THE ALLOCATION OF FAMILY RESOURCES TO FARM AND NON-FARM ACTIVITIES IN A VILLAGE IN NORTHERN THAILAND

By

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ABSTRACT

THE ALLOCATION OF FAMILY RESOURCES
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The Multiple Cropping Project (MCP) at Chiang Mai University has attempted to develop cropping systems which are biologically stable and economically viable for the Chiang Mai Valley. The ultimate goal of the MCP is the adoption of these systems by farmers in order that these might be a substantial increase in the farm income and living standard of the farmers. The project is now in the period of measuring its impacts on farmer with references to changes in cropping systems and income. There is evidence of resistance on the part of farm families to adopt systems that, on the basis of analysis to date, would significantly increase income. This study was designed to provide some insights as to the basis for this resistance. The objectives of the study are as follows:

1) To describe in detail Ban Pa Mark village and the individual households of a 30 family sample of its inhabitants for the two-fold purpose of (a) identifying and measuring critical constraints surrounding the management of typical cropping patterns and (b) specifying representative farms and individual household cases for more detailed analysis.

2) To develop a LP model to incorporate the constraints and to involve the representative farms and household cases from objective 1 in such a way as to determine possible reasons for dry season cropping being less than its full potential.

3) To use the model developed in objective 2 to specify appropriate dry season cropping patterns consistent with the resource endowments and assumed constraints for the various representative farms and case households.

4) To interpret the linear programming solution for their implications for further research and extension program implementation in the MCP at Chiang Mai University.

Ban Pa Mark, a village twenty kilometers south from Chiang Mai was chosen to provide daily record data from July 1, 1973 to June 30, 1974 from the 30 households on labor utilization, employment, cash and non-cash income and expenditure. These data are explored and analyzed in a descriptive fashion to determine the nature of family household constraints.

The case households and representative farms were selected on the basis of resource constraints for the subsequent analysis using a poly-period linear programming model.

The main findings and implications are as follows:

1) Each household represents a unique case with regard to resource endowment and other constraints thus each situation will have its own best cropping system.

2) Even with the crop well established in the community there is room for possible resource reallocation to improve the farming system and the level of farm income.

3) The existence of a farmer who is doing better than the LP solution for his farm suggests a need to continually monitor on the part of the MCP of what farmers are doing and to introduce change only as it can be demonstrated consistent with the resource situation for individual farm families.

4) Any multiple cropping system in the area must be rice based.

5) The domination of women in production of dry season crops may be very significant for the extension and outreach personnel of the MCP.

6) The dominant role of exchange labor implies that it is difficult for a cropping system regarded as an innovation to be accepted by one farmer if it is not generally acceptable to the entire community.

7) The cultural inflexibility of time allocated to non-farm community commitment implies that crops specified should not compete for capital and labor in the high priority non-farming period and the cash flow management problem is found in the non-farm employment and the management of crop inventories rather than in producing crops that can be harvested in time of primary need.

To Kanya

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CHAPTER 1

INTRODUCTION

1.1 Background

Thailand, like any other developing country, relies to a great extent on the agricultural sector. It is therefore expected to perform all the roles often cited by development economists, i.e., supply of food, capital formation and supply of labor to the development of economy at large. In 1976, 70 percent of the country's total working population was engaged in agricultural employment. Agriculture contributes about 30 percent of Gross Domestic Product and the bulk of Thailand's exports are agricultural products.

Traditionally, the agricultural economy of Thailand has been dominated by a single crop . . . rice. Since 1950 more crops have been introduced and the area under nonrice crops has expanded greatly. During the 10 year period ending in 1976, the area planted in rice rose by 18 percent while the area in all other cash crops quadrupled. This corresponds to the 1972-76 Third National Development Plan which stated that for one of the highest priorities in agricultural development, a policy guideline is "to accelerate the diversification and improvement of agricultural production" (Royal Thai Government, 1973; p. 12).

The 1976-79 Fourth National Development Plan states the same important position of agriculture. The policy guidelines emphasized diversification and the growth of agricultural production through

intensification and increased productivity to ensure adequate food supplies for the growing population and to increase the farm income and the standard of living in the farming community (Royal Thai Government, 1976; p. 167).

Multiple cropping is a means to serve these policy purposes since multiple cropping is the practice of planting in a given field a crop or crops two or more times in one year. Land and labor will be used more intensively. New technology and the introduction of new farming practices may need to be used. Multiple cropping also is a means of organizing production to better utilize water and energy resources.

The environment of Northern Thailand is particularly favorable for multiple cropping. It is concentrated in the valley basin and it is supplied with water by a large number of streams, many of which flow year round. The Chiang Mai Valley is one of the largest and is the most important river valley in Northern Thailand. The two main towns are Chiang Mai and Lumpoon. It has an area of 1,500 square kilometers which supports a population of one million people. It is one of the chief sources of the country's food supplies as well as being a primary center for political and economic activities.

Although crop yields in Northern Thailand are higher than other parts of Thailand, they are still low in comparison with their potential. Compared to elsewhere in Thailand, the Valley is relatively well endowed with roads and irrigation facilities. The potential for intensified crop production in this area is very substantial: the soil, climate and water resources of the low land area are favorable and the technology for increasing both yield and land use intensity is being continually developed. So it is possible to substantially increase the intensity of land use through multiple cropping.

Research on the development and adoption of improved cropping systems in Thailand has been conducted as part of the Great Chao Praya Basin Development Project to develop high yielding crop varieties, and combinations of crops and cropping patterns suitable for the Central Region of Thailand (ADC, 1974; pp. 126-132).

The most comprehensive program of research in multiple cropping systems in Thailand has been carried out by the Multiple Cropping Project (MCP) located at Chiang Mai University. Initiated in 1969, financed jointly by the Ford Foundation and the Thai government, it has the following objectives:

a) to develop, on a pilot basis, ecologically sound systems of multiple cropping with soil and water management designed to substantially increase farm income

b) to get all agencies of government and private business concerned with agriculture to develop a "package of services" for farmers that will enable them to make the best possible use in both economics and production terms, of the improved production technology and other resources

c) to monitor the adoption process in order to continuously evaluate the project and improve its impacts on the village farm community

To achieve the above objectives, work plans were set into 5 stages:

1) inventory of farm systems

2) synthesis of prototypical farming systems

3) technology design and farm system validation

4) evaluation of impact of the farms

5) implementation of multiple cropping process in village development

At the beginning of the project, 1969-70, most of the time was spent in developing, building facilities, equipment and an experimental farm of 35 rai[1] area. The inventory of farming systems was conducted during 1970-74 by a socioeconomic team to study the resource base and the behavior of farmers (Chiang Mai University, 1975), assess the market potential for various crops and evaluate the capacity and behavior of the marketing system (Wiboonpongse and Thodey, 1974). Analyses of the optimum multiple cropping systems (Thodey and Sektheera, 1974) were developed and at the same time, the synthesis of prototypical farming systems was also conducted at the experimental farm (Chiang Mai University, 1974). During 1975-76 the technology and farm system validation was carried out at the Village of Ban Harn Keow and Ban Mai Kuang about 20 kilometers south of the University. The evaluation of impact on the farms was scheduled for the period 1977-78 and the implementation of multiple cropping process in village development will follow.

The agronomy program includes observations on agroclimatic conditions at the experimental plots, variety trials and cultivation methods for cereal, oil and vegetable crops. The work also includes production trials on six alternative cropping systems at the experimental farm.

The socioeconomic program deals with production economic and farm management, socioeconomic surveys and marketing studies (Chiang Mai University, 1974).

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[1]One rai (the unit of land measurement in Thailand) is equal to 1600 square meters, .16 hectares or .395 acres.

1.2 Need for the Study

The ultimate goal of the Multiple Cropping Project, apart from developing multiple cropping systems adapted to Northern Thailand, is the adoption of these systems by farmers in order that there might be a substantial increase in the farm income and the living standard of the farmers. Two studies have been done in the socioeconomic program to gain a better understanding of the process by which farmers make their farm-related decisions. One focused on physical factors affecting crops choice (see Multiple Cropping Project Annual Report 1975), another focused on social factors (Ireson, 1976). Neither of these studies attempted to study a farm household as an integral unit of production, consumption and exchange. To do so requires a careful assessment of the resource endowments of individual families and to study how these resources are allocated toward the fulfillment of family goals. Lack of understanding of these facets of the Multiple Cropping Project handicaps the project management in its direction of future research and extension needs. The project is now in its scheduled period of measuring its impacts on farmers with reference to changes in cropping systems and changes in family income. There is evidence that there has been resistance on the part of farm families to adopt systems that, on the basis of analysis to date, would significantly increase income. There is need for further research which will provide insights as to why this resistance exists. It is in response to the need that this thesis is undertaken.

1.3 Related Research

1.3.1 Farming Systems/Multiple Cropping Research

There is a vast literature dealing with cropping systems and cropping patterns research.[2] The increasing number of books, journal articles and unpublished papers is an indication of the vast resources that are being channeled into this kind of research (especially in the international research institutes) in recent years. The motivation for this is the realization that, with the increasing ratio of population to arable land, more intensive use of land must be undertaken to provide food for a growing world population. A further motivation is that on most of the continents the agricultural production system is represented by growers working small farms with little hope of working a larger farm. Their household income is low and intensification in land use provides one hope of increasing farm income.

The increases in the literature on cropping systems/patterns research is due not only to the increase in the research investment in this area but also to its interdisciplinary nature making it difficult to decide what is a part and what should be excluded from the literature of relevant research.

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[2] "Cropping systems" is defined as the cropping patterns utilized on a given farm and their interactions with farm resources, other farm enterprises and the available technology which determine their makeup. "Cropping patterns" specifically refers to the yearly sequence and special arrangement of crops or of crop and fallow on a given year. (From R. R. Harwood, farmer-oriented research aimed at crop intensification, in Proceedings, Cropping Systems Workshops, IRRI 1975, appendix, Los Banos, Laguna: International Rice Research Institute, 1975).

In response to the growing interest in cropping systems research worldwide and the lack of a comprehensive listing of literature dealing with the subject and problem concerning it, the Library and Documentation Center of the International Rice Research Institute (IRRI) was commissioned to prepare an international bibliography on cropping systems. The product of that effort was published in August 1976 and claims to "embrace all published and unpublished technical works dealing with all aspects of cropping system produced in 1973 and 1974" (Ramos, 1976). It is unquestionably the most comprehensive listing of literature available dealing with cropping systems. It contains 1416 references on cropping system research arranged according to the following classifications: general works, followed by studies concentrated on physiology and biochemistry, crop ecology and meteorology, crop varieties and breedings, agronomy, irrigation/drainage/water management and crop water requirements, mechanization, plant protection, economic and sociological aspects of multiple cropping research. According to the listings less than 10 percent of the literature is devoted to economic aspects including works in statistics and statistical methods. This section does include the published works from MCP in Chiang Mai published during 1973-74 period. Only 6 citations in total referred to the relationship between labor utilization and cropping systems according to the title.

The conclusion to be reached is that research in farming/cropping systems has received a renewed interest in recent years but that the economic analysis constitutes a minor share.

1.3.2 Research on Distribution of Farm Labor Between Male and Female Family Member

Throughout the present study, there is a thread of interest pertaining to the female level of participation in farm and nonfarm income producing activities of the rural household. This area of interest has also received renewed attention as people have become more concerned about women's role in development. The primary interest in this thesis is to identify the contributing roles that various family members play in supplying their labor services to the economic activities of the household. Research on the division of labor in agriculture between sexes has taken many forms and has been conducted in many parts of the world.

Baumann (1928) conducted an extensive survey of the division of labor by sex in Africa. He concluded that men's labor input on farms consisted of clearing bush before the land was tilled. It was confined to a short period whereas work done by women continued throughout the agricultural year. Women were in charge of growing root crops, kitchen vegetables and spices.

Meek (1931) studies the Jukun-speaking people of Nigeria and his findings concerning the division of labor between men and women agreed with Baumann's.

Edel's study of the Chiga of Western Uganda (1957) appears to agree with Baumann's observations. The division of labor among the Chiga suggested that the entire responsibility of agricultural production rested mostly with women who turn soil, sowed, weeded and harvested. Men clear the land and that was all. Women were also responsible for domestic work.

Spencer's work on Sierra Leone, using mostly cross-sectional data, concentrated on a detailed microeconomic evaluation of the effects of female participation and household decision making on income generation. His study shows that women in the Integrated Agricultural Development Project of Sierra Leone play a substantial role in the cultivation of a "development crop" (swamp rice) using improved technology which proved incorrect the hypothesis that women do not use the improved technology introduced by agricultural development project.

Esther Boserup (1970) discussed the division of work within African agriculture according to two systems; one in which food production is cared for by women with little help from men, and one where food is produced by men with relatively little help from women. These two are the female and male farming systems. In her view, most traditional African agricultural systems are female farming systems where women do most of the routine work related to food crop production. She presented quantitative evidence of different work inputs in terms of hours per week according to sex in eight African countries. She found that men spend an average of 15 hours per week on agricultural work, while women spend between 15 and 20 hours per week. In some areas of Gambia and Uganda, men work less than 10 hours a week in agriculture while in some areas in Kenya, Uganda and Congo (Brazzaville) women do agricultural work for as many as 25 hours a week. In percentage terms, it was found that women account for between 70-90 percent of agricultural work. This high participation of women in agricultural work can be partly explained by a number of factors: women tend to marry older men so that they continue to work in the field long

after their husbands are too old; there are more men away from home with wage employment; and more boys than girls go to school and there is a higher drop out rate for girls. While Boserup's statistics may not be entirely representative for Africa as a whole, they do point to the large contribution of women in African agrarian systems.

Simmon's (1976) research on women in Zaria involved several surveys, i.e., consumption survey, survey of food grain marketing system and several small studies of the adoption of innovations. The extent of women's economic participation in village commerce was significant in the consumption survey while men function largely as producers and traders of agricultural raw materials. These initial findings on the divisions of labor led her to explore systematically and quantitatively the economics of women's money-earning enterprises in three villages in Zaria provinces in Northern Nigeria.

The findings from research in Asia are not unlike those of Africa. Kahn (1976) reports that in a Pakistan village a typical woman works for 14 hours in a normal day, i.e., a day outside the hectic harvesting or sowing seasons. Activities include animal care, collecting, carrying and preparing fodder, milking, churning, cooking and carrying food to the fields. Planting, harvesting and processing seasons intensify the physical chores of the village women. During the wheat harvest, for example, women spend about 10 hours a day in the fields. They also take part in husking, winnowing and storing of wheat. They help their husbands in rice transplanting and sowing. Picking cotton and chilies are also major annual activities. A rural woman performs all the duties of a wife, a mother and a daughter-in-law and simultaneously shares the burden of field work with her husband.

Castillo (1977) reports that for the Philippines in addition to being farm laborer, the housewife "participates in the management not only of matters concerning household and family but also of farming and livelihood. In the Philippines, the decision making pattern in the Filipino household is more egalitarian and joint-with-husband rather than patriarchal. The Filipino wife is the keeper of family finances." This indicates the degree of authority and influence which a woman exercise in farm and family matters and also the quality of her input into the decision making process and what might be done to enhance the content of what she contributes.

The above studies are of interest and are related to the present study. However, the focus of the present investigation will be more on the cooperative and integrative aspects of family member labor utilization than on the unique roles for the adult female.

1.3.3 Linear Programming in Farm Planning

Prantilla and Heady (1972) state the multiple cropping problem concisely by claiming that the goal is to "minimize the number of days that land is made idle." They see the problem as best handled by employing linear programming techniques which for given resource constraints and cropping opportunities, the solution will provide an optimum use of limited land (with a minimum period idle) as well as an optimum use of labor, the most abundant resource in the small farm household. The focus of cropping systems research in irrigated areas is on the choice of dry season crops, the combination of those crops and the sequencing of them through time. If the concept involved in programming are suitable for cropping system analysis, then modification of linear programming to incorporate the time dimension make this

methodology even more suitable. Polyperiod linear programming (PLP) can handle the time dimension quite adequately because of the timing of inflow and outflow and maintenance of reserves between periods are critical in present agricultural production systems. Realistic analysis of the situation requires careful attention to the linkage between periods and to intertemporal resource allocation. PLP is designed precisely to incorporate such an interperiod relationship (Crawford, et. al., 1977).

The mathematical framework of a LP matrix requires a number of important assumptions to be made about the nature of the process being represented. These assumptions include additivity of resources and activities, linearity of objective function, non-negativity of the decision variables, divisibility of activities and resources, finiteness of the activities and resources restrictions, proportionality of activity levels to resources and single value expectations (Agrawal and Heady, 1972; 31-33).

Although for many purposes, these assumptions may provide a useful simplification of reality, risk considerations are also important in small holder decision making and some method of incorporating risk factor into a LP framework is desirable (Kenedy Francisco, 1974; Upton and Casey, 1974).

There have been several studies designed to test the hypothesis that small farm operators behave rationally (Yotopoulos, 1968; Hopper, 1965 and Schultz, 1964). Such studies generally conclude that producers, even in the most backward areas, act as profit maximizers within their technological and institutional constraints. Other

findings conclude that peasant farmers seek status (Wolf, 1966) and security (De Wilde, 1967) as objectives. Norman (1973, 43) found that farmers in Zaria, Northern Nigeria have both security and profit maximization in their goal set, since he learned that farmers in this area used inputs in a manner consistent with a profit maximizing objective but also adopted intercropping as an insurance against risk. Heyer (1971) has stressed the "difficulty of deciding what it is that the subsistence farmer aims for," and suggests that ensuring an adequate food supply in drought years, producing a suitably varied diet, maximizing the number of people fed and maximizing the market value of output can be alternative objectives.

Connor (1954) discusses various hypotheses concerning the motives of decision makers. He enumerates them as follows:

1. maximizing profits
2. producing at a level below the profit maximizing output
3. producing at a level above the profit maximizing output
4. preserving status quo
5. maximizing some preference function
6. survival of the firm
7. maximizing sales after obtaining some minimum profit level
8. selecting a course of action consistent with a satisficing principle

The complexity of behavior and decisions of small scale farmers, especially when the household is viewed as an integrated group, makes it difficult to accurately model the rural household. Any choice of analytic methodology is bound to be a gross oversimplification of reality.

There are critics of the use of linear programming for farm planning in peasant agriculture (Upton, 1974). Criticism usually relates to the assumptions pertaining to its basically static nature, the perfect knowledge assumption regarding prices, technology, etc., and the need to specify a single objective function. Nevertheless, for a relatively low cost analytical device, it does provide the most adequate analytical procedure for planning whole farm situations than any of the commonly used techniques available to us.

1.4 Objectives of the Study

The general purpose of the study is to determine the effect that certain heretofore ignored constraints on farm planning have on the intensity of dry season cropping in an area known for its dependable year round irrigation. Some of the constraints to be studied include labor needed to maintain the traditional noncropping farm activities (such as supplementary livestock enterprises, vegetables grown in the "kitchen plot" and the harvesting of native fruits) and labor committed to off-farm non-income generating activities (such as community service, religious functions, weddings, funerals, etc.). Also attention will be given to the extent to which the specialized functions of males and females in crop production both by activity and by season of the year may serve to constrain choice of dry season crops. In addition, the need for the family to supply basic foodstuffs (especially rice) as well as to meet certain family cash consumption needs on a seasonal basis (particularly religious commitments) will be examined for their influence on decisions regarding cropping patterns. Other constraints customary in farm management analysis such as farm credit and the

availability of family and hired labor during critical crop production periods will also be considered.

Specific objectives of the study may be stated as follows:

1) to describe in detail Ban Pa Mark village and the individual households of a 30 family sample of its inhabitants for the two-fold purpose of (a) identifying and measuring critical constraints surrounding the management of typical cropping patterns, and (b) specifying representative farms and individual household cases for more detailed analysis
2) to develop a linear programming model to incorporate the constraints and to involve the representative farms and household cases from objective 1 in such a way as to determine possible reasons for dry season cropping being less than its apparent full potential
3) to use the model developed in objective 2 to specify the most appropriate dry season cropping patterns consistent with the resource endowments and assumed constraints for the various representative farms and case households
4) to interpret the linear programming solutions for their implications for further research and extension program implementation in the Multiple Cropping Project at Chiang Mai University.

1.5 Methodology

1.5.1 Data

Data for this thesis came mainly from agro-socioeconomic studies of Multiple Cropping Project (MCP) with which the researcher has been

working closely in designing, collecting and supervising the acquisition of data. In 1971 the MCP began a longitudinal study in two lowland villages in the Hang Dong District including Ban Pa Mark. This study aimed to collect a wide range of agro-socioeconomic data on a semi-annual basis, i.e., at the end of rainy and dry seasons. It was found that the six month interval was too long for farmers to recall accurate information on crops, employment, income and expenditures. As a result, an intensive study of Ban Pa Mark was conducted involving a sample of 30 households[2] including some of those contained in the original sample.

Detailed information was collected daily from the 30 households from July 1, 1973 to June 30, 1974. The main items of information collected were: all labor (male, female, children, hired and exchange), as well as power and supplies used in the production of each crop. Specifically:

- the employment of each household member in economic activities
- the cash and non-cash expenditure on food and other items
- all cash and non-cash income

In addition, time and motion observations were made of all labor operations. Each plot was surveyed to enable these observations to be converted to a common unit (man hours per rai or tang[3] per rai).

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[2]The 30 households constituted a sample from a total of 44 households in the village of Ban Pa Mark.

[3]"Tang" is a local unit of yield measurement approximately equal to 10.0 kilograms of paddy rice.

Residents of Ban Pa Mark were employed as enumerators to collect information from each household and also to observe family members in their work. Each day the enumerators had to spend at least ten minutes for an entire year with the farmer to get information of each day's cropping activities, utilization of labor, income and expenditure apart from observing them working in the field.

The survey data were aggregated into 13 periods of 28 days each and some were published in report form by the project. These reports provided some of the needed information for this study. However, for this study detailed information on each household was required. This was obtained from original field schedules and summary sheets obtained by the researcher during a one month visit to Chiang Mai University in July, 1978.

1.5.2 Procedures

The first step taken to fulfill the thesis objectives will be to analyze in a descriptive fashion the data referred to above for the purpose of determining the nature of the family household constraints. This activity will also guide in the selection of case households and representative farms for the subsequent analysis using a polyperiod linear programming model.

The effects of household resource endowments and other types of constraints on farm organization and family income will be analyzed using a polyperiod linear programming model wherein the following comparisons will be made:

1) case households within farm size strata will be compared on the basis of 1973-74 existing conditions with programmed

solutions utilizing the resource conditions found in the actual cases. This will include a labor constraint in which the actual reported amount of family labor allocated to non-crop farm production and to off-farm community services will be maintained.

2) The programmed results from the previous step involving the described labor constraint will be compared with programmed results obtained by relaxing the labor constraint. This is to suppose that the above constraints are basically unchangeable. This comparison will give an indication of the importance of taking this type of constraint into account while doing farm planning. The experiment will be referred to as a comparison between "the constrained system" with the "unconstrained system" with regard to specialized family labor activities.

3) The final comparison will be directed toward analyzing the effect of farm size on the allocation of family resources with regard to farm reorganization and family income. For this phase, the LP solution from the constrained system for the representative farms for the four farm size groups will be compared.

1.6 Organization of the Study

The physical and institutional features of the Village of Ban Pa Mark for their possible influences on household behavior will first be undertaken. The findings will be presented in Chapter 2.

Three chapters will deal with issues of farm family labor allocation and utilization. The first (Chapter 3) will examine the

relationships between labor and the use of land. Out of this discussion, the case households will be selected. The second chapter on labor utilization (Chapter 4) will concentrate on how family labor is used in the farm business with attention given to crop labor by enterprise requirement, by sex, by source, and by annual seasonal distribution. Chapter 5 will follow a similar format but will concern itself with both the off-farm labor activities as well as a summary of the utilization in both farm and nonfarm work.

From the discussion on the use of farm inputs, the attention will then be diverted (in Chapter 6) to the rewards accruing to farm family resources in the form of income and asset ownership. This will be followed in Chapter 7 with an examination of how rural households spent their money for business and other purposes.

The previous chapters will have identified the resource levels and decision rules that will be incorporated in the model to be explained in Chapter 8. Then in Chapter 9 the model will be utilized to conduct the experiments described above. The results of using the model will be presented in Chapter 9 with the findings and implications presented in the final chapter.

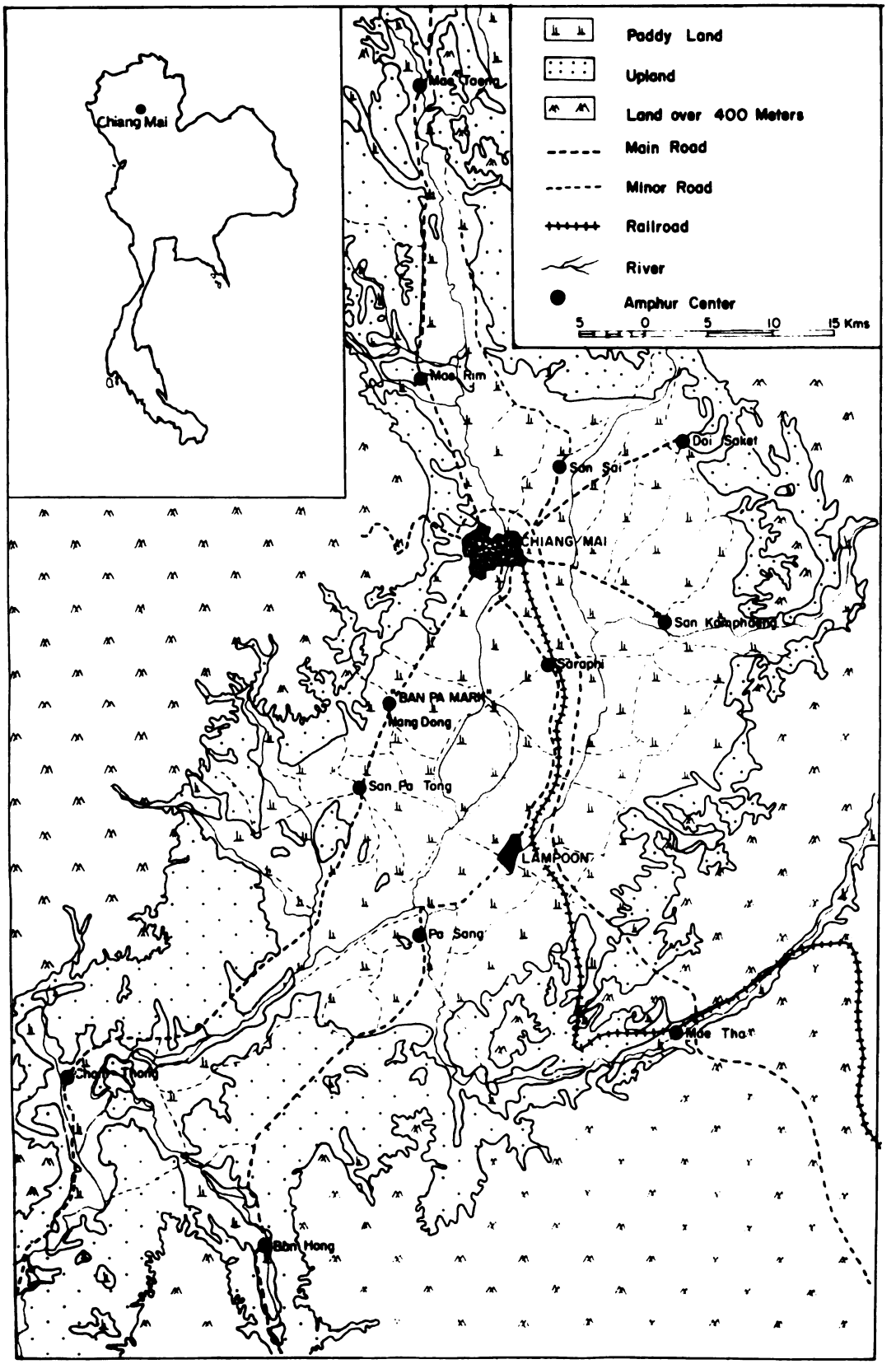
CHAPTER 2

DESCRIPTION OF THE STUDY AREA

2.1 The Village of Ban Pa Mark

Ban Pa Mark is located three kilometers from amphur Hang Dong (district center) and twenty kilometers south of Chiang Mai city (see Map 1). The road to Hang Dong is a two lane paved highway that is quite busy since it is part of the main highway that leads into other districts such as San Pa Tong, Chom Tong and other provinces, i.e. Mae Hong Son. To reach Ban Pa Mark, travel south along this road toward Hang Dong, pass an open market before the district office, turn left on a well graded laterite road, go for about three kilometers, and the destination will be reached by crossing the bridge to the left.

The village itself has three subvillages, Ban Pa Mark, Ban Don Ka and Ban Muang Nga. The subvillages are surrounded on all sides by open rice fields and are connected by an old narrow winding road. As in most of the northern villages, the houses are clustered on the highest land, along both sides of the road. Each compound has up to five houses with no fence between the home lots. Many trees grow around the edge of the compound, giving a nice cooling shade. Each household is composed of a house, a rice barn, a pig pen, a buffalo shade and perhaps a small kitchen plot. The houses are generally uniform in construction, made of wood floor, raised about six feet off the ground



Map of Chiang Mai Area

and with clay tile roof. The open area under the house is conveniently used for carpentering, handicrafting, cleaning, sorting crops, resting and for neighbors to gather. The rice storage barns are of similar shape. They are supported by six to eight wooden posts which must be strong to bear the weight of the rice. The size of the barn varies according to the household's rice production and thus it is an indication of the family wealth and income. Most of the families raise a few pigs in the adjacent pen and some raise chicken and ducks allowed to run freely about the compound. Buffalo and cows are usually tied under a tree in the compound or at the rice barn post. Almost every household has its own well which has water all year round and from which the water is drawn for drinking and domestic uses. Sanitation has been introduced into the village; newly built bathing rooms near the well and lavatories (separate outbuilding) are evident.

2.1.1 Demographic Features

In July 1973, the village contained 69 households of which 44 households are in Ban Pa Mark, 11 households in Ban Don Ka and 14 households in Ban Muang Nga. At the time of the village survey, there were 300 persons, composed of 105 male, 107 female and 88 children. The birth rate is relatively low (3 percent) due to economic reasons and the accessibility to knowledge and facilities for a family planning program. The female heads of household interviewed prefer to have an average of four children, two sons and two daughters, since they perceive that both sexes can perform work equally well and can have more or less the same responsibility. The desire to have children to provide labor is offset by the cost of raising and educating a child.

The death rate in the village is quite low. There is no evidence of serious epidemic or sickness. The villagers themselves are relatively well nourished and strong. Local diet seems unappetizing for the urban people but is composed of adequate protein, minerals and other nutrients. In case of sickness, medicines are firstly purchased at the pharmacies in the Hang Dong district center and/or the local trained doctors are visited and then to the Chiang Mai hospital. The deaths reported are mostly old age and from accidents.

Few families have migrated to this village mainly because they have taken over the farm from their parents, or some men are married to the village women and moved in with her families. The migration out from the village has been due also to marriage and jobs in town. Not many young men and women permanently leave the farm to study and/or work in town, due to few full time job opportunities. In 1978, in the village itself, there were two households, one with a carving business, and another with a furniture business, which together employ 7-8 male and female skilled laborers. There is also a porcelain factory at the entrance of the village which is expanding and employs some of the villagers.

2.1.2 Physical

a. Soil Type

Ban Pa Mark is on low flat land with soil of a clay-loam, mostly classified as part of the Hang Dong series soil type. According to Dent and Onakupt (1966), "Hang-Dong soils are Low Humic Gley soil. The top soil is loam to clay loam and the subsoil is clay loam to sandy

clay loam. Hang Dong soil adjacent to Lampang soils of the lower parts of the low terrace (as in Ban Pa Mark) have a sandy clay loam subsoil from a depth of 40 to 60 centimeters. Structure is predominantly fine to medium, subangular blocky to a depth of 1 meter or more. Consistency is hard when dry and firm, slightly sticky and slightly plastic when wet. Scattered iron-manganese concretions may occur in the deeper subsoil."

Because of this type of soil, farmers have drainage problems in the rainy season but since it has a high water table, it is favorable for the dry season crops.

b. Rainfall

Ban Pa Mark has a tropical climate which is characterized by distinct wet and dry seasons mollified by the mountainous topography of the Chiang Mai Valley. Tropical climate has three major seasons. The rainy season lasts from May until October but occasionally from June to November while the Valley is under the influence of the South West Monsoon. The average rainfall is about 1,200 millimeters a year, with from 85 to 90 percent occurring in the rainy season.[1] Typhoons from South China bring substantial amounts of rainfall during October and November. On the average, September is the wettest month and January the driest, but any of the months from November through April may be exceptionally dry in some years. In late June and early July, temporary drought may occur and persist for two to three weeks resulting in severe damage to the young rice crop. Rainfall becomes certain

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[1]Meteorological Department, Climatological Data of Thailand 1951-1970, Bangkok, Thailand, 1971.

again in July, reaching the peak in September, then receding in mid-October. The rainy season is followed by the cool dry season from November to February and the hot dry season from March to early May.

c. Irrigation

The cultivated land in Ban Pa Mark, a fertile loamy soil, requires irrigation in the dry season. Also supplementary irrigation water is necessary for the young rice crop in the rainy season. The cultivation of a second rice crop and some upland dry season crops are entirely dependent on irrigation.

Before 1971, the village cultivation depended on the rainfall or small streams flowing through the village or wells and dry season cropping was minimally practiced. After the completion of the Royal Irrigation Department Mae Taeng Project in 1971,[2] the village has been dependent on irrigation water which has been delivered to the fields by means of a traditional irrigation system.[3] Because the new water source provides more reliable rainy season water it permits a large area of land to be farmed in the dry season. This has resulted in a dramatic change in the use of farmers' labor and resources. Some dry season crops such as soybeans, peanuts, and garlic are now being planted. Additional cash inputs are needed but in so doing additional cash income is provided. Farmers' time is used more effectively for crops, but additional labor must be provided also to maintain the

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[2]After the Mae Taeng Irrigation System completed in 1971, the dry season area under cultivation increased from 8493 rai to 74,731 rai in 1974. Rapeepun Sektheera and Alan R. Thodey, "Irrigation Systems in the Chiang Mai Valley: Organization and Management." Agricultural Economics Report No. 6, Chiang Mai University, p. 88.

[3]For more detail on traditional irrigation systems, see IBID, pp. 81-95.

irrigation canal. A small annual contribution is made to the water users' association serving the village. This contribution varies according to land size and is used for local maintenance material but beyond this, no charge is made for water. The availability of water has increased the value of land in this area.

2.1.3 Institutions and Ban Pa Mark Development

a. Infrastructure

Perhaps the greatest factor facilitating the development of the Chiang Mai Valley into a market economy has been the development of the transportation system. The highway system has been improved and expanded as well as the feeder roads. The road from Chiang Mai to Hang Dong is well travelled and runs to other districts and provinces. There are two roads linking the village of Ban Pa Mark to Hang Dong. One is a new well paved government road which runs east to Saraphi located on the opposite side of the Ping River, another is a small winding traditional road which runs through and around villages. This road, even though small is good in all seasons. Transportation for goods and people in and out of the village has become very regular. Although special arrangement has to be made for a pick-up truck to carry crops into town, there are regular buses for children and people who study and work in town. The ox-cart is declining in numbers and importance. In 1978 two households in Ban Pa Mark owned small Japanese pick-up trucks which they use for carrying their own crops and servicing their neighboring farms. Farmers have nearby motorist transportation available at a reasonable cost.

There is no pipe-water in the village. Each household depends on the well in their compound for water. There is no electricity, even though it is to be found at the district center, two kilometers away. Kerosene is used for light, wood is used for fuel. Naturally there is no television but nearly every household has a battery operated radio. There is no school in the village. Children must go to school in the adjacent village. A health clinic is not found in the village but there is one in the district center. Farm supplies ranging from seeds, fertilizer and chemical spray to tools and small tractors are available at the shops in the district center. The shops there carry a wide range of both farm and household consumer goods. Bicycles, motorcycles, and small tractors can be purchased by installment with a good credit record. In the village itself, there are some small shops selling vegetables, cooking ingredients, packed snacks, cigarettes, drinks, and candy. One of the shops is owned and operated by a household in the sample. A small diesel rice mill in the middle of the village is owned by a local merchant who charges the going rate for the service. Most households mill their rice here. Until 1975, there was no temple, families had to go to a temple in another village. However, in 1975 the site of an abandoned temple was used for a new temple. The villagers constructed a new residence for a monk and a temporary worship hall and invited a monk from Lampoon to reside. The new temple and permanent worship hall was finished in 1978 and a few more monks have now moved to this new temple even though the temple has not been recognized as the official temple for the village. The headman is now involved in the process of getting such permission. The villagers have already transferred their merit making activities to their local Wat (temple).

Institutions to support agriculture have been very slow to develop, especially farmer organizations and institutionalized credit. A farmers' association with joint responsibility for the debts of association members and to provide a better basis for providing supplies for production including credit required to intensify production has been introduced in the area. Trips for farmers to visit farmer organizations in other village was arranged by the MCP but the development of one still seems so far away. Farmers still have some problems in obtaining long term credit and some problems in having a timely supply of high quality seed and other supplies.

Marketing facilities are quite well developed in the Chiang Mai Valley. Chiang Mai center crop market is quite active in supplying goods to other retail markets in other provinces and Bangkok. Farmers in Ban Pa Mark either sell their products at the farm or take them to the market center. They usually use their rice barn to store crops like soybeans and peanuts for a higher price. The decision to sell at the farm or at the market depends on the price-cost differential. If the trouble and expense of renting a truck to take their crop to Chiang Mai themselves is not covered by the price differential received, they would sell to local merchants who buy crops from numerous farmers and resell them in the market. Some of these merchants apparently have developed a good relationship with farmers who seem willing and satisfied to sell the product to them rather than to seek a higher price in the market.

b. Administrative Structure

The Thai government has a pyramidal administrative structure with five major levels: the central government at the top, the 71 changwads second, the 414 amphurs (districts) third and the 3650 tambols (community) fourth, and the 50,000 muban (hamlets) at the base. Ban Pa Mark ranks fifth in the administrative structure. The head of this muban, Puyaiban, is a senior and fairly well-to-do farmer. This position is elective, often prestigious but not paid. Puyaiban Pa Mark has been chosen by Puyaibans from among their own members in conjunction with the head of the amphur (the Nai amphur) to be Kamnan of the Tambol Ban Wan, too.

Puyaiban and Kamnan are for most farmers the primary contacts with government officials. Their main tasks are to gather statistics (for census), to settle minor disputes, to advise villagers on agriculture and health and to serve as a channel of communication between the villagers and the higher levels of government.

c. Conclusion

From this brief overview of the environment within which Ban Pa Mark farmers carry out their work, there are few institutional constraints to the development of agricultural production.

Attention is now directed to the types of constraints over which individual families may have some control.

CHAPTER 3

HOUSEHOLD CONSTRAINTS ON AGRICULTURAL PRODUCTION

3.1 Introduction

The previous chapter described the environment within which the Ban Pa Mark household functions as a producing, consuming and social unit. Given that environment, the purpose of this chapter is to examine individual households more closely in order to identify and to determine the extent to which certain conditions may serve as constraints for the linear programming analysis to be done later in the thesis.

The attributes described in the previous chapter are, on the whole, not subject to change by the actions of a single household and, for the most part, affect one household one family about the same way as they do another. The attributes to be discussed below pertain to resource endowments under the control of individual households but, in reality, may be difficult to alter except in some long term sense. They vary among households and this variation may go a long way in explaining differences among families in such economic indicators as per capita income, possession of material goods and quality of housing.

3.2 Land and Land Use

Land is a cherished asset in any culture. In addition to being prized in its own right, the amount of land operated, its fertility and

the kinds and amounts of crops grown on it will, to a great extent, determine the level of income that a family will enjoy from farm sources. The aspects of land and its use to be discussed here include the area of land holdings by household, the matter of fragmentation of land, tenure of land and cropping patterns in use. The paragraphs to follow will summarize general findings. Those interested in detail for individual households may find them in the appendix.

3.2.1 Land Holdings

The area of land operated by individual families is shown in Table 3.1 in the appendix. A summary of individual household data are tabulated in Table 3.1 The range in farm size is from 1.79 to 24.25 with a mean of 11.64 rai. The unequal distribution of land is noted by the observation that the 10 percent of the farms on the low end of size scale operate only 2 percent of the land area and that 40 percent of the farms operate but 23 percent of the land area. The upper 20 percent of the families operate 34 percent of the land area. Later in the study a comparison between land distribution and income distribution will be made.

3.2.2 Land Fragmentation

The number of separate land parcels operated by a family and their location having bearing on the efficiency with which resources, particularly labor, are utilized and may enter into the decision of what individual crops will be grown. The number and size of individual pieces of land managed by a family may be governed in part by traditional land transfer procedures. In Thailand the inheritance custom

Table 3.1

Distribution of Land Area Operated per Household

Size Class (rai)	Farms			Area			
	Number	Percent	Accumulative %	Rai per Household	Rai	Percent of Total	Accumulative
Less than 2.5	2	6.7	6.7	1.87	3.75	1.1	1.1
2.5 - 4.99	1	3.3	10.0	3.04	3.04	.9	2.0
5.0 - 7.49	2	6.7	16.7	5.96	11.92	3.4	5.4
7.5 - 9.99	7	23.3	40.0	8.70	60.89	17.4	22.8
10.0-12.49	7	23.3	63.3	11.49	80.41	23.0	45.8
12.5-14.99	5	16.7	80.0	13.99	69.96	20.0	65.8
15.0-17.49	3	10.0	90.0	16.35	49.04	14.1	79.9
17.5 and over	3	10.0	100.0	23.38	70.14	20.1	100
TOTAL	30	100	xxx	11.64	349.15	100	xxx

calls for the division of land equally among children, male or female. This means, when they are married both man and woman can bring land into the household. Further, the matter of land fragmentation is related to the availability and size of parcels for sale when a farmer attempts to buy land to expand his business. If land becomes available to a potential buyer, it is quite likely that it will not border the land he already owns.

The number of noncontiguous fields, the plots per field and their respective areas are shown for each household in Appendix Table 3.1. When summarized on the basis of farm size we note, as might be expected, that the largest farms have the most noncontiguous fields (Table 3.2). The 8 farms in the smallest quartile by farm size average 1.4 fields whereas those in the large farm size quartile average 2.9 fields. Interestingly also, the size of field in the large farms is about 64 percent larger than found on the smallest farms.

The size of plot within field is the area considered by the farmer to be appropriate for good water and crop management. The average size plot within fields for households ranges from .22 to .49 rai but a safe generalization is that there will be about 3 plots to make a rai regardless of the size of farm overall.

How important is the matter of land fragmentation for the purposes of this study? It is granted that the number of separate parcels, their individual land areas and their respective distances from the family dwelling can be a factor in choice of the amount and kind of crops to be grown. However, in the analysis to follow, the matter will be ignored for the following reasons: (1) seventy percent of the

Table 3.2

Non-Contiguous Fields and Plots within Fields by Farm Size Groups

Item	Farm Size Class								All Farms	
	Small		Lower Middle		Upper Middle		Large			
Field Distribution	Farms (No.)	Percent	Farms (No.)	Percent	Farms (No.)	Percent	Farms (No.)	Percent	Farms (No.)	Percent
1	5	62	1	14	5	71	1	12	12	40
2	3	38	4	57	0		2	25	9	30
3	0	0	2	29	1	14	2	25	5	17
4	0	0	0	0	1	14	3	38	4	13
Total	8	100	7	100	7	100	8	100	30	100
Fields per Household	1.4		2.1		1.7		2.9		2.0	
Plots per Household	17.1		31.1		37.3		52.2		34.5	
Plots/Field	12.4		14.5		21.8		18.2		17.0	
Rai/Field	3.9		4.6		7.4		6.4		5.7	
Rai/Plot	.32		.32		.34		.35		.34	

households have only 1 or 2 fields, (2) all fields are within walking distance from the dwelling, (3) all fields in the village are very similar with regard to fertility, water availability, drainage and other such management considerations and, finally, the matter of incorporating the problem of fragmentation into a household-firm linear programming model is highly intractable.

3.2.3 Land Tenure

The effect of land tenure on income distribution, economic incentives and political power are quite apparent among the countries of the world with a dominant agricultural production sub-sector. It affects the level of production, technology and determines the interpersonal distribution of production and income.

The level of tenancy is low in this village. Only 3, or 10 percent, of the sample households operated as full tenants and one of these families was renting from parents without having to pay rent (Table 3.3). A third of the sample households own all of the land[1] they farm and the remaining 57 percent have been able to expand their farm land base by renting additional land. About a fifth of all land cultivated is rented in one season or both under some kind of rental arrangement. Many of the rental agreements are between relatives and the amount of rent paid in cash or kind varies according to individual

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[1] Most households have either "Bai Chang" (reserve license) or "Nor Sor" title (exploitation testimonial) which provides permission to occupy land temporarily without the right to transfer until the land is under a full title deed (Chanode Tidin).

Table 3.3

Land Ownership, Land Rented and Rental Rates

Tenure Pattern	No. of Farms	Land Area/Farm (rai) Owned	Rented	Total	Average Rent Per Rai (฿)
Ownership only	10	10.54	0	10.54	----
Tenants only[1]	2	0	9.53	9.53	217
Own plus rent					
Rent Wet Season Only	10	9.21	3.50	12.71	642
Rent Dry Season Only	4	8.74	.69	9.43	564
Rent All Year	3	14.75	3.33	18.08	1094
Average All Farms[1]	30	9.22	2.42	11.64	539

[1]One household renting from parents rent-free not included.

circumstances. One tenant pays 30 percent of crops produced. Others pay up to 50 percent of the rice crop. In dry season some farmers will grow crops on rented land but the rent paid is tied to the rainy season crop. Because of these situations, it is difficult to generalize as to the true market condition for rented land and the amount of rent paid per rai varies widely from farm to farm (see Appendix Table 3.1). Nevertheless, from Table 3.3 it appears safe to say that dry season rental rates are lower than rainy season rates even though some dry season crops may have higher profit potential than rainy season rice.

In the analysis of case farms to follow some will be cases involving rented land. However, there is no evidence that rented land is managed differently than owned land. Therefore, it will not be considered a constraint to cropping decisions. The cost of land rent will be deducted from projected net income in cases where appropriate.

3.2.3.1 Land Use

Cultivated land in the Chiang Mai Valley can be distinguished into three utilization categories; paddy land, upland and orchards. Land where flooded rice could be grown is paddy, while the cultivated area that is too elevated for inundation is considered upland. With respect to the orchards, this is mostly used in the growing of lumyai (a tropical tree fruit). Land in the studied area is utilized mostly as paddy. Each household compound contains an area used for vegetables, native fruit and care of livestock. This compound area is excluded from the discussion of cultivated area and from Table 3.3. The paddy land is usually inundated in the rainy season but with the irrigation and a suitable drainage system, it can be used for dry season crops.

During the 1973 rainy season, all thirty households under study planted on the average of 11.64 rai, almost all in glutinous rice. Apart from climatological suitability, rice growing is traditionally regarded as the basic staff of life for the Thai farmers. It is necessary for then to grow enough rice for their families for the year and it is a disgrace to have to buy rice. Thus, growing one's own rice is preferred even if to means to forego some income earning from other crop activities. Some farms may use the nursery area to plant soybeans which are intended to provide some seed for the dry season soybean production.

During the following dry season they planted on the average 10.25 rai per farm or 88 percent of the average farm size of 11.64 rai. The dry season land area was utilized on the average as follows: 4.12 rai (40 percent of dry season land) in dry season rice, 5.34 rai (52 percent) in soybeans, .69 rai (7 percent) in peanuts and .10 (1 percent) in garlic (see Table 3.4).

Table 3.4

Area per Farm and Dry Season Crop and Cropping Intensity Index by Farm Size Group

	Farm Size Group				
	Small	L. Middle	U. Middle	Large	Total
Dry Season Crop Area					
Rice	3.64	2.39	3.63	6.55	4.12
Soybeans	1.80	5.23	6.04	8.37	5.34
Peanuts	.22	.23	1.55	.81	.69
Garlic	.14	.19	.05	.01	.10
Total	5.80	8.04	11.28	15.74	10.25
Total Land	5.43	9.88	12.68	18.48	11.64
Intensity Index	207	180	189	185	188

From Table 3.4 in which land use has been organized by farm size group it can be observed that the amount of soybean increases absolutely and relatively as farm size increases whereas garlic decreases absolutely and relatively as farm size increases.

The crop intensity index[2] averaged 22 points higher on farms in the small farm quartile by farm size than for the farms in the large size quartile. The cropping intensity index ranged from 147 to 270 and averaged 188 for the samples (see Appendix Table 3.2). When household heads interviewed in July 1978 were asked why they chose one dry season crop over another, they responded with the following: higher expected

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[2] $\frac{\text{Dry Season Crop Area} * 100}{\text{Total Land Area}} + 100 = \text{Cropping Intensity Index}$ because 100 percent of land is used in the rainy season.

yield, expected price, easy to grow, land suitability, water availability, capital availability for seed and fertilizer (peanuts and garlic) and labor availability.

3.2.3.2 Existing Cropping Systems

Rice is the staff of life in Thailand and glutinous rice (126 day traditional varieties, not high yielding varieties) is the preferred form for consumption in the Chiang Mai area. One can safely generalize that all available land on individual farms will be prepared as paddy for this crop in the rainy season. The nursery for rice may be prepared as early as June and as late as the end of July. Of course, the planting date for rainy season rice will determine the harvesting period and thus effect the starting date for potential dry season crops. Figure 3.1 identifies ten crop sequencing patterns found in the thirty households. They are summarized below:

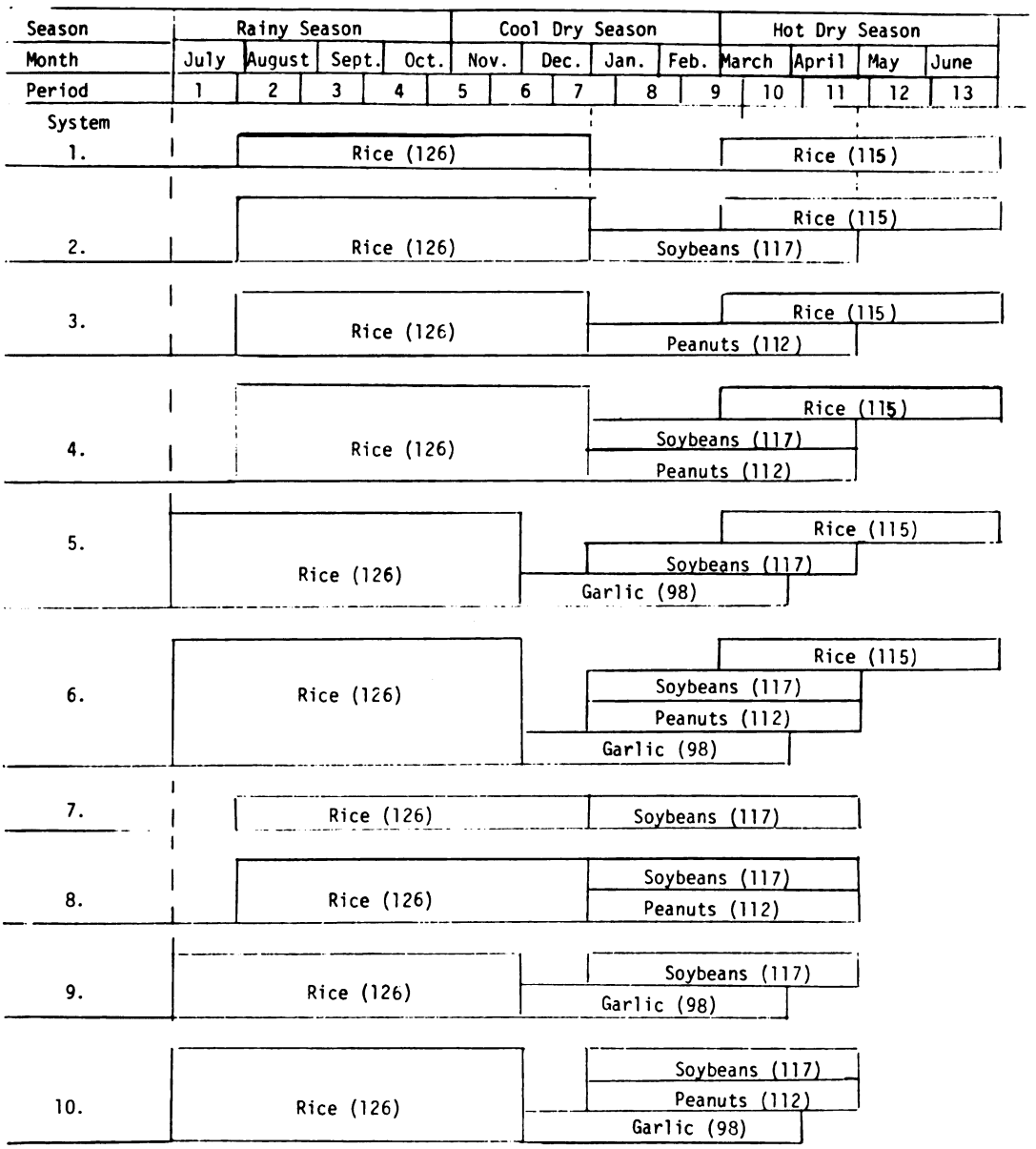
System No.	Rainy Season followed by --
1	Dry season rice
2	Dry season rice with soybeans
3	Dry season rice with peanuts
4	Dry season rice with soybeans and peanuts
5	Dry season rice with soybeans and garlic
6	Dry season rice with soybeans and peanuts
7	Soybeans only
8	Soybeans and peanuts
9	Soybeans and garlic
10	Soybeans, peanuts, and garlic

Figure 3.1 was prepared to reflect usual periods on which crops are grown and should not be interpreted as showing the only periods that they can be grown. With irrigation water available in the dry season, many possibilities are open according to the unique circumstances of individual families. The depicted simplification was done to accommodate the modeling to follow. After examination of individual household data, it became evident that any modeling effort employing the linear programming method that functions within the time and financial constraints of the typical graduate student would fall short of simulating the true management behavior of the Thai household. The primary reason for this is that farmers manage their labor and other resources on a day to day (if not hour to hour) basis rather than weekly, monthly or other uniform time block through the year. Their actions also impinge upon such other things as weather conditions of the day or general state of health or energy.

Even describing activities on a period basis delineates sharp differences among farms as can be seen by comparing Figures 3.1.1 and 3.1.2. Household number 37 has the highest cropping intensity index in the sample and has some of each of the 5 crops grown in the area. In period seven we observe participation in 10 different activities involving work on all five crops. Whereas household number 45 following the simplest system never has more than three activities reported in a single period. The latter system can be easily modeled. The former one can be modeled but at great expense.

3.3 Family Composition and Labor Force

The primary unit in Thai society is the family. Unlike many traditional societies where the household is characterized as extended



Note: Numbers in parentheses represent number of days in the field within the designated periods.

Figure 3.1 Existing Cropping Systems in Ban Pa Mark

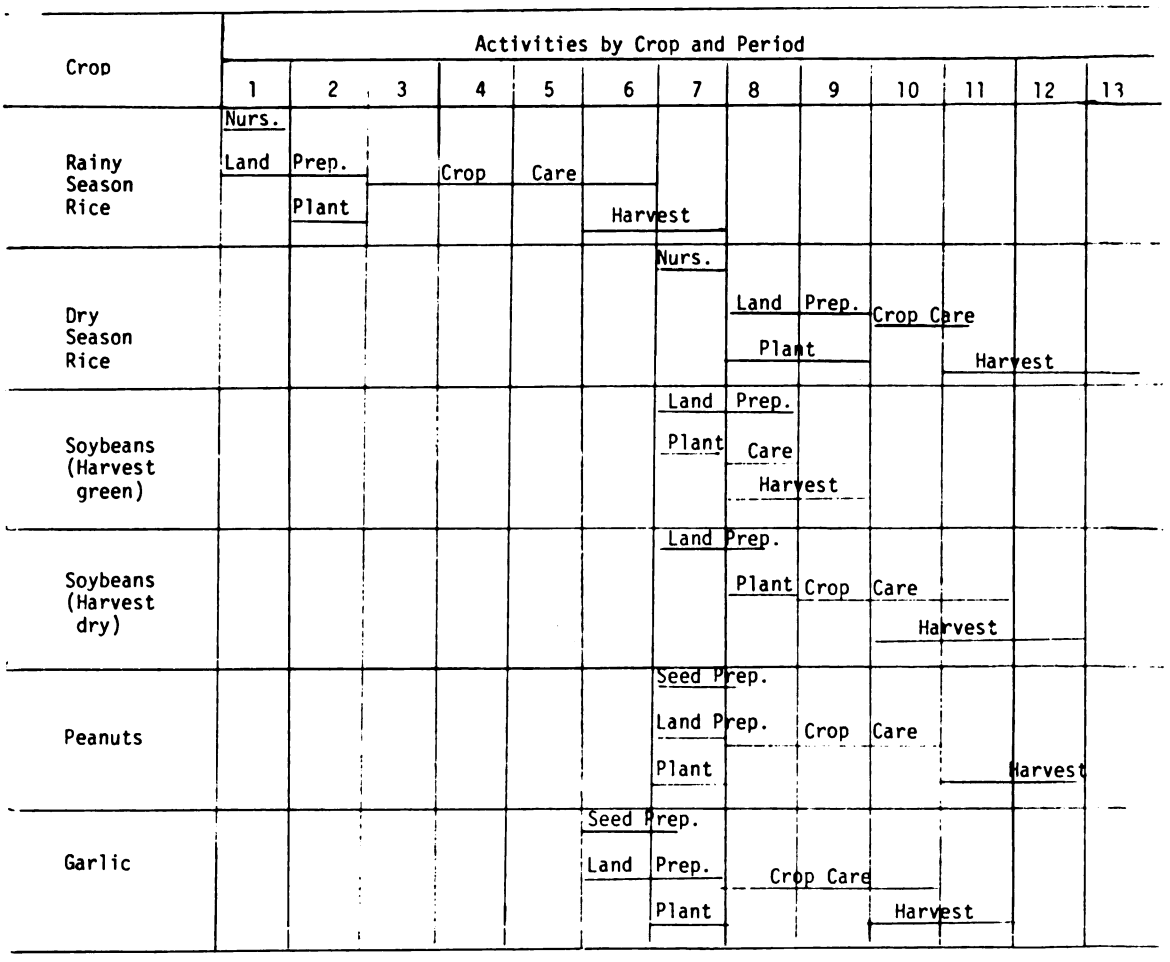


Figure 3.1.1 Activities Profile by Period for Household 37

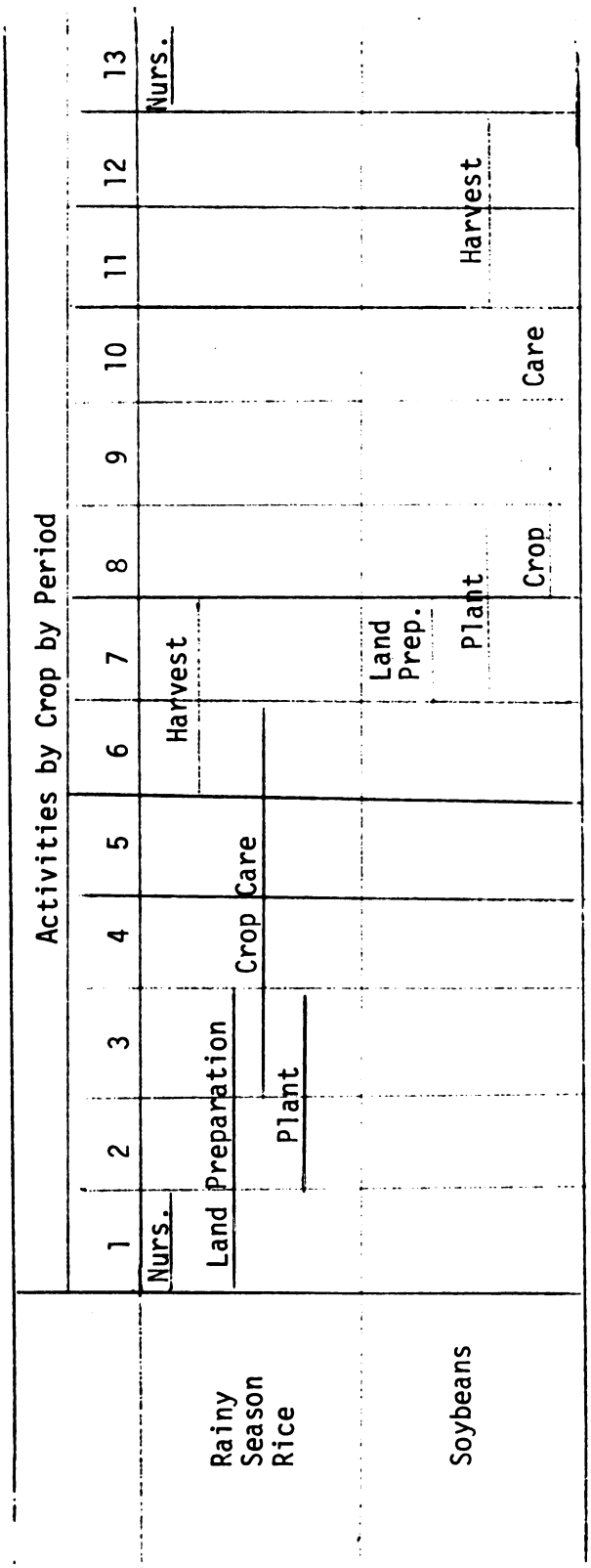


Figure 3.1.2 Activities Profile by Period for Household 45

family, a typical Northern Thai household includes the immediate family and occasionally grandparents and grandchildren. The 30 households in this study totalled 163 members with the household size ranging from 3 to 10. On the average, there were 5.4 members per household. Most households are composed of a husband, wife and one or more children. Some households have in terms of relationship to household head children-in-law (5 percent), grandchildren (5 percent), parents (3 percent), brothers (3 percent), and aunts (1 percent). The distribution of all members in the households in terms of their relationship to the household head and his or her spouse is shown in Table 3.5.

Table 3.5

Composition of Household by Relationship to Household Head

Relationship to Household Head	Male	Female	Total Number	Total Percent
		(number of people)		(percent)
Head and spouse[1]	30	24	54	33
Children	35	47	82	50
Children-in-law	5	3	8	5
Grandchildren	6	2	8	5
Parents	1	4	5	3
Brothers	4	--	4	3
Aunts	--	2	2	1
Total	81	82	163	100

Source: Terminal Survey, July 1974.

[1]Where applicable. Six households with head without spouse.

The age of male heads of the household ranged from 26 to 78 with an arithmetic mean of 48 years. The average age of female heads of the household was 44 years and the average age of all household members is 28 years.

A distribution of family members by age and sex for each household is given in Appendix Tables 3.3 and 3.4 and are summarized by family size in Table 3.6. In the total sample, 30 percent of the family members are under 15 years old and 8 percent are over 60 years old. This means that 62 percent are in the active economic working group (that is, in the range of 15 to 60 years of age).

Each member of these families was reported to be in good health except 4 persons of old age in households 6, 17 and 18 and which were too old for full-time farm work.

In general, family members under 45 years of age have four years of education whereas nearly all of the women and men over 45 have less than four years of formal education. This is due to the compulsory primary education decree in 1921 which required the children to attend school at least through the fourth grade. Of the 30 male household heads, one had 11 years of schooling, 16 had 4 years, 6 had one to 3 years and 7 had no formal education at all. All children are attending schools in the adjacent villages if they are at or under fourth grade. Higher grade schooling has to be obtained from the district center or in Chiang Mai. Since schooling is taken seriously, labor contributions from children are very limited except in some periods which coincide with school vacation and in periods of peak labor demand.

Table 3.6

Age Distribution by Family Size

Households			Total Members	Age Distribution of Total Members										Average Age of Total
				Under 15		15-29		30-44		45-59		60 & over		
Family Size	No.	Percent of all		No.	%	No.	%	No.	%	No.	%	No.	%	
3	2	6.7	6	0	0	2	33.3	1	16.7	2	33.3	1	16.7	38.0
4	7	23.3	28	7	25.0	9	32.1	6	21.4	3	10.7	3	10.7	28.8
5	10	33.3	50	16	32.0	13	26.0	9	18.0	9	18.0	3	6.0	27.6
6	3	10.0	18	6	33.3	2	11.1	6	33.3	0	0	4	22.2	33.0
7	5	16.7	35	9	25.7	15	42.9	2	5.7	9	25.7	0	0	25.7
8	2	6.7	16	8	50.0	2	12.5	2	12.5	2	12.5	2	12.5	27.0
10	1	3.3	10	3	30.0	4	40.0	1	10.0	2	20.0	0	0	22.7
TOTAL	30	100	163	49	30.1	47	28.8	27	16.6	27	16.6	13	7.9	28.0

Farming is the household's major occupation. Adult males of the household also engage in other activities such as trading, handicrafts, carpentry, and working as hired men for others. The female adults of the household may engage in handicrafts, trading and dress-making for additional income besides performing the customary household duties. The amount of time spent and the contribution of non-farm activities to family income will be examined in a later chapter. Also the contribution of women's labor to farming activities will be investigated in some detail. For the moment, our interest is in viewing the family as a composite of members varying in age who contribute to the family labor supply and participate as consumers.

Because of the variations in family size and in sex and age composition a common denominator is needed for comparing families and groups of households. Two approaches will be employed here. The first will be to compute adult male labor equivalents for households.

The idea of converting family labor to adult male equivalents has been with us for many years in farm management analysis. However, the factors for converting the labor of men, women and children to a common unit are not universal. The lack of standardized conversion factors may be explained by perceived differences in labor productivity by age and sex but they may also be explained by the different ways one may look at the problem. Some would approach it by weighting labor by the amount of wages the respective age and sex classes might earn in the farm labor market. Others may approach it by using judgement as to the varying capacities of individuals to do farm work. Still others may view it as a matter of estimating the proportion of time the various classes of family labor are available for farm work.

This latter approach is the one preferred for this study. Unfortunately, there are no data from the survey which would reveal the amount of time available for work. All that is known is the amount of time spent by individual in various activities. Hence, to develop conversion factor on the basis of time available will be based on the researcher judgement and first hand observation of family behavior in the study area. For this study, the following conversion factors are used to compute what will be called a "full time labor force equivalent."

	Age Group in Years			
Sex	<8	8-14	15-60	>60
Female	0	.20	.72	.20
Male	0	.30	1.00	.30

It is proposed that these factors represent the proportion of an average working day that respective family members are available for farm and non-farm work and for non-income generating community commitments in addition to performing domestic chores (and/or attending school in the case of children). For example, if men can work an average 7 hour day, then the availability of female children in the 8 to 14 age category, women in the 15 to 60 age category and women over 60 years will be 1.4, 5.04 and 1.4 hours respectively.

Full time labor force equivalents have been computed for each household and reported in Appendix Table 3.3. Later in the study these will be used to define labor constraints on farm work when case farms and representative farms are analyzed.

The number of consumers in a family exceeds those actively engaged in farm work. A method for converting families of different compositions to a common denominator is needed. The method used here is that adopted by Hart[3] from the work of Epstein. It differentiates by age and sex as follows:

	Age Class					
	<1	1-3	4-5	6-9	10-15	16+
Children	.10	.30	.50	.65	---	---
Females	---	---	---	---	.75	.80
Males	---	---	---	---	.80	1.00

Adult male consumer equivalents for each household were computed and reported in Appendix Table 3.4. The relationships between family size, full time labor force and adult male consumer equivalents are summarized in Table 3.7. The average size family of 5.4 members has 4.4 adult consumer equivalents and 3.3 adult full time labor equivalents. The total population is about 51 percent female but with the lower weights placed on female for both consumption and farm work they represent only 42 percent of the total in these conversions. Using information in Appendix Table 3.3 and Table 3.7 it can be shown that children under 15 constitute only 6 percent of the adult equivalent labor force but make up more than 11 percent of the adult equivalent consumers.

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[3]Hart, Gillian, "Labor Allocation Strategies in Rural Javanese Households," unpublished Ph.D. thesis. Cornell University, 1978.

Table 3.7

Family Size, Adult Consumer Equivalents and Labor Force by Farm Size

Item	Farm Size: Small			Lower Middle			Upper Middle			Large			All Farms		
Number of Hshlds	8			7			7			8			30		
Sex	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Family Mem.	21	15	36	15	26	41	18	20	38	25	23	48	79	84	163
Mem/Family	2.62	1.88	4.50	2.14	3.72	5.86	2.57	2.86	5.43	3.12	2.88	6.00	2.63	2.80	5.43
Percent	58.3	41.7	100	36.6	63.4	100	47.4	52.6	100	52.1	47.9	100	48.5	51.5	100
Adult Male Consumer Equivalent	Per Hshld		%	Per Hshld		%	Per Hshld		%	Per Hshld		%	Per Hshld		%
Children	.39		10.4	.89		19.9	.41		9.3	.37		7.3	.50		11.4
Women	1.18		31.6	2.01		45.0	2.16		49.1	2.07		40.9	1.84		41.7
Men	2.17		58.0	1.57		35.1	1.83		41.6	2.62		51.8	2.07		46.9
Total	3.74		100	4.47		100	4.40		100	5.06		100	4.41		100
Adult Full Time Labor Equivalent	Per Hshld		%	Per Hshld		%	Per Hshld		%	Per Hshld		%	Per Hshld		%
Female	1.00		35.9	1.43		44.9	1.53		45.9	1.49		38.9	1.35		41.7
Male	2.79		64.1	1.76		55.1	1.80		54.1	2.30		61.1	1.92		58.3
Total	3.79		100	3.19		100	3.33		100	3.79		100	3.27		100
Land Area (rai)															
Per Household	5.43			9.58			12.68			18.48			11.64		
Per Family Mem.	1.21			1.69			2.33			2.84			2.14		
Per Consumer Equ.	1.45			2.14			2.88			3.65			2.64		
Per Labor Equiv.	1.95			3.10			3.81			4.88			3.59		

3.4 Land-Labor Relationships

Land worked primarily by family labor is the chief source of food and income to the farm family. For a given area of farm land available the amount and kind of crops grown may be related to both the number of family members to be fed and cared for as well as the available family labor to work in the fields.

The relationships among these variables are summarized in Table 3.7 according to size of farm. We observe that larger farms have more family members and consequently a larger labor force. The land farmed per adult labor equivalent is 1.95, 3.10, 3.81 and 4.88 rai for farms in the small, lower middle, upper middle and large sized farms respectively. This indicates that the farms in the large size group have more than twice as much land per adult labor equivalent than the farms in the small size group.

3.5 Selection of Case and Representative Households

Before explaining the method for selecting them, it is in order to comment on the need for having both case households and representative farms in the analysis.

Ideally, because each household represents a unique situation, a farm plan using linear programming procedures would be prepared for each farm in the sample. However, this is not a practical approach from either a research or extension point of view. Therefore, it is desirable to select a household or households representative of all farms in the sample or of some sub-sets of the total sample.

Availability of land, labor and operating capital constitute the resource constraints which largely determine the volume and kind of farm business for a particular household. Levels of land and labor resources of individual households have been described above. The amount of capital for each family will be discussed in a later chapter. Realizing that cash on hand for any family may vary widely from week to week, it is felt that the most appropriate criterion for selecting case households and/or representative farms on the basis of resource levels is one which takes account of land and labor only.

The selection process entailed first stratifying the 30 households into four strata on the basis of total land farmed and letting the composite of the farms within these strata to become the "representative" farms by farm size class.

Selection of a case household within each stratum took into account the amount of male and female labor in the families expressed as adult labor equivalents. The attempt was to identify the household most like the stratum average when land area, available female labor and available male labor were taken into account. Since land and labor amounts are expressed in different units, the stratum average for each variable was expressed as a base=100 and an index using this base was computed for each variable for each household. The ultimate selection was made by choosing the household within strata which had the minimum value for the following expression

$$.5\ (L_i\text{-}100)^2 + .25\ (FL_i\text{-}100)^2 + .25\ (ML_i\text{-}100)^2$$

where

i = identifying household number

L = land area as an index of strata average

FL = adult female labor equivalent as an index of strata average

ML = adult male labor equivalent as an index of strata average

The land area for the representative farms is the average of the farms within the four strata obtained by classifying the samples according to farm size (Table 3.8). The amount of labor available for the representative farms was obtained by average female and male adult labor equivalent obtained from the farms in these strata.

Following the selection criterion described above household numbers 65, 63, 50 and 3 were chosen for farm size categories small, lower middle, upper middle and large respectively. These are the households that have the least weighted deviations from the representative farms using the procedures outlined above.

The amount of land and the amount of labor available expressed in adult labor equivalents for these selected farms may be compared with the land and labor resources available in the corresponding representative farms by farm size in Table 3.8.

This selection process suggests now the pattern for comparative analysis to follow. Linear programming solutions for eight examples (including 4 cases and their corresponding strata representative farms) will be obtained for comparisons based on the effect of farm size in relation to available labor on cropping patterns. In addition, the 4 case household LP solutions will be compared with their respective actual cropping programs.

Having defined a representative farm and corresponding case households, attention will be given to how they utilize family labor in the production of crops.

Table 3.8

Land and Labor Resource Level for Representative Farms and Selected Case Households

	Farm Size Group			
	Small	L. Middle	U. Middle	Large
Representative Farms				
Land Area (rai)	5.43	9.88	12.68	18.48
Adult Labor Equivalent				
Female	1.00	1.43	1.53	1.47
Male	1.79	1.76	1.80	2.30
Selected Case Household				
Household Number	65	63	50	3
Land Area (rai)	5.67	10.76	12.21	16.24
Adult Labor Equivalent				
Female	.72	1.12	1.44	1.44
Male	1.60	2.00	2.00	2.00

CHAPTER 4

FARM LABOR UTILIZATION PATTERNS

Farm labor use in the family varies according to farm size, the kinds of crops and livestock grown and to a certain extent the family composition. Crop labor needs take precedence over other outlets for labor such as livestock, fruit and vegetables on the farm or trading and handicraft as nonfarm activities and hired labor as an off-farm activity. So our attention to labor use in this chapter will be directed first to crop production labor.

4.1 Crop Production Labor

To examine the relationship between farm size and labor use the sample of 30 farms was divided into two groups of 15 farms each according to size with comparisons made between them (Table 4.1).[1] The farms in the upper half averaged more than twice as much farm land per household and about 75 percent more land per man equivalent. Why a larger labor force is associated with the larger farms is not explained with data available. It is likely that larger families seek additional land to utilize the larger labor supply.

Care must be exercised in interpreting the labor efficiency ratios reported in Table 4.1. Reported hours in crop production includes labor

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[1] Four size groups were not used in this table because atypical farms seemed to negate the relationship.

Table 4.1

Labor Use Per Household by Farm Size

Item per Household	Farm Size								
	Lower Half			Upper Half			All Farms		
Land area farmed (rai)	7.51			15.77			11.64		
Labor force (man equivalent)	2.98			3.57			3.27		
	Hrs.	Hrs/rai	Hrs/m.e.	Hrs.	Hrs/rai	Hrs/m.e.	Hrs.	Hrs/rai	Hrs/m.e.
Crop Labor	1703.1	227	572	3262.2	207	914	2482.6	213	759
Other Farm Labor	567.1	75	190	569.8	36	160	568.4	49	174
Total Farm Labor	2270.2	302	762	3822.0	243	1073	3051.0	262	933
Non and Off-Farm Labor	3533.1	470	1186	3067.6	194	859	3300.4	284	1009
Total Labor	5803.3	772	1948	6889.6	437	1930	6351.4	546	1942
Rai/Man Equivalent	2.52			4.42			3.56		

from all sources including family, exchange and hired. Large farms hire more labor resulting in crop hours per family man equivalent averaging nearly 60 percent higher than found on the smaller farms. On larger farms, the cropping program is more demanding for labor and relatively less time (per unit of land or labor) is spent on livestock, and off-farm activities. It is particularly interesting to note that on the smaller farms there are enough additional hours spent in livestock production and off-farm work to compensate for the less time spent in crop production.

4.1.1 Labor Requirement for Individual Crops

Attention will now be given to the requirements for labor for the commonly grown crops in the study area; namely, rice in both the rainy and dry seasons and soybeans, peanuts, and garlic in the dry season. Each crop has a different level of labor requirement depending on the activities performed.

Table 4.2 summarizes the time spent on the various cropping activities for the several crops with averages computed using only the farms growing the respective crops.

4.1.2 Nursery for Rice Production

On the average, a household requires 5.18 hours and 3.29 hours for .05 rai of nursery, the amount needed to provide seedlings for one rai of rainy season and dry season rice respectively. Labor is required to soak rice. The time required for soaking rice is minimal but before planting the seeds the grower must wait a few days before they are ready to be sown. Meanwhile, the family members may cut grass

Table 4.2

Crop Labor Requirement by Crop

Labor Activity	Hours Per Rai by Crop				
	Rainy S. Rice	Dry S. Rice	Soybean	Peanut	Garlic
Farms Growing Crop	30	25	28	11	6
1. Nursery[1]	5.18	3.29	--	--	--
2. Land Preparation					
Plow & Harrow	19.88	17.99	--	3.57	46.76
Other (Bed)	4.83	1.61	21.21	32.83	150.85
Sub-total	24.71	19.60	21.21	36.40	197.61
3. Transplant/ Plant					
Pull Seedlings[2]	9.94	13.58	--	17.15	90.51
Transplant/ Plant	11.06	17.22	35.28	38.85	194.60
Other	3.64	1.96	4.83	2.80	--
Sub-total	24.64	32.76	40.11	58.80	285.11
4. Care of Crop[3]	14.70	17.36	15.83	21.91	205.30
5. Harvest					
Cut (Pull)[4]	19.46	20.65	23.94	66.50	67.83
Bundle (Clean)[5]	6.37	9.52	10.64	--	123.90
Thresh	6.93	8.12	14.84	76.65	--
Move Grain	4.90	7.49	13.09	31.50	--
Other[f]	3.99	.21	3.64	7.42	--
Sub-total	41.65	45.99	66.15	182.07	191.73
6. Total Labor	110.88	119.00	142.80	299.18	879.48

[1]Nursery labor is for .05 rai of land, the amount needed to establish 1 rai of rice crop.

[2]Also include seed preparation for peanut and garlic.

[3]Includes irrigation, insect and weed control, fertilization, fence building, etc.

[4]"Pull" applies to soybeans, peanut and garlic.

[5]Clean refers to soybean and garlic.

[f]Includes straw handling, cleaning, cutting ties, etc.

Source: Computed from recorded hours on farms growing the crop. 1973-74 survey.

or irrigate the field so that they can plow and harrow. A seed bed must be prepared which is the major task in the nursery. Sowing is done after the seed bed is prepared. The difference in time required for nursery in the rainy season and dry season is due to more time spent on grass cutting in the rainy season and some farmers bought seedlings in the dry season rather than taking time to grow them in their own nursery.

4.1.3 Land Preparation for Crops

The labor requirement for land preparation varies according to crop grown. Soil condition requirements for planting as well as planting methods vary. Land preparation for rice involves cutting grass, irrigating the land, plowing and harrowing and the repair of bunds. On the average, farmers spent about 25 and 20 hours respectively for rainy and dry season rice land preparation. The difference is again due to the amount of time needed to cut grass in the wet rainy season, an activity not needed in the dry season.

Rice is planted in fields that have been both plowed and harrowed. On the average, 67 percent of the farmers puddled (the harrowing of very wet soil) their fields twice. Puddling once was done by 23 percent in the rainy season and by 27 percent in the dry season. Two passes are made of the field in each puddling. The puddled soil is usually at a depth of from 8 to 12 centimeters.

Land preparation for soybeans involves first cutting the rice straw since soybeans will use the same land. The straw or rice stubble is then burned. Most farmers just make a shallow hole in the rice

stubble in which the soybean seeds are put and covered. Periodically thereafter, the field will be irrigated. On only 9 of 25 farms were soybeans planted on land that had been plowed and bedded. Time to dig drainage channels in the field is also part of the land preparation activity for soybeans.

Land preparation for peanut involves plowing after clearing the rice field then the making of beds (33 hours out of total 36 hours). Other activities are to cut grass, irrigate, plow and dig drainage channels in the field.

Land preparation for garlic involves cutting grass, plowing and bedding up. On the average a household spent 151 hours making garlic beds. Peanuts and garlic are grown on beds of about 10 to 20 centimeters in height. The beds were prepared by hand.

4.1.4 Transplanting Rice and Planting Other Crops

Rice will be transplanted after being in the nursery for 20 to 30 days. The activities involved are pulling seedlings in the nursery, bundling them and then cutting the leaves. Seedlings are moved from the nursery to the prepared fields and then transplanted. The most common transplanting time was August for rainy season rice and March for dry season rice. Most households planted 3 to 4 plants per stand and used 30x30 centimeters spacing for rice. Replanting may be needed a week after transplanting. On the average, a household requires 25 and 33 hours to transplant a rai of rainy and dry season rice respectively.

Soybeans and peanuts are commonly planted in January. They need 3 to 4 seeds per hill with 30x30 centimeters spacing for soybeans and 20x20 centimeters spacing for peanuts. On the average, soybeans require

35 hours for planting and 5 hours per rai for replanting while peanuts require 39 hours for planting and 3 hours for replanting. The replanting requirement for peanuts is less than soybeans due to the bedding technique but about 17 additional hours are needed for shelling peanut seed before planting.

Garlic needs cool weather, so it is usually planted in November or December. One plant is grown per stand with a 10x10 centimeter spacing. Garlic planting is very labor intensive since it is closely spaced and requires careful planting, fertilizing, and irrigating. In addition, each bed has to be covered with rice straw to preserve soil moisture. On the average, garlic requires about 195 hours for planting alone and 285 hours per rai for all that is needed from the time the bed is prepared to the time the sprouted clove is in the ground.

4.1.5 Care of Crops

Activities in crop care are similar for all crops. They include such activities as irrigation (watering), weeding, insect control and post-planting fertilization. The time spent on these activities varied according to crops. Fertilizers are used mostly in the dry season crops such as dry season rice (which is a high yielding variety) and garlic. Manures are commonly used in rainy season rice, soybeans and peanuts. Fertilizers are usually applied 15 to 30 days after planting. Some farmers used a chemical for killing crabs in the rice field.

Irrigation water is usually maintained at 5 to 10 centimeters in the rice field and usually during the dry season the field is flooded once every two weeks. Most households weeded their rice but did not weed soybeans and peanuts. Garlic is weeded heavily. Most weeding is

done by hand and with hoe. For rice, most farmers waited until the weeds were 10 to 15 centimeters high before weeding. On the average, the time requirement for care of crop ranged from 15 hours for rainy season rice to 205 hours for garlic.

4.1.6 Harvesting

The time requirement for harvesting also varied widely among crops for the various activities involved. For rice, harvesting activities begin with cutting rice stalks, bundling them and then moving the unthreshed rice to a central place. Some farmers might make bamboo ties from their own bamboo trees. Threshing is mostly done by hitting the rice bundle against a huge basket (called a "Ku") so that the grains drop into the basket. The rice grains are then cleaned and moved to be stored in the barn. Rice is usually stored in paddy form to be milled a week or as little as a day before consumption. Straw and other crop residues are used for livestock feed or as a mulch for garlic and mushrooms. If straw is sold, additional time may be required to build and stake a straw stack. On the average, a household requires 42 and 46 hours per rai for harvesting rainy season and dry season rice respectively.

Soybeans are generally cut or pulled, bundled for drying one to three weeks before threshing. Cutting, threshing and cleaning are major activities for soybean harvesting and require about 66 hours per rai on the average.

Peanuts are generally dug and dried for 3 days before threshing. Threshing is done by hand and requires about 77 out of the total 182 hours for harvesting activity, the time needed for harvesting one rai.

Garlic requires about 68 hours on average per rai for digging and 124 hours for bundling, cleaning and drying. Typically, farmers will either sell their garlic green in the field or sell them soon after harvest. Garlic is the most labor intensive crop, not only requiring the most per rai but also requiring it for a relatively short period from planting to harvest.

4.1.7 Relative Male and Female Participation in Crop Labor Activities

Table 4.3 shows the relative contribution of men and women and children in the various crop production activities for the several crops in the study area. In general, we can say that men do the activities which need physical strength like plowing, harrowing for rice, bedding for peanuts and garlic, pulling rice seedlings and threshing rice and soybeans. Women are generally more skillful in transplanting and cutting at harvest time. They also do bundling and moving rice. Women spend more time than men in planting dry season crops such as soybeans, peanuts and garlic. Bundling and cleaning soybeans and peanuts were done more by women than by men.

Women represented 38 percent of the average family labor force on a man equivalent basis and contributed 47 percent of the total labor utilized in crop production. Children play a minor role in farming operations due to schooling. Their contribution will be used primarily in the critical periods for planting/transplanting or post harvesting activities in the dry season. On the basis of adult man equivalent, children constitute 8 percent of the labor force but contribute only 3 percent of the labor spent on crop production (Appendix Table 4.1).

Table 4.3

Percentage Crop Labor Uses by Sex for Activities by Crop[1]

	Rainy Season Rice			Dry Season Rice			Soybean			Peanut			Garlic		
	M	W	C	M	W	C	M	W	C	M	W	C	M	W	C
Nursery	85.1	13.5	1.4	83.0	17.0	0									
Land Prep.															
Plow & Harrow	99.3	.4	.4	98.4	1.6	0	56.1	41.3	2.6	100.0	0	0	0	0	0
Other (bed)	84.0	15.9	0	78.3	21.7	0	0	0	0	95.9	4.1	0	88.4	11.6	0
Sub-Total	96.3	3.4	.3	76.8	3.2	0	56.1	41.3	2.6	96.3	3.6	0	74.8	25.2	0
Transplant/Plant Pull Seedling (prep. seed)	58.4	38.7	2.8	56.7	43.3	0	0	0	0	39.6	60.4	0	3.3	96.7	0
Transplant/Plant	25.3	73.4	1.2	23.6	76.4	0	32.9	63.3	3.8	38.5	58.0	3.4	31.0	69.0	0
Other	36.9	71.1	1.9	46.4	53.6	0	39.1	56.5	4.3	85.0	15.0	0	0	0	0
Sub-Total	38.9	59.0	2.1	38.7	61.3	0	33.7	62.5	3.8	41.1	56.7	2.3	22.2	77.8	0
Care of Crops	84.2	15.2	.5	74.6	25.4	0	60.3	39.3	.5	70.9	29.1	0	33.9	58.7	7.3
Harvest															
Cut (Pull)	49.3	49.7	.9	37.3	61.0	1.7	38.9	50.0	11.1	51.3	37.0	11.7	33.1	55.7	11.1
Bundle (clean)	48.4	48.4	3.3	47.8	50.7	1.4	19.1	77.6	3.3	0	0	0	41.6	58.4	0
Thresh	94.9	6.0	0	98.3	1.7	0	72.7	22.6	4.7	16.5	69.6	13.9	0	0	0
Move	41.4	57.1	1.4	46.7	53.3	-	43.9	46.0	10.1	58.9	29.3	11.8	0	0	0
Other	66.7	31.6	1.8	100.0	0	-	55.8	38.4	5.8	35.8	64.2	0	0	0	0
Sub-Total	57.3	41.3	1.3	51.6	47.3	1.0	45.2	46.9	7.9	37.3	50.5	12.2	38.5	57.5	4.0
Total	66.8	32.1	1.1	59.7	39.9	.4	45.2	49.6	5.2	47.7	44.5	7.8	40.3	57.1	2.6

[1]Rounding may result in totals less than or more than exactly 100 percent.

One may wonder whether the relative contribution of women to the production of crops varies according to farm size. Obviously, the reported time spent by women will vary according to farm size class if the proportion of women in the labor force varies from class to class. On the basis of adult labor equivalent, the proportion of women in the total labor force per household varied from 32 percent in the small farm class to 43 percent in the upper middle farm size class. Therefore, to examine the relationship between women's contribution according to farm size adjustment was required which assumes the same sex composition in the labor force for all farm size classes. This was done and is reported in Appendix Table 4.1. With the adjustment for constant sex composition, we observe that the women's contribution to crop production work varied from 45 percent in the small farm class down slightly to 40 percent in the upper middle farm size class and 42 percent in the large farm size class.

We need not conclude from these findings that women are incapable of doing those activities which are dominated by men nor that men are incapable of doing those activities usually done by women. Nevertheless the figures strongly suggest that the kinds of labor by sex and age are not perfectly substitutable. Whether the apparent differentiation is due to local tradition and/or differences in physical stamina and functional skills cannot be documented from data available from the study. In any case, it appears that this facet of family labor utilization appears sufficiently important not to be ignored in the implementation of proposed cropping systems. Later in the thesis labor requirements for both male and female will be specified separately for the

various crop activities. These requirements will follow the relationship shown in Table 4.3 in which it can be noted that the woman labor contribution to individual crop production varied from 32 percent for rainy season rice to 57 percent for garlic. The assumption that male and female labor are used in fixed proportions as differentiated inputs may not be fully defensible. Nevertheless, on the basis of the results in Table 4.3 this assumption seems more reasonable than an alternative one which would assert that all family labor is perfectly substitutable regardless of age or sex.

Further observation on the contributions of women to the farm labor effort will be made in subsequent sections of this chapter.

4.1.8 Crop Labor by Source

Labor for cropping is available from three main sources: the family, exchange labor from other households and hired labor. Table 4.4 shows the percentage of the various crop labor that were provided from these activities by sources. In general, labor for crop production is drawn from family more than from other sources (above 50 percent). The family supplies 77, 65 and 73 percent of the total in the production of soybeans, peanuts and garlic respectively, while for both rainy and dry season rice the share is about 56 percent.

Exchange labor is used extensively for the threshing of rainy season rice (66 percent) and for transplanting it (43 percent). It is also high for rice threshing (73 percent) and rice cutting (42 percent) in the dry season. Exchange labor is also used in other dry season crops for activities such as threshing soybean (44 percent), plowing

Table 4.4

Percentage Crop Labor Uses by Source and Activities[1]

	Rainy Season Rice			Dry Season Rice			Soybean			Peanut			Garlic		
	Family	Exchange	Hired	Family	Exchange	Hired	Family	Exchange	Hired	Family	Exchange	Hired	Family	Exchange	Hired
Nursery	39.2	4.0	56.8	83.0	6.4	10.6									
Land Preparation															
Plow & Harrow	74.7	20.1	5.3	74.0	22.9	3.1	78.9	14.5	6.6	0	84.4	15.6			
Other (Bed)	94.2	2.9	2.8	78.3	21.7					50.7	46.1	3.2	32.0	68.0	0
Sub-Total	78.4	16.7	4.8	74.2	22.9	2.9	78.4	14.5	6.6	49.5	46.6	3.8	44.3	55.7	0
Transplant/Plant															
Pull Seedling (prepare seed)	21.8	14.1	64.1	50.0	34.5	15.5				86.1	9.8	4.1	100.0	0	0
Transplant/Plant	31.0	43.0	25.9	39.4	20.3	40.3	63.7	29.6	6.7	72.1	20.2	7.7	47.3	32.6	20.1
Other	86.5	7.7	5.8	46.4	25.0	28.6	85.5	13.0	1.5	87.5	12.5				
Sub-Total	35.5	26.1	38.4	44.2	26.5	29.3	66.3	27.6	6.1	76.9	16.8	6.3	54.0	22.2	13.8
Care of Crop	95.7	2.4	1.9	89.5	10.5	0	89.0	9.6	1.4	85.9	14.1	0	91.2	8.8	0
Harvest															
Cut (Pull)	34.9	25.5	39.6	37.0	42.0	21.0	87.1	12.0	.9	71.0	27.4	1.6	86.7	8.8	4.4
Bundle (Clean)	48.4	23.1	28.5	54.4	26.5	19.1	87.5	7.2	5.3	44.1	54.1	1.8	100.0	0	0
Thresh	28.3	65.6	6.1	9.5	73.3	17.2	55.6	44.3	0						
Move	65.7	24.3	10.0	65.4	21.5	13.1	86.1	13.4	.5	82.7	14.7	2.6			
Other	84.2	7.0	8.8	100.0	0	0	90.4	9.6	0	78.3	21.7	0			
Sub-Total	44.2	29.9	25.9	40.6	40.8	18.6	80.1	18.6	1.3	62.0	36.2	1.8	95.3	3.1	1.6
TOTAL	56.5	21.3	22.2	55.5	28.5	16.0	77.0	19.6	3.4	65.2	32.0	2.8	72.7	22.5	4.8

[1]Rounding may result in totals less than or more than exactly 100 percent.

and harrowing (84 percent) and cleaning peanut (54 percent) and making bed for garlic (68 percent).

A household will keep record of the exchanged labor days which have been received and given for the purpose of having the days given be equal to days received. The decision of whom to send in the family for exchange work depends on the activities. A woman would represent a family in transplanting while a man would be sent for making bed. Exchanging labor is traditional and considered a social function. It improves community morale as each household shares in the social obligation to finish some rice crop operation within a short period of time. The host will usually provide food and drinks to the helpers. The fact that received exchange labor is paid back in like effort means that there is very little indebtedness of duty carried over from one period to another. The general community concern for successful crop production in general and the exchange labor phenomenon in particular is an important aspect of agricultural production in Ban Pa Mark. However, in the linear programming model to follow, the exchange labor procedures will be omitted for the following reasons: (a) it is unusual for a family to engage more exchange labor than can be repaid by the family members, and (b) the repayment of the exchange labor usually is done within a period of less than 28 days. These reasons combined make the linear programming model behave essentially the same whether account is made of exchange labor or not.

Hired labor is used to supplement family labor in the critical periods of both the rainy and dry seasons. It accounted for 22 and 16 percent of all labor in the production of rainy season and dry season

rice respectively (Table 4.4). It is particularly important for the pulling of rainy season rice seedlings where it accounted for 64 percent of the total on the average. It accounted for 26 percent of the labor in rainy season rice transplanting but increased to 40 percent of the transplanting labor to dry season rice.

At the opposite extreme, labor use for the production of soybeans, peanuts and garlic involved only 3, 3, and 5 percent hired, respectively. A family may prefer to hire men to women or vice versa depending on the kind of work. For example, women are preferred to men for transplanting rice and for undertaking dry season post-harvesting activities. Of course, the wage rate and the productivity of hired labor are important in determining the demand for it by farmers. Wages paid for hired labor seasonally and for specific task will be discussed in a later chapter when crop production and expenses are analyzed.

4.1.9 Seasonal Distribution of Crop Labor

Growing period and the labor required for production activities govern the seasonal pattern of crop labor. To analyze the annual labor profile for crop production, the year was divided into 13 periods of 28 days each (except for the first period which was assigned 29 days). The periods are as follows:

Period No.	Starting Date	Ending Date
1	July 1, 1973	July 29, 1973
2	July 30	August 26
3	August 27	September 23
4	September 24	October 21
5	October 22	November 18
6	November 19	December 16
7	December 17	January 13, 1974
8	January 14, 1974	February 10

Period No.	Starting Date	Ending Date
9	February 11	March 10
10	March 11	April 7
11	April 8	May 5
12	May 6	June 2
13	June 3	June 30

The seasonal distribution of labor will be presented and analyzed by these periods. However, in the LP model, periods 2, 6 and 10 will be divided into two and periods 3, 4 and 5 will be combined to more accurately represent the actual timing of crop production activities.

4.1.9.1 Seasonal Crop Labor Distribution in the Total Sample

Figure 4.1 shows the profile of farm labor used in crop and other farm production. It is clearly seen that crop labor uses are highly seasonal. In general, time in period 1 is used for nursery and land preparation, period 2 is primarily for land preparation and transplanting and period 3 is for transplanting. On the average, a household used 122, 253 and 219 hours for crop production in periods 1, 2 and 3 respectively. The transplanting period for individual farms can be either periods 2 or 3 depending on whether the family harvested dry season crops in period 1.

Periods 4 and 5 are slack periods when the crop labor use dropped to only 48 hours in period 4 and 39 hours in period 5. After rice is in the field these two periods become the waiting periods. During this time some farmers will fertilize, weed, and irrigate the crops.

Period 6 is the rice harvesting period. Period 7 is a combination of rice harvesting and dry season land preparation and planting. It is the most critical one requiring 476 hours of labor. Rice harvesting

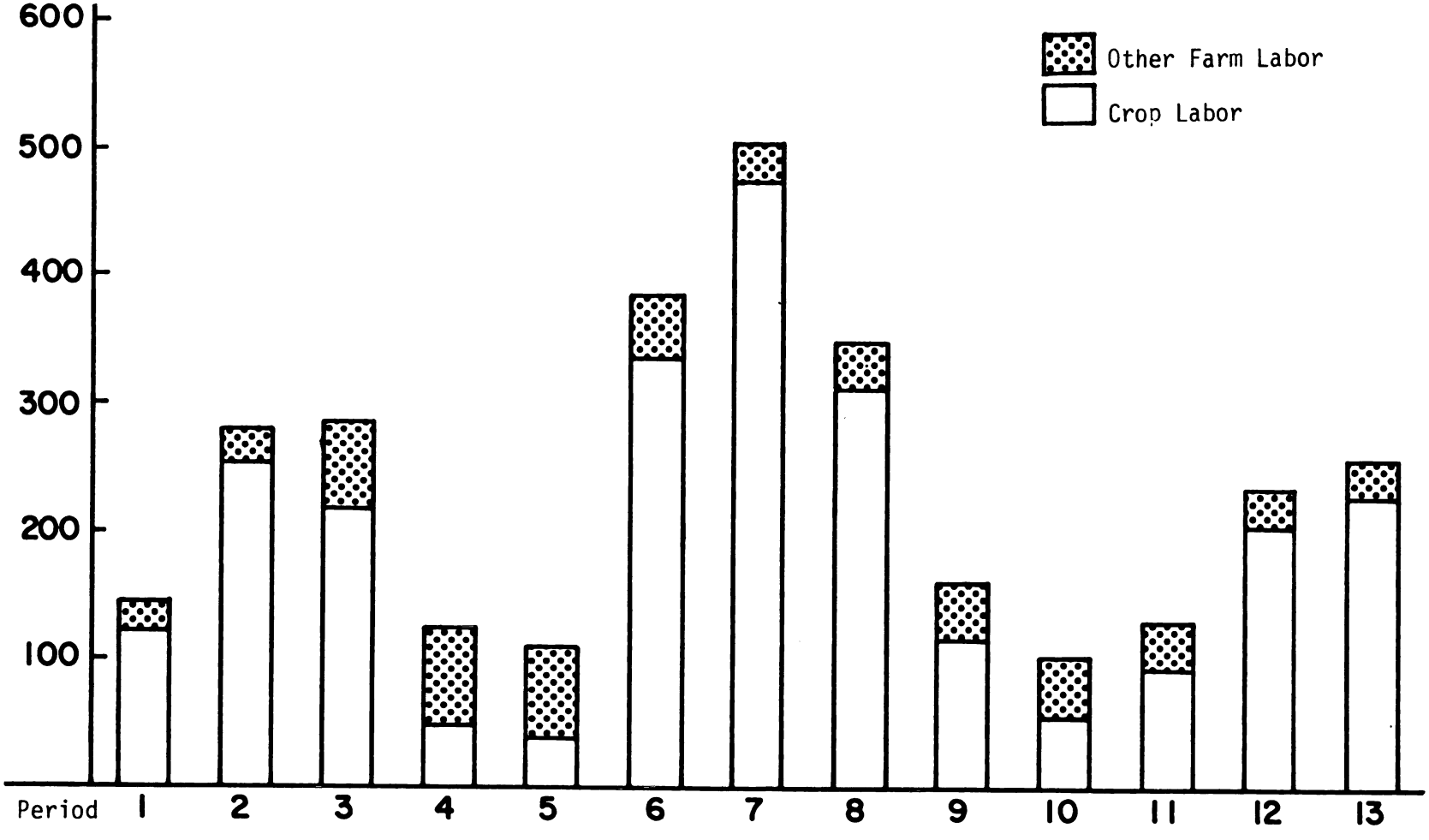

Figure 4.1 Farm Labor Profile, Average Hour per Period on 30 Farms

can occur in either period 6 or 7 depending on whether it was planted in period 2 or 3.

Period 8 is primarily for dry season planting. Periods 9, 10 and 11 are the dry season slack period using 115, 54 and 93 hours for crop labor respectively.

Periods 12 and 13 comprise another peak period in the dry season when dry season crops are harvested. They averaged 207 and 228 hours of crop labor per household respectively.

The share of the work load in farm work borne by men, women and children is shown in tabular form for each period in Figure 4.1. The distribution of work according to sex varies through the season as they perform their respective specific tasks. Men carry the heaviest share of the crop work load (88 percent) in period 1 when rice nursery and land preparation activities take place. The women's role is shown in periods 2 and 3 (31 percent and 53 percent of the crop work respectively) when rainy season rice transplanting takes place.

In periods 6 and 7 women share almost equally with men in harvesting rice and planting dry season crops while in period 12 women worked more than men (48 percent compared with 41).

It can be noticed that the labor contribution from children in relative terms is most in the dry season (highest in period 12 with 11 percent of total). During the school break from March 15 to May 17 (periods 10 to 12) children are called upon to contribute more heavily at the time when dry season rice is harvested. Though minor in relative terms, the contribution of child labor is evident in other peak labor periods of the year.

4.1.9.2 Seasonal Crop Labor Distribution for Representative and Case Farms

Labor profiles for crop production and other farm work are presented as bar graphs in Figures 4.2, 4.3, 4.4, and 4.5 for comparing the selected case farms with their corresponding group average (representative farm). In each figure for each period, the case farm appears on the right with the representative farm on the left. In making these comparisons it is appropriate to begin by comparing the kinds and amounts of crops grown which in turn determine the seasonal labor requirements for crop production (Table 4.5). Obviously, for a given farm, a larger area for the production of dry season crops will result in a higher labor requirement especially if they include labor intensive crops such as garlic. Considering the representative farms, they will contain all crops grown even though, for a particular farm, only one dry season crop may be grown. In Table 4.5 we see that all four representative farms show at least a little of each possible crop being grown when in fact for the 30 household sample, there was but one farm where all possible crops were grown. This is one difficulty with using the representative farm approach. Nevertheless, as the labor profiles indicate, the peaks and troughs of the seasonal distribution of crop production labor follow similar patterns whether we speak of an individual farm or a representative farm defined as a composite of farms of a similar farm size.

Another point worth noting is that the composite representative farm tends to depict a much more uniform labor requirement over the year than that actually required for an individual farm. This is because the critical periods for all farms do not coincide. Different

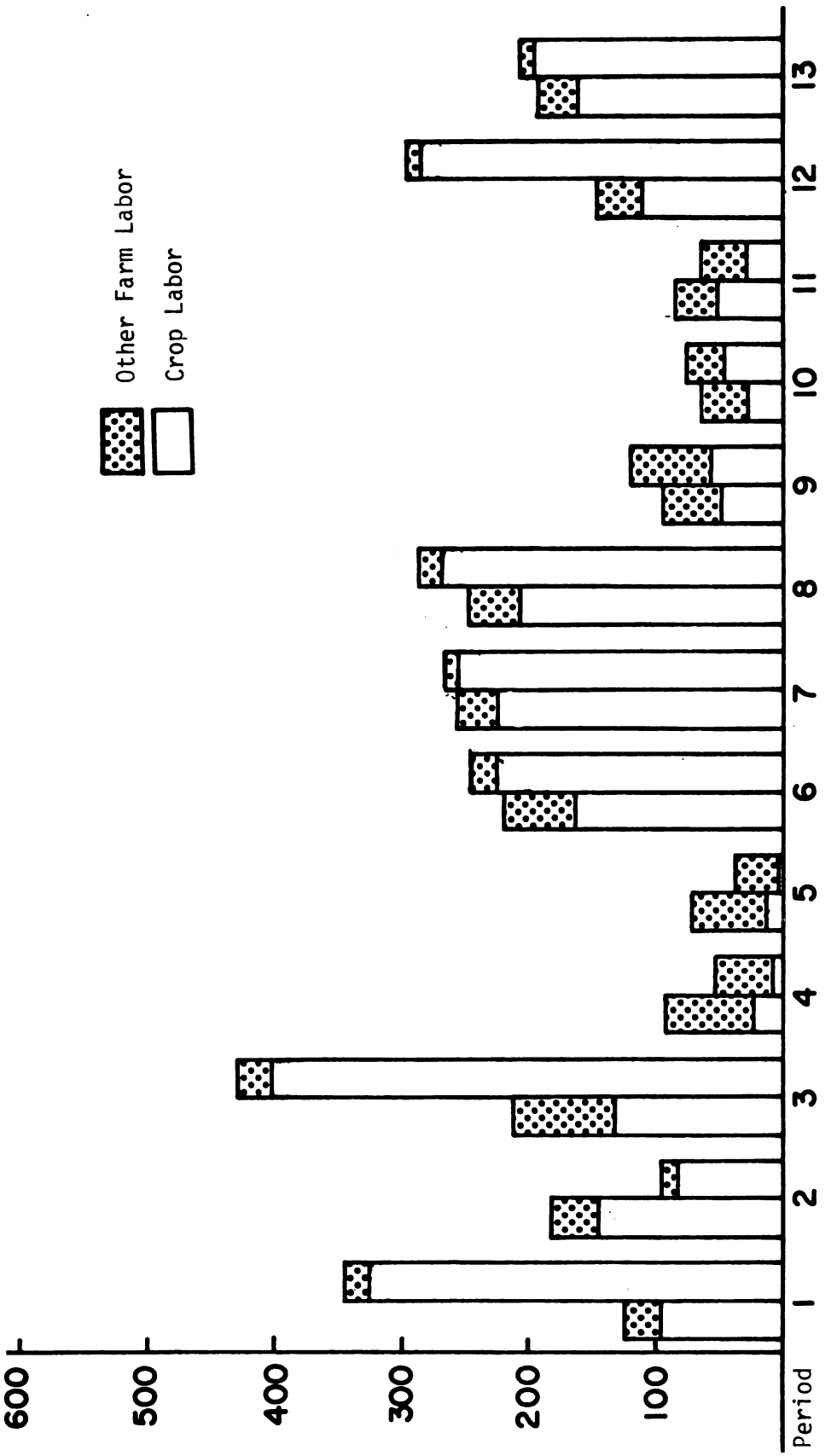

Figure 4.2 Farm Labor Profile, Average Hours per Period for Small Representative Farm and Household 65

Figure 4.3 Farm Labor Profile, Average Hour per Period for Lower Middle Representative Farm and Household 63

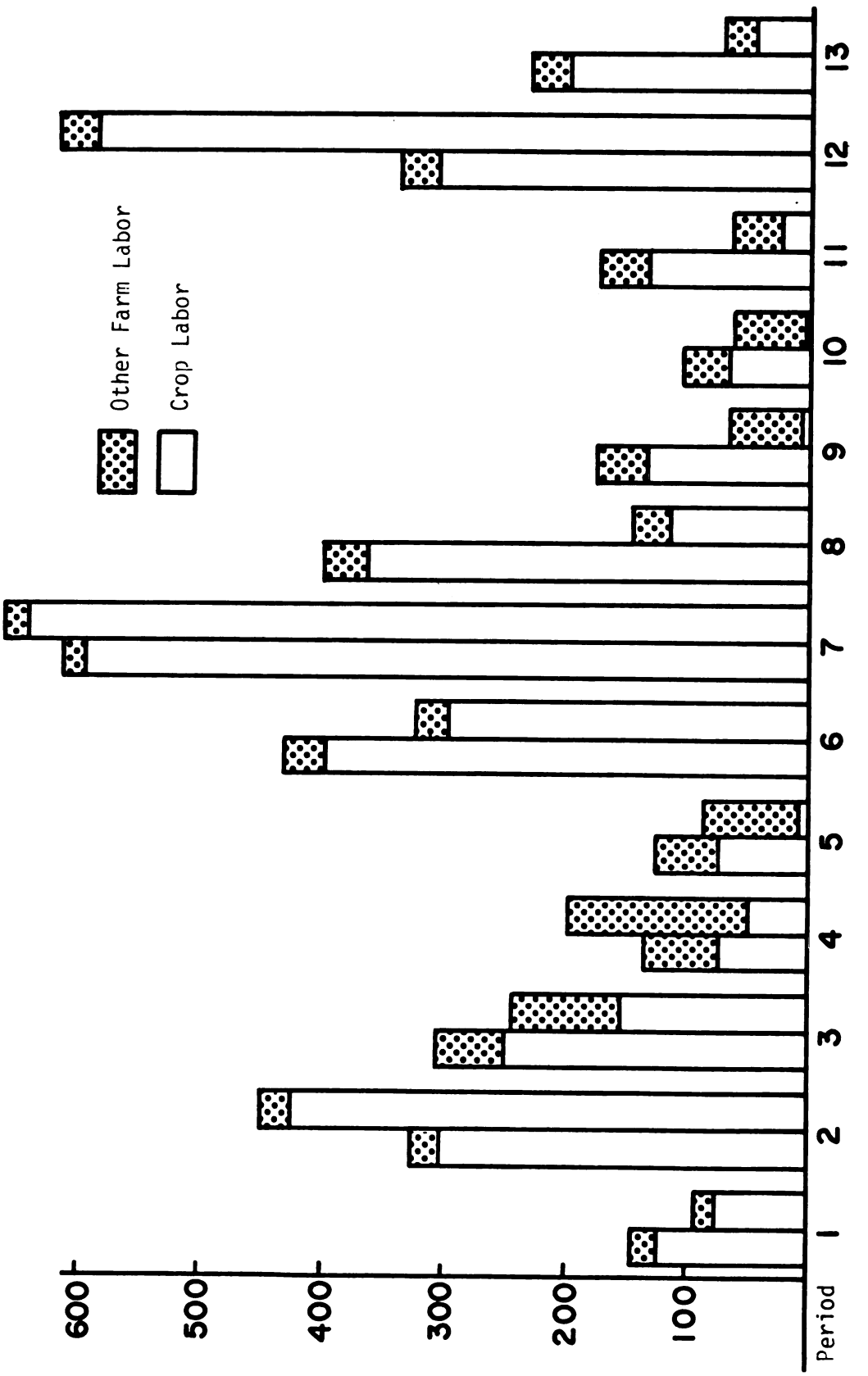

Figure 4.4 Farm Labor Profile, Average Hour per Period for Upper Middle Representative Farm and Household 50

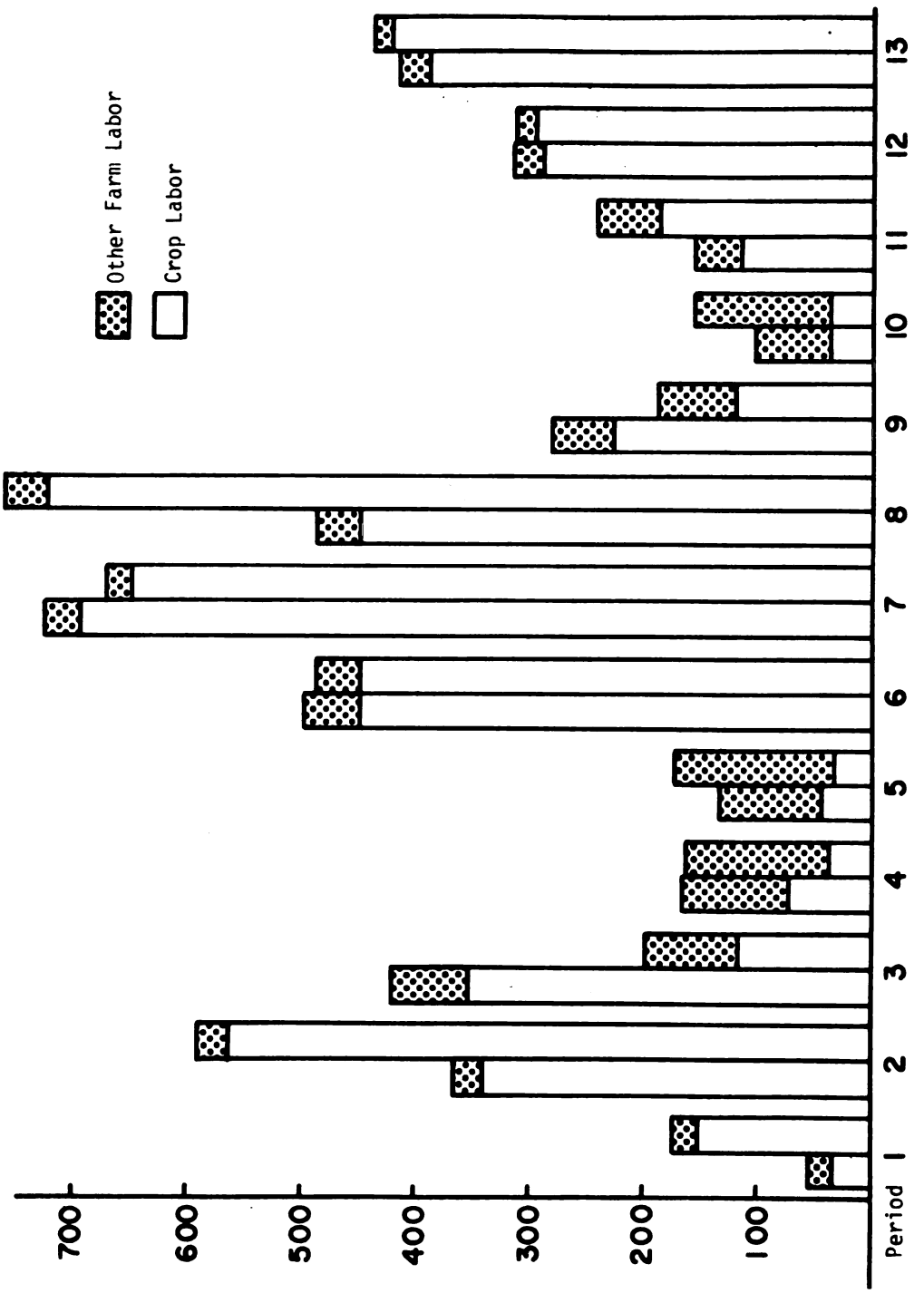

Figure 4.5 Farm Labor Profile, Average Hour per Period for Large Farm and Household 3

Table 4.5

Crops Grown, Case and Representative Farms

Rai and Percent of Cropland by Crop	Farm Size Class							
	Small		Lower Middle		Upper Middle		Large	
	Household 65	Rep.[1]	Household 63	Rep.[1]	Household 50	Rep.[1]	Household 3	Rep.[1]
Rainy S. Rice								
Rai	5.67	5.43	10.76	9.88	12.21	12.68	16.24	18.48
Percent	100	100	100	100	100	100	100	100
Dry S. Rice								
Rai	3.69	3.64	3.06	2.39	1.06	3.63	10.22	6.55
Percent	65.1	67.0	28.4	24.2	8.7	28.6	62.9	35.4
Soybeans								
Rai	5.20	1.80	----	5.23	4.82	6.04	10.54	8.37
Percent	91.7	33.1	0	52.9	39.5	47.6	64.9	45.3
Peanuts								
Rai	----	.22	----	.23	2.18	1.55	----	.81
Percent	0	4.1	0	2.3	17.8	12.2	0	4.4
Garlic								
Rai	.22	.14	----	.19	----	.05	----	.01
Percent	3.9	2.6	0	1.9	0	.4	0	.1
Total Crop Hours	2212	1407	1438	2041	2429	2988	3771	3480

[1]Rep.= representative farm for farm size class.

crops grown in different proportions and with different planting and harvesting periods among the several households make this true.

It is possible to make some simple observations at this time to explain why the case farm profiles differ particularly in some periods from the corresponding representative farms. For example, Farm 65 has a relatively high labor requirement in period 1. This is due to the need to harvest soybeans and dry season rice in this period which postpones the transplanting of rainy season rice to period 3, another period with labor use higher than average. (Detailed crop production activities for each crop on each case farm are shown in Appendix Tables 4.2 to 4.5.)

Comparing household 63 with its corresponding representative farm in the lower middle farm size class (Figure 4.3) we observe that the seasonal peaks are similar for each period except period 7 where the representative farm was ten times more than household 63. This difference is explained by the fact that household 63 grew only rice in the dry season whereas the representative farm had over 50 percent of its land to soybeans requiring land preparation and planting labor in period 7.

Comparing household 50 with its corresponding representative farm in the upper middle farm size class (Figure 4.4) we observe that the peak periods occur for both in periods 2, 6, 7 and 12. Their cropping systems are similar except that the representative farm has a much higher proportion of land in dry season rice. Household 50 required more labor in period 2, 7 and 12 than the group average. This is explained by the fact that rainy season rice land preparation and

transplanting were concentrated in period 2 resulting in the harvesting being spread to periods 6 and 7. Period 7 was also the period for planting soybeans and land preparation for peanuts.

Comparing household 3 with its corresponding representative farm in the large farm size class (Figure 4.5) we observe that the seasonal profile is similar to that of other farms discussed except that as the farm size increases the total crop labor increases accordingly. The critical periods are more pronounced on farm 3 because of the larger area of dry season land being used for rice and soybean than was the situation for the representative farm in this size class.

The annual crop hours by crop and activities for the four case households are summarized in Appendix Table 4.6.

4.2 Other Farm Labor

Labor spent on other farm work is primarily for the care of livestock and poultry including buffalo and cattle, pigs, hens and ducks.

Time spent (mainly by men) in taking care of buffaloes and cattle is for cutting grass or taking them to and from pasture which are not fenced. In the care of swine, time is spent collecting pig weeds and banana stems which are cut up and cooked before adding bran, household waste, broken rice, etc., for feed. This work is mainly done by women.

Fruit production is not a significant activity. Generally no time is spent taking care of these trees until harvesting for either the local market or home consumption.

Vegetable gardens are mainly for home consumption. Time requirements for the vegetable gardens are chiefly for watering and picking the crop. Women and children are generally engaged in these operations.

All of these non-crop labor activities on the average represented 19 percent of farm work and 9 percent of total family labor.

4.2.1 Seasonal Distribution of Other Farm Labor

Figure 4.1 shows that these other farm labor activities are distributed throughout the year but the hours spent do not fluctuate as widely as for the crop labor. On the average, the least time spent (24 hours) was in period 1 while the peak (79 hours) was in period 4. The slack periods for crop production appear to coincide with the periods when the other farm work activities are the highest. For example, periods 4 and 5 are generally slack for crops but peak for other farm work (79, 71 hours).

Table 4.1 shows that on the average a farm spent 568 hours of their labor in the other farm activities. In general the figures show that this time spent in these other farm activities per household per year was independent of the farm size.

4.2.2 Seasonal Distribution Comparison of Other Farm Labor Between the Farm Size Groups and the Case Households

The other farm labor distribution of the representative farms and the cases in general followed the same pattern, i.e., the other farm peak labor occurred at the slack crop labor periods, mostly period 4 and 5 (Figure 4.1). The difference in labor used in each period and annual total labor used between case and representative farms depended chiefly on the kinds and number of livestock raised (Table 4.6).

The small representative farm averaged 576 hours annually in the other farm work compared to 291 hours for household 65. The difference was in the time needed to take care of cattle in the small representative

Table 4.6

Livestock and Poultry, Numbers and Average,
Representative and Case Farms

Size Group/ Case	Livestock and Poultry									
	Buffalo		Cows		Swine		Hens (฿)		Ducks (฿)	
	Number	Average	Number	Average	Number	Average	Number	Average	Number	Average
Small										
Rep. Farm	4	.9	3	1	9	1.1	298	37	0	0
Household 65	0	---	0		2	2.0	45	45	0	0
Lower Middle										
Rep. Farm	4	1.0	3	1	24	3.4	915	131	0	0
Household 63	2	2.0	0		9	9.0	200	200	0	0
Upper Middle										
Rep. Farm	7	1.7	5	1	13	1.9	1198	171	120	17
Household 50	0	---	2		1	1.0	60	60	0	0
Large										
Rep. Farm	7	1.1	2	1	15	1.9	339	42	30	4
Household 3	0	---	1		1	1.0	45	45	0	0
Total	22	1.2	13	1	61	2.0	2750	92	150	5

[1] Included in the average for buffalo.

farm while household 65 did not have any. The lower middle representative farm averaged 557 hours annually compared to household 63 which spent 766 hours for its other farm works. From Table 4.6, household 63 had 2 buffaloes, 9 pigs, 200 baht worth of poultry which is a larger livestock inventory for the representative farm for the size group. The upper middle representative farm averaged 505 hours compared with household 50 which spent 645 hours. The difference can be seen from the number of pigs. The large farm group averaged 626 hours which was less than the 758 hours spent by household 3. Since the number of cattle were comparable in the two groups, the difference can be due to time spent by the family on the kitchen plot.

In the linear programming analysis to follow, the livestock, vegetable and native fruit activities will be excluded from the set of productive activities in the model. However, this section has demonstrated that these farming activities are an integral part of every household. It will be assumed that these activities should be maintained at the reported levels regardless of what the cropping program might be.

CHAPTER 5

OFF-FARM LABOR PATTERNS

The pattern of labor availability and use over the season is a key to understanding the village agricultural system. Chapter 4 described the crop labor use pattern. This chapter described the off-farm labor uses and commitments. From this description, we will hope to determine the extent to which the off-farm labor activities complements and to what extent they compete with the all-important family function of crop production. For purposes of this description the off-farm labor activities are classified into exchange labor, paid labor and other income generating activities and unpaid special activities.

5.1 Exchange Labor

Exchange labor has been practiced in Thai rice production for centuries. It usually occurs in transplanting and harvesting periods when the work must be done quickly. Farmers have experienced that if the seedlings are transplanted too young, they will be weak and damaged. If transplanted too old, the tillering phase is shortened and yield is consequently reduced (Janlekha 1955: 108; Grist 1959: 120). It also reduces yields if unrooted seedlings are transplanted in a dried out condition (Thailand 1947: 67). In order to minimize these dangers, farmers usually transplant in large work groups so as to accomplish

the task quickly. Similar arguments apply to harvesting. Farmers fear that "if the harvesting is delayed for even a short period of three or four days, the paddy will be over-ripe, resulting in a higher proportion of breakage and hence in a lower price" (Janlekha 1955, p. 109, Kaufman 1960: 41). These reasons explain why exchange labor is a major community concern and why all families engage in it. The whole village must plan and schedule transplanting and harvesting dates in such a way as to permit everyone to have a chance to receive the labor of others and to give of their labor. Exchange labor practices have also extended to the planting and harvesting of some dry season crops.

The notion of exchange labor carries with it the obligation to provide meals and drinks to others when you receive it. Meal expenditure for exchange labor is reflected in the consumption expenditure pattern presented in the next chapter. The host tries to make the atmosphere relaxed and pleasant so that work can be done smoothly and quickly and to see that everyone is happy.

The commitment that exchange labor received must be paid back equally and timely is a constraint to labor availability for the care of crops on one's own farm. But if it can be assumed that laborers are of equal productivity, the result is to make debts equal credits and by staggering crop production events the community is able to accomplish more than if each household functioned independently.

On the average, men provide 62 hours per person and women provide 61 hours per person of exchange labor (Table 5.1). Thus, for the entire year the role of women in exchange labor activities is essentially equal to that of men. However, the share of exchange labor provided

Table 5.1

Average Annual Non-Farm Activities by Sex

Activity	Men	Women
	(Average Hours per Person)	
Exchange Labor	62	61
Paid Labor Activity		
Laborer	269	92
Service Activity	4	6
Handicraft	101	648
Trading	44	169
Fishing and Cooking[1]	15	27
Sub-Total	433	942
Unpaid Special Activity		
Ceremony	53	43
Community Activity	34	8
Other	127	55
Sub-Total	214	106
Total	709	1109

Source: Survey.

[1]Cooking or preparing food for sale.

by women varied widely from season to season (Table 5.2). The most exchange labor activity takes place in period 2 (land preparation and transplanting), period 6 (rice harvesting), and period 8 (planting dry season crops). Except for period 4, 9 and 10 exchange labor may take place at other times of the year but not at a very significant level.

As might be expected, the differentiation of crop production activity in exchange labor by sex followed closely that found in home crop production activity. During the transplanting period, men are engaged mostly in pulling, cutting, bundling and carrying seedlings while women do the actual transplanting. This is explained by saying that the strength of men is suited for the more demanding physical tasks while women have more nimble fingers and thus excel in the delicate work of transplanting. The division of labor is also a matter of culture and propriety. For example, it is considered improper for women to raise their legs in order to knock the soil from the root of seedlings. Nevertheless, when practical circumstances require it, women do the work of men and men do the work of women.

5.2 Unpaid Special Activities

Special activities are classified into three types: ceremonial, community activity and others. Ceremonial activities include weddings, funerals, anniversary celebrations, house dedications, and monkhood ceremonies for sons, all of which are traditional and important to a host family. These sometimes involve the whole community since in Ban Pa Mark it appears that nearly everyone holds some kinship relationship to all others. Thus, it has been common practice for every household

Table 5.2

Seasonal Distribution of Non-Farm and Off-Farm Labor for the 30 Households

Period	Class[2]	Percentage by Period[1]							
		Exchange		Off-Farm Labor		Special		Total	
		P%	T%	P%	T%	P%	T%	P%	T%
1	M	59	1.4	20	1.4	61	3.8	28	1.9
	W	41	1.0	79	5.6	39	2.4	72	4.8
	T	100	2.4	100+	7.1	100	6.3	100	6.7
2	M	46	7.3	23	2.2	73	2.8	28	2.6
	W	54	8.6	77	7.5	27	1.0	71	7.2
	T	100	15.9	100	9.7	100	3.8	100+	9.0
3	M	57	6.7	31	3.5	81	5.8	39	4.1
	W	41	4.8	68	7.5	19	1.4	60	6.3
	T	100+	11.6	100+	11.1	100	7.2	100+	10.5
4	M	-	-	34	4.2	68	4.4	38	4.0
	W	-	-	65	7.8	32	2.1	61	6.4
	T	-	-	100+	12.0	100	6.5	100+	10.4
5	M	6	*	36	3.9	64	5.4	40	4.0
	W	94	1.0	63	6.9	36	3.0	59	5.9
	T	100	1.0	100+	10.8	100	8.4	100+	9.9
6	M	66	25.7	36	1.8	55	3.3	48	3.3
	W	34	13.1	64	3.2	45	2.7	52	3.7
	T	100	38.8	100	5.0	100	6.1	100	7.0
7	M	23	.3	26	1.0	60	2.0	31	1.2
	W	77	1.4	73	2.9	40	1.3	68	2.6
	T	100	1.7	100+	4.0	100	3.4	100+	3.8
8	M	25	4.4	29	2.0	53	1.9	31	2.1
	W	74	12.5	70	4.8	47	1.7	68	4.6
	T	100+	17.5	100+	6.8	100	3.5	100+	6.8
9	M	-	-	28	2.9	61	6.6	34	3.4
	W	100	*[3]	72	7.5	39	4.2	66	6.6
	T	100	*	100	10.5	100	10.8	100	10.0
10	M	-	-	33	3.0	55	6.4	38	3.5
	W	-	-	66	6.0	45	5.1	61	5.6
	T	-	-	100+	9.2	100	11.5	100+	9.1
11	M	32	*	32	1.7	60	6.5	40	2.5
	W	68	.2	68	3.7	40	4.3	59	3.6
	T	100	.2	100	5.4	100	10.9	100+	6.1
12	M	65	2.9	32	1.4	73	6.3	46	2.3
	W	35	1.6	64	2.7	27	2.3	52	2.6
	T	100	4.5	100+	4.3	100	8.6	100+	5.0
13	M	55	3.4	15	.6	61	8.0	36	2.0
	W	45	2.8	83	3.3	39	5.0	64	3.6
	T	100	6.3	100+	3.9	100	13.0	100+	5.6
Total Hours		XX	174	XX	2584	XX	586	XX	3344

[1]P% = Percentage of Period; T% = Percentage of Annual Total.

[2]If men plus women < 100%, the difference is child labor indicated by +.

[3]* = less than 1%.

to offer some help and participation. These activities in general take priority over crop production or activities for the earning of cash.

The economic implications are that the more ceremonial activities there are that occur in the village the less time there is available for farming. Actually these ceremonies (except for funerals) generally occur in the dry season (periods 9 through 13) when farm work is not labor demanding (Table 5.2). It is forbidden to have a wedding during the three rainy season months of Phansa, the so called Buddhist Lent (July through September). All marriages customarily take place either just before plowing or just before harvesting. As a young bachelor explained, the "old people won't permit marriage at any other time. They say that the son-in-law would then be coming just in order to eat their cooked rice" (Moerman, 130).

In the central plain, funerals are held in the dry season. Corpses are often held in the morgue of the temple until after harvest when public ceremonies begin. But in Ban Pa Mark, funerals may occur any time during the year. The ceremony involves religious functions and decorating the cremation platform which may take more than 8 hours a day for 3 to 7 days.

House dedication and anniversaries are held mostly in the dry season. The monkhood ceremony is preferred before the Phansa. In the North, parents usually get their boys aged 12-15 to a monkhood rather than wait until the son has reached 20 years or more since labor is so important in farm production. Even though it is the son that has been given up for a religious purpose, the ceremony involves the entire family for a few days. Referring again to Table 5.1 we see that men

spent 53 hours and women spent 43 hours annually for ceremonial activities.

Community activities are usually social events as well as an obligation to all households. Examples for Ban Pa Mark included irrigation canal cleaning and repairing, repairing a road to the village and building a new road to the temple. The village has its own traditional irrigation which is administered and maintained locally. Each farmer is obliged to be a member of the association and must agree to provide material and labor to maintain the canal in exchange for the right to use water. Cleaning and repairing usually takes place in period 1. Each household must prepare materials such as bamboo baskets, rocks and/or wood in an amount proportional to their farming area and to bring them to repair the weir. This is usually done in period 3. Repairing the road to the village and building the road to the new temple were done in periods 12 and 13. Table 5.1 shows that men provided more of their labor than women (34 hours compared with 8) per person on the above community activities.

Other non-regular activities included: unspecified trips away from home, government type business, farmer group or cooperative meetings, visiting friends and relatives, trips to the hospital, special shopping trips, getting haircuts, repairing vehicles, repairing the bridge to the household compound, hunting, finding ant eggs, baby sitting, chopping wood and some other pleasure and business excursions. On the average, these activities took 127 hours for men and 55 hours for women annually.

5.3 Paid Labor

The off-farm income generating activities in the rainy season reflect how farm family members use their time while waiting for the crops to be ready for harvest. Working in handicraft or as a laborer may be a good way to occupy one's time. Table 5.1 shows that women spent more time than men in handicraft and trading. Men concentrated more on the wage laboring activities such as house building and furniture construction which are usually done in the dry season. These activities take men away from farming, leaving women to be responsible for dry season crops. The implication of this finding to the Multiple Cropping Project is that if new crops are to be introduced, their planting requirements must be suitable to women or their expected return must be high enough to attract men away from their current non-farm income generating activities in the dry season. Some men engaged in trading but to a lesser degree than women. Performing services such as hair dressing and dress making and preparing food for sale accounted for some of the women's time but not a significant amount.

5.4 Seasonal Distribution of Off-Farm Labor

Figure 5.1 and Table 5.2 show the seasonal distribution of non-farm and off-farm labor for the 30 households under study. Exchange labor that a family must give corresponds to the special crop activity periods and especially in period 6. None of the exchange labor given occurs in the crop slack times of periods 4 and 10. Off-farm income generating activities of the family members occur in every period of the year but are concentrated in the slack periods such as periods 4, 5, 9 and 10. Special activities also occurred in every period but were

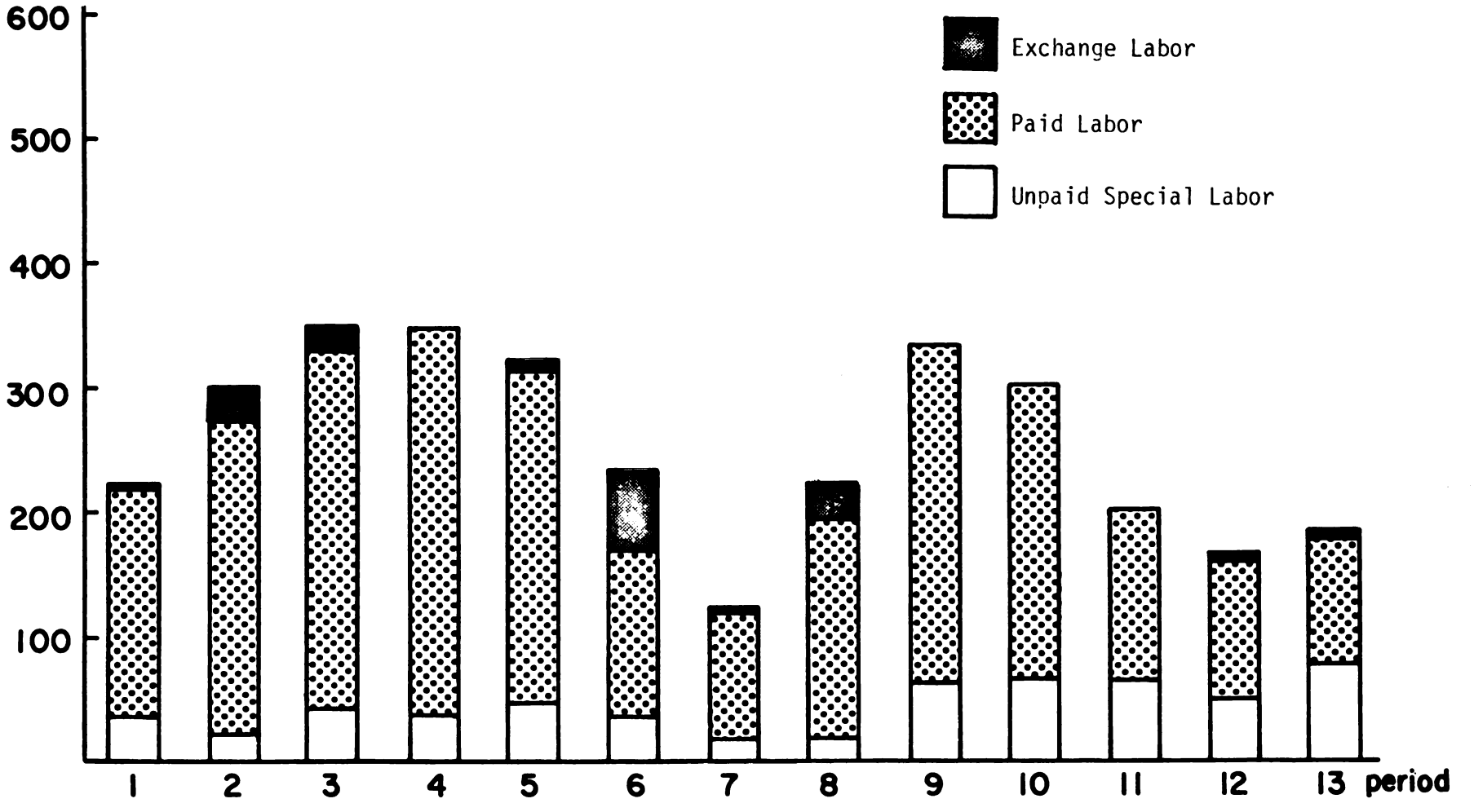

Figure 5.1 Seasonal Profile of Exchange, Paid and Unpaid Special Labor

concentrated in periods 9, 10, 11 and 13. This demonstrates that the non-farm labor complements the farm labor efforts and serves to smooth out the total family labor seasonal profile. In periods where there was a high demand for crop labor, less time was allocated to non-farm and other activities. In the period where less labor was required, farm family members supplement their income by working off the farm, trading and by engaging in handicraft activities.

5.5 Seasonal Profile of Total Labor

5.5.1 Seasonal Profile of the Total Sample

The seasonal labor profile of the 30 households and the percentage breakdown between farm and non-farm work is shown in Figure 5.2. It shows that farming activities dominated in periods 6, 7 and 8 as well as periods 12 and 13. We learn from this that in the sample households, the families are able to allocate their labor in such a way as to remove most of the peaks and troughs observed earlier in the annual labor profile of farm labor distribution alone. This is an important observation because it indicates how inappropriate it would be for a farm advisor to recommend farm reorganization on the basis of only the crop labor requirements.

5.6 Seasonal Distribution of Labor by Farm Size Group and Case Households

Table 5.3 is a summary of average annual total labor uses by farm size groups. It reports hours per household and percent of total hours spent on the various kinds of labor activities. It shows that on the average a family used 48 percent of its labor for farm and work and 52 percent of its labor in off-farm paid and unpaid activities. Of the

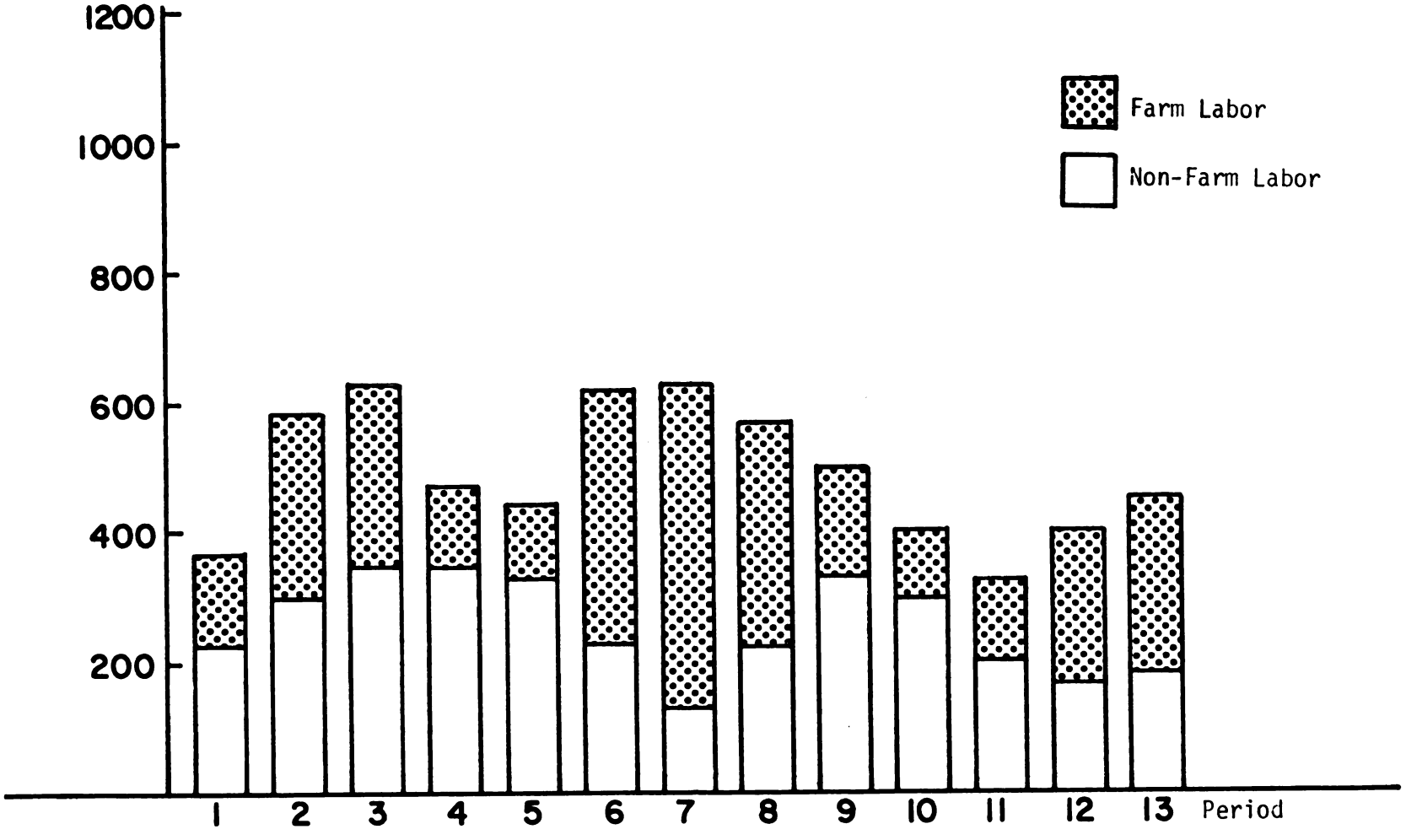

Figure 5.2 Seasonal Profile of Farm and Non-Farm Labor, Average of the 30 Households

Table 5.3

Average of Annual Total Labor Uses by Farm Size Groups, Hours per Household and Percent of Total

		Small Farm		Lower Middle Farm		Upper Middle Farm		Large Farm		Total Farms	
		Hours	%	Hours	%	Hours	%	Hours	%	Hours	%
Crop Labor	M	792	14.3	1049	17.2	1619	25.7	1919	25.7	1367	21.3
	W	567	10.2	932	15.3	1340	21.3	1430	19.2	1063	16.5
	C	48	.8	60	1.0	68	1.1	131	1.8	77	1.2
	T	1407	25.3	2041	33.5	3027	48.1	3480	46.7	2507	39.0
Other Farm	M	207	3.7	268	4.4	296	4.7	396	5.3	292	4.5
	W	265	4.8	289	4.7	185	2.9	215	2.9	242	3.8
	C	104	1.9	-	-	25	.4	15	.2	37	.6
	T	576	10.4	557	9.1	505	8.0	626	8.4	571	8.9
Total Farm Labor	M	999	18.0	1317	21.6	1915	30.4	2315	31.0	1660	25.8
	W	832	15.0	1221	20.0	1525	24.2	1645	22.1	1304	20.3
	C	152	2.7	60	1.0	93	1.5	146	2.0	114	1.8
	T	1983	35.7	2598	42.6	3533	56.2	4106	55.1	3078	47.9
Exchange	M	76	1.4	54	.9	54	.9	172	2.3	91	1.4
	W	47	.8	86	1.4	126	2.0	76	1.0	82	1.3
	C	7	.1	-	-	-	-	-	-	1	-
	T	130	2.3	140	2.3	180	2.9	248	3.3	174	2.7
Off-Farm Labor	M	767	13.8	683	11.2	808	12.8	818	11.0	768	12.0
	W	2093	37.7	2187	35.9	1179	18.8	1531	20.5	1797	28.0
	C	-	-	11	.2	5	.1	48	.6	19	.3
	T	2860	51.5	2881	47.3	1992	31.7	2397	32.1	2584	40.3
Special	M	378	6.8	294	4.8	285	4.5	504	6.8	370	5.8
	W	205	3.7	173	2.8	298	4.7	188	2.5	215	3.3
	C	-	-	-	-	-	-	4	*[1]	1	-
	T	583	10.5	467	7.6	582	9.2	696	9.3	586	9.1
Total Non-Farm	M	1221	22.0	1031	16.9	1147	18.2	1494	20.1	1229	19.2
	W	2345	42.2	2446	40.2	1603	25.5	1795	24.1	2094	35.6
	C	7	.1	11	.2	5	.1	52	.7	21	.3
	T	3573	64.3	3488	57.3	2756	43.8	3341	44.9	3344	52.1
Total	M	2220	40.0	2348	35.6	3062	48.7	3809	51.1	2889	45.0
	W	3177	57.2	3667	60.2	3128	49.7	3440	46.2	3398	52.9
	C	159	2.8	71	1.2	98	1.6	198	2.7	136	2.1
	T	5556	100.0	6086	100.0	6288	100.0	7447	100.0	6424	100.0

[1] Less than 1 percent.

farm work, 81 percent was for crop production with the remainder spent on livestock and other farm work. Exchange labor accounted for only 3 percent of total labor but paid hired labor off the farm constituted about 40 percent of the total labor. The special unpaid activities involving ceremony, community services and other activities accounted for 9 percent.

Comparing labor allocation by farm size groups we noted that crop labor requirement as a share of total labor increases with farm size. Farms in the upper half by land area expend nearly twice as much labor in crop production as that used on the smallest farm when expressed as a percent of total. Consequently non-cropping activities diminished as a percent of total with increases in farm size. Off-farm work was 52 percent of all labor in the small farm size and only 32 percent for the large farm size. This indicates again how the labor requirements for crop production is largely determined the residual amount of labor that is available for off-farm work. Non-cropping farm works ranged from 8 to 10 percent in the four farm size classes and roughly inversely by farm size. Exchange labor as a percent of total was approximately 2 to 3 percent for all size groups.

In the four farm size groups, periods 4 and 5 as well as 9 and 10 was when the most family labor was expended off farm. The periods of least off-farm activities were 6 and 7 when rice was being harvested and periods 12 and 13 when dry season crops were being harvested. Nevertheless, it can be noted that, even in a critical crop production period such as period 6, farmers spent on the average 21 percent of their time in off-farm income generating activities. We are led to

believe that for many farms the labor bottleneck is not serious and that on these farms there is surplus labor that can be hired by farming households in greater need and/or can be marketed in the form of income generating activities such as trading. The evidence that non-farm work occurred in some degree the year around probably indicates the need for most households to seek off-farm employment to meet the normal cash flow requirement of the family.

The seasonal distribution of non-farm activities by case households within farm size classes are shown in Appendix Tables 5.1 to 5.4. The seasonal unpaid special labor activities shown in these tables will be used later in the analysis where it will be assumed that time spent in these activities is of sufficient priority as to effectively constrain the family labor available in the case households for crop production.

5.7 Interpreting the Findings

Average hours per household and per activity as well as by sex have been reported. A close examination of the many tables showing detailed characteristics of individual households in the appendices could demonstrate that statistics describing labor utilization may vary widely among families. One may be quick to conclude that labor measurements in agriculture are inherently subject to error and that the reported findings are totally unreliable. Difficulty in labor measurement is not denied and no claims are made to error free data especially since different enumerators were involved in the measurement process. On the other hand, the average number of man hours utilized per activity or per rai of a given crop may vary widely among households as a consequence of differing levels of productivity per worker. Such differing

levels of productivity may be expected from a variety of causes: differences in age, differences in nutritional intakes and differing states of health, differences in the environmental conditions of works such as temperature and/or humidity and presence of a breeze during time of work or differing conditions facing workers in the accomplishment of a given task. Examples of the latter include differing soil conditions and differing work capacity of the draft buffalo in the plowing operation or differing size and number of weeds in weeding operation.

Since the specification of labor as a required input in farm production is imprecise at best, one is faced with the problem of deciding what coefficients to use in the preparation of farm budgets or for setting up a linear programming tableaux. For this study in the linear programming analyses to follow, labor requirements by period for individual crops will be based on average reported hours utilized on farms less than 10 rai for one set of coefficients and the average reported on farms with 10 or more rai as another set. The reason for not developing coefficients around the quartile size grouping is that the number of observations was too small for reliable estimates. The reason for not developing coefficients around equal numbers (the lower half and the upper half) on the size groupings is that the farm size distribution is skewed to the right. Thus, it was concluded that farms with less than 10 rai would be considered small farms and farms with 10 or more rai would be considered large.

Another implication of the description of labor utilization phenomena in the previous chapters is the manner in which peasant families manage

their labor to cope with the seasonal peaks and troughs in the labor requirements in crop production. All sub-classes of labor (exchange, family labor hired out, handicraft activities, off-farm activities) have their own seasonal profiles. Exchange labor and hired farm labor correspond to peak seasons in crop labor requirements. Other activities contribute to smoothing the year long labor profile. Recognition of the importance of maintaining the subsistence level livestock enterprises, the cultivation of a household kitchen plot, the harvesting and the need for a family to uphold its community responsibilities are considered to understanding the economics of multiple cropping systems. It is for this reason in the analysis to follow that comparisons will be made between linear programming solutions that have been obtained with and without these labor utilization considerations as effective resource constraints.

Before turning to how the above constraints fit into a linear programming model, it seems appropriate to first give attention to the rewards to the labor effort; namely, to the family income and to the accumulation of family assets.

CHAPTER 6

FAMILY INCOME AND ASSETS

6.1 Sources and Definition of Income

The components of the household income include (1) income from farm sources, and (2) income from non-farm sources. For present purposes, farm gross income is classified into (1) income from field crops computed as the gross value of field crop production, and (2) receipts from the sale of other farm produce including vegetables from the garden plot, fruits sometimes found in the family compound and livestock (excluding the sale of capital assets). This second category is referred to as "farm non-crop income."

The non-farm income is unambiguous if we regard it as the income to family labor for income producing activities conducted in the home (handicraft activities), on another farm (hired farmed labor) or in the community (activities for payment as non-agricultural laborer or services). No attempt, however, has been made to compute a value for the production services rendered by the family within the home as a form of expense saving even though they do constitute a significant (but unknown) portion of the time spent particularly by the female labor force. Reference is made here to activities such as child care, food preparation, other services for the family and maintenance of the home.

In the discussion to follow, attention will first be given to gross value or gross receipts from the productive enterprises. This

is taken as a measure of business volume. In subsequent sections a conversion to net income will be made by taking account of the respective enterprise expenses.

6.1.1 Crop Income

The level of crop income in the rainy season (expressed as the value of rice produced) in each household depends on rice price, the area of rice harvested and the yield of rice per unit of land. The dry season crop income depends on area planted, and the gross value per rai for the various dry season crops grown. Rainy season rice is the major crop accounting on the average for 57 percent of the value of all crops grown (Table 6.1). Dry season crops represent, on the average, the remaining 43 percent for which the major crops are dry season rice and soybeans. On the average, the households generate in crop value ฿8250 for rainy season rice, ฿2596 for dry season rice, ฿2714 for soybeans, ฿449 for peanut and ฿458 for garlic.

Consistent with the earlier finding that smaller farms have a higher cropping intensity index than large farms, the percent of crop value provided by dry season crops is highest on the smallest farms. This implies a somewhat heavier dependence on dry season cropping for the smaller farms than is true for the larger farms. Larger farms will grow some dry season rice either to insure food supplies or as a cash crop. In general, soybeans (basically a woman's crop) contribute the most to dry season crop income in the dry season. See Appendix Table 6.1 for the distribution of crop income by enterprise and by household.

Table 6.1

Crop Value per Household by Crop and Percent of All Crops for Representative Farms

Item by Representative Farm	Rainy Season Rice	Dry Season Crops					All Crops
		Dry Season Rice	Soybean	Peanut	Garlic	Sub-Total	
Small							
฿ per Household	4967	2343	1196	169	912	4620	9587
Percent of Total	51.8	24.4	12.5	1.8	9.5	48.2	100.0
Lower Middle							
฿ per Household	6697	1377	3545	64	236	5222	11919
Percent of Total	56.2	11.6	29.7	.5	2.0	43.8	100.0
Upper Middle							
฿ per Household	9948	1583	2694	1159	257	5693	15641
Percent of Total	63.6	10.1	17.2	7.4	1.6	36.3	100.0
Large							
฿ per Household	11406	4802	3523	443	375	9143	20549
Percent of Total	55.5	23.4	17.1	2.2	1.8	44.5	100.0
All Farms							
฿ per Household	8250	2596	2714	449	458	6217	14467
Percent of Total	57.0	17.9	18.8	3.1	3.2	43.0	100.0

6.1.2 Farm Non-Crop Income

The farm non-crop income is derived from the sales of fruits and vegetables grown in the household compounds and kitchen plots, the sale of swine, the sale of poultry and eggs and also (in rare situations) the sale of fish. Appendix Table 6.2 shows that 16 households have receipts from fruits and vegetables and 24 households sold swine. Only eight families raised enough poultry for a surplus to sell and only one had egg sales. Nine households have livestock as the only source of non-crop income. On the average, the household earned ฿806 in farm non-crop sales in which swine provided ฿722 (90 percent) and fruits and vegetables provided ฿57 (7 percent). Poultry, eggs and fish are mainly for home consumption. It should be noted that, for this summary, the money received from the sale of cattle and water buffalo owned for more than one year have been excluded. The reason for this exclusion is that from an accrual accounting point of view, the cost of such animals was offset by their end of year inventory value and the sale of them is offset by their beginning of year inventory value. From the 30 household study, there were a total of six cows and buffaloes sold from five farms with an average of ฿2283 bahts per animal sold. It should be apparent that on no farm are any of the non-field crop enterprises of sufficient size to be called a commercial venture. They are best regarded as supplementary enterprises that utilize a limited amount of land around the household compound and/or some family labor primarily to provide additional substance and variety to the family diet. If there is more than the family will eat, it can be sold. There is the exception of pork production where

the hogs are fed primarily on grain byproducts and kitchen waste and are sold at a time to meet critical cash contingencies such as when school fees must be paid.

The amount of food supplied by these supplementary enterprises is shown in Table 6.2. As a share of the total value of home produced consumption, the enterprises contribute only 8 percent because rice is the staple food. Of the non-rice portion, meats constitute about two-thirds with about three-fourths of the meat being consumed in the form of poultry or fish. The value of the consumed fruits and vegetables is about the same as the amount sold on the average. The value of meat consumed is only about 16 percent (฿176 compared with ฿1099) of the value of meat sold because of the practice of selling the swine.

In the linear programming analyses to follow, it will be assumed that these farm non-crop income activities be maintained at the reported levels. This means that the family labor used to maintain them will not be available for allocation to alternative uses. Furthermore, when the LP results are obtained, it will be reasonable to add the appropriate amounts of home consumed farm production and sales from these supplemental enterprises to the value of the objective function in the LP solution.

6.1.3 Family Non-Farm Income

The return to family labor used in the productive activities apart from the care of livestock, maintaining the vegetable plot, harvesting native fruits and cultivating their own land are discussed in this section. Family income is supplemented by household family labor being hired to work in someone else's land in agricultural production

Table 6.2

Average Value of Food Self-Supplied by Household, Ban Pa Mark, 1973-74

Food Type	Baht	% of Class	% of Non-rice	% of All
Meat				
Poultry	67.10	38.1	26.2	3.2
Fish	67.26	38.2	26.2	3.2
Eggs	12.60	7.2	4.9	.6
Other	29.01	16.5	11.3	1.3
Sub-total	175.97	100	68.6	8.3
Vegetables				
Leafy Vegs.	37.26	48.6	14.6	1.8
Pepper	.58	.8	.2	-
Other	38.81	50.6	15.1	1.8
Sub-total	76.65	100	29.9	3.6
Fruit	3.95	100	1.5	.2
Total Non-Rice	256.57	--	100	12.1
Rice	1865.96	100	--	87.9
Total	2122.53	--	--	100

Source: Thodey, A. R. and Peter LaRamee. Ban Pa Mark, Northern Thailand. Results of a Daily Record Keeping Study, 1973-74. Agricultural Economics Report No. 4 Chiang Mai University. 1974.

and post-harvesting work or to work in the non-farm work such as carpentry, house building and repairing. Handicraft activities within the household and trading outside the home are also common non-farm income producing activities. On the average, the household earned ฿2715 from non-farm sources including ฿419 from farm labor hired out, ฿1144 from non-farm hired labor, ฿31 from services, ฿286 from handicraft and ฿835 net from trading (Table 6.3).

Expenses for trading were deducted from gross receipts yielding the net return. About a third of the family non-farm income is received from trading. On this basis approximately 42 percent of the non-farm receipts come from self-employed receipts. Handicraft activities utilized 80 percent of the labor expended on non-farming activities but represented only 10 percent of the total receipts.

Most of the handicraft activities are in the form of braiding hats from material prepared by the family from bamboo. Some households made winnowing trays, sieves, water dippers and baskets. Handicraft work, especially hat braiding, has the lowest return of all non-farm income activities but it takes little skill and it is a means of using slack time.

Appendix Table 6.3 shows the hours spent, annual returns and return per hour for non-farm income by household and by source. From this we can see that paid labor receipts ranged from nil to more than ฿3000 per household. There were four households which earned income from carpentry work including sawing and building with receipts averaging ฿2675 per household. Three households did some carving with an average of ฿2632 per household. One household reported income from

Table 6.3

Cash Receipts from Hired and Self-Employed Labor[1]

Source	Baht	Hours/ H.H.	Baht/ Hour	Percent of Class	Percent of Total
Labor Hired					
In farming	419	*	*	26.8	15.5
Other	1144	*	*	73.2	42.1
Sub-total	1563	777	2.01	100.0	57.6
Self-Employed					
Services	31	13	2.38	2.7	1.1
Handicraft	286	1370	.21	24.8	10.5
Trading	835	328	2.54	72.5	30.8
Sub-total	1152	1711	.67	100.0	42.4
Total	2715	2488	1.09	--	100.0

Sources: Appendix Table 6.2.

[1]Trading receipt adjusted for trading expenses. Household data seemed unreliable in relationship between reported hour and reported earning have been omitted.

*Data available do not provide division of hours between farm and non-farm hired labor.

sewing and in another occasional printing was done with earnings totalling ฿2743 and ฿7654 respectively. Other paid non-farm work was for works such as assisting a carpenter in sawing, wood planing, carving wood or other like tasks. Labor hiring for non-farm work provided annual receipts per household of an average of ฿1144. This is approximately three times the receipts from hired labor in farming activity.

Annual non-farm receipts are reported in Table 6.4 summarized per household and per hour for the four representative farms. Receipts from labor hired were highest for the upper middle sized representative farm, and lowest for the small representative farm. With regard to receipts from self-employed activity, the large representative farm received the most even though the hours spent were less than either the small or lower middle sized representative farm size. In general we observe that the rate of return per hour received in non-farm employment increases steadily with farm size.

6.1.4 Total Income

The value of crop production plus the receipts from labor hired out and from self employed activities yielded an average of ฿18,536 (Appendix Table 6.4). The farm component of this income (crop and non-crop) represented 82 percent of the total leaving 18 percent for receipts to the family labor in off-farm activities.

When summarized on the basis of representative farms, we observe that the non-farm income is substantially higher as a percent of total for the small representative farm than is true for the rest of the sample (Table 6.5). It amounted to 25 percent for this representative

Table 6.4

Receipts Per Household from Hired and Self-Employed Labor by Farm Size Group

Source	Farm Size Group (Representative Farms)							
	Small		Lower Middle		Upper Middle		Large	
	Baht	Bht/ hr.	Baht	Bht/ hr.	Baht	Bht/ hr.	Baht	Bht/ hr.
Labor Hired	1227	1.83	1557	1.93	1876	2.50	1632	1.86
Self-Employed								
Services	59	2.47	67	2.47	--	--	--	--
Handicraft[1]	334	.18	424	.22	271	.24	132	.19
Trading	173	2.64	416	2.28	175	2.79	2443	2.57
Sub-total	566	.29	907	.43	446	.38	2575	1.55
Total	1792	.70	2464	.85	2322	1.21	4207	1.66

Source: Appendix Table 6.3.

[1]The returns per hour to handicraft activities are extremely low and may not be comparable to returns to handicraft activities reported in studies in other parts of the world. The bamboo braiding skills are expected to be learned by all younger family members even if the returns to family income from doing it are minimal. It is the type of activity one might see in a social setting just as women in Western culture may be seen knitting at any time or place. It is possible that hours for handicraft work are over-reported because of the training, recreational and joint-product nature of these activities.

Table 6.5

Total Family Income and Net Income per Household

Item	Farm Size Group (Representative Farms)							
	Small		Lower Middle		Upper Middle		Large	
	Baht	Pct.of Gross	Baht	Pct.of Gross	Baht	Pct.of Gross	Baht	Pct.of G ross
Farm Income								
Crop Income	9587	67	11,919	81	15,641	81	20,549	81
Other Farm Income	1198	8	358	2	1,115	6	536	2
Total Farm	10,784	75	12,277	83	16,756	87	21,084	83
Non-Farm Income	3,534	25	2,444	17	2,574	13	4,289	17
Gross Income	14,330	100	14,722	100	19,331	100	25,373	100
Expenses	3,271	23	3,382	23	4,860	25	5,120	20
Net Income	11,071	77	11,340	77	14,472	75	20,253	80

Source: Appendix Table 6.4.

farm and approximately 17 percent for the large representative farm. We see the attempt on the part of the small farmers to compensate farm income with income from other sources. Nevertheless, the gross income for the small representative farm is only about 66 percent of that found on the large representative farm. When gross income is adjusted for all expenses, the net family income was ฿11,071, ฿11,340, ฿14,422, and ฿20,253 per household for the small, lower middle, upper middle, and large representative farms, respectively.

6.1.5 Distribution of Income

The matter of income distribution has become an important consideration in economic development. Economic planners have long concerned themselves with increased productivity in agriculture and increased farm income absolutely and on the average. Such an objective could be met by concentrating development effort on the largest and most advanced farmers. However, this approach to development has increased the income gap between the poorest of the poor and those best off. To examine the income distribution in Ban Pa Mark, Lorenz curves were constructed on the basis of net income per capita, per adult consumer equivalent and per household. These are shown in Figures 6.1 and 6.2. The Gini coefficients are .233, .192, and .232 for income per capita, per consumer equivalent and per household respectively. These coefficients are very low for a developing country and the per capita income coefficient is considerably lower than Sundrum's[1] (1973) estimated figure of .44 for rural Thailand. This

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[1] Sundrum (1973:91) cites Gini coefficients on income for rural areas in India, Sri Lanka, the Philippines and Thailand of 0.34, 0.45, 0.43, and .44 respectively.

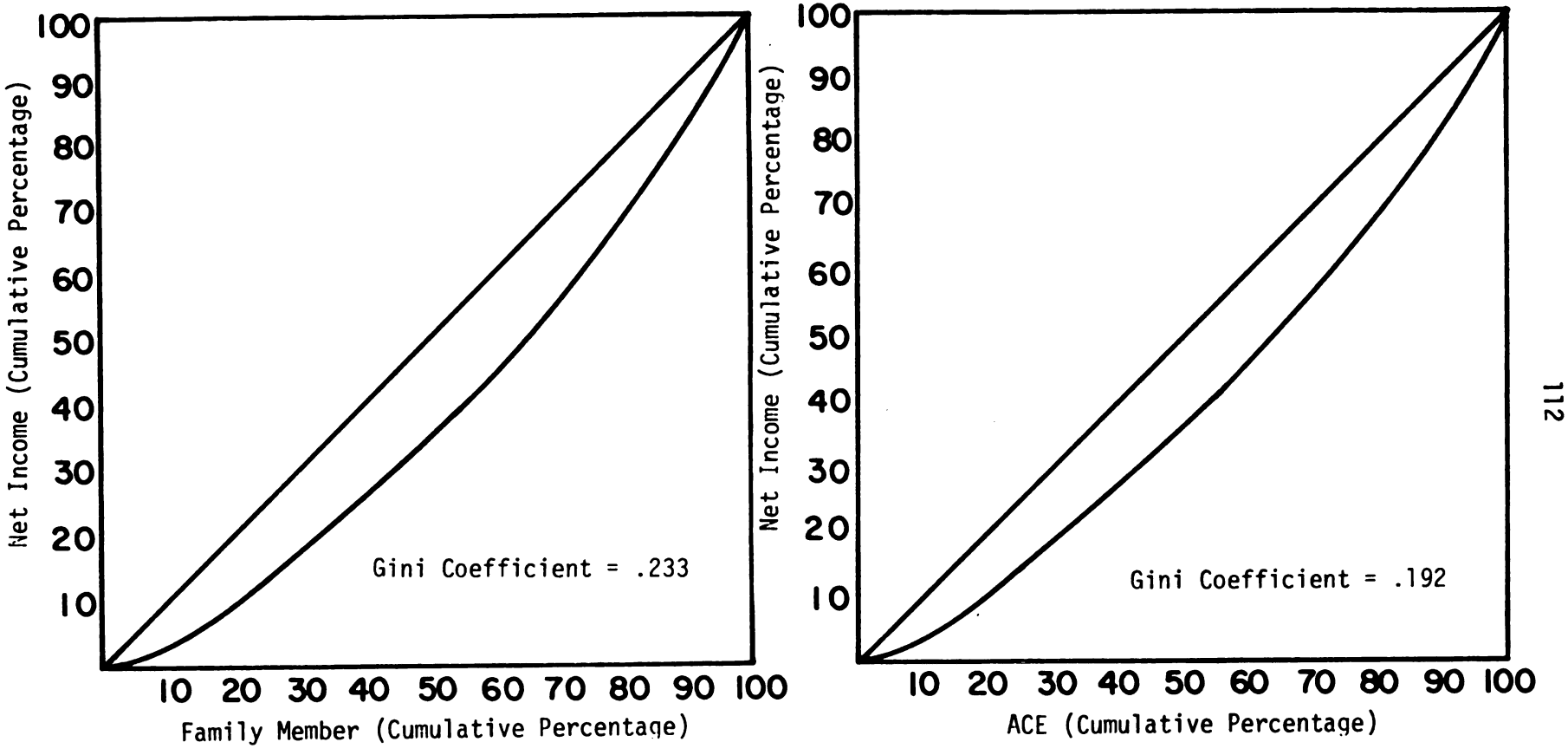

Figure 6.1 Lorenz Curve of Per Capita and Per Consumer Income Distribution

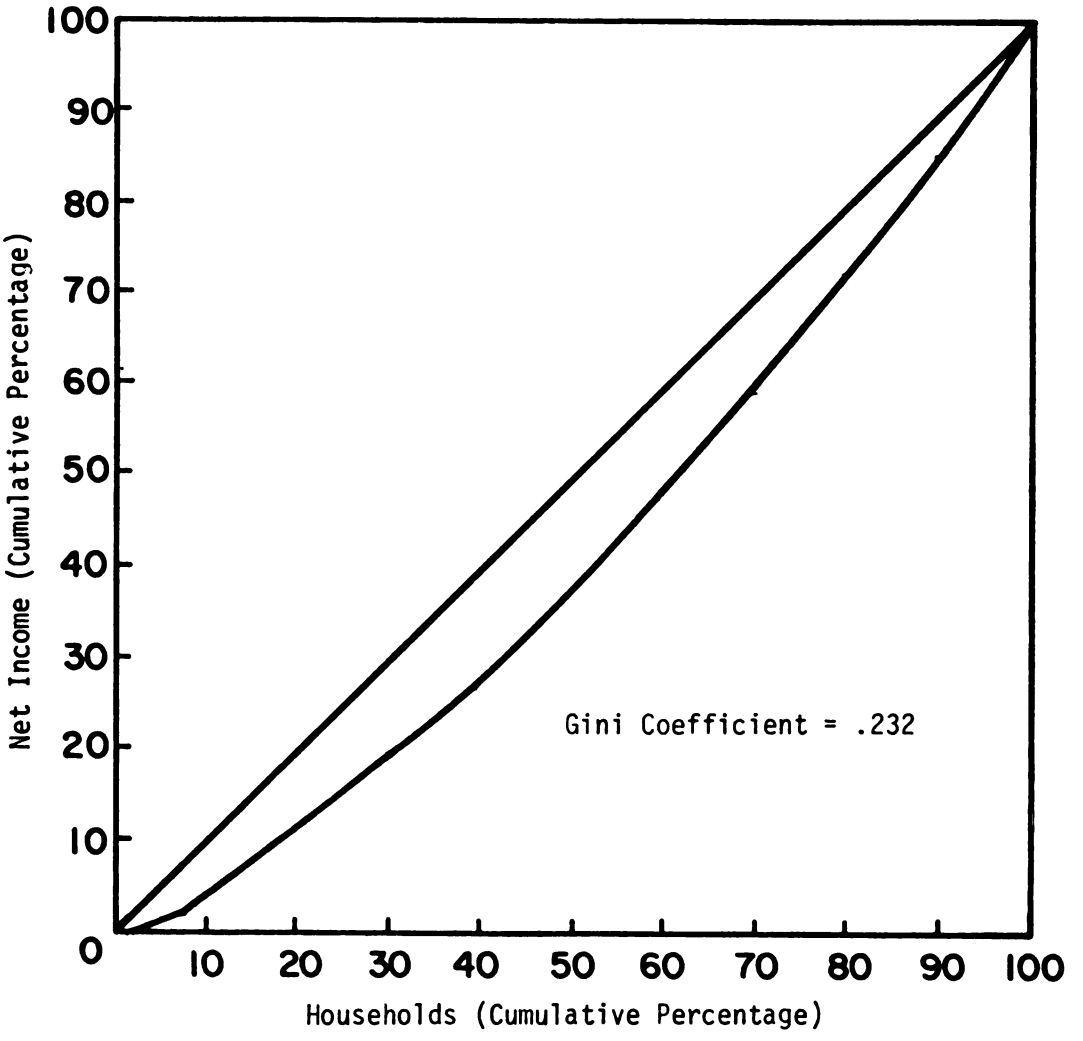

Figure 6.2 Lorenz Curve for Net Income per Household

suggests that the income distribution within a village is more equal than income distribution between or among villages. The following are offered as possible reasons for the relatively equal income distribution in Ban Pa Mark (1) there is a high degree of kinship among households and an overt concern for one another among all families; (2) there is evidence that farms with a high labor-to-land ratio provided hired labor to those farms with a low labor-to-land ratio. This has an equilibriating effect in that the income received by one farm is an expense for another farm; (3) it was observed above that small farms have a lower family income than large farms but with the larger family size on large farms, the per capita and per consumer income measures become more alike when comparisons are made among families; (4) fortunately, the Ban Pa Mark area appears to have off-farm employment opportunities to utilize at least some of the surplus labor where it exists so that labor under-utilized on the farm may be marketed off the farm to augment farm income. The distribution of income among households on the basis of household net income, per capita and per consumer equivalent is shown in Appendix Table 6.5. The annual per capita income average of ฿2,648 is equivalent to $132 and the per consumer income average of ฿3,260 is equal to $163. The average income per consumer is higher than per capita because there are fewer adult consumer equivalents in a household than there are family members. The estimated per capita income for Ban Pa Mark is only 43 percent of the national average reported in the 1977 statistical yearbook for 1974.[2]

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[2]1977 Statistical Yearbook shows the 1974 per capita income to be India=$136, Pakistan=$154, Indonesia=$175, Sri Lanka=$228, Philippines=$326, Thailand=$304, Korea=$436, Malaysia=$715.

This is not surprising since much of the wealth of the kingdom is concentrated in the large cities, especially Bangkok.

6.2 Family Assets

Assets possessed by the sample households will be discussed under the following classifications: real estate including land and buildings, other farm assets including livestock and farm implements and non-farm assets including consumer durables and cash holdings.

6.2.1 Real Estate

6.2.1.1 Land and Land Distribution

Land is the major valuable asset held by the farm family. It is usually used as collateral for long term loans. The value of farmer land holdings determines the ability to borrow. Thus, farmers try to expand the area of land ownership. Land is kept in the family and it is usually passed from one generation to the next. Land sale transactions occur but are rare.

As part of the July 1974 household survey, the farmers were asked to estimate the value of their land. Estimates ranged from ฿5,000 to ฿10,000 per rai with the following distribution: seven operators valued their land at ฿5,000 per rai, one at ฿5,500, 16 at ฿6,000, 2 at ฿7,000, 1 at ฿8,000 and 3 operators valued their land at ฿10,000 per rai. This distribution resulted in an average of ฿6,283 per rai for the village. Given the wide range in farmers' estimates, it was decided to use the village average in the analysis to follow.

Of the 30 households, three own no land (Appendix Table 6.6). The remaining 27 average 9.2 rai with a total average valuation of

฿7,936. Land is the major farm investment constituting about three-fourths of the total farm investment of ฿76,272.

Since land is the primary producer of family income, it was felt appropriate to make note of the distribution of land ownership. The Lorenz curve for relationship between land ownership and household population is shown in Figure 6.3. The Gini coefficient is .418. This coefficient is higher than the Gini coefficient for family income largely because 10 percent of the population own no land at all.

Access to the services of land is as important as land ownership in determining the level of farm income since most of the farmers are tenants as well as land owners, the distribution of land operated is much more evenly distributed than the amount of land owned. The Lorenz curve showing the relationship between land operated and household population is shown in Figure 6.4. The Gini coefficient is .256, a figure quite comparable to the Gini coefficient for the distribution of family income.

6.2.1.2 Buildings

All farmers own their houses. Houses are built and improved over time in stages and each stage is paid for in cash which has been saved with this specific purpose in mind. The value of the house varies with the building material used, its age and size. Wood is the most common material used for walls and flooring and cement tile or clay tile is the material used for roofing on the more expensive house. The expensive house would have brick walls instead of wood. The least expensive one would be built with bamboo flooring and walls and the roof will be covered with tree leaves. This type of roofing is

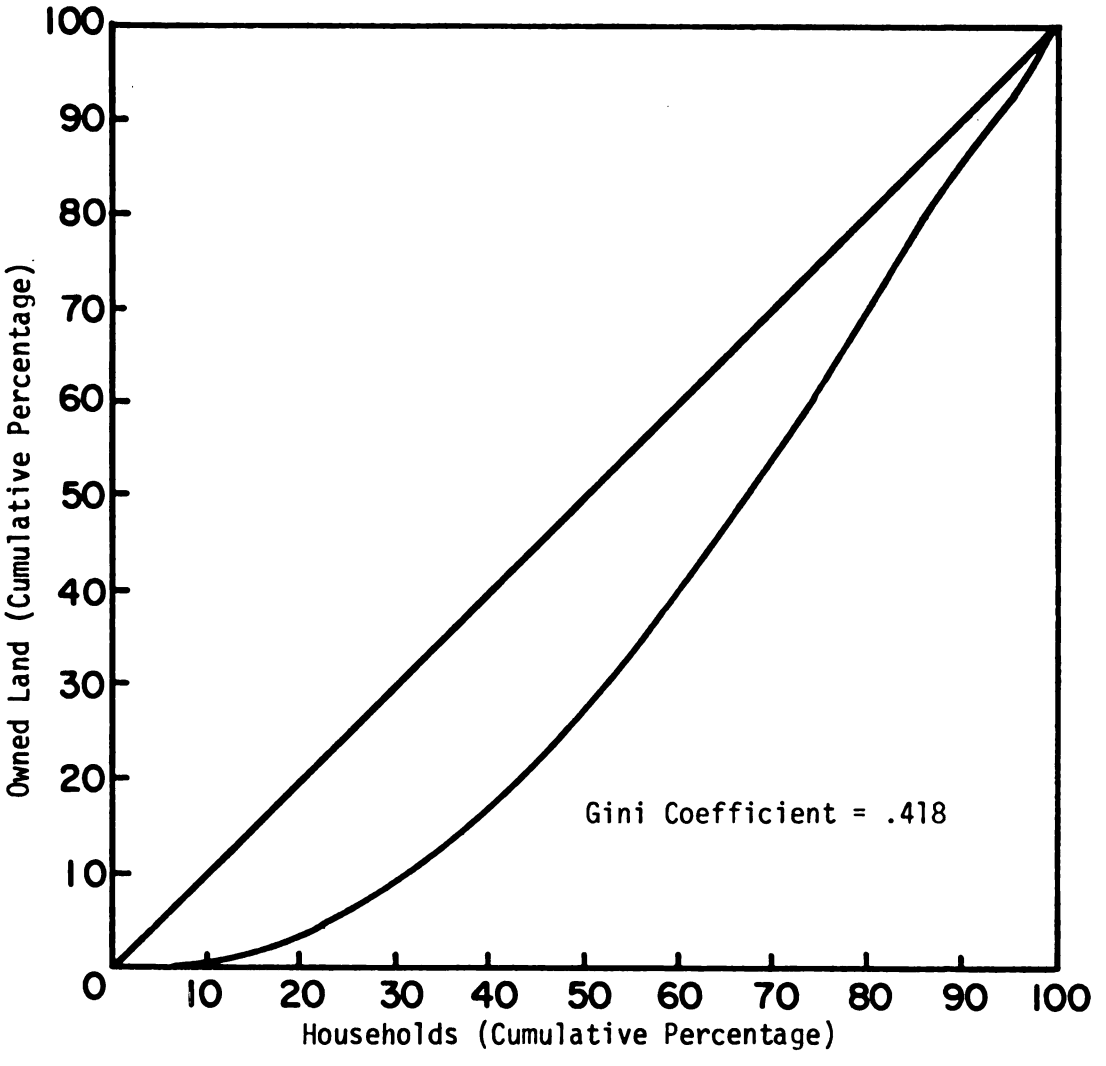

Figure 6.3 Lorenz Curve of Distribution of Owned Land

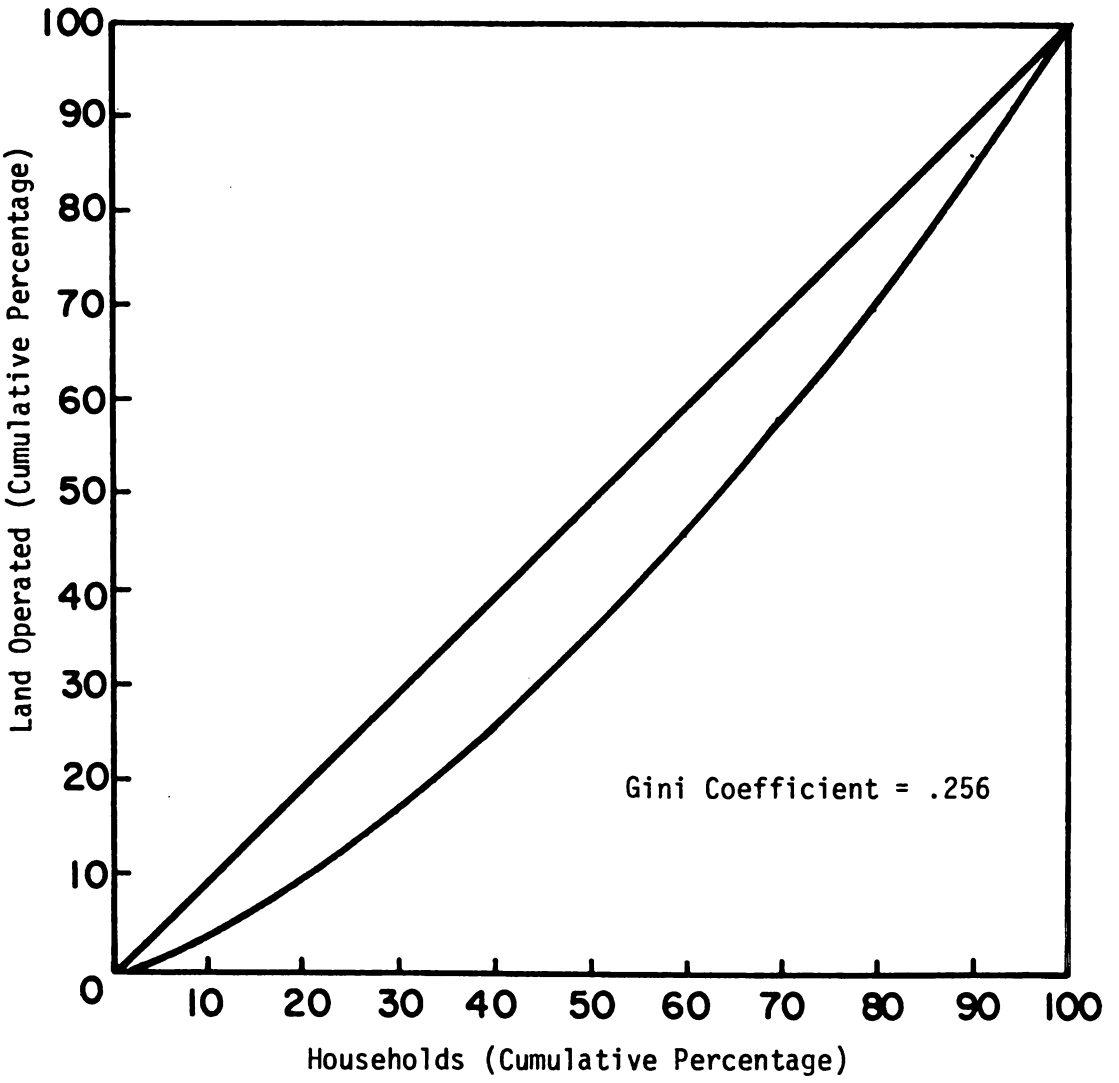

Figure 6.4 Lorenz Curve of Distribution of Land Operated

inexpensive because tree leaves are abundant, but it requires annual repair and maintenance. The value of housing as reported in 1973-74 survey for individual household is shown in Appendix Table 6.6. It ranges from ฿400 to ฿30,000 reflecting the differences in material use, the size and the age of the houses. The house has an average value of ฿10,970. It is an indicator of household wealth because surpluses from farming and labor income may have been saved for many years and then invested in the building. The capacity to save depends in part on the size of farm and we note in Appendix Table 6.6 that the small representative farm has an average house value less than ฿4,000 compared with an average value of more than ฿16,000 for the large representative farm.

A house is not the only building to be found on the typical Ban Pa Mark compound. Farmers store their grains in a separate building called the rice barn. Twenty-three households have their own barn, the remaining seven stored their grains with parents, brothers or neighbors. As with the house, the value of the barn varies according to material used, age and size of the building. In general, the material and the size of the barn correspond with the house. Appendix Table 6.6 shows that the barn value ranged from ฿300 to ฿10,000 with the lowest valuation occurring with the least expensive house and the highest valuation in general occurring with the highest value house. Hence the small representative farm has a rice barn value less than half of the average valuation of the rice barn for the large representative farm.

6.2.2 Livestock

Since there are no commercial livestock enterprises in Ban Pa Mark it is very difficult to make an accurate accounting of the amount of livestock maintained in the sample households. The amount of livestock on hand is a function of both essential family need (for example, draft animal requirement for specific period, cash requirements from the sale of swine in other periods and the need for poultry to meet special food requirements for group in critical labor periods or the time of religious events) and the amount of feed in the form of byproducts available. Appendix Table 6.7 presents the June 30, 1974 inventory of livestock on hand. It shows an average per household of .73 buffalo, .43 oxen, and 1.77 swine. Inventory for chickens and ducks expressed in monetary terms averaged 92 and 5 baht respectively.

Water buffalo and oxen provide animal power for plowing, harrowing threshing and pulling carts. Water buffalo like wet land and thus are normally used for land preparation in the rainy season. Either oxen or buffalo can be used for plowing in the dry season. Carts are normally drawn by oxen.

Because of their relatively high unit value, ownership of buffalo and/or oxen is an indication of wealth. In most parts of Thailand, they are used as collateral for short term loans but in Ban Pa Mark, farmers resist borrowing money regardless of their level of collateral. Short term credit requirements are met with personal loans on the basis of verbal agreement.

In the Chiang-Mai area both buffalo and cows may provide a sort of liquidity. Farmers may sell their animal at a cattle market such as the one located about 10 kilometers south of Kan Dong District

Center if they need cash. This open market is especially active in the dry season after dry season crops have been planted when farmers sell their buffalo and may transact for a bicycle which will be used for transportation until the rainy season begins. Buffalo are considered costly to keep, income is forgone from time that could be spent on alternative activities and all farmers fear the risk of having their buffalo stolen. Even though they buy at the beginning of the rainy season at a relatively high price and sell in the dry season at a relatively low price, this behavior is considered rational for the above reasons. Some farmers prefer not to own buffalo at all. They will either have plowing done by custom work or will rent buffalo from a neighbor.

Even though the inventory shows only 23 households with swine, hog production is a universal phenomenon. One can expect that the 7 households without the swine would have one or more sometime during the year. The number of hogs kept is determined by a sensitive balance between the amount of byproduct feed available and the amount of cash needed to buy protein supplement. The small hog enterprise is raised in confinement using low cost homemade pens constructed in the compound area.

A small family flock of chickens is maintained in each household. They are raised for both meat and egg consumption and run freely unconfined in the home lot. Three households at the time of inventory were raising ducks. The average value of livestock per household totalled ฿4836. It is of interest to note that there were eight households where the livestock valuation at time of inventory was greater than the value of the family residence.

6.2.3 Farm Implements

From Appendix Table 6.6 it can be seen that farm implements represent an almost negligible part of the total value of farm assets (averaging only ฿138 out of a total of ฿76,272). This points out very clearly that the traditional cultural practices are rather primitive. The usual complement of implements includes one or two plows, one or two harrows, two to four hoes and/or spades and about four sickles. One family (HH34) without a male adult had all land preparation work hired therefore owned only a few sickles for crop harvest.

In 1974, at the time of the closing survey, no farmers in this village owned a tractor. Some tractor services were hired in the dry season but not in the rainy season because of the high cash requirement and because of the waiting time. Farmers in the 1973-74 crop year did not consider a tractor suitable since individual land parcels are small. Nevertheless, when the village was revisited in July 1978, about one family in six now owns a small tractor. However, without repeating the type of study done in 1973-74 it is not possible to evaluate the impact of mechanization in Ban Pa Mark.

6.2.4 Total Farm Assets

In summary, real estate in the form of land and housing represents almost 94 percent of the value of farm assets. Most of the remainder (6 percent) comes from the value of the small livestock and poultry enterprises. In the context of farming practices carried out by families in this study, farm implements are not considered long term capital assets because annual replacement is commonplace. Consequently

in the preparation of the budget for LP analysis, a charge was made for the annual cost of replacement of farm tools.

6.3 Non-Farm and Total Assets

6.3.1 Selected Durable Goods

At the time of the survey, it was decided to enumerate and evaluate selected consumer goods and to ignore those parts of the household inventory (bed, chairs, cooking utensils, etc.) that would be common to all families. Hence the value of the total household inventory is deficient by the amount of these omissions. Selection of the consumer durables was made on the basis of the extent to which they would provide insight regarding differential levels of living among households. The selected items included bicycles, motorcycles, watches, clocks, radios, and sewing machines. The distribution of ownership of these items by household is shown in Appendix Table 6.8. Of the items mentioned, bicycles are the most common among families. This reflects the role of the bicycle as a means of transportation for both people and goods. A radio was the second most frequent item found in the selected list. All families but five have one or more radios with an average value of ฿178. Radios are locally produced and relatively inexpensive but nevertheless, the value of the radio still exceeds that of the total value of the farm implements inventory.

Motorcycles when new are the most expensive items in the inventory of personal property (costing as much as ฿9,000 and averaging ฿3,313 in value for the 12 vehicle inventory). This item probably best represents financial well-being since it appears that most families are

anxious to replace the bicycle with a motorcycle. In general, motorcycles are to be found in the families with the highest income.

Like motorcycles, sewing machines are individually costly. Sewing machines were found in only 6 households with an average value per machine or almost ฿2,600. The motivation for owning a sewing machine is more closely tied to the potential for expense saving or income earning than it is to status.

In summary, the availability of consumer goods in the stores in the district center can be an incentive for farmers to work harder so that they can earn more income and save for such items. Ownership of a radio and a bicycle are an incentive for a family of moderate means. Motorcycles being more expensive can serve to raise the aspiration level particularly of young farmers.

6.3.2 Cash Holdings

An inventory of cash on hand was taken July 1, 1973 and again on June 30, 1974. The reported results are shown by household under non-farm assets in Appendix Table 6.7. The average of the beginning and ending of year amounts give us some indication of how much cash is kept on hand by families at the beginning of the rainy season. The level of cash holdings and the wide variation that we observe in Appendix Table 6.7 is probably explained by such things as the following: (1) the amount of dry season crop sold at time of harvest; (2) the amount of indebtedness to friends and neighbors that must be repaid at this time; (3) the amount of cash considered essential to enter the rainy season cropping program; (4) the amount expended during the dry season for home improvement or other abnormal purchases; and (5) differences in general saving habits among individual families.

We observe that families in the small farm size class appear to be always at a fairly low level of cash reserve. But we can also note that many families in larger farm size categories were holding little cash at this time of the year. With regard to the reliability of this figure we recognize that it is difficult to get truly accurate responses in an interview situation and, for obvious reasons, it is considered confidential information.

The amount of cash assumed to be on hand for the linear programming model was guided by the reported inventory of cash on hand. When individual case households were being analyzed, the July 1, 1973 figures were used. When the representative farms according to farm size were analyzed, ฿500, ฿1,000, ฿1,500 and ฿1,500 were assumed for the small, lower middle, upper middle and large representative farms respectively. In addition to this, assumptions were made with regard to a cash value for the beginning of year rice inventory necessary to meet family consumption requirements from the beginning of the year to the time of rice harvest. This assumption will be explained in more detail in Chapter 8.

6.3.3 Total Assets

Total assets per family for individual households ranged from ฿6,655 to ฿166,248 with an average of ฿80,992. The averages for representative farms ranged from $27,169 for the small to $129,622 for the large (Table 6.6). Since most of the value of family assets comes from real estate, it is to be expected that total asset increases with farm size. The percentage of total assets in the form of livestock

Table 6.6

Farm and Non-Farm Assets for Representative Farms

	Farm Size Group (Representative Farms)									
	Small		Lower Middle		Upper Middle		Large		All Farms	
	฿	%	฿	%	฿	%	฿	%	฿	%
Farm Assets										
Land	16,862	62.1	43,416	68.4	72,461	69.4	99,004	76.4	57,936	71.5
Buildings	5,525	20.3	11,686	18.4	16,271	15.6	20,125	15.5	13,363	16.5
Livestock	3,050	11.2	5,716	9.0	6,419	6.1	4,465	3.5	4,835	6.0
Implements	54	.2	140	.2	217	.2	150	.1	138	.2
Total Farm	25,491	93.8	60,958	96.0	95,368	91.3	123,744	95.5	76,272	94.2
Non-Farm Assets										
Selected Durables	1,206	4.4	1,551	2.5	6,926	6.6	4,459	3.4	3,489	4.3
Average Cash	472	1.8	977	1.5	2,139	2.1	1,419	1.1	1,231	1.5
Total Non-Farm	1,678	6.2	2,528	4.0	9,065	3.7	5,878	4.5	4,720	5.8
Total Family Assets	27,169	100.0	63,486	100.0	104,433	100.0	129,622	100.0	80,992	100.0

Source: Appendix Table 6.6.

decreases with farm size (from 11 percent in the small representative farm to less than 4 percent in the large representative farm.

One farm in the upper middle farm size group is of particular interest because of the unusually high value of selected durable goods. Household 33 possessed at the time of the end of year inventory, bicycles valued at ฿1,000, two motorcycles values at ฿18,000, a watch and a radio each valued at ฿200 and a sewing machine valued at ฿5,600 for a total of ฿25,000. This farm alone had valuation of these selected durables over seven times the average of all households. In such a small sample overall, this situation distorts the assets distribution for this household's farm size group as well as the distribution on the average for the entire sample. Nevertheless, it is reasonably safe to say that approximately 3 percent of the family total assets are comprised of these selected durable items.

Earlier, attention was given to the distribution of assets in the form of owned and operated land. One may wonder what the distribution of assets would look like if the value of assets are considered except for land. The Lorenz curve for this distribution is illustrated in Figure 6.5, which has for it an associated Gini coefficient of .378. Assets ownership defined in this fashion has a more unequal distribution among households than is true for family income (.232), income per capita (.288), income per adult consumer equivalent (.192) and the area of land operated per household (.256). The reason for this is that the two major components of the non-land assets, namely house and durable consumer goods, are highly correlated and rather widely distributed in value.

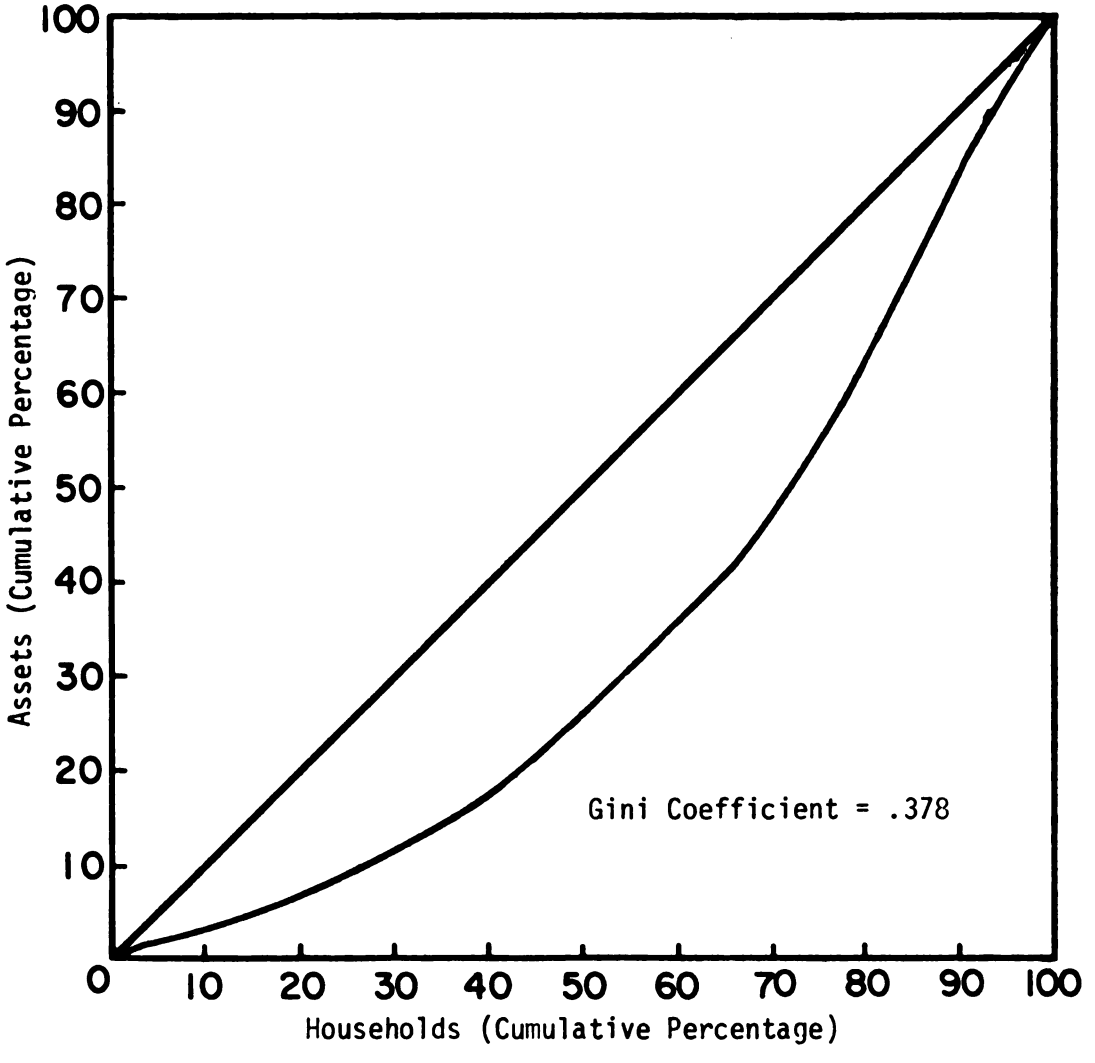

Figure 6.5 Lorenz Curve of Distribution of Assets

Having summarized the income and assets for families on the gross value basis, it is appropriate now to give attention to the relationship between income and assets to the farm business and consumption expenditure patterns.

CHAPTER 7

HOUSEHOLD EXPENDITURE PATTERNS

The purpose of this chapter is to describe the household expenditure patterns with particular attention given those features which will be useful in the linear programming model. Discussion of household expenditures is organized in the following order: (1) field-crop production expenses, (2) non-crop farm production expenses, and (3) expenses in family consumption.

7.1 Field Crop Production Expenses

The crop expenditure for each household depends on the kind and amount of crops grown and the level of technology employed. It was found, except for two cases using hired tractor for plowing land in the dry season, farmers have what can be called a "traditional" technology, characterized by a high labor to capital ratio.

All household expenditures for individual households are classified and recorded in Appendix Table 7.1. They will be discussed in the order of their importance to the family budget.

7.1.1 Hired Labor

All families had some hired labor expenses and regardless of farm size it constituted the highest percent of crop production cash cost. On the average of all households, hired labor expenditures represented 43 percent of total farm expenses and 40 percent of total household

expenses (Table 7.1). For individual farms, hired labor expenses ranged from ฿80 to ฿4882 averaging ฿659 per household (Appendix Table 7.1).

For the representative farms in the study, hired labor expense per family increased substantially by farm size but there was no pattern in the relationship between farm size and hired labor expenditure per rai. One might expect hired labor to increase with farm size but it has already been noted that the large farms tended to grow a smaller proportion of labor intensive crops.

With regard to the LP model, neither hired labor per family nor per rai as reported by farmers will be used. This is because the model calls for a labor hiring activity to be employed when the family labor force is inadequate for crop requirement. It will be necessary, however, to have hired labor rates corresponding to each period. How these were obtained will be discussed in the next chapter.

7.1.2 Land Rent

Two-thirds of the households rented some land (Appendix Table 7.1). The rental arrangement in the village was discussed in Chapter 3. It was noted that the rate for land rent was not institutionalized at a fixed level but varied by season, quality of land and personal arrangements that may have been worked out between leasee and leasor (frequently among relatives). For the sample as a whole, the value of rent paid represents a third of total production cost. However, for the reasons given in Chapter 3, rent as a production cost will be excluded from the LP models. When interpretations of the solutions are made, rental payments will be subtracted from the value of the objective function where appropriate.

Table 7.1

Total Non-Consumption Family Expenditure,
Average per Household by Farm Size

Items	Farm Size Group (Representative Farms)												All Farms		
	Small			Lower Middle			Upper Middle			Large					
	฿	%A	%B	฿	%A	%B	฿	%A	%B	฿	%A	%B	฿	%A	%B
Crop Production															
Labor	951	38	30	1353	41	40	2424	52	50	1965	39	38	1659	43	40
Power	89	4	3	230	7	7	128	3	3	16	*	*	112	3	3
Equipment	5	*	*	64	2	2	161	3	3	22	1	*	60	2	1
Supplies	331	13	10	515	15	15	813	17	17	595	12	12	553	14	13
Water	7	*	*	11	*	*	14	*	*	17	*	*	12	*	*
Rent	926	37	28	1029	31	30	917	20	19	2224	44	44	1294	33	31
Total	2310	92	71	3187	96	94	4458	95	92	4839	96	94	3690	95	88
Livestock	208	8	6	138	4	4	245	5	5	194	4	4	197	5	5
Total Farm Expenses	2518	100	77	3325	100	98	4703	100	97	5033	100	98	3887	100	93
Non-Farm															
Handicraft	17	2	*	---	--	--	---	--	--	---	--		5	2	*
Trading	736	98	23	57	100	2	157	100	3	88	100	2	269	98	7
Total Non-Farm	753	100	23	57	100	2	157	100	3	88	100	2	274	100	7
Total	3271	--	100	3382	--	100	4860	--	100	5120	--	100	4161	--	100
(Land area)	5.43 rai			9.58 rai			12.68 rai			18.48 rai			11.64 rai		
Crop Expenses per rai															
Hired Labor	175			141			191			106			143		
Power	16			24			10			1			9		
Equipment & Supplies	62			60			77			33			53		
Rent and Water	172			108			74			121			112		
Total	425			333			352			261			317		

Source: Appendix Table 7.1

Note: 1) %A = % of Farm Expenses
%B = % of Total Farm & Non-Farm Expenses
2) * = less than 1%

7.1.3 Farm Supplies and Equipment

Farm supplies including seed, fertilizer and chemicals are third in importance for crop production expenses. Since equipment purchases are typically minor outlays for replacement of small tools or maintenance for the plow and harrow, they can be discussed along with farm supplies.

Seed

Seeds for rainy season rice are usually provided by farmers themselves.[1] All households planted the same variety of glutinous rice (Keow Daw) which is a local variety having been selected by farmers over the years.

For dry season rice, the newly released "high yielding varieties" were used which are a cross between IR8 and some local varieties selected for high yield, disease resistance and short-growing season. Farmers plant them in the dry season as "selling rice." Almost all planted RD1, a non-glutinous rice while only 13 percent planted RD2, a glutinous rice. The non-glutinous rice is for the market but the families planting glutinous rice keep it for home consumption. RD1 and RD2 seeds were purchased from the Rice Experimental Station. The cost of dry season rice seed was ฿130.8 per household, averaging ฿6 per rai.

Some farmers grow their own soybean seed in the small parcel of land which was used for rice nursery. This is done to avoid purchase of seed but are of relatively low yield. Most of the farmers purchased their seed from the Mae Jo Crop Experimental Station where SJ1 and SJ2

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[1] However, in developing the budgets for the LP model, the cost of seed at 1 baht per rai was included whether supplied by farmer or purchased. This is based on a seeding rate of .77 kilograms for 1.05 rai of nursery and 1.3 baht per kilogram of rice.

were developed. The cost of purchased soybean seed was ฿292.10 per household averaging ฿43.70 per rai.

Peanut seeds were usually purchased from the merchant. The cost was ฿216.1 per household averaging ฿73 per rai.

Garlic seeds were mostly purchased at the beginning of the planting season when the price is very high. This is due to the farmer not wanting to take risk of seed spoilage coming from early purchase. The cost of garlic seed is very high compared to the seed for other crops. A household spent an average of ฿332 for garlic seed averaging ฿673 per rai.[2]

With regard to fertilizer use, some farmers put buffalo or ox manure on their fields, some used chicken or duck droppings and some used pig manure. Manure was used for all crops but the amount per crop varied somewhat. For rainy season rice, 30 percent of the households did not use any kind of fertilizer, 60 percent used manure and only 10 percent used chemical fertilizer (Table 7.2). The average cost for fertilizer for rainy season rice is only ฿1.10 per rai (Table 7.3). This includes a value for the home produced manure.

Of the farmers growing dry season rice, 46 percent used chemical fertilizer and 27 percent used manure making the average cost of fertilizer equal to ฿11.30 per rai which is about 10 times the cost of fertilizer for rainy season rice.

Soybeans use the residual fertilizer from rice supplemented with the addition of more manure. Ninety-two percent used fertilizer for

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[2] ฿300 per rai was used for garlic in the model. On the basis of the researcher's experience, the reported average was unreasonably high. The ฿300 per rai assumption has also been used previously in research at Chiang Mai University.

Table 7.2

Use of Fertilizer and Chemical by Crop

	Rice		Soybean	Peanut	Garlic
	Rainy S.	Dry S.			
			(Percent)		
Type of Fertilizer					
Manure 1-2 kwien[1]	23	9	23	30	--
3 kwien & over	37	4	28	30	--
Not known	--	14	31	30	--
Chemical 1-2 bags	10	41	4	--	50
3 bags & over	--	5	--	--	17
Not known	--	9	--	--	33
None Used	30	18	4	10	--
No Response	--	--	--	--	--
Total	100	100	100	100	100
n	30	22	26	10	6
Type of Chemical					
Crab Killer					
Parawin	44	26	19	--	--
Folidon	--	5	--	--	--
Insecticide					
Not known	3	5	--	5	7
None Used	50	59	77	95	93
No Response	3	5	4	--	--
Total	100	100	100	100	100
n	30	22	26	10	6

[1] 1 kwien = 100 tangs = 2,000 litres = 5283.4 gallons

Table 7.3

Production Expenses for Crops by Farm with Crop and Per Rai

	Kind of Crop				
	Rainy Season Rice	Dry Season Rice	Soybeans	Peanuts	Garlic
Farms with Crop	30	23	26	9	7
Expenses/HH with Crop					
Hired Labor	927.50	595.20	163.20	262.80	146.40
Other Product. Expense					
Power	99.90	.40	---	57.8	---
Equipment	70.60	.80	.30	22.2	---
Seed	10.10	34.10	269.60	168.10	284.60
Fertilizer	12.30	60.90	28.80	42.80	249.40
Chemicals	2.70	.30	.40	1.30	4.70
Sub-Total	195.6	96.50	299.10	292.20	538.70
Total Crop Expense	1123.10	691.70	462.30	555.00	685.10
Area of Crop	11.64	5.38	6.16	2.30	.42
Expenses per rai					
Hired Labor	79.70	110.60	26.50	114.30	348.6
Other Product. Expense					
Power	8.60	.10	---	25.10	---
Equipment[1]	6.10	.20	---	9.70	---
Seed[1]	.90	6.30	43.70	73.10	673.00
Fertilizer[1]	1.10	11.30	4.70	18.60	589.90
Chemicals[1]	.20	.10	.10	.60	11.10
Sub-Total	16.90	18.00	48.50	127.10	1274.00
Total Crop Expense	96.60	128.6	75.10	241.40	1622.6

[1]Used in LP model for all crops except for garlic.

soybean in the form of manure, only 4 percent used chemical fertilizer and 4 percent did not use any at all. The cost of fertilizer averaged ฿4.70 per rai for soybeans.

For the farmers growing peanuts, 90 percent used manure and 10 percent used none. All growers of garlic used chemical fertilizer. The cost of fertilizer for peanuts averaged ฿18.60 per rai while chemical fertilizer for garlic cost ฿590 per rai. This difference is due to the high price of imported fertilizer compared to that of local manures which are available on the farm or are purchased from other farmers at very low cost.

Not many farmers used chemicals. Table 7.2 shows the percentage of households not using any were: 50 percent for rainy season rice, 59 percent for dry season rice, 77 percent for soybean, 95 percent for peanut and 93 percent for garlic. The most commonly used chemical, parawin, was for killing crabs (44 percent for rainy season rice, 26 percent for dry season rice and 19 percent for soybean). Table 7.3 shows that the cost per rai for chemicals was ฿.20 for rainy season rice, ฿.10 for dry season rice and soybean, ฿.60 for peanut and ฿11.10 for garlic.

The expenses for equipment are very small compared to other items since they are usually made by the farmer himself. Plow and harrows may last 5 to 10 years with some maintenance and repair. Hoes, spades and sickles usually last for 2 to 5 years but need to be sharpened. No major equipment expenditures were reported. The indicated cost of equipment was only for the buying of the blades for plow, spade, hoes and sickles. The most expensive piece of equipment is the threshing

basket (Ku) which would last more than 5 years. On the average, a household spent only ฿60 for equipment (Table 7.1).

7.1.4 Power Cost

Power is the cost of renting oxen or buffalo using the farmer's own labor to plow and harrow the land. Households 53 and 45 are exceptions in that power cost included ฿200 and ฿100 respectively for the cost of hired tractor service in the dry season in addition to some renting of buffalo. Seven households reported renting buffalo, mainly used for rainy season rice. The cost varied depending on the hours used. Expenditures varied from ฿60 to ฿1500.

Because of this wide range accounted for by many farmers owning their own animals, it was decided in the preparation of the LP budgets to assume that each farmer would hire animal power services at the going rate ranging from ฿20 to ฿25 per rai.

7.1.5 Water Charge

Even though every farmer is subjected to some water charge, it is minor in total cost of production, averaging only ฿12 per household. It represents the fee that farmers pay as member of an irrigation association providing for the right to use water. In addition to this small cash outlay farmers are expected to provide material and labor for cleaning and repairing the canal. In the LP budgets, no accounting was made of the material supplied in the cost of production and the labor contribution was included in community services rather than as a labor requirement for crop production. Water charge along with land rent was deducted from the value of the objective function where applicable.

7.1.6 Summary of Crop Expenditures by Crop

For the purpose of the linear programming to follow, it became necessary to summarize the expenditure for each crop on a per rai basis. Since the representative farms were defined on the basis of land area, the question arose as to whether crop expenses should be estimated according to farm size. Since hired labor, rent of animal power, land rent and water charge will be excluded from the budget, this leaves only expenses for equipment and supplies for consideration. Table 7.1 indicates little relationship between farm size and the expenses for equipment and supplies on a per rai basis as an average per farm. The relevant consideration, however, is the expenditure for these items per rai on the individual crop basis. It was felt that the limited number of farms and limited area devoted to individual crops did not justify the estimation of these expenses stratified according to farm size. It seemed more reasonable to make these estimates on the basis of the total sample and to use the results for each of the representative and case farms. This decision is further justified by the fact mentioned above that the primary crop production expenses are for hired labor and land rent which are handled outside the crop budget in the LP model. The expenses per rai by crop are summarized in Table 7.3.

7.2 Livestock Expenses

Buffalo, oxen and cows are kept and fed with straw, grass and some grazing along the rice field bund. Pigs are kept mainly on the household waste, rice bran, weeds and banana stems. Chicken and ducks fed themselves but occasionally were fed with paddy rice. Thus, the expenditure for livestock was mainly for some additional bran, banana

stems, supplemental diet and veterinarian. Pigs share more of the livestock expenditure than others due to the number and the amount each consumes. On the average, a household spent ฿197 for livestock which is only 5 percent of the total farm expenditure (Table 7.1). To interpret the LP solutions, these expenditures were deducted from the gross value of non-crop farm income yielding a net return which was added to the total value of the objective function.

7.3 Non-Farm Business Expenditures

7.3.1 Expenses for Handicrafts Activities

The handicrafts in which the families engaged are mostly for hat braiding and the making of winnowing trays, sieves, water dippers and baskets. They utilize local materials such as the bamboo which is grown on the household compound. Farmers did not purchase them so there is no cost to it. Only one household reported spending ฿138 for the handicraft expenses but the details of this expenditure are not known.

7.3.2 Expenses for Trading Activities

Trading activity expenses are considered to be the cost of produce that a household buys from off the farm and resells in the market, the cost of transportation and market fee. However, from the data available it is difficult to draw clear conclusion about what the expenses represent and the nature of the profit function for these activities. Only six households reported having incurred trading expenses including the household identified in Chapter 2 as running a small store in the village. However, as was noted in Chapter 6, there were 23 households reporting income from trading activities. It appears that trading income must be interpreted as the sale of farm produce and cannot be

related to expenses reported in Table 7.1. This finding will not affect the subsequent analysis because the LP model does not contain a trading activity.

7.3.3 Total Business Expenses

On the average, a household spent ฿4161 annually for its farm and non-farm business. Farming constituted 93 percent of total business leaving 7 percent for the non-farming business expense. As would be expected, total expenses increase as farm size increases (primarily hired labor and land rent) as indicated by the fact that the small representative farm shows an average annual expenditure approximately three-fourths of the large representative farm.

7.4 Family Consumption Pattern

Household family consumption expenditures vary by family size, income level and household composition. Three components of the family consumption expenditures will be presented as follows: 1) value of rice consumption requirement, 2) other food expenditure and, 3) non-food expenditure.

7.4.1 Rice Consumption Requirement

Rice is the major component in the three meals consumed a day by families in the Thai household. Each household grows its own rice and to sell it only if there is a surplus beyond consumption requirements. In the previous chapter, income was ascertained by taking the value of crops including rice as crop income to a family. Some rice purchases were indicated in the expenditure survey and expenses were shown for the cost of milling the family's own rice. However, there were

insufficient data for estimating rice consumption in a family. The value of rice consumed by the family was estimated using information obtained from a survey of the households in which the question was asked as to how much rice was cooked in the household per day. From this it was determined that the average consumption of milled rice per meal per adult consumer equivalent was a little less than one-quarter liter. The quantity of milled rice was converted to paddy equivalent, valued at paddy price to which was added the cost of milling using the average cost per liter reported by the family in the expenditure survey. The resulting value of rice consumed per adult consumer equivalent was ฿297.54 per year. The value of rice thus computed plus other household expenditures will be used in the linear programming model as one of the constraints. The value instead of quantity of rice consumed was used in the LP model as a matter of simplification. With money as a common unit, all financial requirements for periods were combined into a single constraint.

7.4.2 Other Food Expenditure

Meat, eggs, vegetables, fruits, fat and oil, condiments and food away from home are major categories in the other food expenditure. Meats consumed are usually pork, beef, chicken, and fish both prepared and fresh. Eggs include chicken, duck, bird and ants. Vegetables were leafy vegetables, garlics, onions, and peppers. Fruits were mainly bananas, mangoes, and oranges. Fat and oil were for cooking including land and vegetable oils. Condiments were mainly spices for cooking, fish sauce and coconut or cane sugar. Food away from home included soft drinks, prepared meals and snacks.

Food expenditure by class (as well as non-food expenditure) have been summarized for representative farms in farm size classes and for the total sample in Table 7.4. In this table, rice has been computed following the procedure outlined above and other expenditures were those actually reported in the field study. From this we can see that the value of rice and meat constituted about three-fourths the total value of the food budget and about a half of total family non-business expenditure. The amount purchased by individual families may depend on the amount consumed from farm produce sources. The value of the food supplied to households directly from farm production is summarized by case household and representative farms in Table 7.5. This value averaged ฿257 per household of which, it was found, 61 percent was in the form of meat and 39 percent from fruits and vegetables. The food away from home on average is about one-tenth of the total food outlay.

7.4.3 Non-Food Expenditure

The main elements of non-food expenditure are expenditures for improving or repairing house and barn, purchasing furniture and household items, expenditure for tobacco, whiskey and fermented tea, for clothing, personal expenses, transport, gifts, and taxes. Seven households incurred maintenance and repair costs for housing. This can range from the minimum repairs to the change of the roof, the floor and some cases the addition of a bath and/or sanitation facilities. On the average, a household spent ฿319 (13 percent of non-food and 4 percent of total consumption expenditures), for such needs. Three households incurred expenses for barn improvement and spent ฿197 on the average. Every family purchased something for the household in the

Table 7.4

Average Household Consumption Expenditures

	Farm Size Class (Representative Farms)								Total	
	Small		Lower Middle		Upper Middle		Large			
	฿	%	฿	%	฿	%	฿	%	฿	%
Food Expenditure										
Rice[1]	1859	33.7	2220	36.3	2182	26.8	2514	26.2	2193	29.8
Meat	1156	21.0	1262	20.6	1767	21.7	1656	17.3	1457	19.8
Vegetables	337	6.1	364	6.0	487	6.0	468	4.9	411	5.6
Fruits	56	1.0	59	1.0	101	1.2	62	.6	69	.9
Fat and Oil	68	1.2	100	1.7	101	1.2	126	1.3	100	1.4
Condiments	89	1.6	117	1.9	194	2.4	97	1.0	122	1.7
Food away from home	350	6.3	381	6.2	559	6.8	635	6.6	482	6.5
Total Food Expenditure	3915	70.9	4507	73.6	5391	66.1	5558	57.9	4834	65.7
Non-Food Expenditure										
Housing	64	1.2	82	1.3	91	1.1	981	10.2	319	4.3
Barn	-		40	.7	-	-	702	7.3	197	2.7
Furniture & Household Items	205	3.7	179	2.9	484	5.9	373	3.9	309	4.2
Tobacco, Whiskey, Fermented Tea	501	9.1	441	7.2	422	5.2	460	4.8	458	6.2
Clothing	283	5.2	238	3.9	371	4.6	207	2.2	273	3.7
Personal	105	1.9	150	2.5	171	2.1	196	2.0	155	2.1
Transport	78	1.4	138	2.3	334	4.1	392	4.1	236	3.2
Gift	360	6.5	343	5.6	821	10.1	691	7.2	552	7.5
Tax	7	.1	5	*[2]	64	.8	34	.4	27	.4
Total Non Food Expenditures	1604	29.1	1617	26.4	2759	33.9	4036	42.1	2525	34.3
Total Expenditure	5519	100.0	6124	100.0	8150	100.0	9594	100.0	7359	100.0
Number of Households	8		7		7		8		30	

[1]Computed Average Value of Rice Consumed
[2]Less than .1%

Table 7.5

Value of Farm Supplied Food for Case Households and Representative Farm

Farm Size	Case Households		Representative Farms
	HH No.	Baht	Baht
Small	65	242	334
Lower Middle	63	366	120
Upper Middle	50	426	348
Large	3	46	151
All Households	xxx	xxx	257

in the form of furniture and household items. These items ranged from mirror, picture frame to bed, table and chairs, which cost in total ฿309 on the average. Farmers in the North usually smoke local tobacco and chew fermented tea (instead of beetle-nut which is chewed by farmers in the Central Plain). These two items are also for receiving guests. Some men drink local whiskey especially during the off-farm ceremony season. The household spent ฿458, on the average for these items. Clothing expenditures depend on household size and composition by sex and age. The younger families or families with teenagers tend to spend more than others. The clothing expenditure was ฿273 on the average. Personal expenditures were for haircuts, beauty salon, cosmetics, medicines, and unspecified personal items. These expenditures averaged ฿155 per family. Expenditure for transportation such as bus, bicycle, and jitney are primarily for non-business trips such as visiting friends and relatives, shopping, cinema and a relaxing excursion. Transportation expenditures per household were ฿236 on the

average. Gifts were mainly for "merit making" such as offering clothing to the monks and giving money or other necessities for the temple. They also included gifts given at house dedications, weddings and money given at the funeral. The household expenditure on gifts amounted to an average of ฿552 and constituted the highest non-farm expenditure.

Not all households paid a tax on property. Compound land area less than an amount indicated by law is exempt. Twelve households paid the tax averaging only ฿27 for the entire sample.

7.4.4 Seasonal Variation in Household Expenditures

The seasonal distribution in baht for non-rice food expenditure, the seasonal distribution of non-food expenditure and total expenditure per household are shown in Figure 7.1. On the average, periods 4, 5 and 11 were the peaks for food expenditure while periods 4 and 11 were the peaks for non-food expenditures. Period expenditures as a percent of the period average are shown in Table 7.6. From Figure 7.1 and Table 7.6 we can see that food expenditures fluctuate less from average than for the case of the non-food expenditure. It can be seen that the food expenditure peaks correspond with the non-food expenditure peaks and these periods corresponded in turn to the ceremonial periods. Period 4 was the end of Buddhist lent when there were usually "merit making" events (Pa Par and Katin) and weddings. Period 11 corresponds to the Thai New Year (Songkran). Table 7.7 shows the non-food expenditure by item and their seasonal indices. It is clear that expenditures for tobacco, whiskey, fermented tea, clothing and gifts were particularly high in these periods. Merit making in periods 4 and 11 involved offering

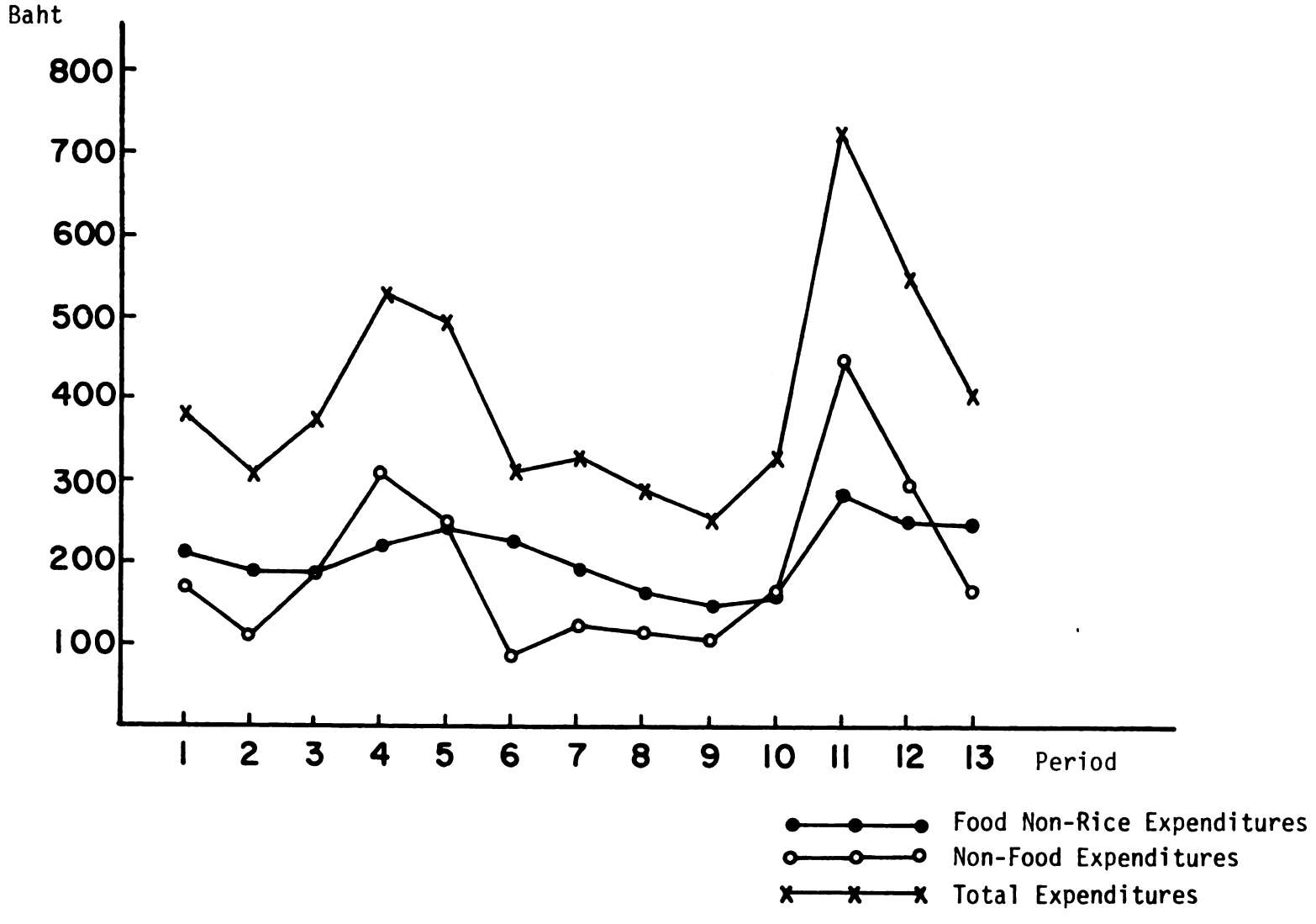

Figure 7.1 Seasonal Distribution of Household Expenditures

Table 7.6

Seasonal Index of Food - Non-Rice and Non-Food Expenditure

Period	Food Non-Rice Expenditures					Non-Food Expenditures				
	Representative Farms					Representative Farms				
	Small	Lower Middle	Upper Middle	Large	Total	Small	Lower Middle	Upper Middle	Large	Total
	(Percent of Period Average)					(Percent of Period Average)				
1	104	114	110	80	100	137	71	115	64	89
2	94	107	87	78	89	60	85	60	49	59
3	114	89	87	82	91	92	81	113	93	95
4	120	120	98	93	105	89	140	123	215	158
5	95	81	181	89	114	130	125	150	117	128
6	84	105	110	119	106	35	88	43	37	45
7	96	92	104	86	94	79	86	67	51	64
8	89	81	68	81	79	50	49	39	78	59
9	72	73	63	74	70	67	69	56	44	55
10	77	81	68	79	76	58	87	154	55	85
11	132	133	130	139	134	284	254	183	218	228
12	102	101	92	171	120	74	79	82	245	148
13	122	121	103	128	119	148	90	117	36	83
Period Average	฿160	฿183	฿249	฿249	฿210	฿121	฿124	฿212	฿308	฿194

Table 7.7

Non-Food Expenditure by Items by Periods

Period	Baht/Household/Period								Seasonal Index (Period Average = 100)							
	House Barn Furniture	Tobacco Whiskey Tea	Clothing	Personal	Transp.	Gift	Tax	Total	House Barn Furniture	Tobacco Whiskey Tea	Clothing	Personal	Transp.	Gift	Tax	Total
1	26	34	13	17	49	25	9	173	41	97	63	143	270	59	432	89
2	19	36	19	17	17	6	-	114	30	103	92	143	94	14	-	59
3	89	37	11	15	22	11	-	185	141	105	53	127	121	29	-	96
4	159	42	32	10	14	50	-	307	251	120	155	84	77	118	-	159
5	64	39	44	14	17	71	-	249	101	111	213	118	94	167	-	129
6	12	43	13	9	8	3	-	88	19	123	63	76	44	7	-	45
7	24	27	16	6	10	42	-	125	38	97	78	51	55	99	-	65
8	61	26	6	8	9	4	-	114	96	74	29	68	49	9	-	59
9	9	26	12	20	14	26	-	107	14	74	58	169	77	61	-	55
10	32	23	26	7	13	50	14	165	51	66	126	59	72	118	673	85
11	126	49	56	7	18	182	4	442	199	140	272	59	99	428	192	228
12	170	40	8	12	25	32	-	288	269	114	39	101	138	75	-	149
13	32	34	12	12	20	51	-	161	51	97	58	101	110	120	-	83
Total	823	456	268	154	236	553	27	2517								
Av.	63.31	35.08	20.62	11.85	18.15	42.54	2.08	193.62	100	100	100	100	100	100	100	100

food, clothing and other necessities to the monks and the temple. In addition, expenditures in period 4 included wedding gifts while period 11 involved gifts to parents and the respectable old people in the village. Both periods involved many social activities such as visiting and receiving guests thus the costs of food, tobacco, whiskey and fermented tea were higher than the period average.

It was surprising to learn that farmers spent the least in the harvesting period (period 6) and less than the average in the subsequent periods for non-food expenditure. This suggests that farmers did not sell their crops immediately after harvesting and that their consumption and expenditure followed a well established pattern revolving around the social, religious and political activities of the community.

7.5 Income Distribution: Another Measurement

Consumption expenditure is another measure of income since consumption expenditure is considered to be a good indicator of permanent income and it is hypothesized to be a more important determinant of consumption patterns [Modigliani and Brumburg, 1954; and Friedman, 1957]. In this study, the distribution of total household expenditure (composed of food, non-rice and non-food expenditure[3]) was examined. The per capita expenditure is used to represent the per capita income. Figure 7.2 shows the Lorenz curve of the income distribution and its .283 Gini coefficient. It can be noticed that this Gini coefficient is close to the Gini coefficient for per capita income derived in the previous chapter.

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[3]Excluding the expenditure on house and barn since they are not consumed within the year and would cause total expenditure to grossly over-represent permanent income. Based on Prais and Hanthakkar (1971).

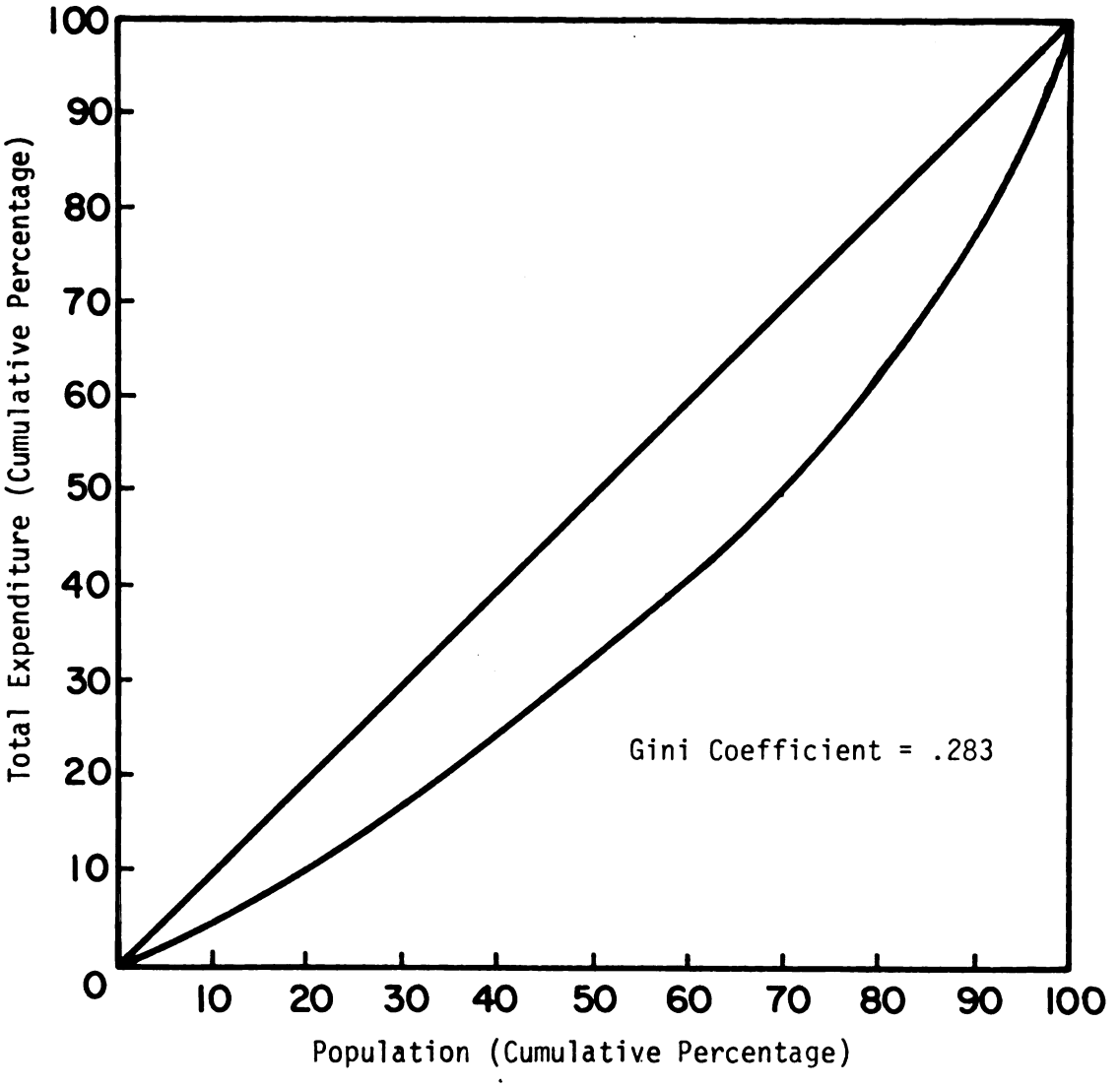

Figure 7.2 Lorenz Curve for Income Distribution Measured by Total Expenditure per Household

7.6 Summary

The analysis in this chapter has provided some of the data and assumptions that will be used in the model to be described in detail in Chapter 8.

Hired labor, the most important crop production expenditure will be handled in the model as a labor hiring activity. This will require labor wage rate by period to be developed in the next chapter.

The cost of land rent, the second largest outlay for crop production will also be excluded from the model. The program will function as though each household or representative farm is owned by an operator. However, the cash cost for cash rent will be subtracted from the value of the objective function for case households that rent land.

The average amount of the cost of renting animal power presented in this chapter is understated for use in the calculation of gross margin by enterprise needed in the LP model. This is because most farm operators own their own buffalo. Rather than attempt to estimate the cost of buffalo ownership and then to allocate this cost to individual enterprises, it was considered much more straightforward to prepare the enterprise budgets assuming that all power requirements were rented.

Water charge will be deducted from the value of objective function rather than to include in the enterprise budget.

The remaining crop production expenses (seeds, fertilizer, chemicals and supplies including equipment) will be incorporated in the model as presented except for the cost of garlic seed which appears to be out of line. It appears that the total area in garlic was too little to make a good estimate from the reported results.

Household consumption expenses will also be incorporated in the model carrying with seasonal fluctuation. Included in these expenditures are (1) a computed value of rice consumed by the family, (2) the actual expenditure for non-rice food, and (3) the expenditure for non-food purchases.

Expenses for livestock enterprises will be ignored in the model but in the interpretation of the LP solutions an accounting will be made for the net return from non-crop farm enterprises.

The expenses for trading activity will likewise be ignored because the off-farm hiring out activity of the model will be defined in terms of estimate hourly returns from all non-farm work, not limited to trading.

The value of self-supplied food identified in this chapter while discussing non-rice food expenditure will also be added to the value of objective function.

CHAPTER 8

THE ANALYTICAL MODEL

8.1 Introduction

Previous chapters have discussed in some detail the many constraints affecting decision making by the families in the village of Ban Pa Mark. Those findings will now be incorporated in the linear programming model in keeping with the second objective of this study which is "to develop a linear programming model to incorporate the constraints and to involve the representative farms and household cases from objective 1 in such a way as to determine possible reasons for the adoption of dry season cropping being less than its apparent full potential." The rationale for employing poly-period programming in the study was provided in Chapter 1.

8.2 General Feature of the Model

The linear programming model may be expressed algebraically as follows:

maximize $Z = CX$ (1)

subject to $AX\ B$, $AX=B$ or $AX\ B$ (2)

$X \geq 0$ (3)

where

$A = a_{ij}$ is an m x n matrix of technical coefficients - such as the resource requirement per unit of activity in each period

B = b_i is an m x 1 column vector of constants constraint levels or "right hand side" (RHS) coefficients such as resources available over a certain period of time or other restraints

C = c_j is 1 x n row vector of constants - return row or objective function - such as the net return of each activity

X = x_j is a control vector of activities to be determined

This notation says "choose the values of the activities $x_1 \ldots x_j \ldots x_n$ that give the highest possible value z (of the objective function) and that are consistent with the technical constraints of equation (2) and the equation constraints of equation (3). The constant a_{ij}, b_j and c_j are the data or parameters for the problem.

The structure of the linear programming model is as follows:

Objective Function. The objective function is the summation of the following five items:

1. The return to all crop activities included (net return per rai x area)
2. Plus the value of borrowed capital
3. Less the borrowed capital plus interest
4. Less the cost of labor hired in
5. Plus the return to family labor hired out
6. Less the household expenditure

The first five components of the objective function represent the return to the farmer's resources of land, family labor and capital.

To allow interpretation in the light of individual circumstances and in keeping with the discussion of the previous chapter, the following adjustments to the objective function were made after the computer results were obtained:

1. If the farm under study rented land, the cost of land rent will be deducted.
2. Water charge (a minor item) will be deducted in the amount of actual payment.
3. The net value (reported sales minus reported expenses) of non-crop farm enterprises (primarily livestock) will be added.
4. The value of home-consumed farm production will be added.
5. The value of initial capital will be deducted. This is composed of cash on hand and the value of sufficient rice to carry the family from the beginning of period 1 to a harvest of rainy season rice.

Activities. The model has seven activity sets. Each activity has a net return either positive, zero or negative (cost). These activities are:

1. Crop activities which are rainy season rice, dry season rice, soybeans, peanuts and garlic
2. A capital borrowing activity in selected periods
3. A capital payback activity in selected periods
4. A capital transfer activity in each period to permit capital remaining at the end of one period to be transferred to the subsequent period
5. A labor hiring activity both male and female hired workers in each period
6. Selling labor activities by both male and female family members in each period

7. A household expenditure activity in each period permitting the household to withdraw cash from the business during the year

Constraints. As resource constraints, the program concerns itself with resource availability including:

1. Land availability in each period
2. Family labor availability for both male and female labor for each period
3. Limit on capital availability in each period
4. Limit on available male labor which can be hired in each period
5. Limit on available female labor which can be hired in each period
6. Limit on the amount of money which can be borrowed in selected periods
7. A requirement that loans must be repaid with interest in selected periods
8. A requirement that all available land must be planted to rice in the rainy season
9. A requirement that the family consumption expenditure including the value of family rice consumption requirement must be met by period
10. A requirement that the family's customary labor commitment to non-crop farming activities and to community services and functions be maintained

Given the above general characteristics of the model, attention is now given to the details of the model in the order of the a) objective function, b) activities, and c) constraints. The structure of the model is illustrated in Figure 8.1.

8.3 The Objective Function

The elements of the crop production activities in the objective function needing discussion here include crop yields, crop prices and crop production expenses. With these the net returns per rai for each crop are computed.

8.3.1 Crop Yields

Accurate crop yield estimates for the Ban Pa Mark area suitable for farm planning purposes were difficult to obtain for all crops except rice. In the case of rice, yield was estimated for both the rainy season and the dry season crops from a rice cutting survey which was conducted in the village for the 1973-74 crops for all households. Averages from this survey were used in the model as shown in Table 8.1. The yield used for computing net return for other crops were obtained by reviewing various studies (Tongsiri, et. a., 1975, 172; and Budget Analysis of MCP, October 1974, 16) and evaluating them for the value most appropriate for the immediate study.

Two issues arose regarding the choice of crop yields for use in the LP analysis. The first is whether crop yields varied according to farm size and the second is whether the 1973-74 crop season was a typical year.

There are many possible explanations in variation for crop yield for a given crop. These may include quality of seeds, care and land

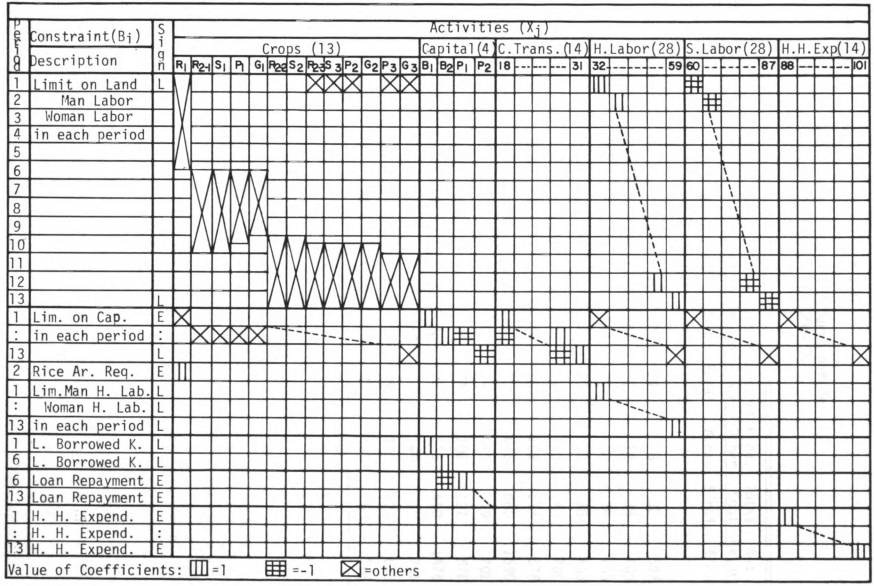

Figure 8.1 Structure of the Linear Programming Model

Table 8.1

Gross Margins on Net Returns per Rai
for Crop Activities

Item	Start Period	Yield/ Rai	Price per kg	Gross Return	Cost of Prod.		Total Cost	Net Return
					Power	Other		
Unit	--	kg.	฿	฿/rai	฿/rai	฿/rai	฿/rai	฿/rai
Crops								
Rice 1	1	553	1.30	719	24	8	32	687
Rice 2.1	6.5	571	1.30	743	20	18	38	705
Rice 2.2	10	571	1.30	743	20	18	38	705
Rice 2.3	10.5	571	1.30	743	20	18	38	705
Soybeans 1	6.5	250	3.00	750	--	49	49	701
Peanuts 1	6.5	255	3.15	803	25	102	127	676
Garlic 1	6.5	1500	1.50	2250	25	635	660	1590
Soybeans 2	10	250	3.00	750	--	49	49	701
Peanuts 2	10.5	255	3.15	803	25	102	127	676
Garlic 2	10.5	1425	1.50	2138	25	635	660	1478
Soybeans 3	10.5	250	3.00	750	--	49	49	701
Peanuts 3	11	242	3.15	762	25	102	127	635
Garlic 3	11	1350	1.50	2025	25	635	660	1365

preparation, weeding practices, harvesting methods and planting date. However the variables for which data were available and comes most readily to mind is the level of fertilizer applications. It was found that cash operating expense per rai (primarily seed and fertilizing expenditures) had no conclusive pattern with regard to farm size. Ranking from low to high on these expenditures per rai on representative farms produce an ordering of large, lower middle, small and upper middle size representative farms in that order (Table 7.1). Taking this finding into account with the wide variation in reported crop yield regardless of farm size and the limited number of grower observations on which to base one's judgement, that average crop yield would not vary on the basis of farm size.

Good judgement did propose however that peanuts and garlic grown in the hot dry season would not yield as much as these crops grown in the cool dry season. Therefore in Table 8.1 the yield for peanuts 3 and garlic 3 have been discounted 5 percent from the yield of peanuts 2 and garlic 2.

Other considerations were taken into account in the decision of appropriate crop yields. Results from the field testing experiments conducted by the MCP in villages of the area including Ban Pa Mark were higher than the yield reported in the survey for this study. This difference is not explained by differences in crop management because it is common practice for families in the area to harvest crops such as peanuts, soybeans and garlic in an immature stage, either for family consumption or early sale. Consequently, the reported yield would be understated in terms of mature crop output. For this reason the researcher used judgement in selecting yield that were within the range

of reported results and those obtained in the MCP experimental trials. This judgement also attempted to incorporate the issue of whether or not 1973-74 was a typical year.

Long term time series yeild data for these crops were not accessible for the Chiang Mai Valley in general and especially Ban Pa Mark in particular. However, national yields for the period 1970 to 1976 were examined to find that the 1973-74 crop year was as a percent of a six year average 101, 96, 97, and 129 for rice, soybeans, peanuts and garlic respectively (Royal Thai Government, 1976). The year 1973-74 would appear to be a typical year in all crops except garlic. However, the national garlic yield averages have been increasing steadily over time primarily as a consequence of an increased proportion of the total crop coming from Chiang Mai Valley which has much higher yield than the national average (Royal Thai Government, 1976, p. 70).

8.3.2 Crop Prices

Prices shown in Table 8.1 and used in the calculation of crop activity gross margin were obtained from an earlier MCP study on agricultural prices (Thodey, et.al., 1974). The summary results of that study are shown in Table 8.2. It can be noticed that the actual 1973-74 prices were higher than normal but have been normalized to a lower level.

8.3.3 Crop Production Expenses

The cost of production figures shown in Table 8.1 were developed using the following assumptions:

Table 8.2

Price Information for Chiang Mai Area

Crop	Medium Term Average as of 1971-72		Actual[1] 1972-73	Actual[1] 1973-74	Normalized for 1973-74
	Range	Expected			
	฿/kg.			฿/kg.	
Rice	.60- .90	.75	1.30	1.60	1.30
Soybean	2.00-2.60	2.30	3.50	4.50	3.00
Peanut	2.69-2.97	2.83	2.72	3.50	3.15
Garlic[2]	1.50-3.00	2.20	1.90	2.50	1.50

[1]Buying prices of merchants in Chiang Mai one to two months after harvest.

[2]Based on medium size garlic price.

Source of Actual Prices: Provincial Economist, Chiang Mai and Budget Analysis of MCP, Ag. Econ. Report #3, October 1974.

1. With the exception of garlic, crop costs per rai excluding power were as reported by farmers and as summarized in Table 7.3
2. The ฿1274 per rai average from the limited number of garlic growers was unreasonably high in relation to the labor requirement and reported yield for the crop. It was assumed that previous cost accounting efforts (See Thodey and Sektheera, 1974) were more reliable and should be used. For a yield of 1,500 kg/rai yield the non-power production costs per rai were thus taken to be ฿275 for fertilizer, ฿300 for seed, ฿50 for spray and ฿10 for farm tool replacement and crop supplies. This gave a net return per rai for garlic equal to ฿1,590, ฿1,478, ฿1,365 for the crop planted in periods 6.5, 10.5 and 11 respectively.
3. As mentioned earlier, it was assumed for the purpose of computed enterprise costs of production that animal power should be uniformly charged as rent for all farms whether the farmer owned a buffalo or not. Since soybeans are planted without plowing, no power charge was made for this crop. Animal power rent as reported by farmers at ฿25 per rai for peanuts was assumed to be a reasonable figure for both peanuts and garlic. It was assumed that plowing for rainy season rice could be rented for 1 baht per rai less and that plowing for dry season rice could be rented for 5 baht per rai less than for

peanuts and garlic. The above assumptions underly the figures shown in Table 8.1.

8.4 Crop Production Activities

Modelling the crop production activities required a knowledge of the length of time needed for each crop from land preparation through harvest and field cleanup. The starting time in terms of period was presented in Table 8.1. The time required for each crop in terms of days was presented in Figure 3.1 and summarized here as follows:

Rainy season rice (Rice 1), 126 days

Dry season rice (Rice 2.1, Rice 2.2, Rice 2.3), 115 days

Soybeans (Soybeans 1, Soybeans 2, Soybeans 3), 117 days

Peanuts (Peanuts 1, Peanuts 2, Peanuts 3), 112 days

Garlic (Garlic 1, Garlic 2, Garlic 3), 96 days

Considering the alternative starting periods and the number of crops, there were 13 separate crop production activities as shown above. How these crops fit together in sequence is illustrated in Figure 8.1. The number of required days for a crop as indicated above is less than the number of days from the beginning of the starting period (P - o) to the end of the harvesting period (P + n) to permit turnaround time from one crop to the next. (P - o) is any one of the alternative periods and $\underline{n}$ in (P + n) is the number of periods needed to bring the crop to the completion point.

To capture the reality of how farmers allocate their resources in critical times, period 2, period 6 and period 10 were divided into two subperiods each. Having made this decision, it was decided to combine period 3, 4 and 5 because these are "waiting periods" in rice production

primarily devoted to crop care during which there is never a shortage of family labor.

From the labor profile described in the previous chapters, it was seen that farmers do land preparation and planting in period 2 and are involved in both rice harvesting and dry season crop land prepartion and planting in period 6. Both harvesting and crop planting also occur for some households for period 10. Therefore, it seemed appropriate to subdivide these periods to make possible the termination of one crop activity and the beginning of another in the same period. Heyer (1971, 59) emphasized the need to carefully define the period if the output is affected by the labor time allocation. Ideally the model would have been refined to even shorter time periods and with more specificity on labor activities but in so doing, it would become extremely complex and perhaps intractable.

The technical coefficients (A_{ij}) for labor used for the thirteen crop activities are the average labor requirements computed for small and for large farms. Labor requirements were not developed for each representative farm because an average of a maximum of 8 observations was considered too small a sample for a reliable estimate. A small farm was defined as one with less than 10 rai and a large farm to be one with 10 rai or more of land operated. Therefore the small and the lower middle size representative farms would be subjected to the small farm coefficients. The upper middle and large size representative farms would be subjected to large farm size coefficients. Case household number 63 with .76 rai more than 10 was treated as a small farm to make it comparable with its corresponding representative farms having 9.88

rai. Because of their respective farm sizes household 65 was treated as a small farm and households 50 and 3 were treated as large farms (Table 8.3).

Labor requirements for crop production activities show coefficients for both male and female labor. The proportion of male to female labor was computed as the average reported in the small and large farm groups as defined above.

Turning now to capital, the A_{ij}s for each crop are those shown as total cost in Table 8.1. These capital requirements include power (with the assumption that all case households will pay normal buffalo rent), fertilizer, seeds, spray where applicable and other including implement replacement or repaids and crop harvesting supplies. These capital requirements were distributed among periods as shown in Table 8.4.

A unit (rai) of land requirement (A_{ij}) is equal to 1 in each period that the crop is in the field including the time for land preparation and post harvest clean up.

8.5 Capital Activities

8.5.1 Capital Borrowing Activities

The model allows farmers to borrow when their initial capital (cash from previous year) is not enough to meet the production expenditure. It is assumed that this borrowed capital is short term and used only for cash operating costs including hired labor and household expenditure. It can be noted that no provision is made for the use of capital to invest in labor saving technology, therefore nothing can be

Table 8.3

Labor Requirements per Rai (A_{ij}) by Sex and Period by Crop and Farm Size

	Rainy Season Rice			Dry Season Rice		Soybeans		Peanuts		Garlic	
	Hours		Period	Hours		Hours		Hours		Hours	
Period	Male	Female		Male	Female	Male	Female	Male	Female	Male	Female
				Small Farms[1]							
1	6.44	.84	P-0	24.50	1.47	13.79	8.68	35.07	1.33	147.84	49.77
2	28.98	1.26	P+1	10.57	24.99	16.59	25.90	25.48	33.32	63.35	221.76
2.5	11.90	14.70	P+2	7.14	2.55	5.63	2.97	7.77	3.19	82.88	122.15
3,4,5	17.92	3.22	P+3	3.57	1.27	2.82	1.49	7.77	3.19	81.55	110.15
6	25.20	19.67	P+4	3.57	1.28	2.82	1.48	89.74	92.33	--	--
	--	--	P+4½	24.01	26.11	37.52	33.67	--	--	--	--
				Large Farms[2]							
1	3.92	.70	P-0	24.43	.21	8.61	8.96	35.07	1.33	147.84	49.77
2	23.03	--	P+1	16.45	10.71	10.71	23.24	25.48	33.32	63.35	221.76
2.5	9.52	14.56	P+2	3.50	.98	2.20	3.04	7.77	3.19	82.88	122.15
3,4,5	10.85	1.96	P+3	3.50	.98	1.10	1.15	7.77	3.19	81.55	110.15
6	24.29	16.45	P+4	3.50	.98	1.10	1.15	89.74	92.33	--	--
	--	--	P+4½	24.50	13.30	29.12	23.87	--	--	--	--

[1]Applicable for Case Farms 65 and 63 and Small and Lower Middle Sized Representative Farms.

[2]Applicable for Case Farms 50 and 3, and Upper Middle and Large Sized Representative Farms.

Table 8.4

Capital Requirements for Crop Activities by Period

Rainy Season Rice		Period	Rice 2.1 Rice 2.2 Rice 2.3	Soybean 1 Soybean 2 Soybean 3	Peanut 1 Peanut 2 Peanut 3	Garlic 1 Garlic 2 Garlic 3
Period	Baht		Baht	Baht	Baht	Baht
1	30	P-0	27	44	108	300
2	2	P+1	5	5	11	250
2.5	--	P+2	4	--	8	100
3-5	--	P+3	--	--	--	10
6	--	P+4	2	--	--	--
Total	32		38	49	127	660

Source: Total from Table 8.3 distributed according to period requirement for input type.

said about the marginal rate of substitution of capital for labor. The c_j row of borrowing activities carried a positive sign because the money is added to the objective function.

8.5.2 Capital Payback Activities

Two capital payback activities are incorporated in the model to force farmers to pay their debts within the production year. The c_j row of the payback activities carries a negative sign and reflects the amount borrowed plus interest which had to be deducted from the total net revenue. The annual interest rate (cost of capital) is 20 percent (normal rate of non-institutional loans in the area).

Cash borrowed in period 1 is paid back in period 6 with a 10 percent rage of interest for six months being paid. Cash borrowed in period 6 is paid back in period 13 with the same interest rate.

8.5.3 Capital Transfer Activities

The capital transfer activities are incorporated in the model to allow capital which is left over from crop and household expenditures to transfer from one period to another. The transfer occurs for all periods and it is assumed cost free (c_j=0). These transfer activities serve as a link between periods for resource allocation. The technical coefficient (A_{ij}) for the period which has unused cash is +1. For the corresponding period to which the cash is transferred, the A_{ij} is -1.

8.6 Labor Activities

8.6.1 Labor Hiring Activities

There are three main sources of agricultural labor--family labor, exchange labor and hired labor. Exchange labor is excluded from the

model due to the equalization of the exchange received having to be met by the family labor within the period. Thus, they cancel out. Farmers hire labor in particular periods when the household labor is inadequate to perform the agricultural operations. Two labor hiring activities occur in each period (both male and female). The total amount of hired labor needed depends on the amount of crop labor required in relation to the amount of family labor available (sex, total) from the households. Men and women hired labor are paid different wage rates depending on the period which in turn reflects the demand and supply of labor (Table 8.5).

The rates for hired male and female labor by period shown in Table 8.5 are admittedly lacking of a strong empirical base. The researcher was convinced that hired labor rates should reflect seasonal variations according to local supply and demand conditions for hired labor even though the data to support this contention were somewhat weak. The model had to be simplified to express labor requirement by period and not labor by activities requirements within period. Therefore, the period requirements represent a composite of labor activity requirements. Consequently, the necessary labor rates by period must be a composite of hired labor rates. The coefficients that were utilized in the program were developed by the researcher's best judgement based on the analysis of hired labor rates in the previous chapter.

Since hired labor activities add to the supply of family labor row, their coefficients are negative. However, the price for hiring labor activities are negative since they are costs, thus reducing the total net revenue.

Table 8.5

Wage Rate of Hired Labor and Family Wage Rate Used in the Model (Baht)

Periods	Hired Labor In			
	Male		Female	
	/hr.	/day	/hr.	/day
1	3.85	27	1.50	11
2	4.20	30	1.50	11
2.5	1.25	9	1.25	9
3-5	1.28	9	1.28	9
6	3.50	25	3.50	25
6.5	3.50	25	3.50	25
7	5.60	39	5.60	39
8	4.30	30	4.30	30
9	1.15	8	1.00	7
10	1.00	7	1.00	7
10.5	1.00	7	1.00	7
11	1.00	7	1.00	7
12	3.00	21	3.00	21
13	3.25	23	3.25	23

Periods	Family Labor Hired Out			
	Male		Female	
	/hr.	/day	/hr.	/day
1	2.00	14	1.00	7
2	2.00	14	1.00	7
2.5	1.15	8	1.00	7
3-5	1.15	8	1.00	7
6	3.25	23	3.25	23
6.5	3.25	23	3.25	23
7	2.00	14	1.00	7
8	1.00	7	.85	6
9	1.00	7	.85	6
10	.85	6	.85	6
10.5	.85	6	.85	6
11	.85	6	.85	6
12	2.70	19	2.70	19
13	2.85	20	2.85	20

Source: Inspection and judgement of survey data.

8.6.2 Selling Labor Activities

The model allows a farmer to hire family labor (male and female) out from the farm. The family labor not needed for farm production and seasonal special labor functions are assumed available to work in non-farm activities. The seasonal distribution of rates for family labor hired out by male and female members is shown in Table 8.5. The range is from 6 to 23 baht per day for both man and woman. However, the rate for females is less than that for men in every period except periods 6, 6.5, 12 and 13 (the periods when the demand for labor for both men and women are critical). The rates for these periods were established as a relatively high rate to reflect this demand condition. For the remaining periods the assumed rates are relatively low with the least being ฿6 per day, an amount higher than might be received in handicraft activities but lower than some other non-farm opportunities described in Chapter 6.

For these periods, the researcher attempted to fix a level which was above the minimum and less than the maximum potentially available and to represent a reasonable composite of off-farm opportunities.

8.7 Household Expenditure Activities

It was assumed that each case family or representative farm should maintain its customary living standard as reflected in its expenditure for non-rice food and expenditure for non-food outlays (exclusive of capital investment) on a seasonal basis. Incorporated additionally in this household expenditure is the value of the necessary milled rice consumed by the family period by period. The resulting period requirements by case households and representative farms are shown in Table 8.6.

Table 8.6

Household Expenditure by Period for Case and Representative Farms (Baht)

Period	Case Household				Representative Farm (Group Average)			
	HH 65	HH 63	HH 50	HH 3	Small	Lower Middle	Upper Middle	Large
1	451	514	791	665	474	468	686	781
2	263	256	313	263	183	236	256	268
2.5	264	256	313	264	184	236	256	269
3-5	1596	1586	3002	7776	1230	1473	2234	2572
6	188	179	219	682	159	237	267	301
6.5	189	179	220	683	159	237	267	302
7	566	413	363	1066	391	447	569	565
8	455	367	352	2611	347	380	434	635
9	398	330	357	482	339	390	878	514
10	288	171	365	240	168	213	331	279
10.5	288	171	366	241	168	214	332	279
11	706	434	425	1637	698	730	881	1210
12	519	458	456	531	408	454	567	862
13	428	494	777	692	519	505	672	624
Total	6479	5835	8319	17,773	5427	6219	8630	9461

The technical coefficient indicated for each period is equal to the amount the household required and has a positive sign in the capital row due to its use of cash. The c_j for each activity is negative since it reduces the net revenue. These activities make it possible for the model to incorporate household production and consumption and to handle them at the same time.

8.8 Resource Constraints

Constraints or restrictions on the model will be discussed in the order of (1) land, (2) labor, (3) financial, (4) consumption, and (5) behavioral. In so doing, the right hand side (RHS) values of the model will be presented.

8.8.1 Land Constraint

Land is treated as a homogenous resource since the village has the same soil type, soil fertility and accessibility to irrigation water. The availability of land is a major constraint. Land was used as a major variable in the selection of the case households. Tables 8.7a and 8.7b show that the case farms, household numbers 65, 63, 50 and 3 have 5.67, 10.76, 12.21 and 16.24 rai of land respectively. The representative farms were similar in size to the corresponding cases with 5.43, 9.88, 12.68 and 18.48 rai for small, lower middle, upper middle and large representative farms respectively. These areas were used as the level of land resource in the LP analysis. They will be treated as land available to the farmer. If the case farmer did not own his farm, the cost of rent was deducted from the value of the objective function for his final plan after the linear programming solution was obtained.

Table 8.7a

Land and Labor Constraints (RHS) for Case Farms

Item		Case Households from Small to Large			
		65 (S)	63 (LM)	50 (UM)	3 (L)
Land (rai)		5.67	10.76	12.21	16.24
Initial Capital (฿)		550	200	1100	1950
Value of Rice (฿)		779	962	825	814
Total Init. Cap. (฿)		1329	1162	1925	2764
Borrowed Capital (฿)		1000	1000	1500	1500
Labor by Sex (hours)					
Period 1	Male	282.90	348.55	329.55	381.58
	Female	129.95	189.32	242.82	266.78
Period 2	Male	152.30	190.67	176.16	186.16
	Female	62.22	69.52	130.49	131.87
Period 2.5	Male	152.30	190.68	176.17	186.17
	Female	63.23	69.52	130.52	131.87
Periods 3-5	Male	801.80	828.25	761.67	822.50
	Female	336.93	210.29	712.30	728.72
Period 6	Male	144.80	196.00	186.16	182.75
	Female	62.43	97.87	138.74	121.12
Period 6.5	Male	144.80	196.00	186.17	182.75
	Female	62.43	97.87	138.75	121.12
Period 7	Male	285.60	366.50	350.75	363.50
	Female	129.60	179.87	250.37	257.04
Period 8	Male	288.27	362.83	351.83	345.00
	Female	128.77	206.52	257.37	250.04
Period 9	Male	266.77	341.10	320.83	238.50
	Female	119.85	176.75	263.37	256.04
Period 10	Male	121.55	170.66	157.50	105.50
	Female	53.42	81.67	129.18	114.52
Period 10.5	Male	121.55	170.66	157.50	105.50
	Female	53.43	81.67	129.19	114.52
Period 11	Male	254.10	352.50	332.50	282.33
	Female	107.85	159.17	253.37	237.04
Period 12	Male	287.60	308.50	343.00	303.33
	Female	120.85	195.50	258.37	252.04
Period 13	Male	187.60	353.13	344.00	318.50
	Female	120.85	187.25	258.37	239.04

Table 8.7b

Land and Labor Constraints (RHS) for Representative Farms by Size Classes

Item		Representative Farms by Size Class			
		Small	L.Mid.	U.Mid.	Large
Land (rai)		5.43	9.88	12.68	18.48
Initial Capital (฿)		500	1000	1500	1500
Value of Rice (฿)		711	854	838	966
Total Init. Cap. (฿)		1211	1854	2338	2466
Borrowed Capital (฿)		1000	1000	1500	1500
Labor by Sex (hours)					
Period 1	Male	307.67	312.59	321.74	430.55
	Female	163.36	249.17	273.10	259.75
Period 2	Male	149.46	160.69	163.75	214.73
	Female	87.99	126.44	139.50	135.85
Period 2.5	Male	149.47	160.69	163.75	214.74
	Female	87.99	126.45	139.51	135.85
Periods 3-5	Male	820.21	817.39	881.89	1081.39
	Female	471.61	702.13	774.41	776.18
Period 6	Male	153.58	155.78	161.24	194.77
	Female	75.12	118.86	133.21	124.15
Period 6.5	Male	153.59	155.78	161.25	194.78
	Female	75.12	118.86	133.22	124.16
Period 7	Male	312.32	310.81	305.48	396.82
	Female	171.17	244.56	268.17	254.07
Period 8	Male	295.72	298.01	304.82	394.21
	Female	171.83	243.99	263.58	246.74
Period 9	Male	171.21	284.04	267.99	360.60
	Female	134.83	244.02	246.84	237.63
Period 10	Male	108.41	137.54	135.51	163.35
	Female	68.18	116.48	114.09	115.90
Period 10.5	Male	108.41	137.54	135.51	163.35
	Female	68.18	116.49	114.09	115.90
Period 11	Male	270.45	277.76	271.92	329.95
	Female	144.70	236.56	230.83	245.26
Period 12	Male	248.91	274.73	288.50	336.69
	Female	158.96	240.48	244.51	265.52
Period 13	Male	263.08	274.69	247.30	350.72
	Female	145.75	223.39	224.69	242.27

8.8.2 Labor Constraints

8.8.2.1 Family Labor Constraints

The constraints on labor can be divided into two main categories, i.e., family labor and hired labor. Family labor is subdivided into male and female labor since we assume that they are not fully substitutable resources. In establishing the level of family labor availability it was assumed that an adult man equivalent is available for work 7 hours a day, 28 days a period for a total of 196 hours per period. It was assumed that a woman has 5 hours[3] a day available for farm and other non-household work 28 days a period for a total of 140 hours available. The time available by men is reduced by 10 hours per person per period in the cool dry season (period 7 to 9) and by an additional 10 hours per person per period in the dry season (periods 10 to 13), because it seems to reflect the attitude in the area about working in the uncomfortable dry season. For the same reasons (but by a smaller amount) the female time available per period was reduced by 5 hours per adult equivalent in the cool dry season and by an additional 5 hours per adult equivalent in the hot dry season. The total time available per period by sex was computed by multiplying the individual family labor force adult equivalents by the appropriate period availability coefficients then subtracting the amount of time the family or representative farm spent on non-cropping farm activities and special community activities period by period.

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[3]Assume that a woman has to spend at least 2 hours a day for cooking, cleaning, child rearing and other household works.

The coefficients computed in this fashion became the amount of labor resources available in each period (RHS) for use in the program (Tables 8.7a and 8.7b).

8.8.2.2 Hired Labor

Setting the appropriate right hand side value for hired labor is a different matter than defining the constraint level for other types of family resources. Land, family labor and available capital are determined by what we know about the farm or the representative farms under study. The amount of hired labor available and the rate at which it will be hired are determined outside the farm and requires information not available from survey data of the type collected in this study. One is required to make assumptions based on what is considered realistic for the area being studied. In the Chiang Mai Valley, it is to be expected that labor available for hiring will be extremely limited in critical periods especially in the production of rice. One can assume perfect knowledge and complete labor mobility . . . the typical neo-classical economics assumption. With these assumptions the effective constraints will most likely be capital. However, to assume that the hired labor supply is not only available to a single farm but to every farm seems to be a highly unrealistic assumption. Therefore in this study with the conviction that capital is not ordinarily limiting under the traditional farming being employed, it was decided to limit the amount of labor available for hiring.

Hired labor was assumed to be available by both sexes. The model allows farmers to hire labor up to two men (392 hours) and two women (313 hours) per period in the rainy season (periods 1 to 6). Available

hired labor was reduced to 1 1/2 men and to 1 1/2 women in the cool dry season (periods 7 to 9) and reduced to 1 man and to 1 woman in the hot dry season (periods 10 to 13). What was said earlier about family labor also holds for hired labor in that in the dry season farmers prefer to spend less time in the field due to hot weather. Some men prefer non-farming activities to working in the field. Some just want to be available for any social events which will occur in the dry season.

8.8.3 Financial Constraints

8.8.3.1 Initial Available Capital Constraints

The amount of capital available at the beginning of the year was assumed to be a seasonable carryover of cash from the previous year plus the amount of money needed to represent the value of home produced rice required for family consumption period by period until the rainy season rice was harvested. Rice storage is a common situation but in this model the value of assumed rice storage was combined into a single financial constraint so it became unnecessary to develop transfer activities for rice storage. The cash carryover figure to the beginning of the year for the case families are the actual June 1, 1973 inventory of cash on hand for the respective families. The cash on hand for the representative farms are roughly the amount equal to the average of the cash inventory for farms in the respective farm groups rounded to the nearest ฿1,000. The RHS values for financial constraints for case households and representative farms are shown in Tables 8.7a and 8.7b.

8.8.3.2 Borrowed Capital Constraints

Borrowed capital is limited in use to farm operating expenses and short term cash requirements assuming that the amount of money that can be borrowed is based on the valuations of owned livestock and residence. It was estimated that ฿1,000 was a reasonable limit for the small farms and ฿1,500 was reasonable for the large farms. With the focus on farm operating expenses, the opportunities for borrowing were limited to either period 1 (the beginning of the rainy season rice crop activity), or to the last half of period 6 (period 6.5) when dry season crops are planted.

8.8.3.3 Borrowed Money Payback Constraints

It was specified in the model that all borrowed money must be paid back with interest. Capital borrowed in period 1 must be paid back in period 6 while capital borrowed in period 6.5 must be paid back in period 13. Both of these payback periods correspond to crop harvesting periods when the value of crop harvested is credited. The RHS value for the payback constraint roles are equal to zero.

8.8.4 Consumption and Behavioral Constraints

8.8.4.1 Consumption Constraints

In each period the model requires that the farm must supply to the household an amount of cash equal to the amount needed for family household consumption. These period amounts were defined and discussed under consumption activities. The RHS value of these constraints appear in each period and is equal to 1.

8.8.4.2 Behavioral Constraints

The requirement that a household must put all available land into rice (within the limit of available family and hired labor) in the rainy season can be viewed as a behavioral constraint as well as a security measure. It has been a common practice for farmers to plant only rice in the rainy season for centuries. This is due in part to ecological conditions but may be regarded as an insurance against hunger since rice is the main diet for the Thai. The model thus forces all available land area into rice in the rainy season by having the area of rice constraint equal to the amount of area available.

Next the model will be applied to specify the most appropriate dry season cropping patterns consistent with the resource endowments and assumed constraints for the case households and representative farms.

CHAPTER 9

RESULTS OF THE ANALYSIS

9.1 Farm Organization and Income Measures

The results of the linear programming analysis will now be presented keeping in mind the conditions the procedures described in the previous chapter. In the presentation, results will be presented by making the following comparisons:

1) case household with actual situation and programmed results
2) representative farms with actual and programmed results
3) representative farms with each other
4) representative farms with and without constraint for non-crop farm labor activities and non-income generating services

These comparisons will be made in order of farm size groupings. Finally, marginal value products of labor and capital resources will be interpreted.

To assist in making the comparisons, certain key variables have been identified and presented for each situation in Tables 9.1 through 9.4. The kinds and amounts of individual crops are shown first with the resulting cropping intensity index. The higher the cropping index, the higher the proportion of the available land is being cropped in the dry season.

The sum of the net returns for all crop enterprises are adjusted for the cost of hired labor, land rent and water charge to yield a net

crop value to the farm. This figure will be used to compute the percentage that crop value is of total household income. To net crop value will be added the value of other farm produce sold to give total farm income. The share that farm income is of total household income will be computed using this figure. Adding off-farm income, either actual or programmed, will yield the total household income. The actual total annual expenditure for non-rice food and non-food outlays plus a computed value of home produced and consumed rice (from the first of the year to the time of harvest) and the amount of cash on hand at the beginning of the year will be deducted to give an indication of the amount remaining for savings or other investment. Finally, some of the above measures will be divided by the size of farm or size of labor force to arrive at some efficiency measures for comparison amount different situations.

9.1.1 Case Farm Comparisons

9.1.1.1 Small Farm: Household 65 with Actual and Programmed Results

The first thing to notice about farm household 65 is that the cropping intensity index is essentially the same for the actual situation and the programmed solution but the crop value of the existing farm organization is higher than for the programmed solution (Table 9.1). This indicates that the crop yields must be higher in the actual situation than were used in the model. It was pointed out earlier that yield estimates are quite unreliable except for rice. It can be said, however, that both the existing and programmed cropping systems are dominated by rice and that the actual yield on farm number 65 was

Table 9.1

Cropping Program, Case and Representative Farms, Actual and Programmed[1]

Crop (rai)		Small Farm 65 Actual	Small Farm 65 LP	Small Farm Rep. Actual	Small Farm Rep. LP	Lower Middle Farm 63 Actual	Lower Middle Farm 63 LP	Lower Middle Farm Rep. Actual	Lower Middle Farm Rep. LP
Rice	1	5.67	5.67	5.43	5.43	10.76	10.76	9.88	9.88
Rice	2.1	----	2.06		2.54	----	1.05		.40
	2.2	3.69	----	(3.64)	----	3.06	----	(2.39)	.45
	2.3	----	3.16		2.89	----	9.70		9.03
Soybeans	1	----	----		----	----	----		----
	2	5.20	----	(1.80)	----	----	----	(5.23)	----
	3	----	----		----	----	----		----
Peanuts	1	----	1.39		1.55	----	1.79		2.10
	2	----	----	(.22)	----	----	----	(.23)	----
	3	----	1.78		2.26	----	.51		.35
Garlic	1	.22	.14		.25	----	.43		.74
	2	----	----	(.14)	----	----	----	(.19)	----
	3	----	----		----	----	----		----
Intensity Index		260	258	207	275	128	225	180	232

Crop (rai)		Upper Middle Farm 50 Actual	Upper Middle Farm 50 LP	Upper Middle Farm Rep. Actual	Upper Middle Farm Rep. LP	Large Farm 3 Actual	Large Farm 3 LP	Large Farm Rep. Actual	Large Farm Rep. LP
Rice	1	12.21	12.21	12.68	12.68	16.24	15.59	18.48	16.09
Rice	2.1	----	6.04		1.80	----	1.21		.54
	2.2	1.06	----	(3.63)	----	10.22	.82	(6.55)	4.17
	2.3	----	6.17		10.85		4.30		6.90
Soybeans	1	4.82	----		----	10.54	----		----
	2	----	----	(6.04)	----	----	----	(8.37)	----
	3	----	----		----	----	9.90		6.86
Peanuts	1	----	2.19		2.07	----	2.07		2.08
	2	2.18	----	(1.55)	----	----	----	(.81)	----
	3	----	1.47		.09	----	----		----
Garlic	1	----	.51		.81		.79		.81
	2	----	----	(.05)	----	----	----	(.01)	----
	3	----	----		----	----	----		----
Intensity Index		166	234	189	223	228	214	185	203

[1]Figures in parenthesis are averages over farms without regard to planting date.

approximately 10 percent more than that used in the program (612 kilograms per rai compared with 553). We conclude that this farmer is not only using his labor effectively in the growing of dry season crops but is also doing a better job than average in crop husbandry. It can also be observed that he used almost twice the amount of hired labor than was called for in the programmed solution. This indicates his desire to exploit farming for its full potential as further indicated by the fact that only 1 percent of total household income came from non-farm sources compared with 28 percent in the programmed solution. The lack of hired labor use in the LP solutions is not explained by the constraint level because the solutions did not use the hired labor to a maximum in any period.

Farm number 65 may well be a model for the extension service to use in pointing out to others what is possible on a small farm.

9.1.1.2 Lower Middle Size Farm: Household 63 With Actual versus Programmed Solution

Household number 63 is a farm of 10.76 rai being worked by a labor force of 3.12 adult equivalents (Table 9.2). This is a somewhat larger farm with a smaller labor force than is the representative farm in its farm size group. Its existing crop organization concentrated entirely on rice production with about a third of the farm being planted to dry season rice resulting in a low intensity index of 128. It is a rented farm, little labor was being hired and only 53 percent of the household income was derived from farm income sources. The programmed solution would suggest a major reorganization. Two crops of rice plus peanuts twice and garlic would be added to dry season

cropping and off-farm employment would be reduced. This reorganization would result in a cropping intensity index of 225 (37 points higher than the current village average), increased farm hired labor and a 75 percent increase in farm income with a 43 percent decrease in off-farm income. In addition to needed farm reorganization, it appears that there is room for improvement in farming methods inasmuch as the yield for rice was only 520 kilograms per rai compared with 553 used in the model (the village average). The apparent weakness in the farm's organization may provide information useful in advising farmers as to the potential for multiple cropping by comparing current performance with the programmed results.

9.1.1.3 Upper Middle Size Farm: Household 50 With Actual versus Programmed Solution

Household number 50 is a farm with 12.21 rai operated (3.5 rai rented) with a labor force of 3.44 adult equivalent (Table 9.3). For both land area and labor source this farm is approximately the same as that of the representative farm for the upper middle farm size group. Its dry season cropping program is distinguished by variety with low intensity. Only two-thirds of the land area was devoted to crops in the dry season including soybeans, rice and peanuts. Substantial hired labor was used and when combined with a high rental payment the result was a rather low crop income per rai of ฿877. If the programming solution can be used to propose organizational readjustment, the following recommendations would be in order: substantially increase the production of dry season crop with a better utilization of family labor supply. This would both increase the total crop value

Table 9.2

Farm and Family Income, Other Factors,
Small and Lower Middle Farms

	Small Farm				Lower Middle Farm			
	65		Representative		63		Representative	
	Actual	LP	Actual	LP	Actual	LP	Actual	LP
Crop Value	12,844	10,185	9,587	10,439	9,293	17,188	11,919	16,571
(-) Hired Labor	966	564	951	478	186	1,717	1,353	1,553
(-) Rent	0	0	926	926	792	792	1,029	1,029
(-) Water	7	7	7	7	6	6	11	11
Net Crop Value	11,871	9,614	7,703	9,028	8,309	14,673	9,526	13,978
(+) Other Farm Income	1,011	1,011	1,198	1,198	200	200	358	358
Total Farm Income	12,882	10,625	8,901	10,226	8,509	14,873	9,884	14,336
(+) Off Farm Income	114	4,158	3,534	4,544	7,632	5,315	2,444	5,301
Total Household Income	12,976	14,783	12,435	14,770	16,141	20,188	12,328	19,637
(-) Consumption Exp.	6,479	6,479	5,427	5,427	5,835	5,835	6,219	6,219
(-) Rice Value	779	779	711	711	962	962	854	854
(-) Cash	550	550	500	500	200	200	1,000	1,000
(+) Value of Home Food	242	242	334	334	356	356	120	120
Net for Saving	5,410	7,217	6,131	8,466	9,500	13,547	4,375	11,684
Labor Force	2.32	2.32	2.79	2.79	3.12	3.12	3.19	3.19
Household Income/Worker	5,602	6,372	4,457	5,294	5,173	6,470	3,865	6,156
Percent Farm Income	99	72	72	69	53	74	80	73
Farm Size (rai)	5.67	5.67	5.43	5.43	10.76	10.76	9.88	9.88
Household Income/rai	2,292	2,607	2,290	2,720	1,500	1,876	1,248	1,987
Net Crop Income/rai	2,094	1,696	1,419	1,663	772	1,364	964	1,415

Table 9.3

Farm and Family Income, Other Factors,
Upper Middle and Large Farms

	Upper Middle Farm				Large Farm			
	50		Representative		3		Representative	
	Actual	LP	Actual	LP	Actual	LP	Actual	LP
Crop Value	17,104	19,410	15,641	20,394	16,330	24,768	20,548	26,742
(-) Hired Labor	2,924	1,574	2,424	1,822	1,707	2,711	1,964	2,294
(-) Rent	3,461	3,461	917	917	0	0	2,224	2,224
(-) Water	11	11	14	14	25	25	17	17
Net Crop Value	10,708	14,364	12,286	17,641	14,598	22,032	16,343	22,207
(+) Other Farm Income	655	655	1,115	1,115	830	830	536	535
Total Farm Income	11,363	15,019	13,401	18,756	15,428	22,862	16,879	22,742
(+) Off Farm Income	7,962	6,365	2,574	5,785	3,418	5,723	4,289	6,130
Total Household Income	19,325	21,384	15,975	24,541	18,846	28,585	21,168	28,872
(-) Consumption Exp.	8,319	8,319	8,630	8,630	17,773	17,773	9,461	9,461
(-) Rice Value	825	825	838	838	814	814	966	966
(-) Cash	1,100	1,100	1,500	1,500	1,950	1,950	1,500	1,500
(+) Value of Home Food	426	426	348	348	47	47	151	151
Net for Saving	9,507	11,566	5,355	13,921	6,038[1]	15,777[1]	9,392	17,096
Labor Force	3.44	3.44	3.33	3.33	3.44	3.44	3.79	3.79
Household Income/Worker	5,617	6,216	4,797	7,370	5,478	8,310	5,585	7,618
Percent Farm Income	59	70	77	72	77	77	80	77
Farm Size	12.21	12.21	12.68	12.68	16.24	16.24	18.48	18.48
Household Income/rai	1,583	1,751	1,260	1,935	1,160	1,760	1,145	1,562
Net Crop Income/rai	877	1,176	969	1,391	899	1,357	884	1,202

[1] ฿7682 spent on house and farm building investment included in this table.

and decrease the amount paid for hired labor and apparently could increase total net crop income by some 34 percent. This reorganization will reduce off-farm income slightly, but overall, the result would be an increase in income per worker of about ฿600 per year. In addition to the number of dry season crops that could be grown, the choice of crops is important. The programmed solution would recommend the entire farm be devoted to rice in the dry season with two planting dates. That is to say, in the cool dry season about one-half of the farm should go to rice with about one-fourth of the farm planted to peanut and garlic at this time. Then a half of the farm would be planted again to rice in the hot dry season. This recommendation seems particularly suitable for this family because his rice yield per rai of 622 kilograms per rai is about 12 percent higher than the village average.

It would have also the effect of placing greater reliance on the farm for the family's income because 70 percent rather than 59 percent of total household income would come from farm sources. It is worth noting that for the two previous farms described it was possible for the families' income to be improved by diverting family labor resources from off-farm employment to the intensification of the farming system.

9.1.1.4 Large Size Farm: Household 3 With Actual versus Programmed Solution

Household number 3 is composed of 3.4 adult members in the labor force operating a farm of 16.24 completely owned rai (Table 9.3). This is slightly smaller in land area and labor force than the corresponding representative farm for this size group. It is an interesting case because the cropping intensity index at 228 is larger by 14 points than

Table 9.4

Farm Organization, Farm and Family Income, Programmed Solutions with Non-Crop and Community Service Constraints, Representative Farms

Items	Representative Farm by Size			
	Small	Lower Middle	Upper Middle	Large
Crops				
Rice 1	5.43	9.88	12.68	16.09
Rice 2.1	2.54	.40	1.80	.54
Soybean 1	-----	-----	-----	-----
Peanut 1	1.55	2.10	2.07	2.08
Garlic 1	.25	.74	.81	.81
Rice 2.2	-----	.45	-----	4.17
Rice 2.3	2.89	9.03	10.85	6.90
Peanut 2	-----	-----	-----	-----
Soybean 3	-----	-----	-----	6.86
Peanut 3	2.26	.35	.09	-----
Intensity Index	275	232	223	203
Crop Value	10,439	16,571	20,394	26,742
(-) Hired Labor	478	1,553	1,822	2,294
(-) Rent	926	1,029	917	2,224
(-) Water	7	11	14	17
Net Crop Value	9,028	13,978	17,641	22,207
(+) Other Farm Income	1,198	358	1,115	535
Total Farm Income	10,226	14,336	18,756	22,742
(+) Off Farm Income	4,544	5,301	5,785	6,130
Total Household Income	14,770	19,637	24,541	28,872
(-) Consumption Expense	5,427	6,219	8,630	9,461
(-) Rice Value	711	854	838	966
(-) Cash	500	1,000	1,500	1,500
(+) Value of Home Food	334	120	348	151
Net for Saving	8,466	11,684	13,921	17,096
Labor Force	2.79	3.19	3.33	3.79
Household Income/Worker	5,294	6,156	7,370	7,618
Percent Farm Income	69	73	72	77
Farm Size	5.43	9.88	12.68	18.48
Household Income/rai	2,720	1,987	1,935	1,562
Net Crop Income/rai	1,663	1,415	1,391	1,202
Land Area/Worker	1.95 rai	3.10 rai	3.81 rai	4.86 rai

the programmed solutions proposed for this farm. Yet the total crop value for the farm was ฿8438 less than the programmed solution would generate. The existing cropping program is dominated by rice at a time when the rice yield per rai was only 416 kilograms per rai or 75 percent of the village average. It appears that in this case more attention is needed in improving yield of the primary crop than to the diversification of the dry season cropping program. The linear programming solution calls for six different dry season crops compared with the two currently grown by the farm operator. Without question the more complex the dry season cropping program becomes, the more skilled the management must be. This seems especially true for this situation because substantially more labor must be hired to accomplish the requirements of the more complex dry season cropping program. On the other hand, the programmed solution does suggest the opportunity for marketing more of the family labor in off-farm employment. Whether these additional opportunities actually exist or not is unknown but if it is quite likely that the rather ingeneous way the program distributed the seasonal crop labor among a variety of crop would make available more family labor for off-farm employment.

Even without the necessity to pay rent, the low value of crops in combination with the rather modest level of off-farm income resulted in household earnings too small to meet the reported level of consumption, to replace the beginning of year cash on hand and to cover the estimated value of rice placed on inventory at the beginning of the year. The reported family consumption expenditure for the year of ฿17,773 included ฿7,682 spent on house and farm building investment.

In keeping with our understanding of household behavior in Ban Pa Mark, it can be presumed that the building investments were paid from long-term personal savings rather than from current income. Therefore, the figure in Table 9.3 representing the residual for savings includes this building investment since it was not deducted from the reported consumer expenditure figure in the table.

9.2 Representative Farm Comparison: Actual versus Programmed Results

All of the representative farms show in the actual situation some of each possible crop in the land use pattern. This is because the representative farms are defined as the average of all units in their respective farm size classes. Because of this it is impossible to identify crops according to planting and harvesting periods. The total area of each crop is shown in Table 9.1 in parentheses.

The LP solution showed for each representative farm areas of improvement in all aspects of the farm and home business. The cropping programs were intensified and also simplified. The cropping intensity index was increased from 207 to 275, 180 to 232, 189 to 223 and 185 to 203 for the small, lower middle, upper middle, and large representative farms respectively. For the small representative farm, hired labor expense was cut in half but for the other representative farms the LP solution and the actual expenditure for hired labor was within ฿400 of each other. The off-farm income was increased for each representative farm except for the one in the upper middle farm size class.

From a reallocation of available family resources the LP solutions show an increase in total household income of 19, 59, 54 and 36 percent for small, lower middle, upper middle and large farms respectively. In

terms of household income per worker, this means an increase of ฿937, ฿2291, ฿2573, and ฿1930 for small, lower middle, upper middle and large representative farms respectively. These are significant income increases which could come from increased resource allocative efficiency given the assumptions of the analysis. This conclusion need not be in conflict with the"efficient but poor"proposition regarding small farms in the developing world (Schutz, 1964). In the first place, the Ban Pa Mark farmers are not at a subsistence level and secondly they may be in a period of transition from a time when dry season irrigation was not possible to one which more completely exploits dry season irrigation potential.

9.3 Representative Farm Comparisons by Farm Size

The purpose of this section is to compare programmed solutions that were obtained for the four farm size classes and to determine whether the optimal solutions differ by farm size for the several variables selected for interpretation.

Looking first to the resources employed, as farm size increases, so does the size of the labor force and the amount of cash that the family has available for productive purposes at the beginning of the year (Table 9.4). A part of the increase in farm size had come about by an increasing amount of land being rented. Hence, the share of crop or cash outlays for rent increase in absolute terms as farm size increases. Assuming that farms were to function as the LP solutions would indicate the effect that this differential resource bundle would have on farm organization and family income appears to be as follows:

1) the smaller the farm, the higher the crop intensity index ranging from 275, 232, 223 to 203 as one moves up the size classes from small, lower middle, upper middle to large farms; 2) even as the crop intensity diminishes as result of less possible land being planted in the dry season, the amount of hired labor required increases with size of farm. Also the higher hired labor and higher rental charge notwithstanding, as the farm size increases, the increase in net crop value increases at an increasing rate because of the larger area of land being farmed. In absolute terms, the value of off-farm income changes inversely with the farm size as a consequence of higher proportion of family labor being involved in cropping activities as the farm size increases. 3) Using net for savings as an indicator of living standards, larger farms would be considered better off. The large representative farm had a programmed net for saving per household slightly more than twice that for the small representative farm. Total household income per adult worker would increase steadily with increases in farm size according to the programmed results. The clue to this relationship is that taking the sample households as we find them, even as labor force increases with the increases with farm size, the land area per worker also increases. The land area per adult labor force member is 1.95, 3.10, 3.81 and 4.86 for small, lower middle, upper middle and large sized farm groups respectively. As farms become larger, the employment opportunity set for individual family members expands.

9.4 Representative Farm: Labor Constraint Effective and Relaxed

The first programming solutions were obtained by assuming that the time spent by the family caring for their livestock and vegetable

plots and participation in non-paid community activities should be maintained at the customary level. The second set of solutions were obtained by assuming that the time spent in these activities could be made available for on-farm or off-farm income producing works. The purpose of the experiment is to observe the consequences of relaxing this constraint. Behind this experiment is the contention that peasant families would be reluctant to forego these activities and that to ignore them is to overstate the amount of labor that is available for productive work. In the case of the small representative farm, the amount of time devoted to these activities amounted to 438.87 hours of male time and 281.02 hours of female time for a total of 719.87 hours (Table 9.5). This represents 13 percent of the total annual farm labor force time available for farm and non-farm work.

Relaxing this constraint had the following effects on the programming solution: it increased the area planted to dry season crops resulting in an intensity index of 291 compared with 275 for the result in the constrained system. Of course, this increase intensity resulted in a higher crop value in total and per rai. Making more time available for the farm family made it possible to hire less labor which resulted in an increase in the total net crop value of ฿708 or 8 percent. In addition, more family labor was made available for off-farm employment resulting in an increase in total household income of ฿913 or an increase of 6 percent.

In case of lower middle representative farm, we note a difference of only 416 hours of labor available in the two situations. This less than 60 percent of the time spent on these activities as was the

Table 9.5

Farm Organization, Farm and Family Income, Representative Farms, With and Without Committed Labor Constraint, LP Solutions

	Small		Lower Middle		Upper Middle		Large	
	With Constr.	Without Constr.	With Constr.	Without Constr.	With Constr.	Without Constr.	With Constr.	Without Constr.
Crops								
Rice 1	5.43	5.43	9.88	9.88	12.68	12.68	16.09	18.34
Rice 2.1	2.54	3.19	.40	1.34	1.80	5.00	.54	2.36
Rice 2.2	-----	-----	.45	-----	-----	-----	4.17	2.94
Rice 2.3	2.89	2.24	9.03	8.54	10.85	7.64	6.90	14.81
Soybeans 1	-----	-----	-----	-----	-----	-----	-----	-----
Soybeans 2	-----	-----	-----	-----	-----	-----	-----	-----
Soybeans 3	-----	-----	-----	-----	-----	-----	6.86	.72
Peanuts 1	1.55	1.81	2.10	2.27	2.07	2.34	2.08	-----
Peanuts 2	-----	-----	-----	-----	-----	-----	-----	-----
Peanuts 3	2.26	2.91	.35	.84	.09	1.30	-----	-----
Garlic 1	.25	.23	.74	.74	.81	.72	.81	.92
Garlic 2	-----	-----	-----	-----	-----	-----	-----	-----
Garlic 3	-----	-----	-----	-----	-----	-----	-----	-----
Intensity Index	275	291	232	239	223	234	203	217
Crop Value	10,439	10,996	16,571	16,997	20,394	21,174	26,742	28,679
(-) Hired Labor	478	329	1,553	1,379	1,822	1,786	2,294	1,914
(-) Rent	926	926	1,029	1,029	917	917	2,224	2,224
(-) Water	7	7	11	11	14	14	17	17
Net Crop Value	9,028	9,736	13,978	14,578	17,641	18,457	22,207	24,524
(+) Other Farm Income	1,198	0	358	------	1,115	0	535	0
Total Farm Income	10,226	9,736	14,336	14,578	18,756	18,457	22,742	24,524
(+) Off Farm Income	4,544	5,947	5,301	6,334	5,785	6,773	6,130	7,817
Total Household Income	14,770	15,683	19,637	20,912	24,541	25,230	28,872	32,341
(-) Consumption Exp.	5,427	5,427	6,219	6,219	8,630	8,630	9,461	9,461
(-) Rice Value	711	711	854	854	838	838	966	966
(-) Cash	500	500	1,000	1,000	1,500	1,500	1,500	1,500
(+) Value of Home Food	334	0	120	0	348	0	151	0
Net for Saving	8,466	9,045	11,684	12,839	13,921	14,262	17,096	20,414
Labor Force	2.79	2.79	3.19	3.19	3.33	3.33	3.79	3.79
Household Income/Worker	5,294	5,621	6,156	6,555	7,370	7,576	7,618	8,533
Percent Farm Income	69	62	73	70	72	73	77	76
Farm Size	5.43	5.43	9.88	9.88	12.68	12.68	18.48	18.48
Household Income/rai	2,720	2,888	1,987	2,117	1,935	1,990	1,562	1,750
Net Crop Income/rai	1,663	1,793	1,415	1,476	1,391	1,456	1,202	1,327
Additional Hours Available — Male	438.87		216.62		260.54		398.25	
Additional Hours Available — Female	281.02		200.07		219.15		123.11	

situation for the representative farm in the small farm group. The reason for this is that for farms of this intermediate size group, work in the care of livestock is of relatively small importance.

The main effect coming from the relaxation of the labor constraint for this representative farm was to reduce the cost of hired labor and increase the amount of income from off-farm sources. The percent of total income coming from farm sources decreased and the total income from all sources increased about 6 percent (the same percentage increase as was true for the small representative farm).

The average amount of family labor for upper middle sized representative farm spent about 260 hours of male time and 219 hours of female time for a total of 480 hours per year to non-cropping farm activities and non-income earning activities of the family. This is about 70 percent of the farm labor supply. For the upper middle sized representative farm, the effect from relaxing the specialized labor constraint was to maintain the level of dry season rice production but to change the proportion of cool dry season and hot dry season rice to accommodate more peanuts in the hot dry season. This increased the intensity index from 223 to 234 resulting in higher total crop value of ฿780. Slightly less hired labor was required because, as noted before, more family labor is presumed available for farm work. Likewise, there is more opportunity for off-farm employment resulting overall in an increase in household income per worker of about ฿206 per year and an increase of ฿689 for the total family. In this case a 6 percent increase in the available family labor supply resulted in only a 3 percent increase in total household income.

One might have guessed that because of the larger farm area to be farmed the available family labor supply would already be utilized in the farm cropping program. However, the programmed solutions indicate a surplus of labor for farm work even with the imposed labor constraint. Consequently, the programmed results appear similar to those previously discussed in that as the constraint is relaxed, the cropping program becomes more intense, less labor is hired and more family labor becomes available for off-farm employment. The overall effect is to increase net crop income about 10 percent and to increase the total household income by 12 percent. From this it may be concluded that the omission of these constraints in planning the large farm is a more serious matter than for the other farm size classes. Even though the percent of income being provided by the farm remained essentially unchanged, the apparent potential earnings for a household in the large farm sized category is grossly overestimated by ignoring this class of specialized labor activity.

9.5 Marginal Value Products of Resources

When the amount of an available resource has been fully used up in an LP program, the addition of one more unit of such a resource at the margin would increase the net revenue by a certain amount. This amount at the margin is called the Marginal Value Product (MVP) or "shadow price" for the resource in question.

This section will report the MVPs of family male labor, of family female labor, of hired labor and of borrowed money as determined by the model.

9.5.1 Marginal Value Product of Family Labor

The MVP of family labor for male and female will be discussed separately by giving attention to the four possible outcomes that may be produced by a linear programming solution as described below and as presented in Table 9.6.

1) The MVP of family labor is equal to a wage rate which the family can receive from working in non-farm activities. The LP solution shows the MVP of family labor at all times to be at least equal to this rate since it was assumed that family labor not used in the farm business could earn additional income by performing non-farm activities and thus pick up some earnings according to the wage schedule by periods. This situation where the MVP is equal to the off-farm working opportunity is represented in Table 9.6 by the word "OUT" in periods where it occurs.

2) The MVP of family labor is greater than the rate that could be obtained from being hired out but less than the rate that would be paid if labor would be hired in by the family. This means that an additional hour of family labor is worth more working in the farm business than in the non-farm activity but that the on-farm work earns too little at the margin to justify hiring additional labor.

3) The MVP of family labor is equal to a wage rate that the family would pay if hiring in. This implies that if an additional unit of family labor is available, cost savings can be achieved from not having to hire labor. The saving would be equal to the MVP for the unit not hired. Whenever this situation occurs, it is represented in Table 9.6 by the word "IN."

Table 9.6

Marginal Value Product of Family Labor,
Case and Representative Farms

Period	Wage Rate Hired In	Wage Rate Hired Out	Case Households HH 65	HH 63	HH 50	HH 3	Representative Farms Small	Lower Middle	Upper Middle	Large
					Male Family Labor					
1	3.85	2.00	2.50	2.62	3.24	IN	2.47	2.53	3.25	3.81
2	4.20	2.00	IN	IN	IN	IN	IN	IN	IN	IN
6	3.50	3.25	OUT	IN	IN	19.47	OUT	IN	IN	19.47
6.5	3.50	3.25	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
10	1.00	.85	IN	OUT	IN	2.37	IN	IN	IN	2.25
10.5	1.00	.85	IN	OUT	IN	4.84	IN	IN	1.79	4.56
					Female Family Labor					
1	1.50	1.00	IN	IN	OUT	IN	IN	IN	OUT	IN
2.5	1.25	1.00	IN	IN	IN	IN	OUT	IN	IN	IN
6	3.50	3.25	IN	IN	IN	IN	IN	IN	IN	IN
6.5	3.50	3.25	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT
7	5.60	1.00	2.07	2.07	1.91	1.90	1.90	1.90	1.91	1.90
10	1.00	.85	3.54	3.67	3.51	2.16	3.51	3.51	3.50	2.29
10.5	1.00	.85	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT
11	1.00	.85	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT

Note: 1. IN means equal to hired in rate
OUT means equal to hired out rate
Underline numbers indicate MVP > hired in wage
Non-underline numbers indicate hired in > MVP > hired out
2. For omitted periods MVP is equal to hiring out rate

4) The last situation possible in an LP solution is where the MVP of family labor is greater than the rate that would be paid by the family for hiring in additional labor. To have the MVP greater than the wage rate means that the resource is very constraining and that if we were able to use an additional unit of family labor, it would yield a return greater than the rate necessary to hire an additional unit. This situation is represented in Table 9.6 by underlined numbers.

9.5.1.1 Marginal Value Product of Male Labor

In all periods except 1, 2, 6, 6.5, 10 and 10.5 the MVP for male labor was equal to the wage rate that male family members could have received if hired outside the farming business. These periods are omitted from the table.

In the exceptional periods the MVP for male family labor is at least equal to the off-farm opportunity wage rate. In period 1, the MVP fell between the hiring in rate and the off-farm opportunity rate. Male labor is constrained in this period by the necessity to harvest dry season crops and at the same time to prepare the nursery for the rainy season rice crop. The only occurrences in which the MVP for male family labor was higher than the hiring in rate was in certain critical periods for the large representative and the same farm, periods on the large case farm. This situation held in periods 6, 10 and 10.5. It occurred because the large farms have a large area to be harvested for both rainy season rice (period 6) and cool dry season crops (period 10) as well as planting hot dry season crops (period 10.5).

9.5.1.2 Marginal Value Product for Female Labor

In all periods except 1, 2, 5, 6, 6.5, 7, 10, 10.5 and 11, the MVP for female labor was equal to the wage rate which female family members could receive if hired outside the farm business. These periods are omitted from the table.

In the exceptional periods, the MVP of female family labor is at least equal to the off-farm opportunity wage rate. In period 7 the MVP falls between the hiring in rate and the off-farm opportunity cost. Female labor is constrained in this period when planting of dry season crops takes place. As noted earlier, women play a major role in dry season cropping. The MVP for female labor is particularly high in period 10 when it exceeds the hiring in rate. This is the period for harvesting dry season crops. In periods 10.5 and 11, the MVP is equal either to the hiring in rate or to the hiring out rate.

9.5.2 Marginal Value Product of Hired Labor

The amount of male and female labor which a household could hire and the corresponding wage rate that would be paid by period was imposed upon the model at the level of two man equivalents per period for male and female in the rainy season, one and one-half man equivalents each for male and female in the cool dry season and one man equivalent per period each for male and female in the hot dry season. One must conclude that this was not a serious constraint because in most periods and for most case farms and representative farms, the MVP for hired labor was zero. An exception was for the large representative farm and the case household within this size class which used all available hired labor in period 6 with a resulting MVP of ฿19 which is more than

four times the hired labor rate for this period of ฿3.50. There was also an effective hired labor constraint for large farms needing to employ labor in period 10 and 10.5 where the MVP ranged from 1.4 to 3.8 times the hired wage for those periods. The MVP for female labor was from 1.2 to 2.5 times the hired wage rate in period 10 for farms in the lower middle size class or larger. The labor constraint was effective on small farms only for female hired labor in period 10.5.

9.5.3 Marginal Value Product of Capital

The linear programming result shows that no capital was borrowed for any representative farm or case farm regardless of size. This shows, given the assumptions of the model, that capital was not a limiting resource. Thus, the MVP of borrowed capital was equal to zero.

In interpreting the MVP for capital, it is well to recall that the LP model was not designed to provide for the substitution of capital for labor. This is to say that labor requirements were specified absolutely with the constraint imposed on the basis of family labor force and assumed hired labor availability. Capital requirements were specified to meet farm and home expenses and constrained by assumed capital on hand with opportunities to increase capital through productive activities. There was no opportunity to reduce capital expenditure by increasing labor input nor to reduce labor input requirement by increasing capital expenditure.

The borrowing activities were included in the design of the model to ensure feasible solutions knowing in advance that is not customary for Ban Pa Mark village people to borrow money to any appreciable extent.

9.5.4 Marginal Value Product of Land

The linear programming model was designed to force all available land to be planted to rainy season rice if other constraints would permit it. Only the large farm (case household number 3 and the large representative farm) were unable to meet this condition resulting in an MVP for land equal to zero for these situations (Table 9.7).

Table 9.7

Marginal Value Product for Land/Rai

Farm Size	Case Farm	Constrained Farm	Unconstrained Farm
Small	฿391	฿342	฿406
Lower Middle	333	310	391
Upper Middle	339	332	332
Large	0	0	268

With these levels of the MVP, an additional return from having one unit land if rented will be less than its cost. It is appropriate to compare this MVP with the rent for one rai of land but as was discussed in Chapter 3, it may be difficult to find an appropriate value for comparison. There was considered variability in land rental rates reported as a probable consequence of the various provision in the rental agreement. The average rent per rai for household reporting land rent was ฿696 and the average per rai computed over all rented land was ฿539.

9.6 Summary

This chapter has presented the findings of the LP analysis. Specific findings will be summarized in the final chapter. General

conclusions point to the following:

1) Without adding to the resource base of small farmers, there is opportunity to increase family income by improved resource allocation to involve, in most cases, a more intensive use of land for cropping in the dry season and an improved allocation of family labor berween farm work and non-farm employment.

2) An increase in the cropping intensity index is not necessarily a means to increase income. Good crop husbandry with better than average crop yield can, with a low cropping intensity index, produce more net crop value than a high crop intensity index with low crop yield.

3) Increasing the crop intensity index usually required the introduction of additional crops. For some farmers the more difficult management problems associated with the care of a larger number of crops could be sufficient to justify a simpler cropping system even if it resulted in a lower total crop value.

4) For the conditions found in Ban Pa Mark, and with the assumptions employed in the analysis, it would appear that neither capital nor labor constitute serious constraints on the improvement of family income. This is not to conclude that the computed income level are necessarily adequate to meet the goals of Ban Pa Mark families. Perhaps the introduction of more advanced technology could make a more significant change in income than was found in this study. But the answer to this question is found outside the scope of this thesis.

5) The consequences of omitting certain type of family labor commitment were evaluated in this chapter. Time customarily used by

families in the care of non-crop farming activities and for non-income producing community activities approaches of one-fifth of all time accounted for. Farm management analysts are prone to ignore this type of constraint in their planning efforts, not because it is considered unimportant, but because the necessary data are seldom available.

Fortunately for this study, the available data did provide an opportunity to measure the extent to which farm and family income may be overestimated by ignoring this constraint.

The implication of these and other findings will be discussed in the next and final chapter.

CHAPTER 10

SUMMARY AND CONCLUSIONS

10.1 Summary

10.1.1 Restatement of the Problem and Research Approach

The 1976-79 Fourth National Development Plan of Thailand emphasized diversification and the growth of agricultural production through intensification and increased productivity to ensure an adequate food supply for the growing population and to increase the farm income and the standard living of the community. Multiple cropping has been offered as a means to serve this policy purposes since it is the practice of planting in a given field, a crop or crops two or more times in one year. Land is limited and the size of farm is generally small in Thailand. This condition is generally true throughout the developing world and multiple cropping is receiving increasing attention as a means to improve the agricultural production system on small farms especially in areas of tropical agriculture. This thesis is a modest contribution to the vast and ever-growing literature on the problem and issues surrounding farming systems and multiple cropping research.

The locational setting for this study is the village of Ban Pa Mark, located in the Chiang Mai Valley of Northern Thailand. This is a location particularly favorable for multiple cropping with a reasonably well developed infrastructure and reliable year-round water supply made

available as part of the Mea Taeng Irrigation Project, the largest of the three irrigation projects serving the Chiang Mai Valley.

The village of Ban Pa Mark first came under study during 1972-73 as part of a socio-economics baseline survey of 22 villages conducted as an early activity of Multiple Cropping Project (MCP) at Chiang Mai University. During the same period it was one of a subsample of 3 selected from the original villages to provide specialized economic and production data at the end of both rainy season and dry season crop harvests. Because more accurate measurement on labor utilization, income sources and expenditure patterns than was possible from the six month interval study, Ban Pa Mark was designated as the single village which would be subject to a full year intensive study with data collected daily throughout the crop year of 1973-74. The primary data needed for this thesis came from the above mentioned studies but mostly from the intensive study of 1973-74.

The Multiple Cropping Project at Chiang Mai University was initiated in 1969 with the following objectives:

a) to develop, on a pilot basis, ecologically sound systems of multiple cropping with silo and water management designed to substantially increase farm income

b) to get all agencies of government and private business concerned with agriculture to develop a "package of services" for farmers that will enable them to make the best possible use in both economics and production terms, of the improved production technology and other resources

c) to monitor the adoption process in order to continuously evaluate the project and improve its impacts on the village farm community

To achieve the above objectives, the work plan called for five sequential stages:

1) inventory of farming system
2) synthesis of prototypical farming systems
3) technology design and farm system validation
4) evaluation of impacts on the farms
5) implementation of multiple cropping process in village development

At the time the current research was undertaken, the project was entering the phase having to do with evaluation of impacts on farms, however, during the validation phase there was evidence to suggest strong reluctance on the part of the farmers to make the kind of changes in their traditional farm organization and practices which would be needed if the research results of the university were to be incorporated into the everyday life of the Ban Pa Mark farmers.

The underlying principle for the conduct of this present research is that it is extremely important to introduce change starting from where the farmer is. In support of this principle little attention was given to the research at Chiang Mai University which concentrates on new production systems. Rather, the attention was given to the systems and practices being followed by the farmers at the time of the intensive study.

With this focus in mind, the following objectives were set forth:

1) to describe in detail Ban Pa Mark village and the individual households of a 30 family sample of its inhabitants for the two-fold purpose of (a) identifying and measuring critical constraints surrounding the management of typical cropping patterns, and (b) specifying representative farms and individual household cases for more detailed analysis
2) to develop a linear programming model to incorporate the constraints and to involve the representative farms and household cases from objective 1 in such a way as to determine possible reasons for dry season cropping being less than its apparent potential
3) to use the model developed in objective 2 to specify the most appropriate dry season cropping patterns consistent with the resource endowments and assumed constraints for the various representative farms and case households
4) to interpret the linear programming solutions for their implications for further research and extension program implementation in the Multiple Cropping Project at Chiang Mai University

The first step taken to fulfill the thesis objective was to describe in detail the land, labor and capital constraints of individual households which would have bearing on the kind and the amount of crops that would be grown in the dry season periods. The analysis of the effect of resource endowment and specialized constraints of farm organization and family income entailed the use of a poly-period

programming model to specify optimal solutions for representative farms derived from four farm sized strata and for one case household selected from each stratum. It was felt, given the objectives of the study, that both case households and representative farms would be useful. There is no individual farm like a representative farm as it was defined because no farm is likely to have exactly the average amount of every kind of crop and the thought that the planting and harvesting dates for an individual farm will include all of the dates found in the sample is somewhat incomprehensible. The individual farm analysis is appropriate if one is attempting to examine what is possible for a particular set of family circumstances and is looking for recommendations to improve the income position of such a family situation. The representative farm is more appropriate if one is attempting to examine certain relationships such as the relationship between the level of earnings and farm size. The reason for this is that some of the determinants for the variation in level of earnings are being controlled in the averaging process from which the representative farm is derived. This study has elements of both types of problem and hence it was decided to use both the case household and the representative farms.

10.1.2 Summary of Production Constraints

10.1.2.1 Land Holdings

The range in farm size for the 30 household sample was from 1.79 to 24.25 rai operated with a mean of 11.64 rai. On the average 9.22 of the 11.64 rai were owned with the rental land operated under a variety of leasing arrangements but with the average computed value of

rent per rai of ฿539. Regardless of farm size, farm operators tend to subdivide their parcels into fairly uniform units of about .34 rai per field plot.

The dry season land area was utilized on the average as follows: 4.12 rai (38.6 percent of dry season land) in dry season rice, 5.77 rai (54 percent) in soybeans, .69 rai (6.5 percent) in peanuts, and .10 (.9 percent) in garlic. This pattern of land utilization resulted in a cropping intensity index of 192 which means that 92 percent of the total land area was utilized during the dry season period. All available land was planted to rice in the rainy season because for reasons of tradition, food security, and the suitable rice growing conditions, no Thai farmer would produce any other crop at this time of the year.

10.1.2.2 Family Composition and Labor Force

Household size ranged from 3 to 10 members with an average of 5.4 per household and an average age of 28 years. The model household size was 5 members with an average age of 27.6 years. For comparability among families, the diverse age and sex distributions were converted to two common denominators. The first was to an adult male work equivalent with consideration given to age and availability of family members for farm work. The average family size of 5.4 members converted to 3.2 adult full time equivalents of which 42 percent was composed of female and 6 percent children with the remaining 52 percent being male adult. This conversion was used to establish the labor availability coefficients (RHS) for each period by sex in the linear programming model.

The family composition was also converted to the common denominator of adult equivalent consumer. On the basis of an estimated share that

members have of total consumption, adult consumer equivalents were computed on the basis of age and sex. This computation revealed an average of 4.4 adult consumer equivalents with 42 percent female, 11 percent children and 47 percent adult male. The computed adult consumer equivalents for each family were used in the analysis of income distribution and compared with income distribution based on all family members.

When the households were stratified by farm size, it was observed that family size (hence adult labor equivalents and adult consumer equivalents) increase in direct proportion to land area operated. It was found that farms in the upper half by farm size average more than twice as much farm land per household but about 75 percent more land per man equivalent.

From the recorded hours of time spent by family members on farming activities, the following statistics were computed for use in the linear programming model: 1) labor requirement by activities by crop and by sex. The labor requirement by crop activity were aggregated to period for use in the model. Requirements for crops were computed using the average of farms with less than 10 rai and from farms with 10 rai or more. Had there been sufficient number of grower for each crop it probably would have been desirable to develop labor coefficients for every representative farm. This was not the case. Given the distribution of farm by land area operated, dividing the total sample into those less than 10 rai and those with more than 10 rai seem quite reasonable. The coefficients obtained from the farm with less than 10 rai would be suitable for the case household found in the small and lower middle farm size classes. The coefficients obtained from the

averages of farms with 10 rai or more would be suitable for analyzing the case household and representative farms in the upper middle and large farm size classes.

Particular attention was given to specialized roles that family members play in crop production. Men carry out the activities which need physical strength like plowing, harrowing for rice, bedding for peanuts and garlic, pulling rice seedlings and threshing rice and soybeans. Women do most of the rice transplanting and participate very heavily in the cutting, bundling and moving of rice at harvest time. They spent more time in planting dry season crops than did men. They also spent more time than men in bundling and cleaning soybeans and peanuts. Children may be regarded as standby labor to be called into service during critical periods and to work on occasion when they are not in school.

Exchange labor is an interesting phenomenon in the Ban Pa Mark agricultural system. Two-fifths of the labor used in rice transplanting and two-thirds of the labor used in rainy season rice harvesting is provided by exchange labor. It is also high for rice threshing (73 percent) and for rice cutting (42 percent) in the dry season. Exchange labor is also used in other dry season crops for activities such as threshing soybeans (44 percent), plowing and harrowing (84 percent) and cleaning peanuts (54 percent), and making bed for garlic (68 percent). Despite its importance to farm production, exchange labor was not included in the design of the linear programming model in view of its fast turnaround requirement resulting in the usual completion of exchange transactions within a single period.

Farming is more than growing crops in the Thai farm family. Approximately 18 percent of the total farm labor is devoted to the care of livestock, maintenance of the family garden and the harvesting of native fruit. These activities contribute only 8 percent of total value of home produce consumed but are a very significant part of farm life. Some enterprises such as swine and poultry are found at some time of the year on all farms. They are sustained mainly from kitchen and field by-products and by using labor that is not urgently needed in other parts of the farm business. Most of the labor for non-crop farm enterprises is supplied by women and children. Since these activities have been maintained primarily for home consumption rather than for commercial purposes, livestock enterprises were not introduced as viable alternatives in the linear programming model. However, because they are so fixed in the system, the labor required to maintain them was regarded unavailable (in one part of the analysis) for crop production or other income generating activities. To measure the effect of this concept, linear programming solutions were obtained for both the case where this labor was assumed available to the program and in another case where it was assumed unavailable. The seasonal pattern of this labor requirement was also imposed on the model.

Non-farm activities were examined both for their contribution to family income and their share of total labor utilization. In addition, the amount of time spent in non-farm income producing and off-farm income producing activities were analyzed.

In accounting for all labor activities of the farm families (except for in-home activities such as preparing meals, sewing, resting, care

of children, etc.), 52 percent of the time was spent away from home with 48 percent in farm production. Of the time spent away from home 5 percent was involved in exchange labor activities, 77 percent was in non-farm income earning work and the remaining 18 percent was involved in community activities or other types of non-income producing effort. Looking at the total labor utilization, off-farm labor represented 40 percent and the non-paying community work activities constituted 9 percent of the total. In terms of gross income, farming is by far the most important because 42 percent of the total time expended produced 82 percent of the family gross income; whereas off-farm labor activities representing 40 percent of the time contributed only 18 percent of the family gross income. Family members hiring themselves out to others contributed 58 percent of the total earnings from non-farm employment. Four-fifths of this was in the form of non-farm employment (for example, carpentry, wood carving, or building construction). Self-employed non-farm activities included paid services (such as barber or beautician), handicraft and trading. The latter represented three-quarters of the income from self-employed works.

Taking into account time spent and the corresponding earnings, a seasonal distribution of wage rates per period was derived for use in the LP model.

All families had some hired labor expenses and regardless of farm size, it constituted the highest percent of total crop production cost. The outlay for hired labor ranged from ฿80 to ฿4882 per farm, averaged ฿1659 and represented 43 percent of total farm expenses. Labor was hired primarily for harvesting but was also important for plowing

(especially when both man and buffalo were hired together). Taking into account time hired and amount spent plus considerable judgement on the part of the researchers, seasonal labor rates paid by the family were estimated for use in the LP model.

10.1.2.3 Capital

Unlike most studies dealing with peasant agriculture, capital availability was not found to be a major limiting resource in Ban Pa Mark for the production technology currently employed. From the data, it was found that the production cost for crops (except garlic) are relatively low aside from the outlays for the hired labor mentioned above. Ignoring rent and considering only rental of buffalo and farm supplies, including seed, fertilizer and chemicals, the average cash expenditures per rai used in the LP model per crop are as follows: ฿32 for rainy season rice, ฿38 for dry season rice, ฿49 for soybeans, ฿127 for peanuts and ฿660 for garlic.

The relatively low capital requirement for crop production and the apparent traditionally high propensity for Thai farmers to save, one finds that the borrowing of money for short term use takes place chiefly among friends and relatives. In designing the LP model, the initial capital on hand for representative farms was estimated from the actual inventory of households within the respective farm size strata. This estimate came to about ฿500, ฿1000, ฿1500 and ฿1500 for the small, lower middle, upper middle and large representative farms respectively.

10.1.3 Household Income and Assets

The value of crop production plus the receipts from labor hired out and from self-employed activities yielded an average of ฿18,536 per

household. As noted above, the farm component of this income (crops and non-crop) represented 82 percent of the total leaving 18 percent for receipts to the family labor from off-farm activities. When summarized on the basis of farm sized group, it was found that the non-farm income component of family income was substantially higher in the small farm quartile than was true for the rest of the sample.

To examine income distribution in Ban Pa Mark, it was found that the Gini coefficients were .233, .192, and .232 for income per capita, per consumer equivalent and per household respectively. The coefficients, reflecting a relatively equal distribution, are low for developing countries and the per capita income coefficient is considerably lower than the .44 coefficient estimated for rural Thailand in an earlier study.

The annual per capita income average was ฿2,648 (or $132 and approximately 43 percent of the per capita income average for the nation reported in the 1977 Statistical Yearbook).

With regard to asset ownership, real estate in the form of land and housing, represents about 94 percent of the total value of farm assets. Most of the remainder (6 percent) comes from the value of livestock and poultry enterprises. The value of farm implements and farm supplies on hand are negligible in value in relation to other assets. In the initial survey on which this study was based, no attempt was made to enumerate or evaluate personal property in total. Attention was given only to certain selected durable goods which might give some indications as to differential levels of living among the households. These goods included bicycles, motorcycles, watches, clocks,

radios and sewing machines. Of these items, bicycles, closely followed by radios, were the most common. Motorcycles and sewing machines being the most expensive were the least common and were found chiefly in the homes of the most well-to-do families.

10.1.4 Summary of the Linear Programming Results

10.1.4.1 Results from Case Household Analysis

Four households were selected which were most like the average of the farms in their corresponding farm size classes (households 65, 63, 50, and 3 in order of size).

In discussing the organization of any farm, what may be regarded optimum from one point of view is not necessarily optimum for another. It is quite possible that the individual farm operators in the present analysis may regard their existing farming systems more satisfactory than the reorganizations that might be recommended from the LP solutions. For example, the linear programming solutions in general call for more crops and in many cases much smaller area per crop than was found on the existing farms. The increased complexity of the system may be in itself sufficient reason to be rejected by the farmer. Nevertheless, the results are presented here as an indication of how farms might be reorganized (if necessary) to demonstrate a more complete utilization of available resources.

Highlights of the linear programming solutions in relation to existing conditions are as follows:

1) For the small farm, the LP solution yielded a lower intensity index with a lower total crop value than that found in the actual case.

Primarily because of a higher crop yield, even with nearly twice the amount of hired labor expenditure, this case farmer had a net crop value 20 percent higher than the LP solution generated. More family labor marketed in off-farm labor activities resulted in a lower percent of total income coming from farm sources.

2) In a reverse situation, the LP solution for household 63 specified a stronger emphasis on the cropping program and a decrease in the allocation of family labor to off-farm activities than holds for the existing situation. The program solution would nearly double crop value because of an expanding dry season cropping program and because of an existing crop yield for rice on farm 63 being less than average. To handle the expanded cropping program, almost 10 times the existing level of hired labor would be needed.

3) Farm 50 was distinguished by high total crop value despite a low cropping intensity index. The dry season cropping program was marked by variety but the total amount of dry season crops utilized only 66 percent of the farm land available. The LP solution would call for dry season cropping using 134 percent of the land available. Less family resources would be utilized in off-farm employment. The net effect would be an increase in income per worker by about ฿600 per year.

4) The farm number 3 in the large farm category had a 14 point higher crop intensity index than would be specified in the LP solutions. The existing organization concentrated on rice and soybeans whereas the LP solution would propose growing some of all of the commonly grown crops. It is quite possible that the farmers present organization is satisfactory if crop yields could be increased. His rice yield was only

75 percent of the village average. Given the rather relatively large supply of family labor on this farm, a substantial amount of off-farm earning could be obtained even with maintenance of an intensive cropping system in the dry season.

10.1.4.2 Results from Representative Farm Analysis

The purpose of the comparison of linear programming results for the various representative farms was to determine how the optimum solution obtained differed by farm size for the several variables selected for interpretation. The results indicated marked differences in the solutions according to farm size with the following generalizations forthcoming:

1) As farm size increases, the cropping intensity index decreases.

2) Even as the crop intensity diminishes as the result of less possible land being planted in the dry season, the amount of hired labor required increases with the size of the farm. Also, the larger hired labor expenditure and higher rental charges notwithstanding, net crop value increases with farm size because of the larger amount of land area being farmed.

3) As farm size increases, the proportion of total family income generated from non-farm sources decreases.

4) Total household income per worker increases steadily with farm size.

10.1.4.3 Results from Relaxed Labor Constraint

In recognition of the fact that, on the average, 18 percent of the total labor accounted for in this study was expended for the maintenance of traditional non-field cropping enterprises and for non-income

producing community activities, it was decided to measure the effect of these constraints on the volume and organization of the cropping system. Obviously freeing more resources should call for either an expansion of a cropping system or an increased amount of non-farm work or some combination of the two.

For all representative farms, the cropping intensity index increased from 3 to 7 percent depending on farm size and off-farm income increased from 11 to 27 percent depending on farm size. In monetary terms, relaxation of this constraint increased the total household income ฿913 (6 percent), ฿1275 (6 percent), ฿689 (3 percent) and ฿3469 (12 percent) for the small, lower middle, upper middle and large sized representative farms respectively. Overall, to ignore this type of labor constraint is to overstate the availability of farm labor supply for cropping or non-farm work by some 13 percent and the income by approximately 6 percent.

10.2 Implications of the Study

10.2.1 Implications of the Findings for the Multiple Cropping Project

The Multiple Cropping Project at Chiang Mai University has been an example of one approach to research and education for the intensification of dry season cropping programs. This approach is to start at the experiment station with the evaluation of potentially biologically stable and economically viable cropping systems. The emphasis is on the evaluation of new crops (such as wheat, sorghum, sunflower, caster bean, cabbage, tomatoes, chickpeas, sweet corn, etc.) with special attention being paid to developing new genetic material and engineering new

cultural practices in the field. After a development stage, the new system components are tested in the farmer's field. Implicit in this approach is the expectation that some new cropping system will evolve which will have general suitability for a large population of farmers.

An alternative approach to the problem of farming systems development is one viewing it as a need to apply basic principles of farm and home management to the individual farm situation. In this approach recognition is given to the fact that each household represents a unique case with regards to resource endowments and other constraints such as attitudes, age, health, experience, etc. Each situation will have its own best cropping system. The cropping pattern is a part of the cropping system which, in turn, is a part of the complete farming system. In this approach consideration will also be given to off-farm employment, off-farm community service obligations and opportunities for individual self fulfillment.

This study has demonstrated that even with crops well established in the community, there is room for possible resource reallocations to improve the farming system and the level of family income. On the other hand, it was found in certain individual cases that researchers themselves can learn from farmers. This was indicated by the case where the farm organization appears to be as good or superior to the LP solution. In the opinion of this researcher, the Multiple Cropping Project should return to the field and to continually monitor what farmers are doing and to introduce change only as it can be demonstrated consistent with the resource situation for individual farm families.

Obviously, any multiple cropping system in the area must be rice-based. The role that dry season rice plays both as an insurance for adequate food as well as for a cash crop needs to be recognized.

The findings from this study indicate that women dominate farm production activities in the dry season. This finding may be very significant for the extension and out-reach personnel of the Multiple Cropping Project. It may have implications to the types of crops that may be acceptable in the area and it may have bearing on how extension programs are conducted. In the Thai setting, it is the man alone who attends public meetings. The man according to his mood will decide how much and in what form his findings at educational meetings will be passed on to family members. The policy implication of this finding that women dominate the dry season cropping scene is not clear but it does seem worthy of evaluation by those responsible for extension programming in the MCP.

The dominant role that exchange labor plays in critical production periods is also worthy of careful attention. Though non-conclusive, there is evidence indicating that the planting dates for rainy season rice are staggered through the village. Exchange labor is an old and well-established practice in Thai farming communities carrying with it both economic and social implications. From the economic side, a different planting date implies a different harvesting period as well as different ecological stress in the life of the plant. Hence, the community decision as to whose crop will be planted first and whose will be planted last raises some interesting welfare economic questions such as who benefits and who loses in this process and how are the

decisions made? On the social side, to assume in the multiple cropping research that the family function independently can lead to invalid analysis. To assume independence may discount unduly the true opportunities for the introduction of more crops to the farming systems. At the same time, since so much of the farm work is characterized by group participation, it will be difficult for a cropping system regarded as an innovation to be accepted by one farmer if it is not generally acceptable to the entire community.

Reference has been made to the amount of family labor time expended in community services and self-fulfillment religious activities for their impact on the amount of total labor that may be available for income generation. There is another dimension of this which may have implications for the adoption of a dry season cropping program. It has to do with the seasonal distribution of this commitment which has a "peak" in period 4 and another in period 11. One might conclude that this is good timing for non-farm work in the sense that these periods are not typically critical in terms of labor requirements for crop production. However, it was observed that these periods correspond to the time for heaviest consumption expenditures because of the expenses related to Par Pa, Katin and Songkarn seasons. The implication is that the greatest drain on the family's cash flow occurs in the periods prior to the harvest of both rainy season rice and dry season crops. It is felt that for cultural reasons, the typical allocation of family labor for these activities is highly inflexible. Therefore, crops should not be specified which compete for labor in this high priority non-farming period. It appears that the solution to the cash flow management problem is found in the non-farm employment effort and in the management

of crop inventories, rather than in producing crops that can be harvested in time of primary need.

The above conclusions have been based on both the descriptive and the linear programming aspects of the study. Both aspects have helped to provide improved insight regarding how rural village farmers utilized their resources. Before turning to the need for further research, it may be appropriate to review the role that the poly-period programming methodology can aid in this type of analysis.

The second objective of the study shows interest in comparing what farmers actually do to what is potentially possible without knowing in advance what the potentialities are under traditional farming methods. The linear programming model helped answer that question. For the resource condition analyzed and the assumption employed including the assumption that family would maintain their current level of labor utilization in non-crop farming activities and off-farm community services, the highest cropping intensity index obtained was 275 on a large representative farm. This can be compared with one household in the village having the highest cropping intensity index equal to 270. The income potential per adult worker equivalent was found to be about ฿7600. This programmed result is nearly ฿2200 per worker higher than what realized by the farm family at the time of the survey. The matter of income potential is more pertinent than is the matter of cropping intensity potential. The former is concerned with maximizing net income in total and from all sources whereas the latter is concerned only with the proportion of available land being cultivated in the dry season. The linear programming method is particularly useful in a

problem of maximization of income for a given resource when all relevant alternatives are considered. All the reasons which might explain why farmers are not achieving thier full potential are not found in this study. Nevertheless, many clues were provided in the LP analysis. It helps to diagnose the effect of lower than average crop yield, the relation between farm and non-farm income, the importance of crop choice, and the contribution of women on total family income. Nevertheless, the well known shortcoming of the LP analysis are conceded. As indicated earlier, the so called optimal solution may only provide possible direction for change and should not be regarded as sacred.

10.2.2 Need for Further Research

Discussion on the need for further research will be based on perceived weaknesses in the current study. The data on which the research was based were abundant and carefully collected. Nevertheless, making estimates of certain parameters (particularly inputs and outputs of dry season crops) was difficult for lack of sufficient observations. If this type of analysis is to continue at Chiang Mai University, it will be necessary to monitor local production conditions more carefully and to isolate the primary variables affecting crop yield and in general to improve the estimates of these parameters.

On the methodological side, more research is needed on how the Thai farmer deals with risk and uncertainty. Risk considerations were introduced primarily as a safety first consideration. The probabilistic aspects of risk were not incorporated. As more work is done in this area, perhaps the linear programming approach would be replaced by one more capable of dealing with stochastic processes. With adequate

resources, this linear programming model could be improved to more closely simulate farmer behavior and hence improve the LP solutions. Every attempt was made to bring reality into the design of this model but some of the simplifications of reality are troublesome. For example, it would have been more realistic but too complex to introduce labor requirements in terms of specific sex and specific activities as well as by period. Dividing periods 6 and 10 improved the performance but a more realistic (but larger and more cumbersome) design would have recognized that some critical farming operations are performed in a matter of a very few days and failure to perform them on time may have consequences for the output. Over-aggregation of these events is a common shortcoming in farm planning by LP, but to cope with this problem completely would require a very major investment.

For whatever shortcoming there may be in this study, it is hoped that the result will have some usefulness to the on-going effort in multiple cropping research at Chiang Mai University.

APPENDIX

Appendix Table 3.1
LAND AND LAND TENURE FACTORS BY HOUSEHOLD

Hshld No.	Land Owned	Land Rented R.S.	D.S	Both	Total	Total Land	Rent/rai (฿) R.S.	D.S	Both	Total	Number Fields	Plots	Pl/Fld	Rai Per/Field	Per/Plot
34	1.79	-	-	-	-	1.79	-	-	-	-	1	6	6	1.79	.30
49	1.96	-	-	-	-	1.96	-	-	-	-	1	9	9	1.96	.22
61	1.54	-	1.50	-	1.50	3.04	-	455	-	455	1	12	12	3.04	.25
65	-	-	-	5.67	5.67	5.67	-	-	*	*	2	18	9	2.84	.32
39	6.25	-	-	-	-	6.25	-	-	-	-	2	20	10	3.12	.31
54	4.56	3.50	-	3.50	3.50	8.06	506	-	-	506	2	26	13	4.03	.31
30	-	-	-	8.30	8.30	8.30	-	-	402	402	1	22	22	8.30	.38
37	5.37	3.00	-	-	3.00	8.37	540	-	-	540	1	21	21	8.37	.40
sub Total	21.47	6.50	1.50	13.97	21.97	43.44	1046	455	402	1903	11	137	xx	xx	xx
Ave	3.57	3.25	1.50	6.98	4.39	5.43	523	455	402	476	1.4	17.1	12.4	3.95	.32
%	4.94	15.0	3.4	32.2	50.6	100	-	-	-	-	-	-	-	-	-
6	7.00	1.49	-	-	1.49	8.49	1268	-	-	1268	1	28	28	8.49	.30
19	4.31	4.30	-	-	4.30	8.61	512	-	-	512	2	25	12.5	4.30	.34
10	8.99	-	.25	-	.25	9.24	-	1712	-	1712	2	29	14.5	4.62	.32
53	5.82	4.00	-	-	4.00	9.82	472	-	-	472	2	36	18	4.91	.27
63	-	-	-	10.76	10.76	10.76	-	-	74	74	3	37	12.3	3.52	.29
4	11.05	-	-	-	-	11.05	-	-	-	-	2	24	12	5.52	.46
59	11.20	-	-	-	-	11.20	-	-	-	-	3	39	13	3.73	.29
sub Total	48.37	9.79	.25	10.76	20.8	69.17	2252	1712	74	4038	15	218	xx	xx	xx
Ave	8.06	3.26	.25	10.76	4.16	9.88	751	1712	74	808	2.1	31.1	14.5	4.61	.32
%	69.9	14.2	.4	15.5	30.1	100	-	-	-	-	-	-	-	-	-
20	10.80	-	.50	-	.50	11.30	-	440	-	440	3	29	9.7	3.77	.39
33	10.31	1.50	-	-	1.50	11.81	1180	-	-	1180	1	41	41	11.81	.29
32	12.08	-	-	-	-	12.08	-	-	-	-	1	30	30	12.08	.40
50	8.71	3.50	-	-	3.50	12.21	989	-	-	989	4	48	12	3.0	.25
45	13.34	-	-	-	-	13.34	-	-	-	-	1	42	42	13.34	.32
25	11.87	2.00	-	-	2.00	13.87	375	-	-	375	1	37	37	13.87	.37
18	13.62	-	.50	-	.50	14.12	-	440	-	440	1	34	34	14.12	.42
sub Total	80.73	7.00	1.00	-	8.00	88.73	2544	880	-	3424	12	261	xx	xx	xx
Ave	11.53	2.33	.50	-	1.60	12.68	848	440	-	685	1.7	37.3	21.8	7.4	.34
%	91.0	8.0	1.0		9.0	100	-	-	-	-	-	-	-	-	-
17	14.29	-	-	-	-	14.29	-	-	-	-	1	29	29	14.29	.49
36	11.34	-	-	3.00	3.00	14.34	-	-	1467	1467	2	46	23	7.17	.31
11	14.16	-	-	1.50	1.50	15.66	-	-	1880	1880	4	43	10.8	3.91	.36
3	16.24	-	-	-	-	16.24	-	-	-	-	4	47	11.8	4.06	.34
16	17.14	-	-	-	-	17.14	-	-	-	-	2	50	25	8.57	.34
58	16.92	5.75	-	-	5.75	22.67	652	-	-	652	4	75	21.7	5.67	.30
31	17.22	6.00	-	-	6.00	23.22	567	-	-	567	3	60	20	7.74	.39
23	18.75	-	-	5.50	5.50	24.25	-	-	676	676	3	68	22.7	8.08	.36
sub Totl	126.06	11.75	-	10.00	21.75	147.81	1219	-	4023	5242	23	418	xx	xx	xx
Ave	15.83	5.88	-	5.00	4.35	18.48	110	-	1341	1048	2.9	52.2	18.2	6.4	.35
%	85.3	7.9	-	6.8	14.7	100	-	-	-	-	-	-	-	-	-
Totl	276.63	35.04	2.75	34.73	72.52	349.15	7061	3047	4499	14607	61	1034	xx	xx	xx
Ave	10.24	3.50	.69	5.79	3.63	11.64	706	762	643	696	2.0	34.5	17.0	5.72	.34
%															

*Rented free from parents. Omitted from all averages.

**Averages computed on basis of farms reporting. Land use percentages based on all farms.

Appendix Table 3.2
CROPS GROWN IN DRY SEASON AND CROPPING INTENSITY INDEX. HOUSEHOLDS STRATIFIED BY FARM SIZE

HH NO	Land Area	Rice		Soybean		Peanut		Garlic		Total	Intensity	System
		Rai	%	Rai	%	Rai	%	Rai	%	Rai	Index	Number
34	1.79	1.59*	89	-						1.59*	189	1
49	1.96	1.96*	100							1.96*	200	1
61	3.04	1.40*	46	-		1.28	42			2.68*	188	3
65	5.67	3.69*	65	5.20	92			.22	4	9.11*	260	5
39	6.25	1.50*	24	1.45	23					2.95*	147	4
54	8.06	3.33*	41	2.29	29					5.62*	170	2
30	8.30	7.38*	89	.53	6			.39	5	8.30*	200	5
37	8.37	8.29*	99	4.91	59	.47	6	.53	6	14.20*	270	6
sub Total	43.44	29.14	67	14.38	33	1.75	4	1.14	2	46.41	207	x
Ave	5.43	3.64	xx	1.80	xx	.22	xx	.14	xx	5.80	xx	xx
6	8.49	4.87*	57	1.56	18					6.43*	175	2
19	8.61	-	-	4.79	56			.63	7	5.42*	163	9
10	9.24	2.39*	26	7.03	76	1.62	17			11.04*	219	4
53	9.82	-	-	8.42	86					8.42*	186	7
63	10.76	3.06*	28	-						3.06*	128	1
4	11.05	3.41*	31	6.62	60			.70	6	10.73*	197	5
59	11.20	3.03*	27	8.18	73					11.21*	200	2
sub Total	69.17	16.76	24	36.6	53	1.62	2	1.33	2	56.31	180	x
Ave	9.88	2.39	xx	5.23	xx	.23	xx	.19	xx	8.04	xx	xx
20	11.30	10.00*	88	5.94	53			.37	3	16.31*	244	5
33	11.81	3.16*	27	5.94	50					9.10*	177	2
32	12.08			9.45	78	2.63	22			12.08*	200	8
50	12.21	1.06*	9	4.82	39	2.18	18			8.06*	166	4
45	13.34	-	-	2.84	21					2.84*	121	7
25	13.87	7.11*	51	3.22	23	3.27	24			13.60*	198	4
18	14.12	4.10*	29	10.11	72	2.75	19			16.96*	220	4
sub Total	88.73	25.43	29	42.32	48	10.83	12	.37	*	78.95	189	x
Ave	12.68	3.63	xx	6.04	xx	1.55	xx	.05	xx	11.28	xx	xx
17	14.29			10.2	71	3.99	28	.12	1	14.31*	200	10
36	14.34	5.96*	42	4.60	32					10.56*	174	2
11	15.66	-	-	8.10	52					8.10*	152	7
3	16.24	10.22	63	10.54	65					20.76*	228	2
16	17.14	7.30	43	6.49	38					13.79*	181	2
58	22.67	6.71	30	6.64	29	2.50	11			15.85*	170	4
31	23.22	22.23	96	4.68	20					26.91*	216	2
23	24.25	-	-	15.69	65					15.69*	165	7
sub Total	147.81	52.42	35	66.94	45	6.49	4	.12	*	125.97	185	x
Ave	18.48	6.55	xx	8.37	xx	.81	xx	.01	xx	15.74	xx	xx
Total	349.15	123.75	35	160.24	46	20.69	6	2.96	1	307.64	188	x
Ave	11.64	4.12	xx	5.34	xx	.69	xx	.10	xx	10.25	xx	xx

*Less than .5 percent.

Appendix Table 3.3
FULL TIME LABOR FORCE EQUIVALENTS BY HOUSEHOLD

HH NO	Family Size	Female Members of Age — Conversion Factor 0 <8	.2 8-14	.72 15-60	.2 >60	Total	Male Members by Age — Conversion Factor 0 <8	.3 8-14	1.0 15-60	.5 >60	Total	Labor Force Female	Male	Total	Ra./ Total Labor Force
34	4		1	2		3			1		1	1.64	1.0	2.64	.68
49	5		2	1		3	1		1		2	1.12	1.0	2.12	.92
61	5			1		1		1	3		4	.72	3.3	4.02	.76
65	4			1		1		2	1		3	.72	1.6	2.32	2.44
39	3			1		1			1	1	2	.72	1.5	2.22	2.82
54	5			1		1		2	2		4	.72	2.6	3.32	2.43
30	7	1	1	2		4	1	1	1		3	1.64	1.30	2.94	2.82
37	3			1		1			2		2	.72	2.0	2.72	3.08
sub Total	36	1	4	10	0	15	2	6	12	1	21	8.00	14.3	22.30	xx
Ave	4.50	.12	.50	1.25	0	1.87	.25	.75	1.50	.12	2.62	1.00	1.79	2.79	1.95
%	100	2.8	11.1	27.8	0	41.7	5.6	16.7	33.3	2.8	58.3	35.9	64.1	100	xx
6	4	1		1	1*	3			1		1	.72	1.0	1.72	4.94
19	4			1		1	1	1	1		3	.72	1.3	2.02	4.26
10	10	2		4		6	1		3		4	2.88	3.0	5.88	1.57
53	7	1	1	2		4			3		3	1.64	3.0	4.64	2.12
63	5		2	1		3			2		2	1.12	2.0	3.12	3.45
4	6	1	2	1	1	5			1		1	1.32	1.0	2.32	4.76
59	5	1	1	2		4			1		1	1.64	1.0	2.64	4.24
sub Total	41	6	6	12	1*,1	26	2	1	12	0	15	10.04	12.3	22.34	xx
Ave	5.86	.86	.86	1.71	.29	3.71	.28	.14	1.72	0	2.14	1.43	1.76	3.19	3.10
%	100	14.6	14.6	29.3	4.9	63.4	4.9	2.4	29.3		36.6	44.9	55.1	100	xx
20	5			2		2		1	2		3	1.44	2.3	3.74	3.02
33	5	1		2		3			2		2	1.44	2.0	3.44	3.44
32	8		2	2		4	1	1	2		4	1.84	2.3	4.14	2.92
50	4			2		2			2		2	1.44	2.0	3.44	3.55
45	5			2		2	1		2		3	1.44	2.0	3.44	3.80
25	5		1	1		2	1			2	3	.92	1.0	1.92	7.22
18	6			3	2*	5			1		1	2.16	1.0	3.16	4.47
sub Total	38	1	3	14	2*	20	3	2	11	2	18	10.68	12.6	23.28	xx
Ave	5.43	.14	.43	2.0	.29	2.86	.43	.29	1.57	.29	2.57	1.53	1.80	3.33	3.81
%	100	2.6	7.9	36.8	5.3	52.6	7.9	5.3	28.9	5.3	47.4	45.9	54.1	100	xx
17	6	1		1	1*	3		2	1		3	.72	1.6	2.32	6.16
36	5			3		3	1			1	2	2.16	.5	2.66	5.39
11	4		1		1	2			2		2	.4	2.0	2.4	6.52
3	4			2		2			2		2	1.44	2.0	3.44	4.72
16	7		1	3		4			3		3	2.36	3.0	5.36	3.20
58	7			4		4			3		3	2.88	3.0	5.88	3.86
31	7		1	1		2		2	3		5	.92	3.6	4.52	5.14
23	8	1		1	1	3	1	1	2	1	5	.92	2.8	3.72	6.52
sub Total	48	2	3	15	1*,2	23	2	5	16	2	25	11.8	18.5	30.3	xx
Ave	6.00	.25	.38	1.87	.38	2.88	.25	.62	2.00	.25	3.12	1.49	2.30	3.79	4.94
%	100	4.2	6.2	31.3	6.2	41.9	4.2	10.4	33.3	4.2	52.1	38.9	61.1	100	xx
Total	163	10	16	51	7	84	9	14	51	5	79	40.32	57.7	98.22	xx
Ave	5.43	.33	.53	1.70	.23	2.80	.30	.47	1.70	.17	2.63	1.35	1.92	3.27	3.55
%	100	6.1	9.8	31.3	4.3	51.5	5.5	8.6	31.3	3.1	48.5	41.3	58.7	100	xx

*Too old to work on the farm, excluded from labor force.

Appendix Table 3.4

Adult Male Consumer Equivalents by Household

HH No.	Family Size	Family Members with Conversion Factor by Age: Children .10 <1	Children .30 1-3	Children .50 4-5	Children .65 6-9	Children xx Total	Female .75 10-15	Female .80 16+	Female xx Total	Male .80 10-15	Male 1.00 16+	Male xx Total	Adult Male Consumer Equiv. C	F	M	T
34	4				1	1		2	2		1	1	.65	1.60	1.00	3.25
49	5				1	1	2	1	3		1	1	.65	2.30	1.00	3.95
61	5					0		1	1	2	2	4		.80	3.60	4.40
65	4					0		1	1	2	1	3		.80	2.60	3.40
39	3					0		1	1	1	1	2		.80	1.80	2.60
54	5				1	1		1	1	2	1	3	.65	.80	2.60	4.05
30	7			1	1	2	1	1	2	1	2	3	1.15	1.55	2.80	5.50
37	3					0		1	1		2	2		.80	2.00	2.80
sub Total	36	0	0	1	4	5	3	9	12	8	11	19	3.10	9.45	17.40	29.95
Ave	4.50	0	0	.12	.50	.62	.38	1.12	1.50	1.0	1.38	2.38	.39	1.18	2.18	3.74
%	100	0	0	2.8	11.1	13.9	8.3	25.0	33.3	22.2	30.6	52.8	10.3	31.6	58.1	100
6	4	1				1		2	2		1	1	.10	1.60	1.00	2.70
19	4				2	2		1	1		1	1	1.30	.80	1.00	3.10
10	10	1	1		2	4	1	3	4		2	2	1.70	3.15	2.00	6.85
53	7				1	1	1	2	3		3	3	.65	2.35	3.00	6.00
63	5				1	1	1	1	2		2	2	.65	1.55	2.00	4.20
4	6			1	1	2	1	2	3		1	1	1.15	2.35	1.00	4.50
59					1	1	2	1	3		1	1	.65	2.30	1.00	3.95
sub Total	41	2	1	1	8	12	6	12	18	0	11	11	6.20	14.10	11.00	31.30
Ave	5.86	.28	.14	.14	1.14	1.71	.86	1.71	2.57	0	1.57	1.57	.89	2.01	1.57	4.47
%	100	4.9	2.4	2.4	19.5	29.3	14.6	29.3	43.9	0	26.8	26.8	19.8	45.0	35.2	100
20	5				1	1		2	2		2	2	.65	1.60	2.00	4.25
33	5		1			1		2	2		2	2	.30	1.60	2.00	3.90
32	8				1	1	2	2	4	1	2	3	.65	3.10	2.80	6.55
50	4					0		2	2		2	2		1.60	2.00	3.60
45	5		1			1		2	2		2	2	.30	1.60	2.00	3.90
25	5		1		1	2		2	2		1	1	.95	1.60	1.00	3.55
18	6					0		5	5		1	1		4.00	1.00	5.00
sub Total	38	0	3	0	3	6	2	17	19	1	12	13	2.85	15.10	12.80	30.75
Ave	5.43	0	.43	0	.43	.86	.28	2.43	2.71	.14	1.71	1.85	.41	2.16	1.83	4.39
%	100	0	7.9	0	7.9	15.8	5.3	44.7	50.0	2.6	31.6	34.2	9.3	49.1	41.6	100
17	6			1	1	2		2	2	1	1	2	1.15	1.60	1.80	4.55
36	5			1		1		3	3		1	1	.50	2.40	1.00	3.90
11	4					0	1	1	2		2	2		1.55	2.00	3.55
3	4					0	1	1	2		2	2		1.55	2.00	3.55
16	7					0	2	2	4		3	3		3.10	3.00	6.10
58	7					0		4	4		3	3		3.20	3.00	6.20
31	7					0	1	1	2	2	3	5		1.55	4.60	6.15
23	8				2	2		2	2	2	2	4	1.30	1.60	3.60	6.50
sub Total	48	0	0	2	3	5	5	16	21	5	17	22	2.95	16.55	21.00	40.50
Ave	6.00	0	0	.25	.37	.62	.62	2.0	2.62	.62	2.13	2.75	.37	2.07	2.62	5.06
%	100	0	0	4.2	6.2	10.4	10.4	33.3	43.8	10.4	35.4	45.8	7.3	40.9	51.8	100
Total	163	2	4	4	18	28	16	54	70	14	51	65	15.1	55.2	62.2	132.5
Ave	5.43	.07	.13	.13	.60	.93	.53	1.80	2.33	.47	1.70	2.17	.5	1.84	2.07	4.41
%	100	1.2	2.4	2.4	11.1	17.2	9.8	33.1	42.9	8.6	31.3	39.9	11.4	41.7	46.9	100

Appendix Table 4.1

Distribution of Labor by Men, Women, and Children to Crop Production and other Farm Work by Size of Farm; Both Unadjusted and Adjusted for Family Composition

Item Per Household	Unadjusted for Composition								Adjusted for Composition[a]								Adjusted All Farms	
	Farm Size Class								Farm Size Class									
	Small		L. Mid.		U. Mid.		Large		Small		L. Mid.		U. Mid.		Large			
Labor Force[b]	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%	Amt.	%
Men	1.56	56	1.71	54	1.71	52	2.13	56	1.52	54	1.74	54	1.81	54	2.06	54	1.78	54
Women	.90	32	1.26	39	1.44	43	1.40	37	1.06	38	1.21	38	1.26	38	1.44	38	1.24	38
Children	.33	12	.22	7	.17	5	.26	7	.21	8	.24	8	.25	8	.29	8	.25	8
Total	2.79	100	3.19	100	3.32	100	3.79	100	2.79	100	3.19	100	3.32	100	3.79	100	3.27	100
Hours on Crops																		
Men	792	56	1049	51	1591	53	1919	55	772	53	1067	53	1684	57	1856	54	1339	54
Women	567	40	932	46	1329	45	1430	41	668	45	895	44	1163	40	1471	42	1060	43
Children	48	4	60	3	68	2	131	4	30	2	65	3	100	3	146	4	78	3
Total	1407	100	2041	100	2988	100	3480	100	1470	100	2027	100	2947	100	3473	100	2477	100
Hours Other Farm																		
Men	207	36	268	48	296	58	396	63	202	35	273	50	313	61	383	62	292	51
Women	265	46	289	52	185	37	215	34	312	54	278	50	162	32	221	35	238	42
Children	104	18	0	0	25	5	15	3	66	11	0	0	37	7	17	3	38	7
Total	576	100	557	100	506	100	626	100	580	100	551	100	512	100	621	100	568	100
Hours Total Farm																		
Men	999	50	1317	51	1887	54	2315	56	973	47	1340	52	1997	58	2239	55	1631	53
Women	832	42	1221	47	1514	43	1645	40	980	48	1172	45	1325	38	1692	41	1290	43
Children	152	8	60	2	93	3	146	4	97	5	65	3	137	4	163	4	116	4
Total Farm	1983	100	2598	100	3494	100	4106	100	2050	100	2577	100	3459	100	4094	100	3045	100
Hours/Rai																		
Crop	259	71	206	79	236	86	188	85	271	72	205	79	232	85	188	85	213	81
Other Farm	106	29	56	21	40	14	34	15	107	28	56	21	40	15	34	15	49	19
Total Farm	365	100	262	100	276	100	222	100	378	100	261	100	272	100	222	100	262	100
Rai/Farm	5.43		9.88		12.68		18.48		5.43		9.88		12.68		18.48		11.64	

[a] Adjustment procedure: (a) total labor force distributed by percentage of all farms, (b) unadjusted hours/man equivalent computed for men, women and children, (c) hours recomputed using revised man equivalents and results of step (b).

[b] Expressed in man equivalent.

Appendix Table 4.2 Crop Labor Distribution for Household 65 (Small Farm)

	Hours of Labor by Crop Activity by Period												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Activity	1.1		1.4	1.4	1.4	1.5	1.5	2.2	2.4	2.4			2.5
Men	48.67		32.00	8.50	3.50	55.25	41.00	71.00	17.50	1.50			127.12
Women	12.50		-	-	-	74.95	-	-	17.50	-			30.80
Children	-		-	-	-	-	-	-	-	-			-
Total	61.17		32.00	8.50	3.50	130.20	41.00	71.00	35.00	1.50			157.92
Activity	1.2	1.2	1.2				2.1	2.3					
Men	31.50	82.83	15.17				4.00	40.50					
Women	-	-	-				1.00	95.75					
Children	-	-	-				-	-					
Total	31.50	82.83	15.17				5.00	136.25					
Activity	3.5		1.3			5.1	3.2	3.2	3.4		3.5	3.5	3.5
Men	42.82		133.50			-	29.50	13.00	-		18.50	161.15	15.50
Women	19.82		222.00			21.50	6.50	-	3.00		20.50	124.28	22.00
Children	-		-			-	-	-	1.50		-	-	-
Total	62.64		355.50			21.50	36.00	13.00	4.50		39.00	285.41	37.50
Activity	3.2					5.2	3.3	3.3	3.3	5.5			
Men	46.25					37.02	57.00	20.00	4.00	21.83			
Women						8.50	77.00	25.50	8.00	19.00			
Children	-					-	-	-	-	-			
Total	46.25					45.52	134.00	45.50	12.00	40.83			
Activity	2.5					5.3	5.4	5.4	5.4	5.4			
Men	54.57					9.63	-	1.50	4.50	3.50			
Women	73.27					25.67	47.50	-	-	-			
Children	-					-	-	-	-	-			
Total	127.84					35.30	47.50	1.50	4.50	3.50			
Activity								3.4					
Men								.50					
Women								-					
Children								-					
Total								.50					
Period Total													
Men	223.81	82.83	180.67	8.50	3.50	101.90	131.50	146.50	26.00	26.83	18.50	161.15	142.62
Women	105.59	-	222.00	-	-	130.62	132.00	121.25	28.50	19.00	20.50	124.28	52.80
Children	-	-	-	-	-	-	-	-	1.50	-	-	-	-
Total	329.40	82.83	402.67	8.50	3.50	232.52	263.50	267.75	56.00	45.83	39.00	285.43	195.42

Crop Code: 1 = R.S. Rice; 2 = D.S. Rice; 3 = Soybeans; 5 = Garlic.
Activity Code: 1 = Nursery; 2 = Land Preparation; 3 = Plant; 4 = Crop Care; 5 = Harvest.

Appendix Table 4.3 Crop Labor Distribution for Household 63 (Lower Middle Farm Size)

Labor Class	Hours of Labor by Crop Activity by Period												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Activity	1.1		1.4	1.4	1.4	1.5	1.5						1.1
M	22.52		-	7.00	5.57	11.78	-						11.00
W	-		8.37	-	1.00	233.90	-						3.00
C	1.58		4.18	-	-	126.45	14.00						-
T	24.10		12.55	7.00	6.57	372.13	14.00						14.00
Activity	1.2	1.2	1.2				2.1	2.3	2.4	2.4		2.5	2.5
M	47.01	65.95	6.17				22.50	39.63	6.50	15.50		121.50	72.25
W	1.50	-	-				2.00	159.83	13.50	22.00		17.00	-
C	-	-	-				-	-	-	-		-	-
T	48.51	65.95	6.17				24.50	199.13	20.00	37.50		138.50	72.25
Activity		1.3	1.3				2.2	2.2					
M		73.62	2.50				5.50	44.00					
W		189.58	59.00				-	-					
C		-	-				-	-					
T		263.20	61.50				5.50	44.00					
Period Total													
M	69.51	139.57	8.67	7.00	5.57	11.78	28.00	83.63	6.50	15.50	-	121.50	83.42
W	1.50	189.58	67.51	-	1.00	233.90	2.00	159.83	13.50	22.00	-	17.00	3.00
C	1.58	-	4.18	-	-	126.45	14.00	-	-	-	-	-	-
T	72.61	329.15	80.36	7.00	6.57	372.13	44.00	243.46	20.00	37.50	-	138.50	86.42

Crop Code: 1 = Rainy Season Rice; 2 = Dry Season Rice.

Activity Code: 1 = Nursery; 2 = Land Preparation; 3 = Plant; 4 = Crop Care; 5 = Harvest.

Appendix Table 4.4 Crop Labor Distribution for Household 50 (Upper Middle Size Farm)

Labor Class	Hours of Labor by Crop Activity by Period												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Activity	1.1	1.3	1.3			1.5	1.5						1.1
Men	24.50	87.57	47.33			194.17	116.50						15.00
Women	4.55	130.17	106.03			100.93	122.11						4.50
Children	-	-	-			-	-						-
Total	29.05	217.74	153.36			295.10	238.61						19.50
Activity	1.2	1.2	1.2	1.4	1.4	1.4	3.2	3.4	3.4	3.4	3.5	3.5	3.5
Men	24.08	201.42	5.83	31.13	8.00	1.00	-	3.50	3.00	2.30	15.00	125.92	13.00
Women	-	6.00	-	16.50	-	-	18.00	-	-	-	5.00	99.95	12.50
Children	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	24.08	207.42	5.83	47.63	8.00	1.00	18.00	3.50	3.00	2.30	20.00	225.87	25.50
Activity							3.3	4.3					
Men							43.00	27.28					
Women							200.03	50.40					
Children							-	-					
Total							243.03	77.52					
Activity							4.1	4.4	4.4		4.4	4.5	
Men							-	3.50	2.00		1.50	162.43	
Women							27.00	-	-		-	197.33	
Children							-	-	-		-	-	
Total							27.00	3.50	2.00		1.50	359.76	
Activity							4.2	4.2					
Men							86.50	12.00					
Women							26.50	20.50					
Children							-	-					
Total							113.00	32.50					
Period Total													
Men	69.05	288.98	53.17	31.13	8.00	195.17	246.00	46.28	5.00	2.30	16.50	288.35	28.00
Women	7.55	136.17	106.03	16.50	-	100.93	393.60	70.90	-	-	5.00	297.28	17.00
Children	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	76.60	425.15	159.20	47.63	8.00	296.10	639.63	117.18	5.00	2.30	21.50	585.63	45.00

Crop Code: 1 = R.S. Rice; 2 = D.S. Rice; 3 = Soybeans; 4 = Peanuts.

Activity Code: 1 = Nursery; 2 = Land Preparation; 3 = Plant; 4 = Crop Care; 5 = Harvest.

Appendix Table 4.5 Crop Labor Distribution for Household 3 (Large Farm)

Labor Class	Hours of Labor by Crop Activity by Period												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Activity	1.1	1.4	1.4	1.4	1.4	1.4	2.1	2.2	2.4	2.4	2.4		2.4
Men	20.72	3.00	33.00	35.50	29.50	5.50	7.00	175.50	41.00	29.00	2.00		.50
Women	-	-	-	-	-	-	2.50	-	13.50	7.50	-		-
Children	-	-	-	-	-	-	-	-	-	-	-		-
Total	20.72	3.00	33.00	35.50	29.50	5.50	9.50	175.50	54.50	36.50	2.00		.50
Activity	1.2	1.2	1.2			1.5	1.5	2.3	2.3			2.5	2.5
Men	129.89	180.99	6.00			203.40	115.00	151.94	-			14.00	149.58
Women	-	-	-			223.63	70.00	187.90	3.00			9.00	90.52
Children	-	-	-			3.50	16.00	-	-			2.00	3.51
Total	129.89	180.99	6.00			430.53	201.00	339.84	3.00			25.00	243.61
Activity		1.3	1.3		3.5	3.5	3.2				3.5	3.5	3.5
Men		132.15	43.50		2.00	12.50	114.50				81.00	136.00	108.97
Women		246.51	34.50		-	-	63.00				52.50	65.00	43.00
Children		3.75	-		-	-	-				49.50	65.00	15.00
Total		382.41	78.00		2.00	12.50	177.50				183.00	266.00	166.97
Activity							3.3	3.3					1.1
Men							79.50	83.00					8.00
Women							162.50	103.00					-
Children							10.50	12.00					-
Total							252.50	198.00					8.00
Activity							3.4	3.4	3.4				
Men							8.50	8.50	51.00				
Women							-	-	10.50				
Children							-	-	-				
Total							8.50	8.50	61.50				
Period Total													
Men	150.61	316.14	49.50	35.50	31.50	221.40	324.50	418.94	92.00	29.00	83.00	150.00	267.05
Women	-	246.51	34.50	-	-	223.63	298.00	290.90	27.00	7.50	52.50	74.00	133.52
Children	-	3.75	-	-	-	3.50	26.50	12.00	-	-	49.50	67.00	18.57
Total	150.61	566.40	117.00	35.50	31.50	448.53	649.00	721.84	119.00	36.50	185.00	291.00	419.14

Crop Code: 1 = R.S. Rice; 2 = D.S. Rice; 3 = Soybeans.

Activity Code: 1 = Nursery; 2 = Land Preparation; 3 = Plant; 4 = Crop Care; 5 = Harvest.

Appendix Table 4.6 Crop Labor Hours by Crop for Selected Households

Household No. & Labor Activity	Hours by Crop																			
	R.S. Rice				D.S. Rice				Soybeans				Peanuts				Garlic			
	M	W	C	T	M	W	C	T	M	W	C	T	M	W	C	T	M	W	C	T
HH-65																				
Nursery	49	12	-	61	4	1	-	5	-	-	-	-					-	21	-	21
Land Prep.	130	-	-	130	71	-	-	71	89	6	-	95					37	8	-	45
Plant	133	222	-	355	40	96	-	136	81	110	-	191					10	26	-	36
Crop Care	44	-	-	44	19	17	-	36	-	3	2	5					9	48	-	57
Harvest	96	75	-	171	182	104	-	286	238	187	-	425					22	19	-	41
Total	452	309	-	761	316	218	-	534	408	306	2	716					78	122	-	200
HH-63																				
Nursery	32	3	2	37	22	2	-	24												
Land Prep.	119	2	-	121	50	-	-	50												
Plant	76	249	-	325	40	160	-	200												
Crop Care	13	9	4	26	22	35	-	57												
Harvest	12	234	126	372	194	17	-	211												
Total	252	497	132	881	328	214	-	542												
HH-50																				
Nursery	40	9	-	49	-	3	-	3	-	-	-	-	-	27	-	27				
Land Prep.	231	6	-	237	18	-	-	18	-	18	-	18	98	47	-	145				
Plant	135	236	-	371	28	61	-	89	43	200	-	243	27	51	-	78				
Crop Care	40	17	-	57	22	5	-	27	9	-	-	9	7	-	-	7				
Harvest	311	223	-	534	27	13	-	40	154	117	-	271	163	197	-	360				
Total	757	491	-	1247	95	82	-	177	206	335	-	541	295	322	-	617				
HH-3																				
Nursery & Seed Prep.	29	-	-	29	7	-	-	7	-	-	-	-								
Land Prep.	317	-	-	317	176	-	-	176	-	-	-	-								
Plant	176	281	4	461	152	191	-	343	163	266	22	451								
Crop Care	106	-	-	106	72	21	-	93	68	10	-	78								
Harvest	318	294	19	631	164	99	6	269	340	160	130	630								
Total	946	575	23	1544	511	311	6	888	571	436	152	1159								

Appendix Table 5.1 Seasonal Distribution of Off-Farm Labor for Household #65 and Small Farm Size Group

Period	Class[2]	Percentage by Period for Group and Case by Type[1]															
		Exchange				Hired Labor				Special				Total			
		Group		H/H 65		Group		H/H 65		Group		H/H 65		Group		H/H 65	
		P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%
1	M	100	2.3	100	1.0	18	1.4	12	1.1	72	5.6	92	9.6	28	2.1	36	2.9
	W	-	-	-	-	82	6.2	88	7.8	28	2.2	8	.9	72	5.3	64	5.1
	T	100	2.3	100	1.0	100	7.6	100	8.9	100	7.8	100	10.5	100	7.4	100	8.0
2	M	34	7.4	11	3.9	16	1.5	39	8.7	85	5.2	75	3.1	25	2.4	33	6.7
	W	66	14.6	89	31.5	84	8.2	61	13.7	15	.9	25	1.0	75	7.2	67	13.7
	T	100	22.0	100	35.4	100	9.7	100	22.4	100	6.1	100	4.1	100	9.6	100	20.4
3	M	53	8.5	55	10.5	24	2.2	6	.8	85	7.0	33	1.4	34	3.2	19	2.4
	W	35	5.6	45	8.6	76	7.0	94	13.9	15	1.3	67	2.8	65	6.1	81	10.6
	T	100 +	16.7	100	19.1	100	9.2	100	14.7	100	8.3	100	4.2	100 +	9.3	100	13.0
4	M	-	-	-	-	29	3.0	15	2.6	65	3.9	55	4.2	33	3.0	20	2.5
	W	-	-	-	-	71	7.3	85	14.7	35	2.1	45	3.5	67	6.2	80	10.0
	T	-	-	-	-	100	10.3	100	17.3	100	6.0	100	7.7	100	9.3	100	12.5
5	M	-	-	-	-	40	3.7	17	1.0	62	5.9	88	26.0	44	3.9	63	6.2
	W	-	-	-	-	60	5.6	83	4.6	38	3.6	12	3.7	56	5.0	37	3.7
	T	-	-	-	-	100	9.3	100	5.6	100	9.5	100	29.7	100	8.9	100	9.9
6	M	81	36.2	62	27.4	36	1.9	-	-	72	3.9	86	8.3	51	3.5	67	6.0
	W	19	8.3	38	17.1	64	3.5	-	-	28	1.6	14	1.4	49	3.4	33	2.9
	T	100	44.5	100	44.5	100	5.4	-	-	100	5.5	100	9.7	100	6.9	100	8.9
7	M	38	.9	-	-	14	.8	-	-	61	1.2	71	4.2	18	.9	71	.9
	W	62	1.5	-	-	86	4.7	-	-	39	.7	29	1.7	82	3.9	29	.4
	T	100	2.5	-	-	100	5.5	-	-	100	1.9	100	5.9	100	4.8	100	1.3
8	M	30	3.4	-	-	22	1.6	-	-	57	1.5	-	-	24	1.7	-	-
	W	45	5.0	-	-	78	5.9	100	4.4	43	1.2	-	-	74	5.2	100	2.7
	T	100 +	11.3	-	-	100	7.5	100	4.4	100	2.7	-	-	100 +	6.9	100	2.7
9	M	-	-	-	-	36	3.8	-	-	52	6.2	100	2.1	39	4.0	5	.4
	W	-	-	-	-	64	6.7	100	11.6	48	5.6	-	-	61	6.2	95	7.3
	T	-	-	-	-	100	10.5	-	11.6	100	11.8	100	2.1	100	10.2	100	7.7
10	M	-	-	-	-	37	3.4	19	1.7	54	6.3	67	9.7	40	3.8	37	3.1
	W	-	-	-	-	63	5.9	81	6.9	46	5.2	33	4.9	60	5.6	63	5.4
	T	-	-	-	-	100	9.3	100	8.6	100	11.5	100	14.6	100	9.4	100	8.5
11	M	-	-	-	-	29	1.9	-	-	55	5.8	61	7.0	35	2.5	29	1.5
	W	100	.7	-	-	71	4.7	100	4.4	45	4.7	39	4.5	65	4.5	71	3.7
	T	100	.7	-	-	100	6.6	100	4.4	100	10.5	100	11.5	100	7.0	100	5.2
12	M	-	-	-	-	22	1.1	100	.1	72	4.5	-	-	32	1.6	100	.6
	W	-	-	-	-	78	4.0	-	-	28	1.8	-	-	68	3.4	-	-
	T	-	-	-	-	100	5.1	100	.1	100	6.3	-	-	100	5.0	100	.6
13	M	-	-	-	-	13	.5	100	2.0	65	7.8	-	-	32	1.7	100	1.3
	W	-	-	-	-	87	3.6	-	-	35	4.3	-	-	68	3.6	-	-
	T	-	-	-	-	100	4.1	100	2.0	100	12.1	-	-	100	5.3	100	1.3
Total Hours		XX	130	XX	205	XX	2360	XX	842	XX	583	XX	288	XX	3573	XX	1334

1/ P% = Percentage of Period; T% = Percentage of Annual Total.

2/ If men plus women < 100%, the difference is child labor indicated by +.

3/ * = less than 1%.

Appendix Table 5.2 Seasonal Distribution of Off-Farm Labor for Household #63 and Lower Middle Farm Group

Period	Class[2]	Percentage by Period for Group and Case by Type[1]															
		Exchange				Hired Labor				Special				Total			
		Group		H/H 63		Group		H/H 63		Group		H/H 63		Group		H/H 63	
		P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%
1	M	63	1.6	100	1.4	12	.9	6	.4	59	5.4	69	6.4	20	1.6	14	1.0
	W	37	.9	-	-	88	6.7	94	6.5	41	3.7	31	2.8	80	6.1	86	6.0
	T	100	2.5	100	1.4	100	7.6	100	6.9	100	9.1	100	9.2	100	7.7	100	7.0
2	M	28	5.1	7	1.8	24	3.1	7	1.1	55	3.1	-	-	26	3.2	7	1.0
	W	72	12.9	93	22.9	76	9.7	93	13.9	45	2.5	100	8.8	74	8.9	93	13.8
	T	100	18.0	100	24.7	100	12.8	100	15.0	100	5.6	100	8.8	100	12.1	100	14.8
3	M	50	3.9	-	-	30	4.3	2	.2	88	11.9	93	30.7	38	5.3	19	2.7
	W	50	3.9	100	8.6	70	9.9	98	12.6	12	1.6	7	2.5	62	8.6	81	11.6
	T	100	7.8	100	8.6	100	14.2	100	12.8	100	13.5	100	33.2	100	13.9	100	14.3
4	M	-	-	-	-	31	4.0	*	*	76	7.4	75	19.4	36	4.3	13	1.6
	W	-	-	-	-	69	8.9	100	11.6	24	2.3	25	6.4	64	7.7	87	10.7
	T	-	-	-	-	100	12.9	100	11.6	100	9.7	100	25.8	100	12.0	100	12.3
5	M	50	2.1	-	-	25	2.6	17	2.1	54	2.7	33	1.8	27	2.6	17	2.0
	W	50	2.1	-	-	75	7.9	83	10.6	46	2.3	67	3.7	73	6.9	83	9.6
	T	100	4.2	-	-	100	10.5	100	12.7	100	5.0	100	5.5	100	9.5	100	11.6
6	M	76	11.9	100	2.8	37	1.8	22	1.4	39	1.7	-	-	36	1.7	23	1.4
	W	24	3.7	-	-	83	3.0	78	5.0	61	2.8	100	1.6	64	3.0	77	4.6
	T	100	15.6	100	2.8	100	4.8	100	6.4	100	4.5	100	1.6	100	4.7	100	6.0
7	M	43	.6	-	-	23	.8	19	1.2	60	2.7	22	.7	30	1.1	19	1.1
	W	57	.8	-	-	74	2.5	81	5.1	40	1.8	78	2.6	68	2.4	81	4.7
	T	100	1.4	-	-	100+	3.4	100	6.3	100	4.5	100	3.3	100	3.5	100	5.8
8	M	22	9.2	5	2.6	28	1.9	25	1.4	62	3.0	100	.2	29	2.3	19	1.3
	W	78	32.8	95	49.7	72	4.9	75	4.2	38	1.9	-	-	71	5.6	81	5.6
	T	100	42.0	100	52.3	100	6.8	100	5.6	100	4.9	100	.2	100	7.9	100	6.9
9	M	-	-	-	-	9	1.0	11	.8	76	5.9	100	3.3	17	1.6	14	1.0
	W	100	.3	-	-	91	9.2	89	6.9	24	1.8	-	-	83	7.9	86	6.1
	T	100	.3	-	-	100	10.2	100	7.7	100	7.7	100	3.3	100	9.5	100	7.1
10	M	-	-	-	-	24	1.6	100	2.8	56	4.3	14	.2	29	1.9	96	2.5
	W	-	-	-	-	76	5.2	-	-	44	3.4	86	1.1	71	4.8	4	*
	T	100	-	-	-	100	6.8	100	2.8	100	7.7	100	1.3	100	6.7	100	2.5
11	M	-	-	-	-	16	.6	23	1.3	56	4.4	-	-	26	1.1	22	1.1
	W	-	-	-	-	84	3.2	77	4.2	44	3.5	100	3.5	44	3.2	78	4.0
	T	100	-	-	-	100	3.8	100	5.5	100	7.9	100	3.5	100	4.3	100	5.1
12	M	40	1.8	33	2.4	25	.6	18	.6	62	5.3	100	2.5	38	1.3	25	.8
	W	60	2.7	67	4.8	65	1.6	82	2.6	38	3.2	-	-	56	1.9	75	2.4
	T	100	4.5	100	7.2	100	2.5	100	3.2	100	8.5	100	2.5	100+	3.4	100	3.2
13	M	65	2.4	33	1.0	15	.6	25	.9	46	5.3	-	-	27	1.3	24	.8
	W	35	1.3	67	2.0	85	3.1	75	2.6	54	6.1	100	1.8	73	3.5	76	2.6
	T	100	3.7	100	3.0	100	3.7	100	3.5	100	11.4	100	1.8	100	4.8	100	3.4
Total Hours		XX	141	XX	251	XX	2881	XX	5871	XX	467	XX	546	XX	3472	XX	6669

1/ P% = Percentage of Period; T% = Percentage of Annual Total.

2/ If men plus women < 100%, the difference is child labor indicated by +.

3/ * = less than 1%.

Appendix Table 5.3 Seasonal Distribution of Off-Farm Labor for Household #50 and Upper Middle Farm Group

Period	Class[2]	Percentage by Period for Group and Case by Type[1]															
		Exchange				Hired Labor				Special				Total			
		Group		H/H 50		Group		H/H 50		Group		H/H 50		Group		H/H 50	
		P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%
1	M	42	1.1	69	2.1	34	2.9	18	1.9	65	3.3	68	14.5	39	2.9	30	3.3
	W	58	1.6	31	.9	66	5.6	82	8.6	35	1.8	32	6.8	61	4.5	70	7.6
	T	100	2.7	100	3.0	100	8.5	100	10.5	100	5.1	100	21.3	100	7.4	100	10.9
2	M	46	4.4	25	4.2	36	2.9	22	3.6	55	1.1	76	7.1	38	2.6	26	4.0
	W	54	5.1	75	12.8	64	5.2	78	12.8	45	.9	24	2.1	62	4.3	74	11.7
	T	100	9.5	100	17.0	100	8.1	100	16.4	100	2.0	100	9.2	100	6.9	100	15.7
3	M	30	2.8	-	-	46	5.0	18	3.4	74	3.2	66	11.7	48	4.5	23	3.9
	W	70	6.5	100	4.2	52	5.7	82	15.0	26	1.2	34	6.0	51	4.7	77	13.0
	T	100	9.3	100	4.2	100 +	10.9	100	18.4	100	4.4	100	17.7	100 +	9.4	100	16.9
4	M	-	-	-	-	38	4.9	5	.7	44	2.7	52	10.9	39	4.1	14	1.7
	W	-	-	-	-	62	7.8	95	12.4	56	3.4	48	9.9	61	6.4	86	10.9
	T	-	-	-	-	100	12.7	100	13.1	100	6.1	100	20.8	100	10.5	100	12.6
5	M	-	-	-	-	37	4.5	9	.7	55	5.0	59	11.5	39	4.3	22	1.8
	W	100	4.0	-	-	63	7.7	91	6.9	45	4.1	41	7.8	61	6.7	78	6.3
	T	100	4.0	-	-	100	12.2	100	7.6	100	9.1	100	19.3	100	11.0	100	8.1
6	M	36	17.8	58	27.5	51	2.7	34	1.2	44	2.6	67	1.0	44	3.6	49	3.9
	W	64	30.8	42	20.1	49	2.6	66	2.4	56	3.3	33	.5	56	4.6	51	3.9
	T	100	48.6	100	47.6	100	5.3	100	3.6	100	5.9	100	1.5	100	8.2	100	7.8
7	M	-	-	-	-	92	2.3	100	.9	61	1.9	52	3.2	76	2.1	77	1.1
	W	100	3.7	-	-	8	.2	-	-	39	1.2	48	2.9	24	.6	23	.3
	T	100	3.7	-	-	100	2.5	100	.9	100	3.1	100	6.1	100	2.7	100	1.4
8	M	10	1.1	8	1.8	47	3.2	51	3.7	34	1.2	40	1.0	41	2.6	39	3.3
	W	90	9.7	92	20.6	53	3.6	49	3.6	66	2.3	60	1.5	59	3.8	61	5.0
	T	100	10.8	100	22.4	100	6.8	100	7.3	100	3.5	100	2.5	100	6.4	100	8.3
9	M	-	-	-	-	25	2.7	-	-	53	6.4	-	-	32	3.3	-	-
	W	-	-	-	-	75	8.0	100	10.4	47	5.7	-	-	68	7.0	100	8.2
	T	-	-	-	-	100	10.7	100	10.4	100	12.1	-	-	100	10.3	100	8.2
10	M	-	-	-	-	29	3.0	-	-	38	4.7	-	-	31	3.2	-	-
	W	-	-	-	-	71	7.5	100	8.5	62	7.5	-	-	69	7.0	100	6.7
	T	-	-	-	-	100	10.5	100	8.5	100	12.2	-	-	100	10.2	100	6.7
11	M	-	-	-	-	51	2.2	23	.8	41	4.6	-	-	46	2.6	23	.6
	W	-	-	-	-	49	2.2	77	2.5	59	6.8	100	.7	54	3.0	77	2.1
	T	-	-	-	-	100	4.4	100	3.3	100	11.4	100	.7	100	5.6	100	2.7
12	M	25	1.4	28	1.5	69	2.7	-	-	36	2.5	-	-	55	2.6	28	.1
	W	75	4.1	72	3.7	31	1.2	-	-	64	4.5	-	-	45	2.1	72	.4
	T	100	5.5	100	5.2	100	3.9	-	-	100	7.0	-	-	100	4.7	100	.5
13	M	27	1.6	100	.6	42	1.5	100	*	53	9.6	100	.9	48	3.2	100	.2
	W	73	4.3	-	-	58	2.0	-	-	47	8.5	-	-	52	3.5	-	-
	T	100	5.9	100	.6	100	3.5	100	*	100	18.1	100	.9	100	6.7	100	.2
Total Hours		XX	181	XX	378	XX	1992	XX	2962	XX	582	XX	410	XX	2756	XX	3749

[1] P% = Percentage of Period; T% = Percentage of Annual Total.

[2] If men plus women < 100%, the difference is child labor indicated by +.

[3] * = less than 1%.

Appendix Table 5.4 Seasonal Distribution of Off-Farm Labor for Household #3 and Large Farm Group

Period	Class[2]	Percentage by Period for Group and Case by Type[1]															
		Exchange				Hired Labor				Special				Total			
		Group		H/H 3		Group		H/H 3		Group		H/H 3		Group		H/H 3	
		P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%	P%	T%
1	M	48	1.1	100	3.8	18	.1	1	*	44	1.9	70	.6	36	.5	14	.6
	W	52	1.1	-	-	82	.6	99	6.2	56	2.3	30	.3	64	1.0	86	3.7
	T	100	2.2	100	3.8	100	.7	100	6.2	100	4.2	100	.9	100	1.5	100	4.3
2	M	65	9.8	100	19.2	20	1.7	16	1.6	84	1.7	100	2.8	30	2.3	43	3.7
	W	35	5.4	-	-	78	6.6	84	8.1	16	.4	-	-	68	5.2	57	4.8
	T	100	15.2	100	19.2	100+	8.5	100	9.7	100	2.1	100	2.8	100+	7.7	100	8.5
3	M	72	9.4	100	24.7	30	3.4	8	1.0	69	3.3	73	7.8	38	3.8	43	5.4
	W	28	3.6	-	-	67	7.5	90	10.5	31	1.4	27	2.8	60	5.9	56	7.1
	T	100	13.0	100	24.7	100+	11.2	100+	11.6	100	4.7	100	10.6	100+	9.9	100+	12.5
4	M	-	-	-	-	41	5.5	-	-	81	4.4	100	4.7	45	4.9	25	1.4
	W	-	-	-	-	57	7.7	100	7.4	19	1.0	-	-	53	5.7	75	4.4
	T	-	-	-	-	100+	13.4	100	7.4	100	5.4	100	4.7	100+	10.8	100	5.8
5	M	-	-	-	-	41	5.3	-	-	76	6.9	65	5.2	47	5.3	21	1.6
	W	100	.2	-	-	57	7.4	100	8.6	24	2.2	35	2.8	51	5.8	79	5.9
	T	100	.2	-	-	100+	13.1	100	8.6	100	9.1	100	8.0	100+	11.3	100	7.5
6	M	79	31.6	100	50.4	25	1.3	36	.8	57	4.3	34	1.9	51	4.2	76	6.0
	W	21	8.6	-	-	75	3.9	64	1.3	42	3.2	66	3.5	49	4.1	24	1.9
	T	100	40.2	100	50.4	100	5.2	100	2.1	100+	7.6	100	5.4	100	8.3	100	7.9
7	M	100	.3	-	-	18	.8	32	3.1	61	2.4	100	.9	27	1.1	36	2.1
	W	-	-	-	-	82	3.5	68	6.5	39	1.6	-	-	73	2.8	64	3.9
	T	100	.3	-	-	100	4.3	100	9.6	100	4.0	100	.9	100	3.9	100	6.0
8	M	37	4.5	-	-	29	1.8	3	.3	57	1.9	75	2.2	34	2.1	12	.8
	W	63	7.8	-	-	70	4.4	97	10.8	43	1.5	25	.8	65	4.0	88	6.6
	T	100	12.3	-	-	100+	6.2	100	11.1	100	3.4	100	3.0	100+	6.1	100	7.5
9	M	-	-	-	-	37	4.3	4	.5	69	7.5	95	16.5	44	4.6	41	5.4
	W	-	-	-	-	61	7.1	96	12.4	31	3.3	5	.9	55	5.8	59	7.7
	T	-	-	-	-	100+	11.6	100	12.9	100	10.8	100	17.4	100+	10.6	100	13.1
10	M	-	-	-	-	39	4.3	-	-	67	8.9	80	11.2	46	4.9	57	3.5
	W	-	-	-	-	58	6.4	100	2.9	33	4.3	20	2.8	51	5.5	43	2.6
	T	-	-	-	-	100+	11.1	100	2.9	100	13.2	100	14.0	100+	10.7	100	6.1
11	M	100	.2	100	1.9	36	2.4	71	4.1	75	9.6	81	8.8	50	3.7	77	5.3
	W	-	-	-	-	63	4.3	29	1.7	22	2.8	19	2.0	48	3.6	23	1.6
	T	100	.2	100	1.9	100+	6.7	100	5.8	100+	12.8	100	10.8	100+	7.5	100	6.9
12	M	96	5.9	-	-	91	3.0	86	.3	95	11.2	93	10.1	93	5.0	93	3.3
	W	4	.2	-	-	9	.3	14	*	5	.6	7	.7	7	.3	7	.3
	T	100	6.1	-	-	100	3.3	100	.3	100	11.8	100	10.8	100	5.3	100	3.6
13	M	63	6.5	-	-	4	.2	-	-	77	8.4	70	7.5	37	2.4	22	2.3
	W	37	3.8	-	-	92	4.3	100	11.8	23	2.5	30	3.2	61	3.9	78	8.0
	T	100	10.3	-	-	100+	4.7	100	11.8	100	10.9	100	10.7	100+	6.4	100	10.3
Total Hours		XX	248	XX	170	XX	2396	XX	1030	XX	535	XX	696	XX	3341	XX	1735

1/ P% = Percentage of Period; T% = Percentage of Annual Total.

2/ If men plus women < 100%, the difference is child labor indicated by +.

3/ * = less than 1%.

APPENDIX TABLE 6.1 CROP GROSS VALUE BY HOUSEHOLD AND SEASON[1]

Household Number	Rainy Season		Dry Season Crops						Total value
	Rice Value ฿	% of all crops	Gross Value (Baht) Rice	Soybeans	Peanut	Garlic	Total	% of all crops	
34	1560	51.3	1480				1480	48.7	3040
49	1390	51.8	1296				1296	48.2	2686
61	6020	58.5	3654		624		4278	41.5	10298
65	3450	26.9	3036	3598		2760	9394	73.1	12844
39	3816	65.0	1540	518			2058	35.0	5874
54	10840	35.2	2540	1025			3565	24.8	14405
30	5460	56.3	3640	105		500	4245	43.7	9705
37	7200	40.4	1560	4320	729	4032	10641	59.6	17841
Sub-total	39736	51.8	18746	9566	1353	7292	36957	48.2	76693
Ave (n=8)	4967	xxx	2343	1196	169	912	4620	xxx	9587
6	6000	65.5	2400	762			3162	34.5	9162
19	4590	59.6		1809		1300	3109	40.4	7699
10	4500	44.4	1909	3283	450		5642	55.6	10142
53	8310	57.8		6078			6078	42.2	13288
63	6920	74.5	2373				2373	25.5	9293
4	7950	52.4	2960	3900		350	7210	47.6	15160
59	8610	48.9		8983			8983	51.1	17593
Sub-total	46880	56.2	9642	24815	450	1650	36557	43.8	83437
Ave (n=7)	6697	xxx	1377	3545	64	236	5222	xxx	11919
20	12100	70.0		3445		1800	5245	30.2	17345
33	10800	74.5	3160	540			3700	25.5	14500
32	9180	61.1		4130	1708		5838	38.9	15018
50	10650	62.3	760	3548	2146		6454	37.7	17104
45	9495	96.4		358			358	3.6	9853
25	9780	60.5	3980	900	1512		6392	39.5	16172
18	7630	39.9	3180	5940	2744		11864	60.1	19494
Sub-total	69635	63.6	11080	18861	8110	1800	39851	36.3	109486
Ave (n=7)	9948	xxx	1583	2694	1159	257	5693	xxx	15641
17	12000	52.6	6890		910	3000	10800	47.4	22800
36	10320	69.6	3460	1045			4505	30.4	14825
11	8850	64.8		4800			4800	35.2	13650
3	7230	44.3	4000	5100			9100	55.7	16330
16	12610	66.1	4440	2015			6455	33.9	19065
58	16740	55.8	5290	5335	2632		13257	44.2	29997
31	17135	52.4	13200	2352			15552	47.6	32687
23	6360	42.3	1140	7534			8674	57.7	15034
Sub-total	91245	55.5	38420	28181	3542	3000	73143	44.5	164388
Ave (n=8)	11406	xxx	4802	3523	443	375	9143	xxx	20549
Total	247496	57.0	77888	81423	13455	13742	186508	43.0	434004
Ave (n=30)	8250	xxx	2596	2714	449	458	6217	xxx	14467

[1]Averages of sub-classes equal the representative farms.

APPENDIX TABLE 6.2 FARM NON-CROP INCOME

H/H #	Source of Other Income (Baht and % of household)								
	Fruits Veg.	%	Swine	%	Poultry & Eggs	%	Fish	%	Total
34	35	1	2560	97	35	1	13	1	2643
49			1980	100					1980
61	35	19	145	81					180
65	611	60	400	40					1011
39	49	9	475	91					524
54									--
30			2645+	100					2645
37			420+	70	177	30			597
Sub-Total	730		8625		212		13		9580
Av (n=8)	91	8	1078	90	27	2	2	*	1198
Av/ H H reprtng	183	xx	1232	xx	106	xx	13	xx	xxx
6	8	1	650	97	12	2			670
19	21	100	+						21
10			600	90	68	10			668
53			400	100					400
63			200	100					200
4	27	5	500	95					527
59	19	100							19
Sub-total	75		2300	80					2505
Av. (n=7)	11	3	336	94	11	3			358
Av. / H H reprtng	19	xx	470	xx	40	xx		xx	xx
20			525	100					525
33	12	+	2662	100					2674
32	4	1	392	58	282	41			678
50	637	97			18	3			655
45	40	4	975	89	77	7			1092
25	135	9	1300+	91					1435
18	9	1	740	99					734
Sub-total	837		6594		377				7804
Av. (n=7)	119	11	942	84	54	5			1115
Av./H H reprtng	140	xx	1099	xx	126	xx		xx	xx
17									
36	40	3	1205+	97					1245
11									
3			730	100					830
16			1705	100					1705
58	19	100							19
31			+		136	100			136
23			450	100					450
Sub-total	59		4090		136				4285
Av. (n=8)	7	1	511	96	17	3			535
Av./H H reprtng	30	xx	1023	xx	136	xx		x	xx
Total	1701		21,659		805		13		24,174
Av. (n=30)	57	7	722	90	27	3	x	xx	806
Av/ H.H reprtng	106	xx	985	xx	101	xx	13	xx	xx

* = less than 1%
+ = excluding the sale of water buffalo and oxen

Appendix Table 6.3 Hours Spent Returns and Returns Per Hour For Non-Farm Income by Source[a]

House-hold Number	Laborer			Service			Handicraft			Trading			Total		
	Hours	Baht	฿/hr	Hours	Baht	฿/hr	Hours	Baht	฿/hr	Hours	Baht	฿/hr	Hours	Baht	฿/hr
34	701.5	2119	3.02				4021	660	.16	238	795	3.34	4960.5	3574	.72
49	1142.4	1339	1.17				1124	158	.14	(71.2)	20	(.28)	3266.4	1497	.66
61	729.6	1589	2.18				3499	530	.15	201	261	1.30	4429.6	2380	.54
65	--	--	--				522	114	.22	(230)	1763	(7.66)	522.0	114	.22
39	728.6	884	1.21				917.7	370	.40	--	--	--	1646.3	1254	.76
54	159.7[b]	321	(2.01)				2343	160	.07	(61)	171[b]	(2.81)	2502.7	481	.19
30	956.0	1232	1.29	72.5[b]	179	(2.47)	1496.7	432	.29	(1154)	3243[b]	(2.81)	2525.2	1843	.73
37	938.0	2334	2.49	118	292	2.47	630.7	245	.39	84	324	3.86	1770.7	3195	1.80
Total	5355.8	9818	xx	190.5	471	xx	14554.1	2669	xx	523.0	1380	xx	20623.4	14338	xx
Ave.	669.5	1227	1.83	23.8	59	2.47	1819.3	334	.18	65.4	172.5	2.64	2577.9	1792	.70
6	--	--	--				--	--	--	--	--	--	--	--	--
19	61.0	142	2.33				327	69[b]	(.21)	90	331	3.68	478.0	542	1.13
10	253.7	616	2.43				3592	632	.18	160	301	1.88	4005.7	1549	.39
53	3161.8	4165	1.32				2920	556	.19	290	442	1.52	6371.8	5163	.81
63	1693.9	5120	3.02	190.4	470[b]	(2.47)	3677	1143	.31	247	899	3.64	3808.3	7632	2.00
4	225.7	331	1.47				569	109	.19	---	--	--	794.7	440	.55
59	261.0[b]	524	(2.01)				2083.3	459	.22	489.5	938	1.92	2833.8	1921	.68
Total	5657.1	10898	xx	190.4	470	xx	13168.3	2968	xx	1276.5	2911	xx	20292.3	17247	xx
Ave.	808.2	1556.8	1.93	23.8	67	2.47	1881.2	424	.22	182.3	415.9	2.28	2898.9	2464	.85
20	650	682	1.05				--	--	--	(21)	(230[b])		650	682.0	1.05
33	2461.6	7871	3.20				504	164	.32	(160[b])	(450)		2965.6	8035.0	2.70
32	1145.2	3012	2.63				1927.6	587	.30	186	813	4.37	3258.8	4412.0	1.35
50	706.8	1115	1.58				1951.2	437	.22	267	410	1.54	2925.0	1962.0	.67
45	197.0	280	1.42				1766	339	.19	--	--	--	1963.0	619.0	.32
25	16.0	52	3.25				641.2	207	.32	--	--	--	657.2	259.0	.39
18	79.0	118	1.49				917	160	.17	--	--	--	996.0	278.0	.28
Total	5255.6	13130	xx	--	--	--	7707	1894	xx	453	1223	xx	13415.6	16247.0	xx
Ave.	750.8	1875.7	2.50	--	--	--	1101	270.6	.24	64.7	174.7	2.69	1916.5	2321.0	1.21
17	--	--	--				161.3	34	(.21)	425.2	417	.98	586.5	451	.77
36	104.9	110	1.05				767.6	206	.27	131.0	216	1.65	1003.5	532	.53
11	390.0	680	1.74				17	4[b]	(.21)	--	--	--	407.0	684	1.68
3	3.0	10	3.33				32.3	7[b]	(.21)	943.8	3401	3.60	979.1	3418	3.49
16	3346.5	5400	1.61				829.6	292	.35	1058	3446	3.26	5234.1	9138	1.74
58	1385.4	3969	2.86				3443.9	451	.13	1561.3	5047	3.23	6390.6	9467	1.48
31	547.0	600	1.10				--	--	--	39	124	3.18	586.0	724	1.24
23	1260.9	2287	1.81				419.9	65	.15	3435.2	6890	2.00	5116.0	9242	1.81
Total	7037.7	13056	xx	--	--	--	5671.6	1059	xx	7593.5	19541	xx	20302.8	33656	xx
Ave.	879.7	1632	1.86	--	--	--	709.0	132	.19	949.2	2443.6	2.57	2537.8	4207	1.66
All Farms	23306.2	46902	xx	380.9	941	xx	41101	8590	xx	9846.0	25055	xx	74634.1	81488	xx
Ave	776.9	1563.4	2.01	12.7	31	2.47	1370	286	.21	328.2	835	2.54	2487.8	2962	1.09

[a]Averages computed on basis of all households in corresponding group.

[b]Reported data considered unreliable. This figure adjusted using average baht/hour for remaining households for this income source. Results of this adjustment shown in parentheses.

Appendix Table 6.4. Total Family Income, Crop Income/Rai and Net Income (Baht)

Household Number	Farm Income						Non-Farm Income		Total Gross Income	Crop Income/ Rai	Expense[a]	Net Income
	Crop	%	Non Crop	%	Total	% of Total	Receipt	%				
34	3,040		2,643		5,683		3,573		9,256	1,698	1,411	7,845
49	2,686		1,980		4,666		1,697		6,363	1,370	1,442	4,921
61	10,298		180		10,478		2,480		12,958	3,388	989	11,969
65	12,844		1,011		13,855		2,342		16,197	2,265	1,640	14,557
39	5,874		524		6,398		1,258		7,656	940	698	6,958
54	14,405		--		14,405		5,075		19,480	1,787	9,468	10,012
30	9,705		2,645		12,350		8,847		21,197	1,169	6,706	14,491
37	7,841		597		18,438		3,195		21,633	2,131	3,815	17,818
Sub Total	76,693	67	9,580	8	86,273	75	28,467	25	114,740	14,748	26,169	88,571
Av (N=8)	9,587		1,198		10,784		3,534		14,330	1,844	3,271	11,071
6	9,162		670		9,832		--		9,832	1,079	3,126	6,706
19	7,699		21		7,720		473		8,193	894	4,998	3,195
10	10,142		668		10,810		1,949		12,759	1,098	2,085	10,674
53	14,388		400		14,788		5,163		19,951	1,465	4,248	15,703
63	9,293		200		9,493		7,163		16,656	864	1,099	15,557
4	15,160		527		15,687		442		16,129	1,372	2,349	13,780
59	17,593		19		17,612		1,921		19,533	1,571	5,770	13,763
Sub Total	83,437	81	2,505	2	85,942	83	17,111	17	103,053	8,343	23,675	79,378
Av (n=7)	11,919		358		12,277		2,444		14,722	1,192	3,382	11,340
20	17,345		525		17,870		912		18,782	1,533	3,099	15,683
33	14,500		2,674		17,174		8,485		25,659	1,228	7,117	18,542
32	15,018		678		15,696		4,412		20,108	1,243	3,106	17,002
50	17,104		655		17,759		3,058		20,817	1,401	7,802	13,015
45	9,853		1,092		10,945		619		11,564	739	1,602	9,962
25	16,172		1,435		17,607		259		17,866	1,166	6,620	11,246
18	19,494		749		20,243		278		20,521	1,380	4,670	15,851
Sub Total	109,486	81	7,808	6	117,294	87	18,023	13	135,317	8,690	34,016	101,301
Av (n=7)	15,641		1,115		16,756		2,574		19,331	1,241	4,860	14,472
17	22,800		--		22,800		1,117		23,917	1,596	3,427	20,490
36	14,825		1,245		16,070		532		16,602	1,034	5,376	11,226
11	13,650		--		13,650		680		14,330	872	4,180	10,150
3	16,330		730		17,060		3,411		20,471	1,005	2,271	18,200
16	19,065		1,705		20,770		9,138		29,908	1,112	2,319	27,589
58	29,997		19		30,016		9,466		39,482	1,323	8,636	30,846
31	32,687		136		32,823		724		33,547	1,408	8,277	25,270
23	15,034		450		15,484		9,242		24,726	620	6,476	18,250
Sub Total	164,388	81	4,285	2	168,673	83	34,310	17	202,983	8,970	40,962	162,021
Av (n=8)	20,548		536		21,084		4,289		25,373	1,121	5,120	20,253
Total	434,004	78	24,178	4	458,182	82	97,911	18	556,093	40,751	124,822	431,271
Av (n=30)	14,467		806		15,273		3,257		18,536	1,358	4,161	14,376

[a]Expenditure includes crop production, livestock, non-farm expenditures see Chapter 7 for detail expenditure.

APPENDIX TABLE 6.5 HOUSEHOLD NET INCOME, PER CAPITA INCOME AND INCOME PER CONSUMER EQUIVALENT (Baht)

H/H #	Household Net Income	Per Capita Income	Per Consumer Income
34	7,845	1,961	2,414
49	4,921	984	1,246
61	11,969	2,394	2,720
65	14,557	3,639	4,282
39	6,958	2,319	2,676
54	10,012	2,002	2,472
30	14,491	2,070	2,635
37	17,818	5,939	6,364
Sub-total	88,571	xxxx	xxxx
Av (n=8)	11,071	2,460	2,960
6	6,706	1,676	2,484
19	3,195	799	1,030
10	10,674	1,067	1,558
53	15,703	2,243	2,617
63	15,557	3,111	3,704
4	13,780	2,297	3,062
59	13,763	2,753	2,484
Sub-total	79,378	xxxx	xxxx
Av (n=7)	11,340	1,935	2,537
20	15,683	3,137	2,690
33	18,542	3,708	4,754
32	17,002	2,125	2,596
50	13,015	3,254	3,615
45	9,962	1,992	2,554
25	11,246	2,249	3,168
18	15,851	2,642	3,170
Sub-total	101,301	xxxx	xxxx
Av (n=7)	14,472	2,665	3,297
17	20,490	3,415	4,503
36	11,226	2,245	2,878
11	10,150	2,538	2,859
3	18,200	4,550	5,127
16	27,589	3,941	4,523
58	30,846	4,407	4,975
31	25,270	3,610	4,109
23	18,250	2,281	2,808
Sub-total	162,021	xxxx	xxxx
Av (n=8)	20,253	3,376	4,003
Total	431,271	xxxx	xxxx
Average	14,376	2,648	3,260
$[1]	719	132	163

[1] Baht converted to dollars using 20:1 exchange rate.

Appendix Table 6.6. Value of Farm Assets (Baht)

Household Number	Land		Buildings		Total Real Est.	Livestock	Implement	Total Farm Assets
	Rai	Value[1]	House	Barn				
34	1.79	11,247	1,000	--	12,247	1,545	8	13,800
49	1.96	12,315	700	300	13,315	3,830	38	17,183
61	1.54	9,676	20,000	5,000	34,676	1,100	83	35,859
65	--	--	1,000	--	1,000	2,045	70	3,115
39	6.25	39,269	4,000	1,500	44,769	3,039	41	47,849
54	4.56	28,650	400	7,000	36,050	2,540	26	38,616
30	--	--	1,000	300	1,300	5,200	50	6,550
37	5.37	33,740	2,000	--	35,740	5,099	120	40,959
Sub Total	21.47	134,897	30,100	14,100	179,097	24,398	436	203,931
Av (n=8)	2.68	16,862	3,763	1,763	22,388	3,050	55	25,491
6	7.0	43,981	1,000	300	45,281	3,625	34	48,940
19	4.31	27,080	1,000	---	28,080	5,340	64	33,484
10	8.99	56,484	20,500	3,000	79,984	9,980	499	90,463
53	5.82	36,567	2,000	500	39,067	1,790	108	40,965
63	--	--	7,000	--	7,000	11,600	78	18,678
4	11.05	69,427	15,000	--	84,427	3,620	140	88,187
59	11.20	70,370	30,000	1,500	101,870	4,060	60	105,990
Sub Total	48.37	303,909	76,500	5,300	385,709	40,015	983	426,707
Av (n=7)	6.91	43,416	10,929	757	55,102	5,716	140	60,958
20	10.8	67,856	30,000	7,000	104,856	2,810	72	107,738
33	10.31	64,778	8,500	400	73,678	17,951	267	91,896
32	12.08	75,899	15,000	--	90,899	10,780	329	102,008
50	8.71	54,725	10,000	3,000	67,725	6,060	282	74,067
45	13.34	83,815	10,000	3,000	96,815	290	66	97,171
25	11.87	74,579	10,000	4,000	88,579	4,054	377	93,010
18	13.62	85,574	8,000	5,000	98,574	2,990	123	101,687
Sub Total	80.73	507,226	91,500	22,400	621,126	44,935	1,516	667,577
Av (n=7)	11.53	72,461	13,071	3,200	88,732	6,419	217	95,368
17	14.29	89,784	8,500	2,500	100,784	5,220	219	106,223
36	11.34	71,249	3,500	1,500	76,249	2,864	86	79,199
11	14.16	88,967	9,000	5,000	102,967	4,235	47	107,249
3	16.24	102,036	30,000	5,000	137,036	4,300	126	141,462
16	17.14	107,691	20,000	1,500	129,191	4,000	150	133,341
58	16.92	106,308	30,000	10,000	146,308	6,570	215	153,093
31	17.22	108,193	25,000	2,000	135,193	3,870	223	139,286
23	18.75	117,806	5,000	2,500	125,306	4,660	134	130,100
Sub Total	126.06	792,035	131,000	30,000	953,034	35,719	1,200	989,953
Av (n=8)	15.83	99,004	16,375	3,750	119,129	4,465	150	123,744
Total	276.63	1,738,067	329,100	71,800	2,138,966	145,067	4,135	2,288,168
Av (n=30)	9.22	57,936	10,970	2,393	71,299	4,836	138	76,272

[1]Valued at ฿6283 per rai.

Appendix Table 6.7. Inventory of Livestock and Average Cash on Hand, June 30, 1974 by Household (Value in Baht)

Household Number	Buffalo		Oxen		Pig		Value of[1]		Total	Cash		
	No.	Value	No.	Value	No.	Value	Poultry	Duck		7/1/73	6/30/74	Average
34	--	--	--	--	1	1,500	45	--	1,545	--	--	--
40	1	3,800	--	--	--	--	30	--	3,830	200	800	500
61	--	--	--	--	1	1,100	--	--	1,100	--	--	--
65	--	--	--	--	2	2,000	45	--	2,045	600	500	550
39	1	3,000	--	--	--	--	39	--	3,039	500	1,550	1,025
54	--	--	--	--	2	2,500	40	--	2,540	300	300	300
30	1	3,500	2	1,700	--	--	--	--	5,200	300	500	400
37	1	4,000	1	1,000	--	--	99	--	5,099	800	1,200	1,000
Sub Total	4	14,300	3	2,700	6	7,100	298	--	24,398	2,700	4,850	3,775
Av (n=8)		1,788		338		888	37	--	3,050	338	606	472
6	1	3,500	--	--	--	--	125	--	3,625	800	1,000	900
19	--	--	1	3,800	1	1,500	40	--	5,340	3,500	4,000	3,750
10	--	--	2	7,500	6	2,200	280	--	9,980	300	500	400
53	--	--	--	--	3	1,700	90	--	1,790	400	1,200	800
63	2	7,500	--	--	9	3,900	200	--	11,600	100	300	200
4	1	3,500	--	--	--	--	120	--	3,620	200	180	190
59	--	--	--	--	4	4,000	60	--	4,060	1,200	--	600
Sub Total	4	14,500	3	11,300	23	13,300	915	--	40,015	6,500	7,180	6,840
Av (n=7)		2,071		1,614		1,900	131	--	5,716	929	1,026	977
20	1	2,500	--	--	1	250	--	60	2,810	6,300	6,000	6,150
33	4	14,567	--	--	4	3,200	184	--	17,951	1,000	3,000	2,000
32	1	4,500	1	4,500	3	1,200	520	60	10,780	1,750	2,500	2,125
50	--	--	2	4,500	1	1,500	60	--	6,060	1,200	1,000	1,100
45	--	--	--	--	--	--	290	--	290	200	500	350
25	--	--	2	3,000	1	1,000	54	--	4,054	300	500	400
18	1	2,500	--	--	1	400	90	--	2,990	--	5,700	2,850
Sub Total	7	24,067	5	12,000	11	7,550	1,198	120	44,935	10,750	19,200	14,975
Av (n=7)		3,438		1,714		1,079	171	17	6,419	1,536	2,743	2,139
17	--	--	1	4,000	1	1,200	20	--	5,220	600	500	550
36	1	2,500	--	--	1	350	14	--	2,864	500	500	450
11	1	3,000	--	--	1	1,200	35	--	4,235	1,000	1,000	1,000
3	--	--	1	3,000	1	1,200	100	--	4,300	1,500	2,400	3,900
16	--	--	--	--	4	4,000	--	--	4,000	--	--	--
58	2	5,000	--	--	2	1,500	70	--	6,570	--	5,000	2,500
31	1	3,500	--	--	1	300	40	30	3,870	2,000	3,500	2,750
23	2	3,600	--	--	2	1,000	60	--	4,660	--	400	200
Sub Total	7	17,600	2	7,000	13	10,750	339	30	35,719	5,500	13,300	11,350
Av (n=8)		2,200		875		1,344	42	4	4,465	688	1,663	1,419
Total	22	70,467	13	33,000	53	38,700	2,750	150	145,067	25,450	44,530	36,940
Av (n=30)	.73	2,349	.43	1,100	1.77	1,290	92	5	4,836	848	1,484	1,231

[1] Inventory taken in Baht only.

Appendix Table 6.8. Durable Consumer Items and Value (Baht)

Household Number	Bicycle		Motor Cycle		Watch		Clock		Radio		Sewing Machine		Total Value of Durables
	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	No.	Value	
34	--	--	--	--	--	--	--	--	--	--	--	--	--
49	1	150	--	--	--	--	--	--	1	600	--	--	750
61	--	--	1	300	--	50	--	--	1	50	--	--	400
65	1	800	--	--	--	--	--	--	1	200	1	3,000	4,000
39	1	150	--	--	--	--	--	--	1	300	--	--	450
54	1	300	--	--	--	--	--	--	1	50	--	--	350
30	2	2,100	--	--	--	--	--	--	1	100	--	--	2,200
37	1	1,100	--	--	--	--	--	--	1	400	--	--	1,500
Sub Total	7	4,600	1	300	1	50	--	--	7	1,700	1	3,000	9,650
Av (n=8)		576		38		6				213		375	1,206
6	1	600	--	--	--	--	--	--	1	100	--	--	700
19	--	--	1	1,800	1	20	--	--	1	100	--	--	1,920
10	1	400	--	--	--	--	1	40	2	800	--	--	1,240
53	--	--	--	--	--	--	--	--	--	--	--	--	--
63	--	--	--	--	--	--	--	--	1	400	--	--	400
4	1	1,000	--	--	--	--	--	--	--	--	--	--	1,000
59	1	100	1	4,000	1	200	--	--	--	--	1	1,300	5,600
Sub Total	4	2,100	2	5,800	2	220	1	40	5	1,400	1	1,300	10,860
Av (n=7)		300		829		31		6		200		186	1,551
20	--	--	1	3,000	1	200	--	--	1	100	--	--	3,300
33	1	1,000	2	18,000	1	200	--	--	1	200	1	5,600	25,000
32	2	1,400	1	5,000	--	--	1	230	1	250	1	600	7,480
50	1	500	1	5,000	1	200	--	--	1	200	1	3,000	8,900
45	--	--	--	--	--	--	--	--	--	--	--	--	--
25	1	1,600	--	--	--	--	--	--	1	100	--	--	1,700
18	3	1,800	--	--	--	--	--	--	1	300	--	--	2,100
Sub Total	8	6,300	5	31,000	3	600	1	230	6	1,150	3	9,200	48,480
Av (n=7)		900		4,429		86		33		164		1,314	6,926
17	2	1,000	--	--	--	--	--	--	1	200	--	--	1,200
36	--	--	--	--	--	--	--	--	1	150	--	--	150
11	--	--	--	--	1	170	--	--	1	200	--	--	370
3	2	500	1	8,000	--	--	--	--	1	200	--	--	8,700
16	3	850	--	--	--	--	1	300	1	150	--	--	1,300
58	1	630	1	8,000	--	--	1	25	--	--	1	2,000	10,655
31	1	900	1	6,000	--	--	1	300	1	100	--	--	7,300
23	1	1,400	1	4,500	--	--	--	--	1	100	--	--	6,000
Sub Total	10	5,280	4	26,500	1	170	3	625	7	1,100	1	2,000	35,675
Av (n=8)		660		3,313		21		78		138		31	4,459
Total	29	18,280	12	63,600	7	1,040	5	895	25	5,350	6	15,500	104,665
Av (n=30)		609		2,120		35		30		178		517	3,489

Appendix Table 6.9. Total Farm Assets, Non-Farm Assets and Total Family Assets

Household Number	Total Farm Assets	Non-Farm Assets			Total Family Assets
		Selected Durables	Average Cash	Total	
34	13,800	--	--	--	13,800
49	17,183	750	500	1,250	18,433
61	35,859	400	--	400	36,259
65	3,115	4,000	550	4,550	7,665
39	47,849	450	1,025	1,475	49,324
54	38,616	350	300	650	39,266
30	6,550	2,200	400	2,600	9,150
37	40,959	1,500	1,000	2,500	43,459
Sub Total	203,931	9,650	3,775	13,425	217,356
Av (n=8)	25,491	1,206	472	1,678	27,169
6	48,940	700	900	16,000	50,540
19	33,484	1,920	3,750	5,670	39,154
10	90,463	1,240	400	1,640	92,103
53	40,965	---	800	800	41,765
63	18,678	400	200	600	19,278
4	88,187	1,000	190	1,190	89,377
59	105,990	5,600	600	6,200	112,190
Sub Total	426,707	10,860	6,840	17,700	444,407
Av (n=7)	60,958	1,551	977	2,528	63,486
20	107,738	3,300	6,150	7,450	117,188
33	91,896	25,000	2,000	27,000	118,896
32	102,008	7,480	2,125	9,605	111,613
50	74,067	8,900	1,100	10,000	84,067
45	97,171	--	350	350	97,521
25	93,010	1,700	400	2,100	95,110
18	101,687	2,100	2,850	4,950	106,637
Sub Total	667,577	48,480	14,975	63,455	731,032
Av (n=7)	95,368	6,926	2,139	9,065	104,433
17	107,223	1,200	550	1,750	107,973
36	79,199	150	450	600	79,799
11	107,249	370	1,000	1,370	108,619
3	141,462	8,700	3,900	12,600	154,062
16	133,341	1,300	--	1,300	134,641
58	153,093	10,655	2,500	13,155	166,248
31	139,286	7,300	2,750	10,050	149,336
23	130,100	6,000	200	6,200	136,300
Sub Total	989,953	35,675	11,350	47,025	1,036,978
Av (n=8)	123,744	4,459	1,419	5,878	129,622
Total	2,288,168	104,665	36,940	141,605	2,429,773
Av (n=30)	76,272	3,489	1,231	4,720	80,992
Percent	95.5	3.4	1.1	4.5	100

Appendix Table 7.1 Household Expenditures: Crop Production Including Land Rent, Livestock and Nonfarm Per Household by Farm Size

HH No.	Crop Production								Livestock	Non-Farm			Total
	Labor	Power	Equip	Supplies	Water	Sub Total	Rent	Total		H/Craft	Trading	Sub Total	
34	465	100	34	215	6	820	--	820	591	--	--	--	1411
49	1093	--	--	--	2	1095	--	1095	167	--	180	180	1442
61	80	--	--	115	2	197	682	879	110	--	--	--	989
65	966	--	--	170	7	1143	[a]	1143	37	--	460	460	1640
39	575	--	--	103	8	686	--	686	12	--	--	--	698
54	1930	--	--	237	7	2174	1770	3944	137	138	5249	5387	9468
30	1846	609	5	734	17	3211	3340	6551	155	--	--	--	6706
37	655	--	--	1076	7	1738	1620	3358	457	--	--	--	3815
Sub Total	7610	709	39	2650	56	11064	7412	18476	1666	138	5889	6027	26169
Ave. n=8	951	89	5	331	7	1383	926	2310	208	17	736	753	3271
6	684	--	35	498	10	1227	1890	3117	9	--	--	--	3126
19	1126	--	199	1312	15	2652	2200	4852	146	--	--	--	4998
10	963	--	62	99	6	1130	428	1558	127	--	400	400	2085
53	421	1500	--	322	11	2254	1890	4144	104	--	--	--	4248
63	186	--	66	--	6	258	792	1050	49	--	--	--	1099
4	1307	112	60	723	18	2220	--	2220	129	--	--	--	2349
59	4784	--	25	548	11	5368	--	5368	402	--	--	--	5779
Sub Total	9471	1612	447	3502	77	15109	7200	22309	966	--	400	400	23675
Ave. n=7	1353	230	64	515	11	2158	1029	3187	138	--	57	57	3382
20	1312	--	--	1510	20	2842	220	3062	37	--	--	--	3099
33	3602	--	468	308	8	4386	1770	6156	961	--	--	--	7117
32	1614	--	162	1028	12	2816	--	2816	290	--	--	--	3106
50	2924	--	20	148	11	3103	3461	6565	142	--	1096	1096	7802
45	487	900	--	127	13	1527	--	1527	75	--	--	--	1602
25	4882	--	350	495	13	5740	750	6490	130	--	--	--	6620
18	2149	--	123	2077	20	4369	220	4589	81	--	--	--	4670
Sub Total	16970	900	1123	5693	97	24783	6421	31204	1716	--	1096	1096	34016
Ave. n=7	2424	128	161	813	14	3540	917	4458	245	--	157	157	4860
17	1653	70	--	459	13	2195	--	2195	532	--	700	700	3427
36	603	--	5	182	12	802	4400	5202	174	--	--	--	5376
11	633	--	6	660	12	1311	2820	4131	49	--	--	--	4180
3	1707	60	7	454	25	2253	--	2253	18	--	--	--	2271
16	1377	--	--	554	13	1944	--	1944	375	--	--	--	2319
58	4168	--	114	412	22	4716	3750	8466	170	--	--	--	8636
31	3588	--	25	1493	20	5126	3100	8226	51	--	--	--	8277
23	1989	--	23	545	18	2575	3720	6295	181	--	--	--	6476
Sub Total	15718	130	180	4759	135	20922	17790	38712	1550	--	700	700	40962
Ave. n=8	1965	16	22	595	17	2615	2224	4839	194	--	88	88	5120
Total	49768	3351	1789	16604	365	71878	38823	110701	5898	138	8085	8223	124822
Ave. n=30	1659	112	60	553	12	2376	1294	3690	197	5	269	274	4161
.	39.9	2.7	1.4	13.3	.3	57.6	31.1	88.7	4.7	.1	6.5	6.6	100
Ave/ HH Rep	1659	479	94	593	12	2396	1941	3690	197	138	1348	1371	4161

[a]Rent free from parents. Excluded from farms reporting.

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