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Analysis of Farming Systems on Denuded Forest Lands in Northern Thailand

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ABSTRACT. *The main objective of the study was to analyze the farming systems in the Khao Kho land settlement, an area of steeply sloping land in northern Thailand. A random sample of 14 villages in the area was selected and farm households were studied. It was found, based on the type of crops cultivated, market values and Gross Margin analysis, that three types of farming systems exist in the area viz., low-value cash cropping system, medium-value cash cropping system and high-value cash cropping system. They differed from one another in socio-economic, agronomic and land type characteristics. It was also evident that 'Contract Farming' in sericulture activity was adopted by a few households in some villages.*

From regression analysis it was identified that farm income was affected by the use of credit, slope of land, land extent cultivated and size of agricultural labour force. Slope of land, credit use and size of full-time farm labour force had direct positive impact on farm income levels. Also it was found that non-productive members in the family tend to cause a negative effect on farm income levels.

INTRODUCTION

Considerable attention is currently being given to assist the small farmers in developing countries. An important way to help them is through agricultural research, extension and related programs specific to their needs.

Farming systems research can specifically concentrate on small farmers and thereby focuses on their conditions and aspirations. The farming system is a complex arrangement of soils, water sources, crops, livestock, labour and other resources within an environment setting that the farm family manages in accordance with it's preferences, capabilities and available technologies (Shaner *et al.*, 1982). This paper is based on a farming systems

study carried out on the Khao Kho settlement program on denuded forest lands in Petchabun, Northern Thailand.

Deforestation and forest settlements in Thailand

It is widely accepted that the forest land and natural areas in Thailand have been exploited and destroyed during the last three decades at a far higher rate than in the past due to population growth and increasing technological capabilities for exploiting land and forests (Phantumvanit, 1990). An assessment in 1989 indicated that only 27.9% of total land area still remained under forest cover (Royal Forest Dept., 1990).

The Khao Kho forest settlement was established by the Royal Thai Army and the Royal Forest Department about 10 years ago in the Petchabun province in northern Thailand. The major objective of establishing the settlement was to rehabilitate the denuded forest lands and to stabilize agricultural production on them.

It consists of 32 villages established along the main road on both sides, each village having about 50 settler families, who are mainly retired army personnel, lowlanders from close by areas, and hill tribe people.

Each settler family was allocated a 20 *rai* (3.2 ha) plot of land for agriculture, and 0.25 *rai* (0.04 ha) for a home-stead on a random basis, taking no account of the topography; resulting in a few families getting poor quality land, unsuitable for arable farming. Very steep sloped lands (25 to 35% slopes) and denuded forest cover in the area has resulted in soil erosion, low fertility levels and low productivity (UNDP/FAO Project, 1990).

The main objective of this study was to analyze the different farming systems existing in the area and also to ascertain whether there are any relationships between slope of land, labour use, credit use, extension contacts and farm income levels.

MATERIALS AND METHODS

Primary data were collected using a structured questionnaire for interviewing sampled settler households in the study area. A random sample

of 14 villages along the Camp Son-Rimsimuang-Petchabun road was selected purposively, from the 32 RTA villages in the area. The total population of the 14 RTA villages selected was of approximately 620 households (HH). The settler households were the sampling units, and the heads of the settler households constituted the sample respondents.

Assuming that the pioneer settlers are homogeneous, the sample size was determined by using Yamani's (1967) sampling equation, with a confidence level of 95 percent, and a reliability of 3 percent. This produced a sample size of 112 households. Simple random sampling method was used to select the sample households.

The processing and analysis of data were done by the use of the dBASE III+ and the SPSS/PC 4+ software. Statistical analyses such as uni-variate and regression analyses were carried out.

RESULTS AND DISCUSSION

Household and farm income levels

It was found that variations existed in net farm incomes and total household incomes among villages and that net farm income was the lowest in Khao Kho (Bt. 4,427.00 p.a/HH) and the highest in Rimsimuang (Bt. 65,686.44 p.a/HH). This variation was due to large number of villagers in Rimsimuang being involved in sericulture activity, under a **'Contract Farming'** arrangement with Chul Thai Silk Co., along with growing other crops. The average total household income per year was Bt. 29,296; while average net farm income/HH/Yr was Bt. 21,374 and average off-farm income/HH/Yr was about Bt. 7,921.60.

Types of cropping systems

The average extent of land cultivated/HH varied from 7 *rai* in Sakchalemkit, to 25.67 *rai* in Rimsimuang. This difference was mainly due to settlers possessing lands having flat to steep slope which were unsuitable for cultivation of any crop.

In certain villages, less than 50% of the land owned by the households was being cultivated which had steep terrain and low productivity levels.

The major crops cultivated in the area are maize, ginger, cabbage, leaf cabbage, green beans, snow peas, and mulberry, while minor crops are fruit trees like sweet tamarind, lychee, longan, and mangoes.

Analysis of the cropping systems practised by the respondents shows the existence of basically 3 types of cropping systems based on, monocrop or intercrop and market value. These are discussed below.

Low-value cash cropping system

In which maize or ginger as cash crops and upland rice as a subsistence crop, are cultivated as monocrops. These crops have low market values and are grown extensively with low levels of input use.

Medium-value cash cropping system

In which maize, vegetables and fruits are cultivated. Mulberry and other crops are cultivated as monocrops or intercrops. Maize is grown extensively while vegetables, fruit trees and mulberry are intensively cultivated. Their market value varies depending on the type of crop having a medium market value.

High-value cash cropping system

Where mainly cash crops like vegetables or fruits or mulberry (sericulture) are cultivated as monocrops or intercrops. These crops are grown intensively with high levels of input use having a high market value.

Table 1 illustrates the different types of cropping systems prevalent and crops cultivated in the area. As shown in the table, only 20.4% of farmers have fully diversified to new crops, while 24.1% still continue cultivating the old cash crops of maize, ginger and upland rice. Also, 55.56% of farmers are in the transitional phase of diversification (adoption of new crops).

The characteristics of the farmers practising different farming systems were analyzed in Table 2. The table shows that practice of a specific cropping systems is affected by the farmer's age, level of education, family size, land quality and net farm income.

Table 1. Types of cropping systems.

Type of Production System	No. of Respds.	Crops cultivated	No. of farmers
1. Low-value cash cropping system	26 (24.07)	Maize	20
		Maize & Ginger	06
		Upland Rice	
2. Medium-value cash cropping system	60 (55.55)	Maize & Vegetables	25
		Maize & Mulberry	12
		Maize & Fruit	03
		Maize, Vegetables & Fruits	05
		Others	15
3. High-value cash cropping system	22 (20.37)	Vegetables	13
		Mulberry	05
		Fruits & Vegetables	03
		Mulberry & Vegetables	01

Values in parentheses are the percentages.

In order to find out whether land topography, labour availability, extent cultivated, extension contacts and credit use affect farm income, a Multiple regression model, with farm income as the dependent variable was formulated. The independent variables such as credit use and extension service contacts and slope variables were converted into dummy variables. The new variables Area4, Area3, Area2 were created from the Slope variable as follows:

Area4 = DSLOPE4 * Extcult.,
Area3 = DSLOPE3 * Extcult.,
Area2 = DSLOPE2 * Extcult.

If the slope of land is :

Steep = 1, then Slope = 1, and DSLOPE1 = 0,
Moderately Steep = 2, then Slope = 2, and DSLOPE2 = 1,

Gentle Steep = 3, then Slope = 3, and DSLOPE3 = 1,
Flat = 4, then Slope = 4, and DSLOPE4 = 1.

For Credit use, Credit used=1, No credit used=0; and
for Extension contacts, Have extension contacts=1, No extension contacts=0, was used for regression.

Table 2. Characteristics of farming systems.

Types of Farming System	Avg. extent cultivated (*rai*/HH)	Net farm income/ HH/yr (Baht)	Avg. HH size (Nos)	Avg. age of head of HH (years)	Education (% no schooling)
1. Low-value system	14.46	8150	5.31	48.04	19.22
2. Medium-value system	14.03	27391	5.00	43.27	6.67
3. High-value system	7.53	29121	4.43	40.48	8.69

Note: 1 US$=Bt 25.45 (Nov. 1991), and 1 *rai*=0.16 ha.

Household members were separated into Agriculture full-time labour, Agriculture part-time labour and Non-productive labour. A Multiple regression model was setup as follows:

$$\text{Farm income} = A_0 + a_1*\text{Extcult} + a_2*\text{Extn} + a_3*\text{Credit} + a_4*\text{Agriful} + A_5*\text{Agripart} + a_6*\text{Nonprod} + a_7*\text{Area4} + a_8*\text{Area3} + a_9*\text{Area2}.$$

A Stepwise Method of Regression Analysis (METHOD=ENTER) was carried out using the SPSS/PC 4+ software. The results of the analysis with the variables selected by the above method are presented in Table 3.

Table 3 shows that the slope of land (Area3 and Area4), agriculture full-time labour availability in the family, non-productive members in the family, credit use and extent cultivated affect farm income levels.

Table 3. Regression analysis on farm income.

Explanatory Variables	Estimated Coefficient (B)	T - Statistic
1. Extcult.	709.143	1.54
2. Nonprod.	-2029.848	-3.16*
3. Agrifull	4807.858	2.32*
4. Credit	18745.522	1.67
5. Area3	1308.656	2.72*
6. Area4	1551.084	2.34*
(Constant)	-7179.399	-0.61

* - significance of T statistics at 5% level Multiple R=0.5964
N=112 df=6 R^2=0.3557 Adjusted R^2=0.3189
Standard error=36970.18 F value = 9.66*

It also reveals that slope and agriculture full-time labour have a positive significant effect (increases income by Bt. 4,808), while non-productive members in the family have a negative significant effect on farm income levels (reduces income by Bt. 2030). A settler using credit can increase his farm income by about Bt. 18,745.50/year as against a non-user of credit, and if he cultivates on flat land his income is further increased by Bt. 1,551/yr/*rai*.

Thus from the regression analysis it can be concluded that the farm income level is dependent on the availability of labour in the family, family size, credit use and land quality (in terms of slope).

CONCLUSIONS

It was found that 3 types of cropping systems exist in the area *viz.*, Low-value, Medium-value and High-value cash cropping systems based on the type of crops cultivated and their market value. Variations were seen among the systems in the average extent cultivated, net farm incomes, family size, education levels and land quality. Less educated older farmers tend to practise low-value cropping systems which generated less income than the

other cropping systems. Monocropping was predominantly practised, with intercropping seen on fruit plots.

From regression analysis it was found that the farm income levels were related to agricultural full-time labour force in the family, credit use and land quality.

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