CHAPTER III

RESEARCH METHODS

This chapter discussed the topics on how the study areas as well as samples were selected, what kind of data was collected and how the data collection was carried out as well as what kind of method and model will be used for data analysis.

3.1. Site selection of the study

The central region of Myanmar was chosen for conducting research. The selection of the study area is based on the areas where groundnut has been widely grown. Magway and Mandalay divisions were selected as the study areas because they are the largest groundnut growing areas of the country. Out of these two divisions, two districts with the largest groundnut production area in each division were selected which are Yamethin Township and Tattkhone Township in Mandalay Division and Magway Township and Aunglan Township in Magway Division. The study area is shown in Figure 3.1.

3.2. Sampling techniques

The cross-sectional data was used to express the groundnut production in central region of Myanmar. A two-stage sampling procedure was used to selected farmers for the study. Firstly, two villages in each selected township, for four townships, were randomly selected. After that, sample firms from a list of groundnut production firms were randomly selected. In total, there were 269 sample groundnut production farm households in two divisions.

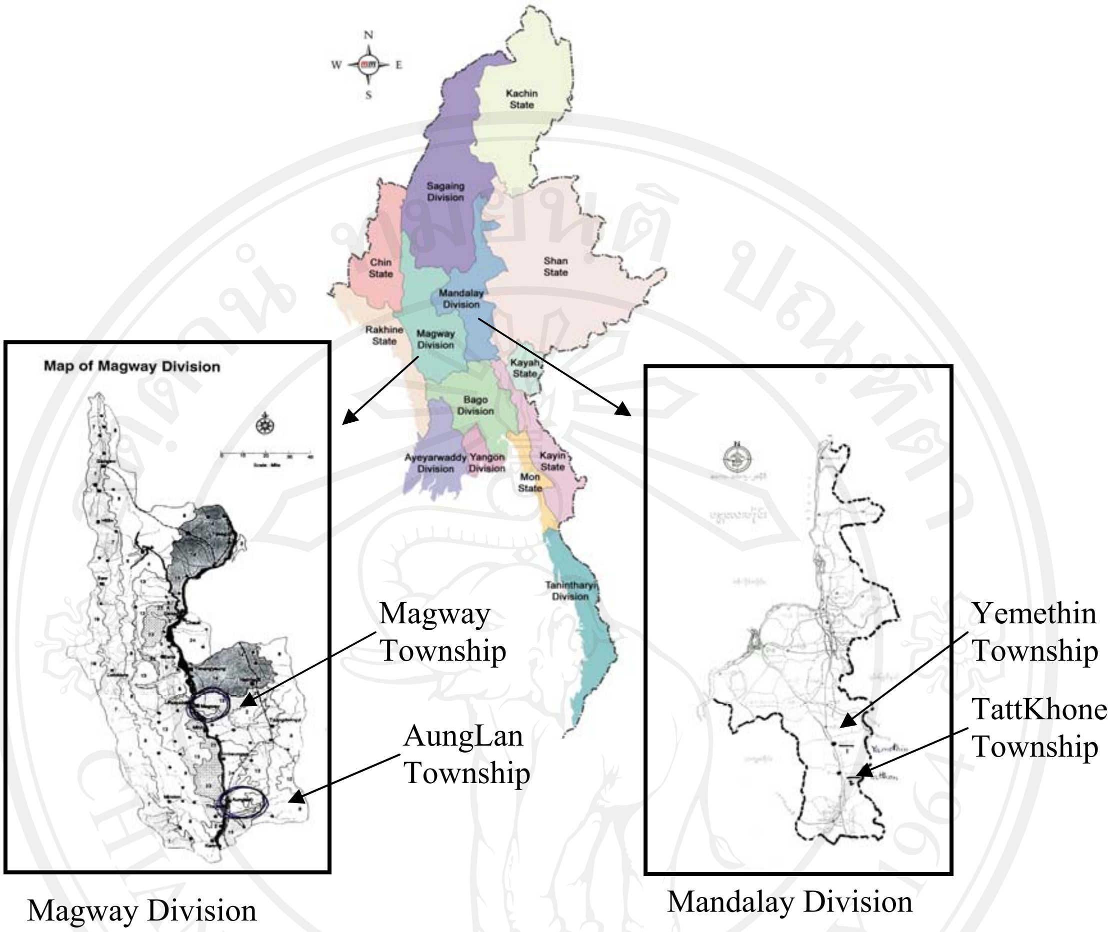

Figure 3.1 Study sites in the central region of Myanmar.

3.3. Data collection

The information used for this study was collected from both primary and secondary sources. Relevant information on groundnut production systems and socio-economic of groundnut production farm households were gathered on seasonal year 2006-07 using methods as below.

3.3.1. Primary Data

Primary data, gathered in this study, includes biophysical and socio-economic information of groundnut production farm households in the study area. Semi-structured interviews and formal survey were employed to gather the data in this study. Formal survey using structured questionnaires were constructed to gather major part of information needed to substantiate the objective of the study. In particular, farming practices such as total cultivated area, the groundnut grown area, the cropping pattern, the land preparation methods, the cultural practice, the crop yields obtained, the credit from agricultural banks, the seed varieties, the constraints of groundnut production such as biological constraints and socioeconomic constraints for yield increase and area expansion and the use of input level such as seed, fertilizers, insecticides and pesticides, etc.

Key informants such as village headmen, school teachers, extension agents etc. were consulted for the overview information of the area. Data collected from survey can be separated to two types as follows.

1) Production data

Production data consist of cropping pattern, total area cultivated, groundnut area cultivated, groundnut varieties, groundnut yields, input utilization and other farm management.

2) Socio-economic data

Socio-economic data consist of land holding, land type, as well as land distribution, farm size, household composition by age and family size, education status and distribution, farm and off farm income, credit and source of credit, labor used on groundnut farms.

3.3.2 Secondary data

Secondary data were drawn from relevant ministerial reports of Ministry of Agriculture and Irrigation Central Statistical Organization. To have a better understanding of the groundnut production system in the study area, the related publications were reviewed. Research studies on groundnut growing, biophysical, socio-economic and demographic characteristic of the study sites were collected from various resources.

3.4. Data Analysis

After completing the field survey, the data were transferred from the questionnaires into Microsoft Excel worksheet as a data base file. The detail of data analysis can be explained as follows.

To achieve the first objective, the data collected from the survey were analyzed using descriptive statistics. The results from descriptive analysis of groundnut production system and socio-economic characteristic of farm households were presented and compared between different divisions by using contingency tables, with percentage, mean, standard deviation values.

To address the second and third objectives, stochastic frontier production for technical efficiency of groundnut production was estimated. The factors affecting technical inefficiency in groundnut production were identified for growers in central region of Myanmar. The stochastic production frontier was used to estimate technical efficiency using maximum-likelihood methods. At the same time, frontier production function was expressed technical inefficiency in groundnut production at the farm level using cross-sectional data.

Determinant of production function included information of input utilization such as production hectares, seed rate per hectare, chemical fertilizer application, manure application, and cost of pesticides and insecticides application. In addition, it was also included the information of socio-economic aspects of the farmer such as educational level, age of household heads, labor availability, credit, and extension services to groundnut production.

In this study, the technical efficiency effects in the stochastic frontier production function specified by using the flexible trans-log specification. The specified model is assumed to be the appropriate model for analysis of the data.

The model to be estimated is defined by:

$$\ln Y_i = \beta_0 + \sum_j \beta_j \ln X_{ji} + \frac{1}{2}\sum_j \sum_k \beta_{jk} \ln X_{ji} \ln X_{ki} + \nu_i - \mu_i, \qquad (1)$$

Where ,

i indicate an observation for the i-th farmer in the survey, i=1,2,3,…..,269

ln = natural logarithms,

β_0 = parameters to be estimated production function.

Y_i = groundnut yield (kg/ha)

X_{ji} = all *j* input variables per ha,

X_{1i} = total groundnut production area (ha)

X_{2i} = seed rate used in groundnut production (kg/ha)

X_{3i} = amount of chemical fertilizer application (kg/ha)

X_{4i} = amount of manure application (tons/ha)

X_{5i} = insecticides and pesticides cost in the application (kyat/ha)

X_{6i} = human labor use (man-day /ha) in groundnut production.

X_{7i} = good in soil quality in groundnut production; dummy variable is used that value is 1 if the soil condition is the best, 0 is otherwise.

X_{8i} = fair in soil quality; dummy variable is used in groundnut production, the value was 1 and if he does not planted, value will be zero.

The error term is defined as

$\varepsilon_i = \nu_i - \mu_i,$

Where,

i = 1,2,…,n farms,

ν_i = an error term, independent and identically distributed (iid with N (O, σ_v^2);

μ_i = a non-negative random term, accounting for inefficiency, iid, with N (O, σ_v^2), truncated half normal.

For the inefficiency terms, variation in efficiency was estimated at the firm level due to farmer-specific characteristics. The inefficiency model was estimated base on the equation given below;

$$\mu_i = \delta_0 + \sum \delta_m Z_i \qquad (2)$$

Where,

δ_m unknown parameters to be estimated

Z_i the vector of observable explanatory variables

In this study, the inefficiency equation is as follows;

$$\mu_{i=} \quad \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_4 Z_{5i} + e_i \qquad (3)$$

Where,

δ_0 = constant

Z_{1i} = years in school of the household head (years),

Z_{2i} = age of the household head (years)

Z_{3i} = availability of labor force in the household (in the Man-equivalent unit),

Z_{4i} = dummy variable for credit access. If the farmer has access to credit, the value was 1 and if not, the value was 0.

Z_{5i} = dummy variable for access to extension officers. If farmer adapt to extension officers, the dummy variable was 1 and 0 if otherwise.

The production function defined by equation (1) has the explanatory variables; land area, family labor, use of the seed rate, use of chemical fertilizer, manure application and cost of pesticides and insecticides involved in farming. These variables were assumed to explain the output of groundnut at Magway division and Mandalay division. It is further hypothesized that the output might also be influenced in this level by the existence of age and education differences between farmers and differences in extension contact offered by the government institution.

The technical inefficiency effects outlined by equation (3) indicated that these effects in a stochastic frontier (1) are expressed in terms of various explanatory variables which include the age of the farmer, the education of the farmer described by dummy and extension contact as dummy. It was expected that a high level of education increases technical efficiency more than contact with extension agents.

Batteese and Coelli (1998) stated that the technical efficiency of production of the i^{th} farmer was estimated as

TE_i $= \exp(X_i \beta + \nu_i - \mu_i) / \exp(X_i \beta + \nu_i)$

TE_i $= \exp(-\mu_i)$

If $\mu_i = 0$, the farms were 100% efficient.

Therefore,

TE_i $= e*p(-U_i)$

The technical efficiency of a farmer is between zero and one and is inversely related to the level of the technical inefficiency.

Technical efficiency was obtained from equation (1) and (3) using the method of maximum likelihood estimation to estimate the production frontier jointly with the inefficiency equation by using the computer program FRONTIER Version 4.1.

FRONTIER version 4.1 is the most commonly used package for predicting for stochastic production frontiers. The estimation process consists of three main steps in estimating the maximum-likelihood estimates (MLE) of the parameters of a stochastic frontier production function. At the first step, the model is applied to estimate the parameters of the production function with Ordinary least-squares (OLS) method. This provides unbiased estimators for the β's with the exception of the intercept, β_0. The OLS estimates are used at the beginning of estimating values to the final MLE model. At the second step, the values for the likelihood function is estimated for different value of γ between 0 and 1 given the values for β's are derived in the OLS. Finally, an iterative algorithm calculates the final maximum-likelihood estimates, using the values of the β's from the OLS and the value of γ from the intermediate step as starting values in an iterative procedure (Coelli, T. 1996).