its restricted network. Therefore an agricultural information system via television should not be limited to public-sector participation if extensive coverage to be achieved.
- Sensitivity to physical, biological, environmental, agronomic, and socioeconomic differences will be key to the success of any agricultural information transfer program for Thailand.
- Enthusiasm toward potentially useful information among advanced farmers suggests that there is a need to provide farmers with continuing education to a greater extent than is currently provided by the agricultural extension structure.
- A program which will direct information toward farmers who adopt without verification would be most helpful if the information were as complete as possible. As important would be a general education program to raise the level of understanding of present farming and cropping systems so that when farmers attempt to fit new practices into existing ones, the process would be more systematic and less random.
- Powerful information transfer mechanisms operate through the business sector. The speed and efficiency of the private sector's information transfer mechanisms might be positive in a number of cases while it could be potentially harmful to the public in other cases. Private merchants and business leaders could, if they chose, promote technologies whose benefits are uncertain.
- The relationship that exists between farmers and their *thao kae* is more intricate than one would realize. The assumption that farmers are individual agents acting entirely on their own may be questioned.
- It is useful to note that if radio broadcasting is to be used to advertize or relay information to farmers, any announcement should be made before 0700 hrs or between 1200 to 1259 hrs.
- Information delivered by the media that expects to reach the emulator group of farmers must be certain that the practices suggested are within their economic and technical capability. In this respect, information on how to do certain things a little better, e.g., how to count insects coupled with knowledge on damage threshold (how many insects before damage is significant enough to warrant spraying), hunger signs in crops, and symptoms that could help diagnose diseases are some examples of methods that might be effectively transferred using the media.
- Large field or village-scale pest management is something that could be encouraged by building upon the tradition of communal collaboration that exists in the North. Extension programs that would educate farmers on the effects of pesticides on the environment (including pesticide resistance and the decimation of predators) and the long-term effects of selective herbicides would be very helpful.

- It would be appropriate to demonstrate how to perform a simple germination test on a television program.
- It should be noted that farmers' felt needs are concentrated in planting methods and on-farm practices which are particularly suited to dissemination by audio-visual mass media.
- The need for information on such important issues as updated government policies, prices, and market situations – supplied in simple, understandable language cannot be overlooked. The use of television and radio for this purpose can be further explored and strengthened.

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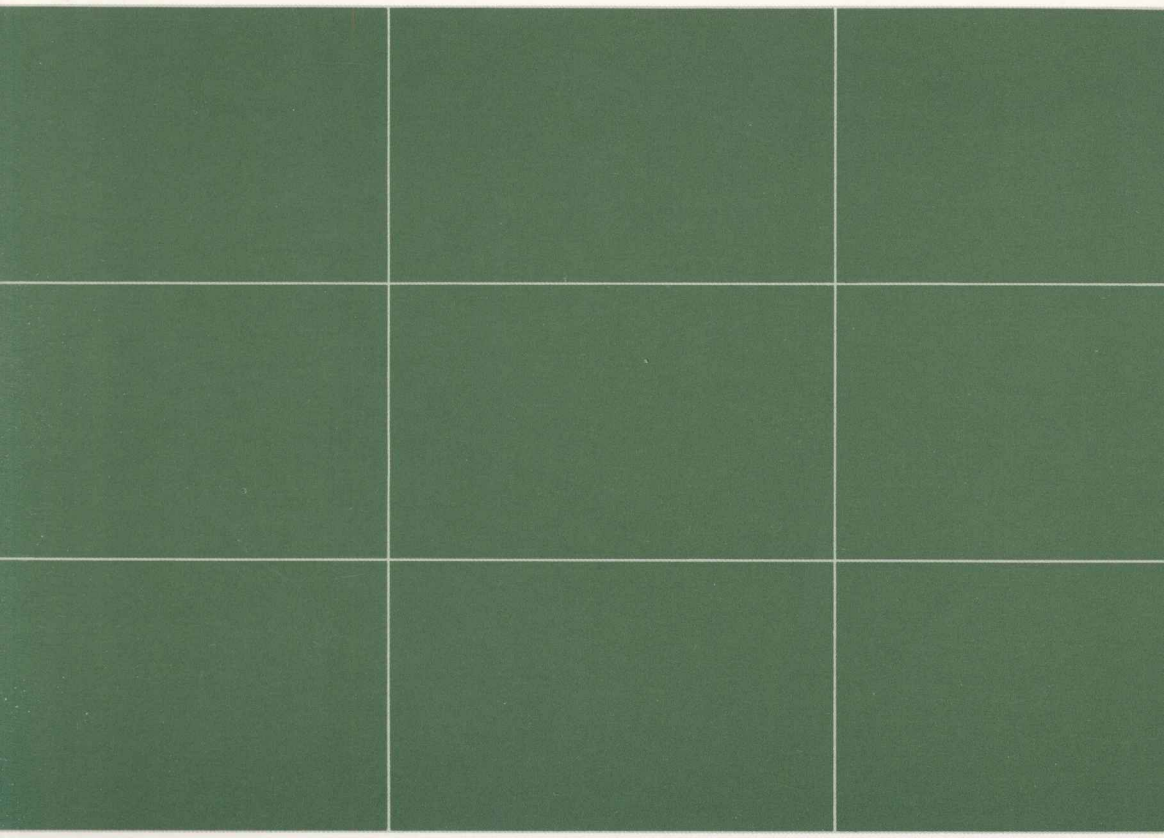
Agricultural Information and Technological Change in Northern Thailand

The Asian Development Bank proposed to look into the possibility of financing the Department of Agricultural Extension to set up a unit to produce audio-visual materials and broadcast programs to disseminate information to farmers. The research was directed toward the existing sources of technology information available. The Agriculture and Rural Development Program of the Thailand Development Research Institute conducted this component of the project. This monograph presents our findings.



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