Chapter II Methodology

3.1 The scope and limitation of the study

Son La was chosen for conducting research area. The study focuses on maize production and its constraints in two districts in Son La province, namely: Moc Chau and Mai son

i. Due to shortage of time in survey and inadequate information, references related to maize production are the main limitation of this study

ii. Data set use for this study was primarily based on the one-year data from results of field survey in two representative districts of Son La province so that some constraints could not estimate in this case.

iii. The data collection and analysis could not cover all factors that related to maize productivity and maize production system poor infrastructure and prevailing farming practices of the farmer.

3.2 Field survey

The formal survey was conducted in two districts namely Moc Chau and Mai Son belong to the rainfed area of Son La province, from March to May 2002. The purpose of field survey is to gain the knowledge of maize production, yield constraint factors, which have affected the maize productivity and then, find out the possible solutions to improve the maize productivity in the rainfed area of Son La province.

3.2.1. Site selection

The criteria used for site selection should follow: The areas should be representative physical and socio-economic conditions for the rainfed area, maize is dominant crop, villagers and leaders willing to participate and help study team organizing PRA workshop.

Four villages, the representative maize production on the rainfed area, were selected for conducting field survey including Ang and Ban Hoa villages in Moc Chau district and Co Noi and Chieng Ban villages in Mai Son district. Of which, Co Noi and Ang villages have the trend of maize production like semi-commercial production while Chieng Ban and Ban Hoa villages have the trend of maize production as subsistence production type.

3.3 Data collection

To evaluate the maize production systems in the study sites, all data related to maize production were collected by semi-structure and formal interviews in four villages of the two above districts. In addition, the Participatory Rural Appraisal (PRA) tools were also applied in evaluating the problems related to low maize productivity.

3.3.1 Secondary data

The secondary data were collected from peoples' committee of the communes, head of village, the district extension center, veterinary station and statistical agriculture division. The data contains land distribution, land use, population, income and the others relating to agricultural production.

3.3.2 Primary data

3.3.2.1 Participatory Rural Appraisal

The Participatory Rural Appraisal (PRA) method was used in finding constraints, and evaluation of their effect on maize system. PRA workshop conducted in Ang village. In PRA workshop, the representative farmers have 21 people including, rich, medium, poor, man and woman, old and young people participated. The PRA tools applied for evaluating were:

Village maps: it was used to identify the infrastructure, current land use, existing resources, and boundaries of the village and other physical characteristics.

Village transects: It was used to identify and analyze the production characteristics of the village, it also describe more in detail the potentials and problems in different parts of landscape. It includes soil characteristics, water resources, crop and farmers' practices, advantage and problems in specific location.

Pie diagram and chart: The pie diagram and charts were used to express the percentage of each types of land use in community, crop yield and yield gap analysis.

Seasonal calendar: It was used to define the crops and crop pattern, which planted in the community within a year. Moreover, it was used to express the activities following the time that related to each crop in growing seasons, labor demand, disease etc

Causal diagram: It used to describe the constraints related to maize productivity, cause and effect relationship, even the grass "root" cause of problems existing in the community.

Semi-structure interviewing: It was used the main method in the study for key informant interview, individual interview, and group interview to gather information on all of aspects, such as farmer's practices on maize production, and soil taxonomy.

Matrix analysis and ranking of feasibility: it was used to get an insight into feasibility aspects of each type of crop, and constraints based on the criteria participatory determined. The result of this showed the relative importance of each constraint that concerned by farmer in their community. The ranking technique follow the Analytical Hierarchy Process (AHP) procedure (Saaty., 1980).

Time trend: it was used to ask farmer to recollect the events in the past time and describe the changes in the community, such as land use change and the change of the crop yield etc under the impact of policies, and incidence of pest and disease and environmental stress.

Community validation: it was organized at the end of workshop. The information gathered in analyzing were feedback to all of farmers with the aim to cross check and further verification. Farmer participants were able to present and explain their findings and then other groups correct and provide recommendations.

3.3.2.2 Interview individual farmer household

Making more samples for analysis, the formal survey by questionnaire was conducted. Total 120 farmer households were interviewed in the four villages. The sampling of farmers for interviewing mostly focused on the maize growers in the flatland, midland and steepland area. The data types were collected including type of maize production, maize yield, input use and yielding constraints involved in maize production system. Moreover, the data relating to other crops, such as rice, cassava, sugarcane, soybean etc also collected to evaluate cropping systems in the study area.

3.4 Data analysis

Descriptive method with table, diagram, chart, and map were used to display the finding results in PRA workshop and RRA. Moreover, in order to measure the effect of inputs used and yielding constraints on maize productivity in this area, the Cobb-Douglas production function was employed. The coefficients of production function obtained after estimation are the basis for explaining the effect of input and constraints to maize productivity.

3.4.1 Descriptive analysis

To review the general information on agricultural production in the study sites, the results from semi-structure interview, formal survey were analyzed using descriptive statistic, such as percentage, mean, standard deviation and presented with support of relevant contingency table to compare the different characteristics, inputs used for crops among villages and within parts of maize cultivation in the upland area.

To achieve the objective of study, the PRA tools, such as causal diagram, matrix and ranking were used in PRA workshop. Firstly, the causal diagram was used to express the yielding constraint that directly and indirectly affected maize productivity in the different land types in the upland area. Secondly, the pair-wise matrix and ranking technique were used to prioritize the yield constraints that were found in the causal diagram in previous section. Finally, yield gap analysis was applied to compare the yield obtained among land types, varieties, and households that could define more specific about the effect of yielding constraints in maize production system.

3.4.2 Quantitative assessment in maize production

The PRA workshop just only pointed out the cause and effect of yielding constraints to maize productivity. The yield gap analysis made more detail in the constraints to yield gap through comparison of the actual yield obtained among land types and farmers' farms. However, it could not quantify the volume of the yield reduction due to each yielding constraint. Therefore, quantitative assessment was employed with the aim to quantify the volume of yield reduction due to each yielding constraint.

In theory, the crop yield increases normally proportionally with amount of input use when it does not reach to the optimum yield. However, the crop yield will slowly increase or stop at the threshold level, although the input uses continuously increasing. In practice, as the relationship between the inputs use and crop yield obtain is not linear trend. Therefore, in order to express the relationship between inputs use to crop yield, the Cobb-Douglas production function was employed popularly to estimate how is the effect of the each individual inputs to the maize yield.

In maize production, the relationship between the maize yield and inputs use is similar the trend in above so that it is essential to express the relationship between the maize yield and inputs use in this study, the Cobb-Douglas production function was employed to measure how inputs and yielding constraints effect to maize yield. The coefficients of production function after estimation were used as the basis for assessing the impact of input factors and yielding constraints to maize yield in the study site.

3.4.2.1 Quantitative model

The empirical model for estimation $Y= \alpha X_1^{\beta 1}\ X_2^{\beta 2} X_3^{\beta 3} e^{\Sigma \gamma i Di} e^{ui}$ (i = 1..6). This equation could be expressed under logarithm type as follow.

$$\ln Y_i = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + g_1 D_1 + g_2 D_2 + g_3 D_3 + g_4 D_4 + g_5 D_5 + g_6 D_6 + u_i$$

Where

Y_i: Total maize yield at farm ith (kg per hectare)

X_i are inputs factors involved in maize production, which consist of

X_1 = amount of pure nitrogen used (kg per hectare)

X_2 = amount of pure phosphorous used (kg per hectare)

X_3 = amount of pure potassium used (kg per hectare)

D_i are dummy variables, which consist of

D1 = 1 if variety is not hybrid variety, and 0 if otherwise

D2 = 1 if land have low fertility, and 0 if otherwise

D3 = 1 if erosion occur and affected the maize yield in the farm, and 0 if otherwise

D4 = 1 if pest & diseases damage and affected the maize yield, and 0 if otherwise

D5 = 1 if weed affected the maize yield, and 0 if otherwise

D6 = 1 if farmer household said lack of technology, and 0 if otherwise

α, β_I and γ_I = parameter to be estimated, u_i random error

The Ordinary Least Square (OLS) method was employed to estimate production function. The EXCEL program was used to run the model and estimate the coefficients of explanatory variables and dummy variables.

The model for estimation the contribution of yield loss due to yielding constraints was conducted base on the comparison of the yield gap between maize yield obtained in the best farms and the farms having yielding constraint occurred in growing season.

3.4.2.2 Definition and measurement of variables

Y - Output of maize is total quality of maize harvested, measured after separate grain in kilograms per hectare.

X_1 - Nitrogen is amount of pure nitrogen used in the farm, measured in kilograms per hectare.

X_2 – Phosphorus is amount of pure phosphorous used in the farm, measured in kilograms per hectare.

X_3 – Potassium is amount of pure potassium used in the farm, measured in kilograms per hectare.

D_1 - Varieties is not hybrid varieties, it means that the OPVs and local varies were used in the farmer farm.

D_2 - Low soil fertility is the soil quality at the farm is low according to farmer evaluation and maize yield has reduced due to this problem.

D_3 - Soil erosion is erosion occurred at the farm and affected the growth of maize and having evidence of maize yield reduction.

D_4 - Pest and disease damage is pest and diseases were appeared at the farm and made the yield loss.

D_5 - Weed competition is weed made maize reduction because farmers have not completed in weeding control.

D_6- Farmer lack of technology: the farmers who could not access with extension workers or participate any training workshop on technology for maize production.

The second objective of this study is the possible solutions will be set up through farmers' suggestions in the PRA workshops combine with the results and information obtain after the first objective is solved completely.