THESIS APPROVAL

GRADUATE SCHOOL, KASETSART UNIVERSITY

Master of Science (Tropical Agriculture)

DEGREE

Tropical Agriculture — **FIELD**

Interdisciplinary Graduate Program — **PROGRAM**

TITLE: Farmers' Adoption of Improved Technological Knowledge on Soybean Production in Northern Shan State Area, Myanmar

NAME: Mr. Naing Kyi Win

THIS THESIS HAS BEEN ACCEPTED BY

(Associate Professor Praderm Chumjai, Ph.D.) **THESIS ADVISOR**

(Associate Professor Pichai Tongdeelert, Ph.D.) **THESIS CO-ADVISOR**

(Associate Professor Yingyong Paisooksantivatana, Ph.D.) **PROGRAM CHAIRMAN**

APPROVED BY THE GRADUATE SCHOOL ON _____

(Associate Professor Gunjana Theeragool, D.Agr.) **DEAN**

THESIS

FARMERS' ADOPTION OF IMPROVED TECHNOLOGICAL KNOWLEDGE ON SOYBEAN PRODUCTION IN NORTHERN SHAN STATE AREA, MYANMAR

NAING KYI WIN

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Master of Science (Tropical Agriculture)
Graduate School, Kasetsart University
2009

Naing Kyi Win 2009: Farmers' Adoption of Improved Technological Knowledge on Soybean Production in Northern Shan State Area, Myanmar. Master of Science (Tropical Agriculture), Major Field: Tropical Agriculture, Interdisciplinary Graduate Program. Thesis Advisor: Associate Professor Praderm Chumjai, Ph.D. 105 pages.

A study was conducted on the farmers' adoption of improved technological knowledge on soybean production in Northern Shan State Area, Myanmar. The objectives of this research were to study the socio-economic factors, knowledge of soybean production farmers and extension activities affecting to adoption of improved soybean production technology, farmers' problems and recommend alternative solutions. The sample was 377 farmers and survey questionnaires were used as tools for collecting the data. The data were analyzed by using the percentage, mean and chi-square test for hypotheses.

Finding: this study revealed that the average age of farmers was 52 years and size of the land owned was 0.64 ha. Most of the soybean farmers 78.25% had formal education and almost all of the farmers cultivated the land their selves. A majority of 72.41% of the farmers had 2-4 supporters and average income per ha 353060-kyats. Also 32.63% of soybean farmers obtained credit, 28.91% worked in off farm employment and 37.40% were members of a farmers' organization. Further, 31.50% of soybean growing farmers had fully known about the improved soybean production technological knowledge. Farmers participated in extension activities such as home or farm visits 39.53%, and group contact 32.36%, while extension agents contributed to 35.30% farmers with mass media and the demonstration to 27.33% of farmers. Adoption level of improved soybean production technology was less than 50% except for adoption of improved varieties.

Hypotheses testing: relationships were found between level of education, family labor, farm income, credit and off arm employment and adoption of improved soybean production technology at the significant level 0.05. There was significantly relation between farmers' knowledge and adoption of improved soybean production technology. Also extension activities such as farm visits and group activities were significantly related with the adoption of improved soybean production technology. Most of the farmer's suggestions mainly dealt with the credit, improved and adaptive varieties, technological knowledge, and extension activities.

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Student's signature Thesis Advisor's signature

ACKNOWLEDGEMENTS

I would like to heartily thank my parents and teachers from primary school up to university and sincerely like to acknowledge all researchers who contributed to the research and to this thesis in particular.

I am profoundly indebted to my thesis advisor, associate Professor Dr.Praderm Chumjai for all his advice, warm encouragement and direction, understanding and helpful comments and suggestions given during my study. Also I would like to thank associate professor Dr.Pichai Tongdeelert, and members of the advisory committee for providing advice during the course of the study at Kasetsart University, Bangkok.

I am very much grateful to the Government of Myanmar and also Oil Crops Development Project responsible personnel and FAO for the fellowship and financial assistance to pursue my graduate studies (Master of Science) at Kasetsart University. I wish to convey appreciation to Government of Thailand who permitted me to stay and study at home land.

I would like to sincere thank all Myanmar students, Thai students, Laos students and all other class mates and staff of the International Studies Center, studying during my learning times at Kasetsart University.

I would like to thank the staff of Myanma Agriculture Service, for their assistance when I collected the research requirement data and very gratefully thank the soybean growing farmers at Northern Shan State.

Finally I am deeply devoted to my loving wife Khin Mya Mya Lwin and my daughter Moe Moe Kyi Win and my son Kyaw Soe Hein for all their encouragement, understanding, patience and tolerance during our long separation while I was studying in Thailand.

Naing Kyi Win
May 2009

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CHAPTER I

INTRODUCTION

In Myanmar, agricultural development and the subsequent development of rural areas, especially “Hilly Region” depends largely on the adoption of improved technologies and farming practices operated by farmers. In mountainous regions, majority of farmers believe in traditional ways and poor in education. Normally their growing crops can be obtained low yield and profit because they have been practicing the local cultivation methods and varieties. And then they do not prefer to change advance technology without understanding themselves.

In Northern Shan State, elevation is about 3000 ft high and annual rainfall is about 55 inches, maximum temperature is 32℃ and minimum temperature is about 1℃ in winter. Most of the soils are red or yellow with low pH. However these areas might be favorable to grow soybean successfully.

Soybean was grown in Myanmar for local consumption in former times. In the 1970s, there is low production and also low yield due to the growing of a local cultivar which is thermo-and photo-sensitive. Therefore exotic varieties have been introduced since 1991. Although high yield varieties have made a change, technological transfer is weak and also production low (Moe, 1993). In 2000, it was the prominent crop for poultry farm and aqua cultural feed in domestic markets. It has become a high potential crop with more utilization for soybean oil and soybean cake according to the market survey.

Soybean is growing in both rainy and cool seasons. Based on the seasonal production statistics, the areas planted with soybean in cool season account for 57 % of the total. In the rainy season, the hill region has the largest sown areas in the country, especially in Southern and Northern Shan State (Kyi, 2003). Nowadays soybean is a popular crop in Myanmar. The crop covers about 153,000 ha, mainly

grown in Shan State areas (42 %) and the rest is in Mandalay Division (21%) Sagaing Division (13%), Ayeyarwaddy Division (7%) and average yield is 1.17 tons per ha (DAP. 2006).

If it is increased soybean production in hilly region it will be need to change new technologies and varieties. There are two ways of improving of soybean production (MAS, 2004). They are growing areas extension and increasing yield per unit area. It is affected by the several factors in soybean production including low yield per ha, high cost of production and inappropriate uses of inputs such as seeds, chemical fertilizers and pesticides. Also, the price obtained by the farmers and rate of return are low.

As a result, area extension is not favorable and we need to increase yield per unit area. Therefore, there is need to know farmers' behavior on adoption of improved technological knowledge in Hilly Region of Northern Shan State. The idea to study for soybean production is important roles for my research.

Problem Statement

Demand for soybean has increased because of natural value, oil requirements and economic aspects. Therefore there is need to study the case of low yield and benefit, production constraints, competitive crops and the appropriate research issues to address such problems, improved soybean varieties grown and the desirable characteristics of soybean and those preferred by the farmers were also included.

The idea for research has been mentioned at Oil Crops Development Project in Myanmar, soybean makes attractive to grow and one of the replacing crops and it also benefits subsequent crops. However, very little research has been done to understand the adoption behavior of farmers and problems encountered in the adoption of innovation, different extension activities used to farmers and available sources of information.

Therefore, there is a need to study the adoption behavior of soybean farmers will improve the planning for research and development considerably. Knowing the factors which have determined the diffusion adoption in the past and will indicate the social characteristics of farmers are likely to affect quick and wide adoption in the future (UTF/MUA/006/MYA).

In this regard, a study needs to answer the following questions: What are the socio-economic factors of the different farm family in Northern Shan State area (Lashio, Hsipaw and Kyaukme Township)? What are the socio-economic factors related to improved technology? How different is the technological knowledge of farmers in adopting the improved technology? How do farmers participate in extension activities of soybean production? Why do they adopt certain package technology partially or fully? Why are the farmers who adopt the improved varieties and technology not able to get expected yield? What are their suggestions to overcome the problem?

Objectives

The general objective of the study is to study the socio-economic factors, knowledge of soybean production farmers and extension activities affecting to adoption of improved soybean production technology, farmers' problems and recommend alternative solutions.

Specifically the study aims:

1. To study the socio-economic factors of the different household farmers in Lashio, Hsipaw and Kyaukme Township.

2. To determine the farmers' knowledge on improved soybean production technology in study areas.

3. To determine the farmers' participation in extension activities toward the

adoption of improved soybean production technology.

4. To determine the farmers' adoption of improved soybean production technology.

5. To determine the relationship between socio-economic factors, farmers' knowledge, participation in extension activities and adoption of improved soybean production technology.

6. To identify the problems faced by farmers, and to obtain their suggestions and alternative solutions to increase adoption of improved technology in soybean cultivation.

Expected Outcome

The outcome of this study will be helpful for development programs as well as the Oil Crops Development Project. Findings will explain the current situation of adoption of improved technology package and their problems. This will lead to country development planers to take remedial measures to improve the existing situation.

Moreover, the result of the study will contribute to increase the adoption of soybean production technology, and will be beneficial to extension agent to change their extension strategies and farmers behaviors to increase the adoption of improved technology.

Scope of the Study

This study was conducted within three townships of Northern Shan State area in 2007-2008 growing season of soybean. There were about 25,743 soybean growing farmers and this study was limited to 377 sample farmers.

This study was scoped to some socio-economic factors such as age , education, size of farm, tenure of land, family labor, farm income, off farm employment, credit, membership in farmers' organization and extension activities such as individual farm visits, group contact, mass media and demonstrations related to adoption.

Only improved technology package likes use of improved varieties, soil fertility management, nutrient management, improved cultural practices and plant protection methods were considered in this study.

These study areas have average agro-ecological and social characteristics of hilly region and include in project areas. Therefore the finding of this study will be applicable only to soybean farmers who lived in Hilly Region and also for project document.

Definition of Terms

Adoption refers to soybean farmers who accept and practice of improved technology package in soybean cultivation.

Farmer refers to people who live in Lashio, Hsipaw and Kyaukme townships and grow mainly the soybean crop for their living.

Shan State refers to one of the state of Myanmar and situated in North-Eastern Part of Myanmar.

Socio-economic factors refer to social and economic factors of soybean farmer such as age of farmer, level of education, size of farm, tenure of land, family labor, farm income, off farm employment, credit and membership in farmer organization.

Age of farmer refers to the age of household head farmer in years.

Level of education refers to the last grade of class attended by household head farmer.

Tenure of land refers to the farmer who cultivated the land: owner of the land, joint owner, or tenant farmer.

Family labor refers to number of family members actively assisted to household head farmer in soybean cultivation (members/ family).

Farm income refers to profit over cash expenditure from soybean cultivation in Kyats per acre.

Off farm employment of farmer refers to any other permanent, casual or temporary employment in an organization or self- employment in addition to farming.

Credit refers to whether farmers obtain credit for soybean cultivation or not during 2007/08 growing season.

Membership in farmer organization refers to member to an organization (farmers' group, NGO), which is a privileged position with respect to other farmers, in terms of access to information on improved technological knowledge and credit for soybean cultivation.

Knowledge on improved soybean production technology refers to the farmers who have the knowledge on five practices of improved soybean production technology and apply this knowledge during the year 2007-08 growing season in the study areas.

Participation in extension activities refers to number of farmers training classes, demonstrations, field days participated by farmers and number of visits by extension officer during the year 2007/08 growing season.

Individual home or farm visits refers to the extension agent meets the farmers at home or farm during the year 2007-08 growing season.

Group contact refers to the extension workers meets face to face with a number of soybean farmers to explain and teach about soybean production technology during the year 2007-08 growing season.

Mass media refers to the media which convey soybean production information by sound (radio, audio, cassettes); moving pictures (television, films, videos); and print (posters, newspapers, leaflets) to be soybean farmers during the year 2007-08 growing season.

Demonstration refers to the method and result demonstrations. Method demonstrations are demonstrations of how actually to carry out single operation that must be mastered by a farmer if he is to use an improved technique. Extension agent shows the methods as how to achieve the desire population per hectare, how to apply pesticide, how to achieve precision sowing at particular depth with careful explanation about soybean growing. And also result demonstrations are to demonstrate what actually happen when the improved soybean production technology is followed. Extension agent invite to soybean growing farmers to come together to see the result.

Soybean refers to the one of the pulses crops and commonly produced the vegetable oil and protein.

Improved technology refers to five practices selected in this study which are the adoption of improved varieties, soil fertility management, nutrient management, improved cultural practices and plant protection methods.

Improved varieties refer to high yielding varieties such as SB45, SB60, Yezin and China varieties recommended by Department of Agricultural Research and Myanma Agriculture Service.

Soil fertility management refers to the land preparation for soil to be good for growing the soybean such as incorporate 3 tons of cow dung, 1 ton of green manure before ploughing, 1 ton of lime 3 months before growing for one hectare and also summer harrowing, one deep ploughing followed by two to three cross harrowing and leveling when there were growing time.

Nutrient management refers to use of fertilizers which is recommended by Myanma Agriculture Service such as Urea, Tsuper and Potash fertilizer and foliar fertilizers as well as rhizobium in right amount and right time to get benefit for soybean production.

Plant protection methods refer to the control of pests and diseases, using the Integrated Pests Management strategy (IPM) and for weeds control, using the Integrated Weed control Practices (IWP) to less lose for soybean growing.

Weeds refer to the any plant that germinates spontaneously in area of soybean cultivation and interfering negatively with farmer activities.

Pests refer to the yield reducing factors of soybean such as bean stem fly, army worms and spotted borers occurring during the year 2007-08 growing season.

Diseases refer to the affect of economic and yield losses factors such as rust diseases, downy mildews diseases and charcoal diseases damages during the year 2007-08 growing season.

CHAPTER II

REVIEW OF LITERATURE

This research was studied the factors which related to farmers' adoption of improved technological knowledge on soybean production in Northern Shan State area, Myanmar. The related concepts and related research were on the following issues;

(1) Adoption and diffusion of innovations
(2) Improved technology for soybean production
(3) Soybean extension in Myanmar
(4) Soybean extension in study area
(5) Related research

Theoretical Concepts

Adoption and diffusion of innovations

Rogers (1995:35-37) has described the meaning of innovation, adoption and diffusion as follows;

An innovation is an idea, method or object which is regarded as new by an individual or other unit of adoption. Characteristics of an innovation such as relative advantages, compatibility, complexity and observability help to explain their different rate of adoption.

Adoption is a process of an individual mind and also the decision-making process.

Adoption of an innovation means the process by which a particular farmer is exposed, considered and finally rejects or practices a particular innovation.

Diffusion of an innovation means the total process by which an innovation spreads out among the farmers until large a number of farmers have adopted it (Mosher, 1974: 46).

The diffusion curve as shown in figure 1 shown three curves with 3 different adoption rates in a given time period. Three curves represent the rate of diffusion of three different innovations. All three curves are S shape. These curve shows that the diffusion of innovation tends to be rather slow at the beginning. Then after some period with adoption of innovation, each graph incline upwards with an increasing rate, and finally rate of diffusion starts to decline (Rogers, 1995: 11).

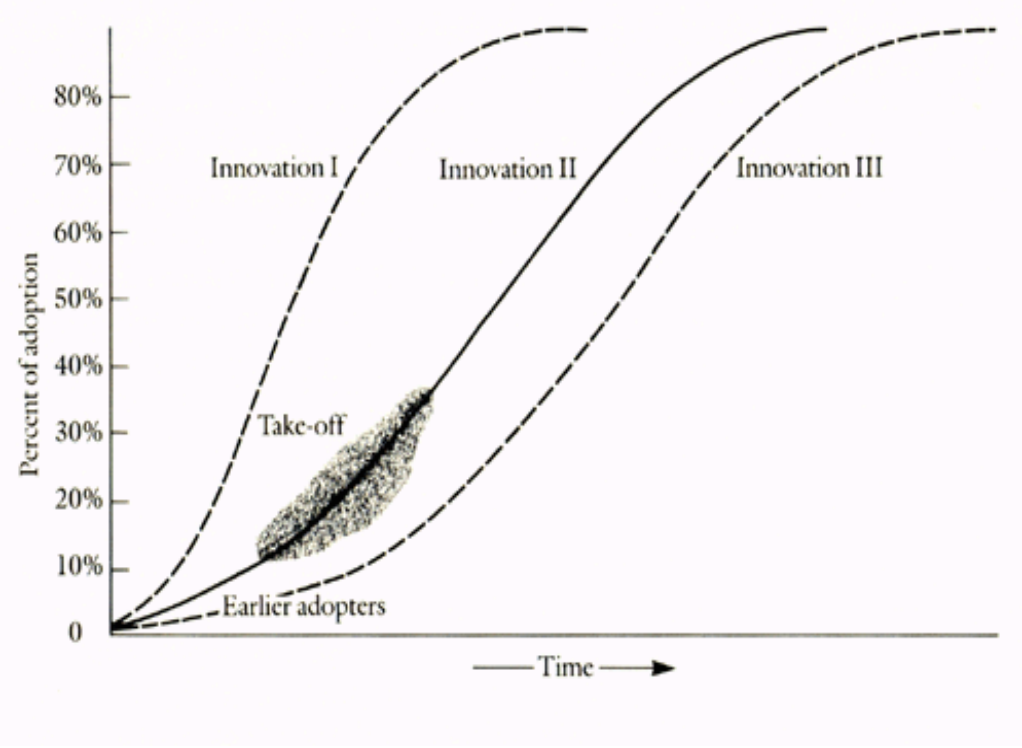

Figure 1 Diffusion of Innovation of Curves

Sources: Rogers

1. Adoption process

The process of adoption of innovation composed of five successive steps: (1) Awareness, (2) Interest, (3) Evaluation,(4) First trial and (5) Either repeated used or rejection (Mosher, 1974: 47-48).

1.1 Awareness

The first step towards adoption of an innovation, obviously, is to become aware that it exists. More is involved here than just hearing about it, for one can hear something without believing it. Hence, result demonstration may be called for even at this first step towards adoption.

1.2 Interest

The second step is to become personally interested. The critical difference between awareness and interest is that, this second step of becoming actively interested occurs when a person comes to believe that innovation might be positive for him.

1.3 Evaluation

Once a farmer has become interested in an innovation, he begins the process of evaluating it, and of deciding whether or not he wishes to try it. Evaluation is also partly a matter of getting more information about the practice and making a mental trial of the innovation.

1.4 First trial

The fourth step is actual trial on the farm. In order to take this step, the farmers must collect the required inputs, learn any new skills that are required, commit some land, labor, and money to trial and see what happens.

1.5. Either repeated use or rejection

Not until a farmer begins to use an innovation, the second, third, fourth time can be said to have “adopted” it. Up to then, he is only getting increasingly interested and experimenting, first imagination and then in fact. Only repeated use indicated that the adoption has taken place. In many cases, after trying an innovation once or perhaps twice, farmers rejected it and never try it again.

2. Classification of adopters

Classification of adopters in a social system is based on the innovativeness (Rogers, 1995: 263-266). They include:

2.1 Innovators: Venturesome

Venturesome is the prominent feature of innovators who are the first people to adopt an innovation. Innovator has the ability to bears loss from unprofitable innovator and to understand and apply complex technical knowledge. The innovator must be able to cope with degree of uncertainty about an innovation at the time of adoption.

2.2 Early adopters: Respect

Early adopter is a more integrated part of the local social system than are innovators. Most of them are opinion leaders of the social system. Change agent generally seeks these adopter categories to speed up the adoption process. Early adopters are not too far ahead of average individual in innovativeness. They serve as a role model for many other member of the social system. Early adopter decrease uncertainty about a new idea by adopting it. They convey the subjective evaluation of the innovation to peers through interpersonal networks.

2.3 Early majority: Deliberate

Early majority adopt new ideas just before the average member of a social system. They interact frequently with the peers, but seldom hold a position of opinion leader in a social system. They link between early adopters and late adopter categories in the diffusion process. Their innovation-decision period is relatively longer than that of the innovator and early adopter. Early majority consist of one-third of the member of a system.

2.4 Late majority: Skeptical

Late majority adopt new idea just the early majority. They also consist of one-third of the member of the system. Late majority do not adopt new idea until most other in their system has done so. The pressure from peers is necessary to motivate adoption.

2.5 Laggards: Traditional

Laggards are last in a social system to adopt an innovation in a social system. Laggards tend to be suspicious of innovation and change agents. Their innovation decision-process is relatively length with adoption. Resources of laggards are limited and they must be certain that the new idea will not fail before they can adopt.

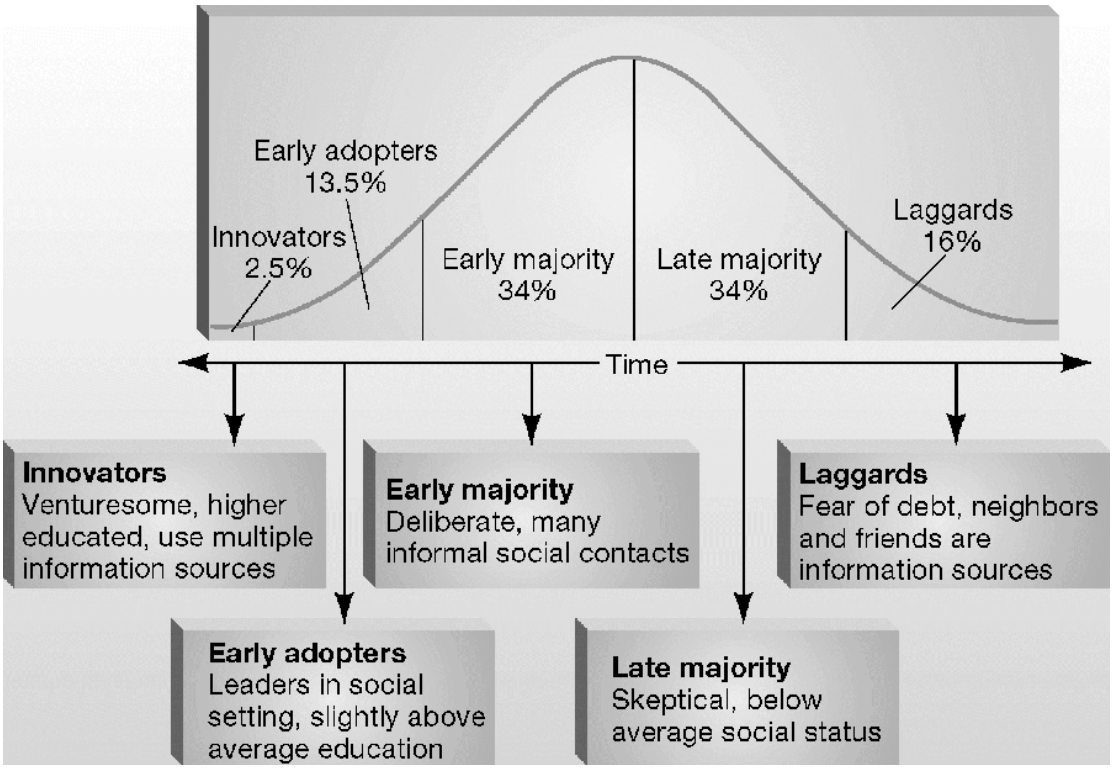

Figure 2 Classification of adopters

Source: Rogers

3. Factor influencing rate of adoption

There are many factors or conditions influencing rate of adoption (Mosher, 1978: 54-58).

3.1 Suitability of an innovation to the local agronomic conditions such as soil composition and drainage, air temperature and rainfall patterns usually set limit to the applicability of a particular innovation.

3.2 Profitability of the innovation; both input and output process must be taken into an account in calculating profitability. Though the technology is feasible, it may be adopted due to low profitability.

3.3 Arrangements for distribution of seeds, fertilizers, pesticide, or equipments that are parts of innovation are a follows:

3.3.1 Input must be technically effective. They must be suited to local condition, fit into each farmer's cropping pattern, not suffer unduly from pests and disease etc.

3.3.2 Input must be dependable quality. Farmers must have confidence that improved seeds, fertilizers, and pesticides really are what they said to be-one cannot tell their quality by looking at them.

3.3.3 Input must be appropriately priced.

3.3.4 Input must be available locally precisely when needed. Farmers cannot be expected to use fertilizer that arrived late.

3.3.5 Input must be offered for sale inappropriate sizes and amounts.

Improved Technology for soybean production

1. Ecological adaptation

Pulses training manual, TCP/MYA/ 0166 (A), Soybean (soya bean) can be grown successfully under a wide range of temperature condition. The minimum and maximum temperatures for germination of soybean seeds are approximately 5 ℃ and 40℃, respectively. The optimum temperature for rapid germination is about 30-35 ℃ moisture availability is particularly critical during the growth period, germination and pod filling. All commercial soybean production depends on rain fall as the primary source of water. In some areas, rainfall is supplementary with irrigation. High humanity and high temperature during late seed improvement, even after maturity if harvest is delayed, may result in poor seed quality. Soybean is highly photosensitive and they are short day plant and require day length of less than 14 hours.

2. Recommended variety

Owing to high photosensitivity of soybean varieties, it is essential to select the varieties suitable for particular region and season. Recommended exotic and local improved soybean varieties are shown in (Table 1). However, these varieties should be tested before use in commercial planting. Farmer should choose the cultivar that most closely meets their requirement.

Table 1 Characteristics of the Recommended Soybean varieties.

Varieties name	**Maturity duration (days)**	**100 seeds wt (gm)**	**Average yield (ton)**	**Seed color**
Jupiter	95-110	19.00	1.2-1.6	Pale Green
SB45	90-100	14.00	1.2-1.6	Straw
SB60	75-90	20.00	1.2-1.6	Straw
GM-91-18	95-100	18.00	1.2-1.7	Straw
CPS-I	95-100	14.00	1.2-1.8	Straw
China	100-120	22.00	1.4-1.8	Yellow
Shansein	100-120	10.00	0.8-1.2	Green
Local	100-120	8.00	0.8-1.2	Straw

3. Seed rate

To achieve the desired plant density, seed rate decided on the basis of seed size, purity and germination percentage. The required seeds rate is generally 70-80 Kg per hectare (0.8-1 basket/ acre) for row planting and 80-120 Kg (1-1.5 basket/ acre) for broadcasting. Germination should be tested before planting. The seeds should be graded and bigger seeds selected for planting.

4. Soil fertility management

Improvement of the soil physical, chemical and biological properties for soybean growing is one of the practices. This time, due to the soybean cultivation

again and again and soil erosion, organic matter content in soybean field has been reduced and pH become low. The top soil is often coarse texture and it is necessary to green manual or animal waste to improve to soil productivity.

Northern Shan State area, most of the soil is also acid soil which will undoubtedly be liming in order to produce high soybean yield. Liming will be applied and incorporated into plough layer several months before soybean is planted (MAS, handbook, 2004).

For good land preparation, one deep ploughing followed by two to three cross harrowing and levelling is required. Although, soybean need as a good seed bed, which is free from weeds and has optimum moisture for good seed germination and emergence.

Myanma Agricultural Service (MAS) recommendation for addition of organic manure and lime for soybean cultivation are as follows:

4.1 Incorporate 3 tons of cow dung per hectare and 1 ton of green manual before ploughing.

4.2 Incorporate 1 ton of lime, 3 months before growing of soybean.

5. Nutrient management

Borkert,and Sfredo (1994: 175) stated that soybean nutrients are often divided into macronutrients and micronutrients. Management for major nutrients such as Nitrogen (N) , Phosphorus (P), Potassium (K), Sulphur (S) , Megnesium(Mg) together with micronutrients where needed in another high priority area in this package of practices.

Large amount of Nitrogen are required for good soybean production. Phosphorus management is critical to the production soybean and needed of

Potassium large mount. Location specific target yield based fertilizer guidelines are available for all age class of soybean in MAS hand book of fertilizer recommendation for soybean.

6. Seed inoculation with bacteria culture

Many soybean growing areas produce inoculate using rhizobium strains selected for survival in the soil, competitive and efficient of N-fixation guidelines for using are available in (DOAE, hand book, 2004).

7. Planting method

There are many ways of soybean cultivation such as broadcasting, line / hill sowing, bed culture and ridge culture depend on cultivation site. It used the broadcasting method on the river banks after the water has reduced. Rain fed area, sowing generally done in rows or hills. High land area, it is usually grown hill sowing or line sowing. However line sowing can get more yield than broadcasting. The recommended spacing for rowing planting is as follows.

1. Row to row - 20cm - 30cm
2. Plant to plant - 4cm - 6cm

Sowing can be done manually or by seed drill. The seed should be placed at a depth of 2-4 cm. Germination and emergence of seeding are severely affected if deep sowing is practised. The optimum plant population is 406,000 with a range of 406000 to 609600 plants per hectare.

1. Soybean cropping patterns

The following cropping patterns are commonly practised in different environment.

1.1 High land (rain fed area)

It is sown with monsoon rain May and harvested in July. It is followed by garlic, wheat, Niger, etc.

1.2 With irrigation

In June or July rice, maize, potato and, etc are sown and harvested in November. And then it left fallow up to January. In February, when temperature rises again, soybean is sown with irrigation.

2. Planting time

The best planting time for soybean varies with region. The optimum sowing times recommended are as follows:

Pre- monsoon planting	- Feb - March (with irrigation)
Monsoon planting	- May - June
Mid- monsoon planting	- August - September

3. Irrigation water

Soybean need to get water at flowering and pod filling for summer and early monsoon growing time essentially, enough moisture because of the occurring the drought situation, it need to give water at that time for monsoon soybean.

4. Plant protection

4.1 Insect pest management

Gazzoni, (1994: 94 -100) showed that the important of insect as a yield reducing factor increase dramatically when moving from temperate to tropical region.

Important environmental factors influencing these relationships are weather condition, plant species present, competitors, soil composition management and human intervention to control insect outbreak.

For insect/pest problem, first it should be done insect identification. After identification the pest, sampling is needed to make estimates of insect numbers and injury. After sampling, the situation must be evaluated to determine if management action is necessary based on potential effect of pests on soybean and the cost associated with managing the pests (Higlay, 1994).

Therefore, more emphasis is given to use safe insecticides at correct amount to minimize pest damages. Implementing Integrated Pest Management (IPM) strategy is intended to reduce the cost while reducing environmental pollution (IPM) practices are as follows:

4.1.1 Deep summer tillage or no tillage.
4.1.2 Use appropriate varieties.
4.1.3 Timely and collective cultivation
4.1.4 Maintenance of appropriate plant density.
4.1.5 Balance fertilizer application.
4.1.6 Proper inside outside weed management.
4.1.7 Appropriate insect surveying procedure.
4.1.8 As a last resort, use chemical pesticide.

4.2 Disease management

Yorinori, (1994: 37) stated that more than 100 soybean diseases have been recorded. As most disease causing organisms are seed-borne, the uses of pathogen-free seeds or chemical seed treatments are essential for preventing or minimizing losses.

Ferreira, (1994: 61) mentioned that soybean diseases caused by bacteria are common everywhere soybean is grow.

Mendes, (1994: 75) showed that nematodes cause little or no damages to soybean but severe damage can be caused by root-not nematodes and cyst nematodes.

In order to manage soybean diseases in farmer's fields, integrated disease management program has to be adopted. This program emphasis on the use of resistant cultivar, planting clean, pathogen-free seed, crop rotation with non-susceptible crops, complete covering plant residues by ploughing after harvest and avoiding work in the crop when foliage is wet.

4.3 Weed management

Weed management is a serious problem in soybean production. It is recommended to adopt integrated weed control practices (IWP). This practice involves combination of control methods that can lower weed infestications without having a great impact on the environment. Methods for control are as follows:

4.3.1 Preventive control

Preventive involves the use of practices that avoid the introduction of weed species into growing area. As general preventive practices, the use of certified seeds, clean equipment, all means of weed control to avoid weed seeds production and crop rotation are suggested.

4.3.2 Eradication

Eradication is the use of whatever means necessary to completely destroy weed seeds or plants on a farm.

4.3.3 Cultural control

Cultural control measures include proper land preparation, varieties selection, and crop rotation management.

4.3.4 Physical control

Hands pulling, hand hoeing and animal or tractor-powered cultivation are common method of controlling weeds in soybean.

4.3.5 Chemical control

Chemical control is one of the most used methods in soybean production. Herbicide can be applied pre-plant incorporate (PPT), pre-emergence (PE) or post emergence (POST) depending on their characteristics.

4 Harvesting and threshing

Soybean should be harvested as soon as the seed mature with a moisture content of about 13-14 %. Delayed harvesting leading to pod-shattering is one of the major causes of yield reduction. At maturity, the pod colour changes to golden yellow and the leaves turns yellow and drop. Crop should be harvested when 95%of the pod reaches maturity.

Harvesting should be done by cutting the stalks from the ground level with sickles the harvesting plants should be left on the threshing floor for drying for 3-4 days. The dried plants can be threshed either by beating with wooden sticks or by thresher. To ensure high seed quality, cracking of seed-coat should be avoid. Clean soybean seed should dried to 9 % or less moisture.

Soybean extension in Myanmar

Soybean is one of the oldest food plants and modern day's success story with many users. Annual area under soybean in Myanmar was about 153,000 ha and producing about 172,000 metric tons (2005-06).

During the five years (2001-02 to 2005-06) growing has increased about 35,000 ha and yield per ha has raised approximately 0.15 tons per ha. And also productivity improved 51,000 metric tons (Table 2).

Table 2 Soybean Growing Area, Yield and Production in Myanmar

Year	Areas (ha)	Yield (Mt/ha)	Production (Mt)
2000	34000	0.80	27000
2001	114000	0.97	110000
2002	118000	1.02	121000
2003	116000	1.07	124000
2004	135000	1.10	148000
2005	145000	1.15	167000
2006	153000	1.17	172000

Source: DAP (2006)

Areas were remarkable progress in growing area, but not increase yield per ha because most of the area were not using the high yield varieties. Thus Department of Agricultural Research (DAR) has made the selection of soybean varieties for adaptation to region and Myanma Agriculture Service (MAS) has introduced the promising varieties such as SB 45, SB 60, Crawford, Clerk and GM 8.

Besides Myanma Agriculture Service (MAS) has carried out the transfer of improved soybean production technology. Moreover it has educated by extension activities likes distribution of literature, training ant demonstration plots continuously.

Myanmar's edible oil crop sector has being developed by increasing oil production and improved oil processing technologies including soybean by Oil Crops Development Project. It has taken place for production the availability of improved seed and also through the adaptation of improved farming system. Therefore it has been promoted by participation in extension approaches such as the establishment of several demonstration fields and the organization or farmers' field school (FAO, 2006)

Soybean extension in study area

In Northern Shan State area, which is situated in Northeastern part of Myanmar, organized five Districts including twenty four townships and wa region. In this area, soybean cultivation has existed for a long time. Soybean is called the 'Pepoke'by the local people who regard it traditional food most commonly used such as soybean grain, tofu, soysaurce, soycard and soysprout, etc. It is usually grown as sole, mixed or intercropped with maize, sorghum or sunflower. In this region, it has grown about 34,000 ha with productivity 40,800 metric tons.

Lashio, Hsipaw and Kyaukme townships, there are largest soybean growing area in Nothern Shan State, commercially cultivated and also potential area. Within these townships, area production and productivity of soybean is as follow;

Table 3 Soybean Grown Areas, Yield and Production in Study Areas

year	Lashio			Hsipaw			Kyaukme		
	Areas (ha)	**Yield (t/ha)**	**Production (Mt)**	**Area (ha)**	**Yield t/ha**	**Production (Mt)**	**Area (ha)**	**Yield (t/ha)**	**Production (Mt)**
2002	2631	1.08	2852	8027	1.17	9470	2178	1.12	2446
2003	2853	1.10	3170	8755	1.19	10497	2343	1.15	2704
2004	3003	1.13	3394	9220	1.22	11267	2482	1.16	2891
2005	4697	1.14	5366	12936	1.27	16508	4042	1.20	4850
2006	3240	1.35	4390	9671	1.36	13248	2703	1.33	3608

There were gradually increasing grown areas and production has been improved year by year by supporting to the soybean farmers. Previous times soybean farmers have used to grow local high yield cultivars and practiced traditional methods. Thus Myanma Agriculture Service (MAS) has given assistance such as distribution of some seeds, fertilizers and extension methods for multiplication of seeds to soybean production farmers. Because of substituting the improved varieties and technology, in some areas grow local varieties and methods, yield has been rising more than previous times.

Nowadays in terms of local major crop, soybean, Myanma Agriculture Service introduces to farmers new varieties and also technology with using extension activities. Besides Project has collaborated with MAS and provided to farmers, improved seeds, and appropriate training and demonstration plots with using improved technology.

Related research

Demir (1976) studied on the adoption of new bread wheat technology in four selected regions in Turkey. The study was carried out on factor affecting adoption of HYV and application of fertilizer. Results from the multivariate analysis of HYV

adoption decision showed that topography, seed availability, and government purchasing activities were most important variable affecting the adoption of HYV. In addition, education, family size, wheat sales and land ownership had a smaller estimated effect on adoption. Two other factors the perceived weather risk and extension activities had a significant impact on adoption of HYV two regions. Membership of organization, field distance, wheat sales, tractor and use of HYV influenced the adoption of fertilizer application in all regions.

Herdt,and Capule (1983) studied the adoption, spread, and production impact of modern rice varieties in Asia. Adoption was related to the province, year, organizational membership and source of information but not to farm size. Tenure made significantly different in both varieties and fertilizers adoption. A positive relationship between credit and adoption was well document. Risk and cost price consideration led to adopt on of modern varieties. The precise difference in the production function of modern and traditional varieties may affect the choice of technology by different farmers. All Asia countries agreed than irrigation facilities and water control essential to modern varieties adoption.

Manuel, Huelgas, and Espanto **(**1987) studied the Adoption of soybean in Lupao, Nueva Ecija, and the Philippine which was the third world country report and assessed the contribution of physical and socio-economic factors affecting soybean yield and evaluated the economic performance of farmers. Preliminary finding of this study implied and interrelatedness of factors that constrained soybean yield. This study showed that the physical variable was found to be significant factors explaining variation in soybean yield. Farm size was found to be significant. Extension services, sources of information and marketing were independent of farm size. Credit positive factors and demonstration farm should be carried out continuously and re-evaluates the agronomic performance to adopt the technology of soybean. Technological assistance, supported by government policy, should be strengthening to increase communication between applied research, extension and farmers. Extension workers must also empower to closer supervision and facilitates the solving the problem associated with the introduction of new technology.

Vongsud (1989) studied the farmers' adoption of rice production technology on rice promotion project in Changwat Chachoengsao. This study proved that there were no different in rice production technological among the farmers who were different in education level, total annual income, size of rice production area and frequency of government official's visit. The significant suggestion of the farmers were diseased and pest resistant seed varieties and suitable for the specific area should be proved and also the recommended formulas and enough quantity of fertilizer should be available in time.

Moe (1993) mentioned as in the 1970s, the soybean production status was low in demand and low in yield because of growing the local varieties. Local varieties are thermo and photo sensitive. Therefore more than 100 exotic varieties have been introduced into Myanmar since 1991. Although, high yield varieties were released, technology for processing soybean into product was weak. Consequently, it was increased in soybean area and production less.

Boonruang (1995) analyzed the farmers' adoption of corn production technology under the Hybrid Corn Promotion Project, Changwat Chumhon. This study revealed that the technology of soil preparation, fertilizer application, seed rate and harvesting were adopted by 78 % and over of farmers. The technology adopted less than 78 % were pest and diseases control, herbicide application and improving corn's quality. There were no different in corn production technology adoption among the farmers with different backgrounds in education level, total income, farm sizes, and extension activity participation.

Upaniskorn (1997) studied the socio-economic factors affecting adoption of dry season mungbean planting technology of farmers in Borommathat Operation and Management Project, Chai Net Province. One hundred and twenty farmers were selected by stratified random sampling. The data collection was collected by using interview schedule. The hypothesis was tested using chi- squire. Results of this study showed significant different between independent variables such as age, education level, income, planted area, labor, extension service that affect support, the adoption

of technology on soil preparation, time of planting, using of rhizobium, cropping method, weed control and harvesting. The problem mostly encounter were seed germination, knowledge on rhizobium, insect control and poor tillage.

Beyene and Gebreselassie (1998) studied the adoption pathway for new agricultural technologies: an approach and an application to vertisol management technology in Ethiopia. The principal component of the technology package is animal drawn drainage equipment called broad bed maker (BBM) which is used to solve the problem of waterlogging of vertisols in order to grow improved wheat varieties. Analysis of sample of 585 households from three sites confirmed that example classification of farmers as adopter and non adopter was inadequate to understand the adoption process. To acquire knowledge about BBM is significantly related to adoption but differently to adoption it continuously or discontinuously. In the tobit model, only area under crop land, work animal ownership, BBM training and access to credit had significant positive influence and family size had significant negative influence on the probability of adoption period of use of BBM. In the truncated model the factors that had influence and directions of their influence were the same as those in tobit model, except area of crop land, which no significant influence.

Thongben (2003) investigated the socio-economic aspect of farmers on adopting of safe vegetable production in Mueng District, Nakhon Pathom Province. Factors such as land size, household labor, income and information gain were not related to adoption. But experiences in safe vegetable cultivation, debtness of farmers were related to adoption of safe vegetable production technology.

Mendis (2005) studied the factors affecting adoption of recommended crop management practices in paddy cultivation in Kulutara District, Sri Lanka. The study revealed that adoption of soil fertility improvement and sustenance practice was significantly related to education, land, income, credit, sources of information, extension activities and visit, and membership in farmers organization and adoption of fertilizer management practices were significantly related to education, land tenure, income, source of information, extension activities and visits and membership in

farmer organization. Furthermore, adoption of cultural and preventive weed control practices were significantly related to land, income, credit, source, of information, extension activities, and extension officer's visist; and adoption of herbicides recommendations were significantly related to land and income. Moreover, insect pest management practices were significantly related to land tenure, income, sources of information, extension activities, extension officer visits and membership in farmers organization.

Masavisuthi (2005) studied the farmer's adoption of sunflower technology under extension and development project. This research revealed a moderate of knowledge about the sunflower production among the farmers and their adoption of sunflower production technology was at the low level. The socio-economic factors were correlated with adoption of sunflower production technology including education, secondary income of farmers and income from sunflower at the 0.05 level of statistical significance. The knowledge about sunflower technology factors were correlated with the adoption of sunflower technology at the statistical significant. On the other hand, the more knowledge the farmers have, the higher level of adoption in sunflower production technology.

Hypotheses

Hypotheses 1 Age of farmers is related to the adoption of improved technological packages in soybean production.

Hypotheses 2 Level of education of household farmer is related to the adoption of improved technological packages in soybean production.

Hypotheses 3 Size of farm is related to the adoption of improved technological packages in soybean production.

Hypotheses 4 Tenure of land is related to the adoption of improved technological packages in soybean production.

Hypotheses 5 Family labor is related to the adoption of improved technological packages in soybean production.

Hypotheses 6 Farm income (Profit over cash expenditure) is related to the adoption of improved technological packages in soybean production.

Hypotheses 7 Off farm employment is related to adoption of improved technological packages in soybean production.

Hypotheses 8 Credit of cultivation is related to the adoption of improved technological packages in soybean production.

Hypotheses 9 Membership in farmers' organization is related to the adoption of improved technological packages in soybean production.

Hypotheses 10 Knowledge on improved soybean production technology is related to the adoption of improved technological packages in soybean production.

Hypotheses 11 Participation in extension activities such as an individual farm visits, group contact, mass media and demonstration in growing season are related to adoption of improved technological packages in soybean production.

Conceptual Frame Work

The more complex the idea, the more slowing it will be adopted (Bohlen, 1964). Getting a new idea adopted, even when it has obvious advantages, it often very difficult. As Roger (1995: 1) stated many innovations required a length period, often of many years, from the time they become available to the time they are widely adopted. Therefore, a common problem for many extensionists and organization is how to increase the number of adopters.

An individual's decision to make and innovation adoption is determined by many factors: socio-economic factors, resources, personal values, profitability, suitability. Characteristics of decision making unit: socio-economic characteristics, personality variables and communications behavior, play a major role in knowledge stage of adoption process (Rogers, 1995: 161-173). Rogers further indicated that persuasion stage of adoption process of an individual is influenced by perceived characteristics of the innovation: relative advantages, compatibility, complexity, trialability and observability. As Van den Ban and Hawkins (1997: 97) mention, farmers cannot be recommended to adoption innovation because this decision should depends on their resources and personal values.

Relationships between independent variable and depended variable are shown in figure 1.

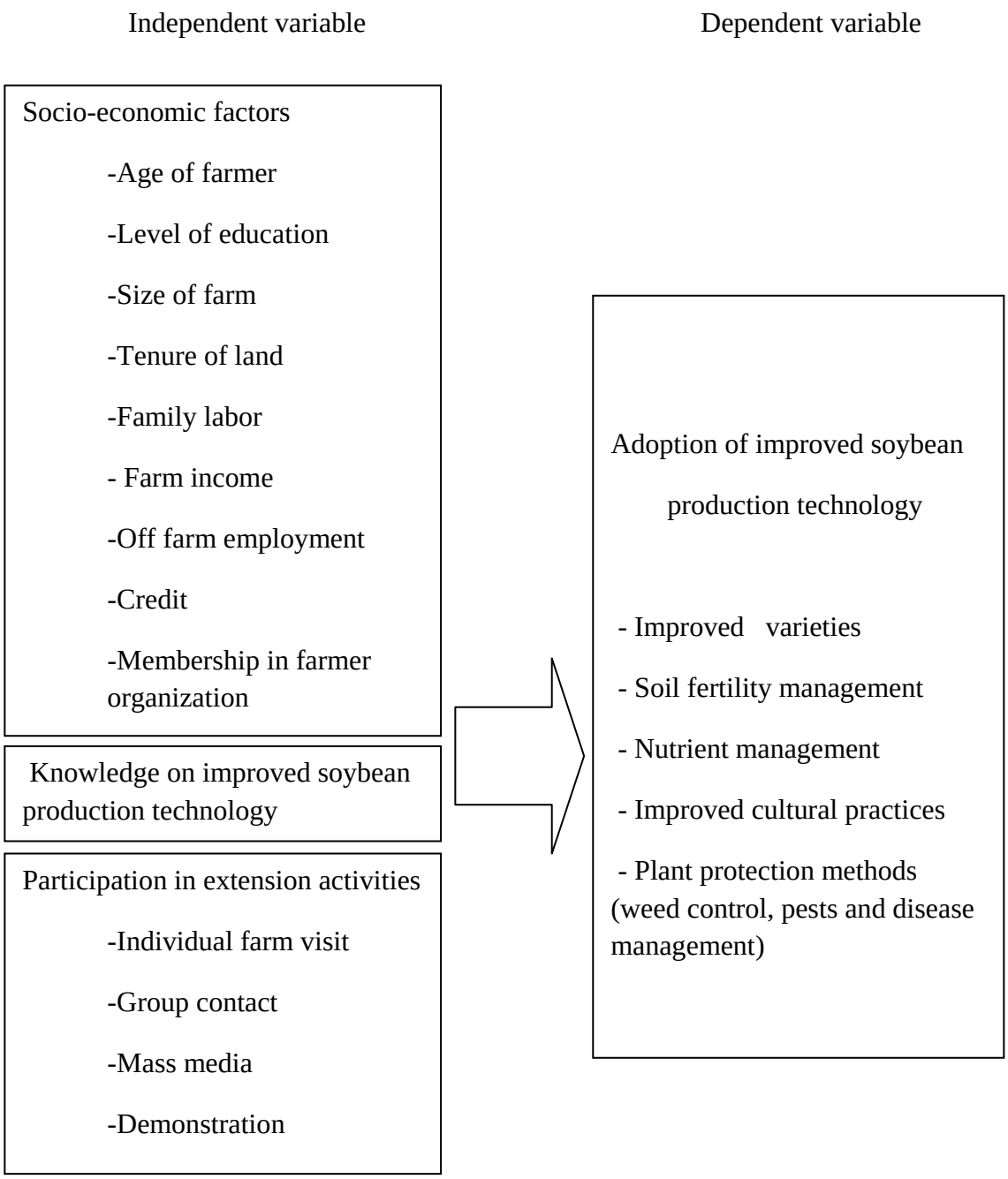

Figure 3 Schematic Diagram of Conceptual Framework

CHAPTER III

RESEARCH METHODOLOGY

Data Collection Procedure

Local of the study

Study was conducted at Lashio, Hsipaw and Kyaukme townships. Northern Shan State in which project has been operated the activities related the oil crops.

Research design

This study used survey research design.

Population and sample technique

There were 25743 soybean farmers representing to about 15,306 hectares in Lashio, Hsipaw and Kyaukme townships (MAS, Northern Shan State, 2005 Report). Stratified random sampling technique was applied to draw the sample for data gathering. Twenty five percent of the agricultural ranges, 6 ranges were selected for the study. Selected ranges were as follows:

1. Lashio Township
    - 1.1 Malhan
    - 1.2 Lashio gyi
2. Hsipaw Township
    - 2.1 Samsal
    - 2.2 Samphate
3. Kyaukme Township
    - 3.1 Myinetine

3.2 Naungpain

There were 6436 soybean farmers in selected Agricultural Ranges. Sample size, allow to 5% error margin, was calculated by using Yamane method and came to (377) samples (Yamane, 1973: 1088).

$$n = \frac{N}{1 + Ne2}$$

Where n = sample size

N =Population

e = margin of error

Representative sample that was proportionate to the population of each Agricultural Instructor Range was calculated using the following formula (Libero, 1996: 40).

$$n_1 = \frac{N1}{N} \times n$$

Where n_1 = Desired sample size for the Agricultural Instructor Range

N1=Population of the selected Agricultural Instructor Range

N = Total population of 6 Ranges

n = Total sample of study

Accordingly, 377 farmers were randomly selected from the 6 selected ranges Table 4.

Table 4 Distribution of farmers from 6 ranges in Lashio,Hsipaw and Kyaukme Townships

Agricultural Instructor Ranges	Population	Sample
Malhan	817	48
Lashio gyi	1023	60
Samsal	1400	82
Samphate	1636	95
Myinetine	950	56
Naungpain	610	36
Total	6436	377

Research Instrument

Interview schedule, consisted of open-ended and closed question, was prepared in English and translated into Myanmar Language (Local Language) by researcher.

Two scholars of Myanmar Language reviewed the translation of the interview schedule for the translation of technical terms, to avoid any misunderstanding on the part of the farmers.

Pre-testing of the instrument was done with 20 farmers within the townships but outside the sample area to find out the validity, soundness, and the weakness of the question. The weakness gathered from pre-test served as the bases for improving the interview schedules before finalizing it.

Research Method (Data collection)

Preliminary data was gather form the State Manager Office and Township Manager Office. Gather of field data was started in early April 2008.

List of name and addresses of farmers were gather from village level extension workers known as Malhan , Lashio gyi, Samsal, Samphate , Myintine and Naungpain.

Researcher and two assistants were organized the team and hold the interview with the farmers. The assistants were trained and content of interview schedule was explained to them to avoid of minimize the any possible that could occur during the data collection in April and May, year 2008.

Measurement of data

Age of household head farmer was measured in year. Age was grouped into: under 35, 35 to 45, and 46 to 55and above 55 years.

Level of education of household head farmers was categorized into 5 groups: non school, primary school (grade1- 5), middle school (grade 6-9), high school (grade 10-11) and above grade 11.

Size of farm was measured in ha and this level categorized into 3 groups: 0.25 and less than 0.25 ha, 0.26 to 0.5 ha, above 0.5 ha.

Land tenure was categorized into 3 groups: owner, tenant farmers, and joint owner.

Family labor was measured in number of family members actively supported to head of household farmers in soybean cultivation. This variable was divided into 3 groups: no supporter, 1-2 supporters and above 2 supporters.

Farm income was calculated as net profit cash receive from monsoon soybean production in per acre. Net profit over cash was calculated by considering total return, production and marketing cost.

Total return = yields ×selling price

Production and marketing cost= input and all services cost

Net profit = total return – production and marketing cost

Farm income divided into 3 groups: 100000 kyats and less than 100000 Kyats, 100000-150000 and more than 150000 Kyats.

Off farm employment was measured, whether farmers were employed in: government sector, private sector, any organization or self employment in addition to farming. The farmers were grouped into 2 groups: employment and unemployment.

Credit was measured whether farmers got credit for 2007-08 soybean growing season. Farmers were categorized into 2 groups: obtained credit and not obtained credit.

Membership in farmer organization was measured as whether farmers were a member of a farmers' group or organization. Variable was divided into 2 groups: member or non member.

Technological knowledge of soybean farmers was divided into three sub variables such as fully knowledgeable famers, partial knowledgeable farmers and non knowledgeable farmers.

1. It was measured to fully knowledgeable farmers who have known the knowledge on the five practices of soybean production technology likes improved varieties, soil fertility management, nutrient management, cultural practice and plant protection methods and applied this knowledge during in year 2007-08 soybean growing season and judged on reasonable criteria.

2. It was measured to partial knowledgeable farmers who have known the

knowledge on some practices of soybean production technology and applied this knowledge during the year 2007-08 soybean growing season and judged on the reasonable criteria.

3. It was measured to non knowledgeable farmers who did not know about the knowledge on five practices of soybean production technology and not applied.

Knowledge on improved soybean production technology of farmer was measured in detail study on improved varieties, soil fertility management, nutrient management, cultural practices and plant protection methods.

1. Farmers' knowledge on improved varieties was measured; due to get the high yield, adaptable to region and resistant to pests and diseases.

2. Farmers' knowledge on soil fertility management was measured; incorporate the cow dung and green manure, incorporate the liming in acid soil and summer polughing and deep ploughing.

3. Farmers' knowledge on nutrient management was measured; use of natural fertilizers and use of appropriate chemical fertilizers and use of appropriate foliar fertilizers.

4. Farmers' knowledge on improved cultural practices was measured; use of high varieties, appropriate growing time, appropriate plant population and water management.

5. Farmers' knowledge on plant protection methods was measured; pests control, diseases control and weeds control.

Sources of farmers' knowledge on soybean production technology, where farmers can get all the possible sources was grouped as; farmers by farmers, extension workers and research station.

Extension activities such as individual farm visits, group contact, mass media and demonstration during in year 2007-08 growing season were measured.

1. Individual farm visits of extension agent to farmers was measured in number of visits during year 2007-08 growing season. It was categorized into 3 groups: no visit, one visits, 2-3 visits, more than 3 visits.

2. Group contact of extension agent to farmers was measured. Variable was divided into 3 groups: no participation, one time, 2-3 times and more than 3 times.

3. Mass media was measured to disseminate the new information by extension agent to farmers. Variable was divided into 3 groups: sound (radio, audio cassettes), moving pictures (television, film, and video); print (poster, newspaper, leaflets).

4. Demonstration of methods or results, take place by extension agent to farmers was measured year 2007-08 growing season. Variable was categorized into 3 groups: take place one time and less than one times, 2-3 times, and above 3 times.

Adoption of improved varieties was measured as whether farmer used improved varieties for cultivation. Variable was categorized into 2 groups: adopted and not adopted.

Adoption of soil fertility improvement and practices was considered application of any kind of organic manure: straw, green manure, cow dung, poultry manure and burnt paddy husk and use of liming for soybean cultivation. This variable was categorized into 2 groups: adopted or not adopted.

Adoption of nutrient management practices was considered three attribute: use of fertilizer, number of fertilizer application, and amount of fertilizer applied Kg/ha, foliar spray and use of rhizobium. Variable was measured as guidance of MAS

recommendation on 3 above mention attributes: Variable was categorized into 2 groups: adopted or not adopted.

Adoption of improved cultivation methods was measured 5 attributes: seed rate, growing time, hill sowing of population plant per unit are, line sowing of plant per unit area and watering. Variable were 2 groups: adopted or not adopted.

Adoption of plant protection methods were measured as follows:

For weed control was measured 6 attributes: use of clean seeds, proper land preparation, maintenance of weed free bund and levees, hand pulling, hand hoeing and animal or tractor and use herbicide (kinds, times). Variable was grouped into 2 groups: adopted or not adopted.

For Pests and diseases occurrence was measured 8 practices: deep summer tillage or no tillage, use appropriate varieties, timely and collective cultivation, maintenance of appropriate of plant density, balance fertilizers, proper inside and outside weed control, appropriate insect survey procedure and use chemical control. Variable was categorized into 2 groups: adopted or not adopted.

Data Analysis

Data was collected and presented through descriptive statistic such as frequency, percentage, and mean. Chi-square test (x^2) at 0.05 levels was employed to test hypotheses.

Figure 4 Map of Myanmar and Northern Shan State

Figure 5 Study Areas of Lashio, Hsipaw and Kyaukme Townships

CHAPTER IV

RESULTS AND DICUSSION

There were study results of socio-economic factors, knowledge on improved soybean production technology, extension activities, adoption of improved soybean production technology, hypotheses testing and problems and suggestions shown parts as follows:

Socio-economic Factors

Socio-economic factors of 377 soybean production farmers in Northern Shan State, age, size of farm, level of education, tenure of land, family labor, farm income, off farm employment, credit and membership in farmer organization were presented as follows;

Age of farmers

Soybean farmers' age ranged from 25 years to 80 years with the average age of 52 years. Most of the farmers at 61.28% were between 35-45 years and 46-55 years old. Nearly the 19.36% of the farmers were under 35 years while the same percentages 19.36% were more than 55years old.

Size of farm

Most of the farmers at 57.82% cultivated more than 0.5 ha soybean land. Then 38.46% of the farmers cultivated 0.26-0.5 ha of soybean land, while a small proportion of 3.72% of farmers cultivated 0.25 or less. So the cultivated area of farmers varied from 0.25 to 2 ha and average cultivated land holding in 2007-08 soybean cultivation season was 0.64 ha.

According to the studying of farmers, soybean growing area cannot be extended now because it has competition with vegetables and summer paddy.

Level of education

The majority of soybean production farmers at 58.09% had primary education grate 1-5, approximately 16.71% of farmers obtained secondary education grade 6-9 and 21.75% had no-education (informal education). A few of the farmers 3.18% had high school education grade 10-11 while only one of the farmers had university level. Overall 20% of the farmers had achieved an education above grade 5 level and so 78.25 % had formal education.

Myanmar is endeavoring to enhance education through two parallel streams-formal education and non-formal education. This is being done by the State with the aims of creating a learning society in Myanmar; by becoming lifelong learners and creating non-formal education with the aim of upgrading education for all. Myanmar has been striving for the increase of the country's adult literacy rate annually with the figures attaining 94.83% in 2008. Therefore finding of this study supported that literacy rate of Northern Shan State was 78.25%.

Tenure of land

Owners 87.80% cultivated their own soybean production land, while 11.94% of soybean farmers were tenant farmers. Only one of the farmers was a joint owner who cultivated for benefits which were divided amongst each other.

All most of the farmers cultivated the land by themselves. Unfortunately tenant farmers were relative of own farmers and joint system was very rare for soybean production.

Family labor

Findings of the survey showed that 17.51% of the soybean farmers had one family member, who actively supported the head of family in soybean cultivation, while 10.08% of farmers did not have any family members to help them. The majority of 72.41% of the farmers had more than 2-4 supporters for the whole season of soybean cultivation.

Farm income

Depending on the production and marketing cost, yield, selling price, return and profit margin per acre in Northern Shan State 2006-07 growing season, farm income was Myanmar kyats 276000 kyats for average yield of 16-18 baskets per acre, 216000 Kyats for average yield of 12-14 baskets per acre, 159168 kyats for averages yield of 8-10 baskets per acre. Most of the farmers at 39.79% received profit over kyats 191000 per acre and 30.50% obtained profit over kyats 131000 per acre, while the remaining 29.71 % received a profit less than 95000 Kyats per acre.

Off farm employment

Some of the soybean farmers at 28.91% were engaged in some other occupation in addition to farming. Most of the farmers were self-employed such as sellers. Most of the farmers at 71.09% were not working in another occupation than other farming.

Credit

More than half of the farmers at 67.37% did not obtain credit 2007-08 cultivation season. The rest of the farmers at 32.63% obtained credit from different sources: state bank 5.69%, money lending organization 3.25%, village money lender 23.58%, traders 55.24%, friends 15.45% and relatives 7.30%.

The establishment of the credit provision mechanism to reach soybean farmer is essential and prerequisite to promote the soybean production technology. In this context, strengthen the credit institutions need to address some of the critical problem of the adoption.

Membership in farmers organization

In this research, 37.40% of the farmers had membership in a farmer organization, while the remaining 62.60% of famers had no membership in any farmer organization. When members were asked what were the benefits and services gained by being a member, 7.80% of the members mentioned nothing important while 92.20% stated that they obtained benefit in many ways such as advice on farming (78.10%), a share of resources (63.12%), credits facilities (49.59%) and solving a problem (24.11%) shown in (Table 5).

Table 5 Socio-Economic Profile of the Farmers of the Northern Shan State

(n=377)

Socio-economic factors	**number**	**percent**
Age of farmers		
Under 35 years	73	19.36
35-45 years old	119	31.56
46-55 years old	112	29.72
Above 55 years old	73	19.36
Size of farm		
0.25 ha and less than 0.25	14	3.72
0.26 ha to 0.50 ha	145	38.46
Above0.5ha	218	57.82
Level of education		
No-Education	82	21.75
Grade 5 and less than grade 5	219	58.09
Grade 6-9	63	16.71
Grade 10-11	12	3.18
Above grade 11	1	0.27
Tenure of land		
Owner	321	87.80
Tenant farmers	45	11.94
Joint owner	1	0.26
Family labor		
No supporter	38	10.08
1-2 supporters	66	17.51
Above 2 supporters	273	72.41
Farm income		
75000-100000 Kyats	112	29.71
100000-150000 Kyats	115	30.50
Above150000 Kyats	150	39.79
Off farm employment		
Employed	109	28.91
No employed	268	71.09
Credit		
Obtained	123	32.63
Not obtained	254	67.37
Membership in farmers organization		
Member	141	37.40
Non-member	236	62.60

Knowledge on Improved Soybean Production Technology

Knowledge of the farmers was measured by asking 10 questions related to improved soybean production technologies. The total score for 10 questions ranged from 0(zero) to 24, with results classified into three levels by using the class interval of Harshbarger, (1977). The reliability coefficient of farmer's knowledge questions was 0.614. Thirty-two percent of the farmers had a high score level knowledge (17-24) on improved soybean production technologies, while 55 % had a medium score level of knowledge (9-16) and 13 % had a low score level (0-8) (Table 6).

High score-level farmers had knowledge about improved soybean production technologies such as using the improved soybean varieties, soil fertility management practices, nutrient management practices, improved cultural practices, plant protection methods and target yields for soybean production. Medium score level farmers had knowledge about improved soybean varieties, soil fertility management practices except for liming, using the chemical fertilizers except for using the foliar spray and rhizobium, improved cultural practices and pests control. Low score level farmers had knowledge only of incorporating cow dung, using chemical fertilizers such as Urea, Tsuper and compound fertilizers, appropriate time of sowing, water management, harvesting in time and weed control (Table 7).

Table 6 Knowledge on Improved Soybean Production Technology of farmers

(n=377)

Knowledgeable farmers	**number**	**percent**
High score level farmers	119	31.56
Medium score level farmers	209	55.44
Low score level farmers	49	13.00

In detail study about the farmers' knowledge on improved soybean production technology, there were technically found that the inquiry of knowledge of farmers who had the knowledge about the improved soybean production technology as shown in (Table 8).

Improved varieties

For farmers' knowledge on improved varieties, 65.78% of the farmers had knowledge which was due to get high yield but 34.22% of the farmers did not know, 56.23% of the farmers had knowledge which was adaptable to the region but 43.77% of the farmers did not know. The 38.20% of the farmers had knowledge of resistance to pests-diseases but 61.80% of farmers did not know and only 68.17% of the farmers answered correctly the name of improved soybean varieties.

Soil fertility management

Similarly, for the knowledge of farmers on soil fertility management, 78.25% of the farmers had the knowledge of incorporating the cow dung and green manure but 21.75% of the farmers did not understand this. The 2.21% of the farmers had the knowledge of liming in acid soil while most of 97.88% of the farmers did not have this knowledge. The 57.29% of the farmers had knowledge about the fact of summer ploughing and deep ploughing, however 42.71% of the farmers did not know and 76.13 % of the farmers answered correctly recommendation of the soil fertility management practices.

Table 7 Farmers' knowledge of Improved Soybean Production Technology

(n=377)

Improved Technology	Correctly answer farmers		Incorrectly answer farmers	
	number	percent	number	percent
Improved varieties	257	68.17	120	31.83
Soil fertility management	309	81.96	68	18.04
Nutrient management	276	73.21	101	26.79
Improved cultural practices	263	69.76	114	30.24
Plant protection methods	187	46.60	190	50.40

Table 8 Detailed Study of Farmers' Knowledge on Improved Soybean Production Technologies

(n=377)

No.	Knowledge of improved technologies	Correctly answer farmers		Incorrectly answer farmers	
		no.	%	no.	%
1.	Improved soybean varieties were				
	(1) SB45, SB60,Yezin and china varieties	257	68.17	120	31.83
2.	Improved soybean varieties were				
	(2) high yield	248	65.78	129	34.22
	(3) adaptable to region	212	56.23	165	43.77
	(4) resistant to pests and diseases	144	38.20	233	61.80
3.	Soil fertility management practices were				
	(5) incorporate of cow dung, green manure	295	78.25	82	21.75
	(6) incorporate of liming	8	2.12	369	97.88
	(7) summer ploughing and deep ploughing	216	57.29	161	42.71
4.	Recommendations for improvement of soil fertility practices were				
	(8) incorporate 3 tons /ha of cow dung and 1 ton of green manure and composes	287	76.13	90	23.87
	(9) incorporate 1 ton of lime	3	0.79	374	99.21
5.	Nutrient management practices were				
	(10) Use of natural fertilizers	221	58.62	156	41.38
	(11)use of appropriate chemical fertilizers (Urea, Tsuper, Potash and compound)	250	66.31	127	33.69
	(12) use of foliar fertilizers (bio super)	44	11.67	333	88.33
	(13) use of rhizobium	4	1.06	373	98.94
6.	Recommendations for using the chemical fertilizers were				
	(14) Urea (65kg), Tsuper(130kg) and Potash (65kg) or compound (100 kg)per ha	222	58.89	155	41.11
	(15) 3 liters per ha of foliar fertilizers	44	11.67	333	88.33
	(16) 10 gm per ha of rhizobium	4	1.06	373	98.94
7.	Improved cultural practices were				
	(17) line sowing	199	57.79	178	47.21
	(18) the best time for pre-monsoon planting January to end of March	247	65.52	130	34.48
	(19) seed rates (70-80 kg per ha)	240	63.66	137	36.34
	(20) good harvesting time (95% of pod maturity stage)	220	58.36	157	41.64
	(21) watering after sowing and seeds setting times	168	44.56	209	55.44
8.	If pests and diseases problems observe in the field, important cultural practice was				
	(22) any steps to control pests and diseases	183	48.54	194	51.46
9.	If the weeds problems happen, important cultural practice was				
	(23) timely inter cultivation weeding	172	45.62	205	54.38
10.	Target yields for soybean production was				
	(24) 50 baskets per ha	176	46.68	201	53.32

Nutrient management

For the farmer's knowledge on nutrient management, 58.62% of the farmers had knowledge about the use of natural fertilizers but 41.38% of the farmers did not while 66.31% of the farmers had knowledge of the use of appropriate chemical fertilizers but 33.69% did not have this knowledge. The 11.67%of the farmers had knowledge about the use of appropriate foliar fertilizers but 88.33% of the farmers did not and 58.89% of the farmers answered correctly recommendation of using the chemical fertilizers.

Cultural practices

For farmer's knowledge on cultural practices, 57.79% of the farmers had the knowledge about the lining sowing practice but 47.21% did not know about it, and 65.52% of the farmers had knowledge of the appropriate growing time but 34.48% of the farmers did not know about it. Most 63.66% of the farmers had the knowledge on the using the optimum seed rates but 36.34% of the farmers did not know, and 58.36% of the farmers knew the points of harvesting in time but 41.64% of the farmers did not know. Less than half 44.56% of the farmers had knowledge on water management but 55.44% of the farmers did not have knowledge.

Plant protection methods

For the farmers' knowledge on plant protection methods were as follows; 30.77% of the farmers had knowledge about pests control but 69.23% did not recognize this, while the 20.42% of the farmers hand knowledge about diseases control but 79.58% did not have this knowledge. Also, 45.62% of the farmers had knowledge on weeds control but 54.38% of the farmers did not know about it.

Only 46.68% 0f the farmers answered correctly the target yields for soybean production and 53.32% did not.

The most prominent sources of information on knowledge of improved soybean production technology were obtained by farmers from farmers (62.60%) and the rest obtained it from government sources: extension agents (35.28%) and research station (2.12%) showed in (Table 9).

Table 9 Sources of Information on Farmers' Knowledge on Improved Soybean Production Technology

(n=377)

Sources of information	number	percent
Farmer from farmer	236	62.60
From extension agents	133	35.28
Research station	8	2.12

Extension Activities

Individual Farm Visits

According to the study, extension agents did not visit most farmers' homes or farms (62.33%) during 2007-08 soybean seasons. Approximately 21.49% of the farmers were visited one time while 12.20% of farmers were visited 2-3 times. The rest of the farmers (3.98%) were visited more than 3 times during 2007-08 soybean cultivating time (Table 10).

Group Contact

More than half of the farmers did not attend the group activities. Extension agents did not organize group activities for all farmers according to the study as 51.46% of farmers did not attend the group activities. However 32.36% of farmers had attended one times and 11.14% of the farmers had attended 2-3 times in discussion and training. The rest of the farmers 5.04% were participated more than 3 times during the 2007-08 soybean cultivation season (Table 10).

Mass Media

By using mass media, extension agents had contributed to change the behaviors of the soybean growing farmers. In this study, extension agents had communicated to 4.77% of farmers by sound, 2.92% of the farmers by moving picture and 31.56% of the farmers by printed media. However more than half of the farmers (60.75%) did not communicate in any mass media approach because they not reach a large number of the soybean farmers and had very rare facilities 2007-08 soybean growing season (Table 10).

Demonstration

There were the two types of the demonstration such as methods demonstrations and results demonstration. In this study, extension agent showed methods demonstrations to 27.35% of farmers and others were not shown likewise. Extension agent showed the results demonstrations to 3.18% of farmers and 96.82%of farmers did not participate in these activities (Table 10).

Table 10 Individual Contact, Group Contact, Mass Media and Demonstration

(n=377)

Items	Individual contact		Group contact		Mass media						Demonstration			
					Sound		Moving picture		Printed		Methods		Results	
	no	%	no	%	no	%	no	%	no	%	no	%	no	%
One time	81	21.49	122	32.36	18	4.77	11	2.92	109	28.91	93	24.66	12	3.18
2-3 times	46	12.20	42	11.14	0	0	0	0	10	2.65	9	2.39	0	0
Above 3 times	15	3.98	19	5.04	0	0	0	0	0	0	1	0.27	0	0
No mention	235	62.33	194	51.46	359	95.23	366	97.1	258	68.44	274	72.65	365	96.82

Adoption of Improved Soybean Production Technology

Adoption of Improved Soybean Varieties

According to the study 51.46% of the farmers cultivated improved soybean varieties, while 38.20% cultivated local high yield varieties and 10.34% cultivated local varieties (Table 14).

When farmers were asked what were the reasons to cultivate the improved varieties, local high yield varieties and local varieties, they specified 10 reasons for improved varieties which were introduced and distributed by Myanma Agriculture Service (MAS) and Department of Agricultural Research (DAR) and some seed selling shops, as they had increased yield (40.09%), were profitable (48.85%), had better response to fertilizers (17.24%) and matured in time (27.85%).

For local high yield varieties which were introduced to this areas but they could not express the origin, through which were well adapted and produced a good yield (23.34%), 36.34% were suitable for soil, 29.97% were less pest and diseases, ensure the market (29.44%) and other (3.7%). For local varieties which were grown long times and they suppose good in yield (3.45%), suitability for soil (8.75%), less pest and diseases (7.69 %) and others (1.5%) shown in (Table 11).

Farmers source of information on improved varieties was government source (47.19%) such as extension agents (72.50%), demonstrations (3.14%) and media (24.38%). The rest of the farmers (52.80%) obtained information non-government sources, farmer from farmer and seed selling shops (Table 16).

Table 11 Reason for Cultivating the Improved Varieties, Local High Yield Varieties And Local Varieties

(n=377)

Reasons	Improved varieties (51.46%)		Local high yield varieties (38.20%)		Local varieties (10.34%)	
	no	%	no	%	no	%
Good in yield	0	0	88	23.34	13	3.35
Increase yield	170	40.09	0	0	0	0
Suitable for soil	0	0	137	36.34	33	8.75
Profitable	154	48.85	0	0	0	0
Better response to fertilizer	65	17.24	0	0	0	0
Less pests/diseases	0	0	133	29.97	29	7.69
Mature in time	105	27.85	0	0	0	0
Low cost of cultivation	0	0	0	0	29	7.69
Ensure the market	0	0	111	29.44	0	0
Others	0	0	14	3.71	6	1.59

Note: Multiple responses

Adoption of Soil Fertility Management

This study revealed that 20.95% of farmers practiced soil fertility management while 79.05% did not (Table 14). Soil fertility management was practiced as summer ploughing and deep ploughing, fine harrowing and leveling and thus utilization of cow-dung, pig waste with composed soil yearly.

Inquiry about farmers' three main reasons for not practicing soil fertility management found the reasons as cost (60.74%), scarcity of organic matter (59.95%) and no time (29.18%) (Table 12).

Most of the farmers 33.74% sources of information obtained from government sources: Extension agents (77.11%), demonstrations and training (2.41%) and media

(26.38%), while others 66.26% obtained non-government source were farmers from farmers (66.87%) and family member (33.13%) (Table16).

Table 12 Reasons for not Practicing the Soil Fertility Management

(n=377)

Reasons	**number**	**percent**
Not change in yield	15	3.98
Costly	329	60.74
Do not know how to do	17	4.51
Scarcity of organic manure	260	59.98
No time	110	29.18

Adoption of Nutrient Management

In this study 13.79% of farmers practiced nutrient management while 86.21% did not practice during the 2007-08 growing season (Table 14). Three attributes: use of fertilizers, number of fertilizers application and amount of fertilizers applied kg/ha, foliar spray and use of rhizobium were considered under the nutrient management. Farmers who did not practice these stated 3 main reasons, in order of importance as (1) financial difficulties (2) sufficient soil fertility and (3) do not know about using the foliar spray and rhizobium.

According to the study, farmers had practiced the nutrient management: not apply any chemical fertilizers (31.83%), apply basal and both top dressing and foliar spray (13.97 %), applied basal and one top dressing (22.55%) and apply only top dressing (31.83%).

The reason given for not applying any chemical fertilizers, ranked in the order of importance as follows: financial difficulties (15.92%), no yield increased (2.92%), increase pests, diseases and weeds (4.77%), and 8.22% do not know about it.

The reasons for not applying the basal fertilizers, again in the order of importance were as financial difficulties (18.83%), sufficient soil fertility (11.41%) and 3.71% do not know about it (Table 13).

The reasons given for not applying any top dressing, again in order to importance were as financial difficulties(42.44%), sufficient soil fertility (24.14%), not available in times (9.12%), not increase in yield and good stand crop (4.77%)and increased weeds(4.51%) (Table 13).

The reasons given for not applying any foliar fertilizers spray, in order of importance were as do not know about it(45.09%), enough soil fertilizers (13.26%), not effective for use (45.09%) (Table 13).

Extension agents explained the reason given for not applying the rhizobium was current inoculants production at Department of Agriculture Research of 0.25 million packets annually is sufficient for only 4% of Myanmar legume. So low production and supply of inoculants is also problems and farmers did not know about it mostly.

In this nutrient management study, financial difficulties become an important reason for not apply the fertilizers and foliar spray because fertilizers are the most expensive and especially soybean is minor crop for local people. Other finding such as sufficient soil fertility, not increase yield, good stand crop, increased weeds and do not know about it suggested that farmers were not fully convinced about applying fertilizers and foliar spray or they had bad experience with it.

In soybean growing in Northern Shan State, 50% of soybean lands are double cropping such as rice fallow soybean which can benefit from the residual fertilizers of rice growing. Soybean growing soil in Northern Shan State mostly categorized in to three groups, red sandy soil, yellow red soil and sandy loan.

However farmers had had the experience on practicing the nutrient management last 10 years ago. The source of information on technological knowledge was government sources. Approximately 54.40 % obtained information from government sources: extension worker (44.56 %), media (7.25 %) and demonstration (2.59%). The rest of farmers from non-government sources: farmers from farmers (35.93%) and fertilizer dealers (10.57 %) (Table16).

Table 13 Reasons for not Applying the Nutrient Management

(n= 377)

Reasons	**Not apply basal**		**Not apply top dressing**		**Not apply foliar spray**	
	no	**%**	**no**	**%**	**no**	**%**
Not enough money	71	18.83	160	42.44	0	0
Enough soil fertilizers	43	11.41	91	24.14	50	13.26
Not available in time	10	2.65	34	9.12	0	0
Not effective in use	15	3.98	0	0	170	45.09
Not increase in yield	0	0	18	4.77	11	2.92
Increased in weeds	0	0	17	4.51	0	0
Pests/diseases occurs	0	0	0	0	4	1.06
Do not know about it	14	3.71	0	0	170	45.09

Note: Multiple responses

Adoption of Improved Cultural Practices

Improved cultural practices considered 2 attributes: hill and broadcasting of plant per unit areas and line sowing of plant per unit area including cultivar selection, seed rate, right planting time, and stand establishment and water control.

This study revealed that 39.26% of soybean growing farmers practiced improved cultural practices and 60.94% farmers did not apply the improved cultural practices fully in 2007-08 growing season (Table 14).

In detail study, 86.21% of farmers were applied and selected appropriate cultivar and optimum seed rate, 13.79 % of farmers did not apply.

About growing the right time 87.53% of farmers grew, on the other hand 12.47% of farmers did not grow the right time were due to (1) not enough moisture (2) lack of labor and (3) not getting seed in time.

Most of the farmers (73.33%) applied line sowing and the rest of the farmers (24.67%) applied the hill sowing and broadcasting. Because of using the buffaloes for the land preparation time, some farmers owned or in most case, rented by other farmers who did not grow line sowing.

Depending on the soil moisture, 76.92% of the soybean farmers irrigated the water at flower and pod-setting stages, coinciding with period of moisture deficit. 51.19% of farmers irrigated water before sowing for normal germination and 7.42% of farmers did not need for watering.

The most prominent sources of information on improved cultural practices were government sources (45.40%) such as 68.87% of farmers obtained by extension workers, 16.98%of farmers obtained by training and demonstrations, and mass media (14.15%). The rest of the farmers (64.60%) obtained by farmers from farmers (49.02%), and family members (50.98%) (Table16).

Adoption of Plant Protection Methods

Weed Control

Weed control of farmers were divided into two groups: adoption of integrated weed control practices (IWP) and non-adoption of (IWP) which includes 6 attributes. Among of the 377 farmers, 19.40% of the soybean farmers fully practiced such as use of clean seeds, proper land preparation, maintenance of weed free bund and levees, hand pulling, hand hoeing and crop rotation, while the rest of the 80.60% farmers

could not practice fully (Table 14). However most of the farmers did hoe weeding one time or two times. Information collected from farmers reveled that almost all the farmers had not have knowledge about using herbicide to control weeds.

The reasons were given for not adopting the IWP fully, ranked in the order of importance were financial difficulties, lack of labor, no weeds in the field and herbicide not available.

Source of information on integrated weeds control practices, 41.60 % of farmer's sources of information obtained government sources such as extension workers (80.85%), media (12.77%) training and demonstrations (2.13 %), while others (58.41%) obtained from non government sources such as farmers from farmers (48.86%), family members (46.21%) and pesticide dealers (4.93%) (Table16).

Pest and Diseases Control

Pests and Diseases control was considered under integrated pests and diseases management. The variable consist of two groups were adoption of integrated pests and diseases management (IPM) and non-adoption of (IPM) such as deep summer ploughing or no tillage, use of appropriate varieties, timely and collective cultivation, maintenance of appropriate plant density, balance fertilizers, proper inside and outside weed control, appropriate insect survey procedure and use chemical control.

According to the study, 24.69% of farmers adopted all 8 components of pests and diseases management, while75.31% of farmers did not adopt all components fully (Table14).

Some farmers used the pesticides when pest infestation occurred normally and some practiced the water flooding in the traditional way. They did not distinguish what is pest and what is disease.

The most important sources of information on pests and diseases were government sources. Approximately 35.49 % obtained from government sources such as extension workers (85.71%), mass media (8.73%) and training and demonstrations (5.56%). The rest of the farmers (64.51%) obtained information from the non-government sources: farmers from farmers (41.58 %), also others (58.51%) from pesticide dealers and family members. Still the extension workers played a vital role because they were the most reliable source of information on (IPM) (Table 16).

Hypotheses Testing

Relationship between socio-economic factors, knowledge on soybean production technology, extension activities and adoption of improved soybean production technology are shown in (Table 17-18).

Hypothesis 1

Chi-square test results revealed that age of farmer was no statistically significance and did not relate to the adoption of improved soybean production technology. Therefore, hypothesis one was rejected.

Hypothesis 2

Chi-square test results revealed that level of education was highly significantly related at the (0.001) level to adoption of improved varieties and adoption of soil fertility management and also significantly related at the (0.05) level to nutrient management and weeds control. There were no significance with adoption of improved cultural practices and pests- diseases control and did not relate to level education of soybean growing farmers. Therefore hypothesis two was partially accepted.

Hypothesis 3

Chi-square test results revealed that size of farm was no statistically significance and did not relate to the adoption of improved soybean production technology. So, hypothesis three was rejected.

Hypothesis 4

According to the chi-square test results revealed that tenure of land was no statistically significance and did not relate to the adoption of improved soybean production technology. Therefore, hypothesis four was rejected.

Hypothesis 5

Chi-square test results showed that family labor was significantly related at the (0.01) level to nutrient management and also significantly related at the (0.05) level to soil fertility management and pests-diseases control. However it was no statistically significance and did not relate to adoption of improved varieties, cultural practices and weeds control. Therefore hypothesis five was partially accepted.

Hypothesis 6

Chi-square test results showed that farm income was highly significantly related at the (0.001) level to only one of the adoption of improved cultural practice. Therefore hypothesis six was partially accepted.

Hypothesis 7

Chi-square test results revealed that off farm employment was highly significantly related at the (0.001) level to adoption of improved varieties and also significantly related at the (0.01) level to adoption of soil fertility management. But it was no significance to adoption of nutrient management, cultural practices, and plant

protection methods. Thus only two impact points were related to off farm employment. So hypothesis seven was partially accepted.

Hypothesis 8

Chi-square test results showed that credit was significantly related at the (0.05) level to only one impact points of improved cultural practice. On the other hand it was no significance to adoption of improved varieties, soil fertility management, and nutrient management and plant protection methods. Therefore hypothesis eight was partially accepted.

Hypothesis 9

Chi-square test results revealed that membership in farmer's organization was no significance and did not relate to the adoption of improved soybean production technology. So hypothesis nine was rejected.

Hypothesis 10

Chi-square test results revealed that the knowledge on soybean production technology was highly significantly related at the (0.001) level to adoption of soil fertility management and nutrient management and also significantly related at the (0.05) level to adoption of improved varieties and weeds control but there were no significance with improved cultural practices and pests-diseases control. Therefore hypothesis ten was partially accepted.

Hypothesis 11

Chi-square test results revealed that participation in extension activities; individual farm and home visits was highly significantly at the (0.001) level to soil fertility management and nutrient management and also significantly related at the

(0.05) level to improved varieties and weeds control. But it was no significance to cultural practices and pests-diseases control.

Moreover chi-square test results revealed that group contact was highly significantly related at the (0.001) level to soil fertility management, nutrient management, and significantly related at the (0.05) level to improved varieties. But it was no significance with cultural practices and plant protection methods.

Similarly chi-square test results found out the demonstration was significantly related at the 0.05 level to adoption of weeds control.

Chi-square test result found out the mass media was no significance to adoption of improved soybean production technology.

Improved varieties, soil fertility management, nutrient management and weeds control were related to extension activities, so hypothesis eleven was partially accepted.

As a result of this study chi-square test analysis indicated that the most of the socio economic factors such as level of education, family labor, farm income, off farm employment and credit were observed significantly relationship with adoption of improved soybean production technology. On the other hand there were no relationships between the age, size of farm, tenure of land and membership in farmers' organization with adoption of improved soybean production technology.

From the results of the hypothesis testing it revealed that farmers have intermediate education (at least primary education) they become more adoption of technology. The investigation indicated that one farm family had more family labor they become more adoption of the technology. Besides farmers had the opportunity to more farm income, they become more adoption the technology while famers had a chance to work off farm employment, they could get the extra money and used for input and services. One of the important factors was credit which was reliance for

poor farmers, gets the credit facilities, become more adoption of the technology, and pointed out by hypothesis study.

The results of the study indicated the relationship of knowledge and adoption, farmers possess the optimum level knowledge they had a chance more to adopt the package technology. It was found that the wide gap of knowledge and adoption should become narrow if farmers had more knowledge.

According to the study results extension activities such as individual farm and home visits and group contact methods were more effective to farmers to adopt the technology. In addition results and methods demonstrations were interested to farmers but mass media was poor in communication to farmers.

Compare with a study on farmer's technology adoption on rubber plantation in Sahatsakhan District, Kalasin Province, Thailand found that relationship between age, income and adoption of rubber plantation technology in terms of income generation and rubber plant protection at 0.05 level. There were significantly related between income of the farmer and adoption of rubber plantation in terms of rubber planting process and rubber plant protection at (0.05) level (Preepradil, 2000).

And also, a study of Indian agriculture, Bhalla reported that small and large farms differed in reasons offer for not using of fertilizers in (1970-71) of lack of credit was major constraints for 48% of small farm and for only 6%of large farm. Similarly many others studies have found that majority of small farms reported shortage of fund as a major constraint on adoption such as fertilizer use.

Similarly a study of factors affecting adoption of recommended crop management practices in paddy cultivation in Kalutara District, Sri, Lanka, revealed that adoption of recommended crop management practices was significantly related to education, land, tenure, income, credit, extension activities (Mendis, 2005).

In addition a study of farmers' adoption of sunflower production technology under the sunflower extension and development project, Changwat Lop Buri, Thailand, revealed that the knowledge about the sunflower production factors were correlated with the adoption of sunflower production technology at the 0.05 level of statistical significance. So according to the study results farmers' knowledge influenced on adoption of sunflower production technology.

The farmer's technical knowledge is a product of extension education. Islam (1972), Kolshus (1972) and Bhati (1975) confirmed that technological knowledge is a positive influence on modern varieties and fertilizer adoption. This variable is the foremost factor in adoption of improved practices among a sample of Indian farmers, Ramaswamy (1973).

Quality of extension service is a major factor in farm adoption. Poor extension may lead to discontinued modern varieties and general farmer's apathy (Rahman and Weaver 1969, Kalirajan 1979). Infrequent contact and lack of follow-up home and farm visits were implied to have been important non-adoption factor in the response of 90 IR rice growers in Bangaldesh(Hoque *etl al*, 1972).

Factors determining intercropping by rubber smallholders in Sri Lanka revealed that extension contacts, education level, and experience with farming other crops were positively associated with the probability of adoption (Herath and Takeya, 2002).

A study on adoption of improved maize varieties in the hills of Nepal was found that ethnic group, years of fertilizer use, off-farm income, and contact with extension services significantly and positively affected adoption of improved varieties. Farmers in village development committees (VDCs) in central Nepal reported lack of seed to be the major constraint to the adoption of improved varieties, while lack of knowledge of new varieties was the major constraint for farmers in the western (VDCs) (Ransom, Paudyal, and Adhikar, 2003).

Table 14 Adoption of Improved Soybean Production Technology

(n=377)

Improved Soybean Production Technology	Adoption of Improved Soybean Production Technology			
	Adoption		Non adoption	
	no	%	no	%
Use of improved varieties	194	51.46	183	48.54
Soil fertility management practices	79	20.95	298	79. 05
Nutrient management practices	52	13.79	325	86.21
Improved cultural practices	148	39.26	229	60.74
Plant protection methods				
-Weeds control	72	19.40	305	80.60
-Pests/diseases control	93	24.69	284	75.31

Problems and Suggestions of Farmer's Expectation to Soybean Production

This research identified the important problems faced by farmers and their suggestions and alternative solutions to overcome the constraints to increase adoption of improved technology in soybean production. This study found out the ten major problems: credit problem (67.67%), improved and adaptive varieties problem (84.88%), fertilizer problem (76.92%), water shortage (11.94%), labor shortage (6.10%), technological knowledge problem (67.37%), need of the extension activities problem (57.03%), selling to markets problem (22.34%), farmers wanting to change to grow another crop (6.63%) and competition with summer paddy and vegetable growing (5.30%) showed in (Table 15).

According to the discussions with farmers, responsible personnel and extension agents, the suggestions and alternative solutions were as follows;

1. Provide for loans from Myanmar Agricultural Bank and private banks and encouragement to private sectors for contract farming.

2. Department of Agricultural Research select and Myanma Agriculture

Service introduces the improved and adaptable seeds by doing field trials and experimental plots.

3. Encourage private sectors to sell fertilizers.

4. Maintenance and control of water distribution by responsible personnel with coordination of farmers.

5. Help family-to-family labor sharing and saving during operation times by practicing a self- help approach.

6. Upgrade the farmer's knowledge by doing more extension activities.

7. Individual contact, group contact, demonstration and mass media by using the knowledge, attitude and practices (KAP) strategies.

8. Create wider markets within region.

9. Introduce the new varieties and technology for increasing yield and more profit.

10. Extension agents discuss with regional planner for competitive crops.

Some of the problem of farmers could be reduced the coordination with local leader and group action of farmers. In addition some problems would be minimized with the strengthening of farmers' organizations. If there were a need to solve difficult problems, then government agencies should undertake them.

Table 15 Major Problems of Soybean Growing Farmers

(n=377)

Problems	**number**	**percent**
Credit for capital	260	67.67
Improved and adaptive varieties	329	84.88
Difficult to buy the suitable fertilizers	290	76.92
Water shortage	45	11.94
Labor shortage	23	6.10
Technical knowledge need	254	67.37
Extension activities need	215	57.03
Available for markets	88	22.34
Farmers desires change to grow another crops	25	6.63
Competitive crops	20	5.30

Note: Multiple responses

Table 16 Farmers' Sources of Information on Improved Soybean Production Technology

(n=377)

Source of information	Improved varieties		Soil fertility management		Nutrient management		Cultural practices		Plant protection methods			
									Weeds control		Pests/diseases control	
	no	%	no	%	no	%	no	%	no	%	no	%
Government sources	160	47.19	166	33.74	105	54.40	212	45.40	188	41.60	126	35.49
Extension agents	116	72.50	128	77.11	86	81.20	146	68.87	152	80.85	108	85.71
Demonstration/training	5	3.14	4	2.41	5	4.76	36	16.98	4	2.13	7	5.56
Mass media	39	24.38	34	26.38	14	13.33	30	14.15	24	12.77	11	8.73
Non Government sources	179	52.80	326	66.26	88	46.50	255	64.60	264	58.41	229	64.51
Other farmers	131	73.17	218	66.87	68	77.27	125	49.02	129	48.86	95	41.48
Family members	0	0	108	33.13	0	0	130	50.98	122	46.21	113	49.34
Fertilizer dealers	0	0	0	0	20	22.72	0	0	13	4.93	21	9.17
Seeds selling shops	48	26.82	0	0	0	0	0	0	0	0	0	0

Note: Multiple responses

Table 17 Relationship between Socio-Economic Factors and Adoption of Improved Soybean Production Technology

(n=377)

Socio-Economic Factors	Adoption of Improved Soybean Production Technology(χ^2)					
	Improved varieties	Soil fertility management	Nutrient management	Cultural practices	Plant protection methods	
					Weeds control	Pests /Diseases control
Age of farmers	2.344	6.602	0.588	0.858	2.207	4.052
Level of education	18.995***	25.123***	9.493*	6.975	9.667*	9.198
Size of Farm	0.195	1.433	0.579	5.446	0.298	2.46
Tenure of land	1.527	4.042	4.042	2.99	3.719	2.769
Family Labor	3.318	7.083*	11.250**	4.051	5.913	8.970*
Farm income	5.600	3.801	1.459	11.892***	0.121	1.775
Off farm employment	13.313***	9.122**	4.393	o.461	1.217	1.603
Credit	0.360	0.617	0.934	4.449*	1.575	2.072
Membership in farmers organization	3.014	0.359	0.090	0.101	0.200	0.121

Note: * Significance level at 0.05
** Significance level at 0.01
*** significance level at 0.001

Table 18 Relationship between Knowledge, Extension Activities and Adoption of Improved Soybean Production Technology

(n=377)

Items	Adoption of Improved Soybean Production Technology(χ^2)					
	Improved varieties	Soil fertility management	Nutrient management	Cultural practices	Plant protection methods	
					Weeds control	Pests /Diseases control
Knowledge on improved soybean production technology	7.377*	21.344***	14.377***	0.303	8.415*	5.736
Extension activities						
Individual farm visit	8.728*	18.040***	44.954***	0.005	5.021*	5.019
Group contact	4.581*	11.013***	16.906***	0.832	3.416	0.107
Mass media	1.05	0.025	0.196	2.203	0.465	0.481
Demonstration	2.393	0.147	0.78	2.983	5.135*	0.03

Note: * Significance level at 0.05
** Significance level at 0.01
*** significance level at 0.001

CHAPTER V

CONCLUSION AND RECOMMENDATION

Conclusion

Yield advantages or better yield would be the first priority of adoption of improved soybean production technology. This study revealed that the average age of farmers was 52 years and size of farm owned was 0.64 ha. Most of 78.25% of soybean farmers had formal education and almost all soybean farmers cultivated the land themselves. A majority of 72.41% of farmers had 2-4 supporters with average income per ha 353060 kyats. Also 32.63% of soybean farmers obtained credit, 28.91% of soybean farmers worked in off farm employment and 37.40% of soybean farmers were members of a farmer's organization.

Secondly, 31.50% of the soybean growing farmers had high score knowledge level about the improved soybean production technology.

Thirdly, some farmers participated in extension activities such as farm or home visits (39.53%), and group activities (32.36%), and extension agents contributed to 35.30% of farmers with mass media and showed demonstrations to 27.33% of farmers.

Fourthly, farmers' adoption of improved soybean production technology was less than 50% except for improved varieties. Analysis of hypothesis testing by using the chi-square test revealed that farmers' level of education, family labor, farm income, off farm employment, credit, knowledge of the farmers and participation in extension activities were the most important points for adoption of improved soybean production technology.

Finally, the problems they faced were credits for capital, lack of improved varieties and not ease to buy fertilizers, water shortage and labor shortage, need of

technological knowledge and extension activities, cannot buy and sell easily due to the distance from the market and farmers wanting to change to grow more profit crops and competitive crops.

For increase soybean production, farmers expected supplement of private sectors and also the government intervention to solve the problems.

Recommendation

For soybean development in Northern Shan State, Myanmar, it is necessary to increase the adoption of improved technological packages in soybean production. Although soybean is minor crop and sufficiency in Myanmar, it becomes high potential crop with more utilization.

This study gives the recommendations that should be considered as follows:

1. For the requirement of improved and adaptive varieties, there is on-farm research as well as local verification trials to identify and analyze the suitable agronomic characters between research, extension and farmers.

2. Requirement of capital for soybean growing is a major constraint of the adoption of improved technological packages. The establishment of a credit provision program to reach soybean farmers is essential for support and off-farm employment should be created by making the soybean products to be produced for the farmers' income and would assist with some of the critical problem of adoption decision process.

3. A self- help approach should be practiced for labors shortage especially helping family-to-family labor sharing and saving during operation times and also change the behavior of soybean growing farmers as an incentive to increase adoption.

4. For improving farmers' knowledge, Extension Institution should classify objectives, information and extension problems need, according to the audience level of knowledge, attitude and practice (KAP) and encourage to the farmers correctly to increase the adoption of improved technology.

5. Myanma agriculture service should upgrade the extension officers and workers' knowledge and their problem solving skills for technology transfer through modified training and should support the transportation and incentive of their improvement and should reduce the general extension works.

6. Under the close supervision of extension officials, they should display simple trial plots and demonstrations in the farmers' fields with cooperation among technical persons involved and farmers as seeing is believing with the filed days to lead more adoption of improved technological packages.

7. Effective success of using mass media should be communicated and translated by changing local languages such as printed media and broadcasting.

8. Farmers' organizations should be organized beneficially and provide to soybean production farmers with advice on improved soybean production technology and sharing of the resources and inputs, credit facilities and solving the problem of farmers.

9. Ease of selling soybean produce within the regional markets, with suitable markets system for soybean production with private merchants or cooperative societies or government agencies and the program for commercial cultivation of soybean to encourage farmers and private sectors to increases adoption of improved technological packages for soybean production.

Future Study

1. Assessing the future impact of the influenced of social physical, social structure of environmental conditions and communication channels used on adoption of improved technology of soybean production should be focused on.

2. Study on extension workers' knowledge level, knowledge management, agronomist-farmer's knowledge encounters, sources of knowledge and challenges of facing the agricultural agents to soybean production are suggested.

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APPENDIX

INTERVIEW SCHDULES

SURVEY ON FARMERS' ADOPTION OF IMPROVED TECHNOLOGICAL KNOWLEDGE ON SOYBEAN PRODUCTION IN NORTHERN SHAN STATE AREA, MYANMAR

Date of Interview……. ……

Interviewer-……. ……

Code no……

Address-……

Name of farmer-……..

Male ( ) Female ( )

Socio economic Factors

1. Age	(a) under 35 years	( )
	(b) 35-45years	( )
	(c) 46 – 55 years	( )
	(d) Above 55 years	( )
2. Size of farm	(a) 0.25 and less than 0.25	( )
	(b) 0.26 ha to 0.5 ha	( )
	(c) Above 0.5	( )
3. Educational level	(a) Grade 5 and less than grade	( )

	(b) Grade 6-9	( )
	(c) Grade 10-11	( )
	(d) Above grade 11	( )
4. Tenure of land	(a) owner	( )
	(b) Tenant farmer	( )
	(c) Joint owner	( )
5. Family Labor	(a) 1 and less than 1supporter	( )
	(b) More than 1 supporter	( )
6. Farm Income	(a) 75000-100000 Kyats	( )
	(b) 100000-150000 Kyats	( )
	(b) 150000 Kyats	( )

7. Do you engage in any other occupation (Off farm employment)?

Yes ( ) no ( )

7.1 If 'yes'	(a) Government sector	( )
	(b) Private sector	( )
	(c) Any organization	( )
	(d) Self employment	( )

8. Do you obtain credit for soybean production in (2007-08) growing seasons?

Yes ( ) no ( )

8.1 If 'Yes' from where?

(a) Government bank	( )
(b) Private bank	( )
(c) Money lending organization	( )
(d) Village money lender	( )
(e) Trader	( )

(f) Friends ( )

(g) Others

9. **Membership in farmer organizations**

9.1 Are you member in farmer organization?

Yes ( ) no ( )

9.1.1 If 'yes' what are benefit or services do you get from organization?

(a) Advice on farming ( )

(b) Sharing of resource ( )

(c) Credit facilities ( )

(d) Solving farming problems ( )

(e) Others (specific) ( )

9.1.2 If 'no' how many others organization does you have membership?

……..……..

9.1.3 Name of the other organization you have membership?

……

10. Knowledge on improved soybean production technology

(Total scores = 24 scores)

Total (1) score

(1) What are the improved soybean varieties?

(1) SB45, SB60, GM18, china	[True]	(1) score
(2) Other varieties	[False]	(0) score

(2) If you used one of improved varieties, why did you use these varieties?

		Total (3) scores
(1) High yield	[True]	(1) score
(2) Adaptable to region	[True]	(1) score
(3) Resistant to pest and diseases	[True]	(1) score
(4) No answer		(0) score

(3) What kinds of practices did you do for soil fertility improvement?

		Total (3) scores
(1) In cooperate of cow dung and green manure	[True]	(1) score
(2) In cooperate of liming	[True]	(1) score
(3) Summer ploughing and deep ploughing	[True]	(1) score
(4) Nothing to do	[False]	(0) score

(4) If you use cow-dung or green manure and liming, how many tons did you use in your field?

		Total (2) scores
(1) In cooperate of cow dung and green manure(3) tons	[True]	(1) score
(2) In cooperate of liming (1) ton	[True]	(1) score
(3) Other answers	[False]	(0) score

(5) What kinds of fertilizers did you use in your field in addition to organic fertilizers for nutrient management?

		Total (4) scores
(1) Use of natural fertilizers (cow dung, green manure)	[True]	(1) score
(2) Use of appropriate chemical fertilizer (U+T+P/compd)	[True]	(1) score
(3) Use of foliar fertilizer (Bio super, compd liqud)	[True]	(1) score
(4) Rhizobium	[True]	(1) score
(5) Nothing to use	[False]	(0) score

(6) If you use any fertilizers, how many Kg did you use in your field?

Total (3) score

(1) Cow dung /green manure (1) ton [True] (1) score

(2)U(25Kg)+T(50Kg)+P(25Kg) or compound (100kg) [True] (1) score

(3) Rhizobium (3) gm/ acre [True] (1) score

(7) What kinds of cultural practices did you apply in your field?

Total (5) scores

(1) SB45, SB60, Yezin CHINA, [True] (1) score

(2) Sowing time (jan→march) [True] (1) score

(3) Plant population per acre (50000-->75000) [True] (1) score

(4) Harvest at the optimum maturity stage [True] (1) score

(Over 70% mature pods in the field)

(5) Irrigation after growing and pod setting time [True] (1) score

(8) What kinds of practice did you do when damage observed in your field?

Total (1) scores

(1) Any steps to control any pest and disease [True] (1) score

(2) Nothing to do [False] (0) score

(9) What is the important cultural practice that can keep the plant weed free or reduce weeds problem?

Total [1] score

(1) Timely inter-cultivation weeding [True] (1) score

(2) No [False] (0) score

(10) Do you know how many baskets of target yield of soybean?

Total [1] score

(1) 20 basket per acre	[True]	(1) score
(2) Less than or more than (20) baskets	[False]	(0) score

11. **Extension activities**

11. 1Individual farm visit

11.1.1 Do you feel that extension agent should visit you?

Yes ( ) no ( )

11.1.2 If 'yes' how many times do they visit in (2007-08) growing season?

(a) No ( )
(b) One visits ( )
(c) 2- 3 visits ( )
(d)Above 3 visits ( )

11.1.3 What are they doing for coming to visit at farm?

(a) To explain the technology ( )
(b) To sell for improved seeds ( )
(c) To identify the pests and diseases ( )
(d) Others (specify ……

11.2 Group contact

11.2.1 How many times do extension agents take group contact in(2007-08) growing season to farmers?

(a) One time or less than one time ( )

(b) 2-3 times ( )

(c) More than 3 times ( )

11.2.2 What purpose for group contact with farmers do you know?

(a) Meeting ( )

(b) Discussion ( )

(c) Training ( )

(d) Others (specify…….

11.3 Mass media

11.3.1 How do extension agents give the improved soybean production technology through mass media?

(a) Sound (radio, audio cassettes) ( )

(b) Moving pictures (television, film, and video) ( )

(c) Print (poster, newspaper, leaflets) ( )

(d) Others (specify) …….

11.3.2 How many times did extension agents give to hear the awareness of improved technological knowledge on soybean production by sound such as radio, cassettes in (2007-08) growing season?

(a)No ( )

(b) One time ( )

(b) 2-3 times ( )

(c) Above three times ( )

11.3.3 How many times did extension agent show to know the improved technological knowledge on soybean production by moving picture likes TV, Film, Video in (2007-08) growing season?

(a) No ( )
(b) 0ne times ( )
(c) 2-3 times ( )
(d) Above 3 times ( )

11.3.4 How many times did the extension agents give to read the print news such as newspaper, leaflets, pamphlets, posters including the improved technological knowledge on soybean production in (2007-08) growing season?

(a)No ( )
(b) One times ( )
(c) 2-3 times ( )
(d) Above 3 times ( )

11.4 Demonstration

11.4.1 Do extension agents take place the demonstration about improved soybean production technology?

Yes ( ) no ( )

I f ‘yes’ how many times they take place?

(a)No ( )
(b)One time ( )
(c) 2-3 times ( )
(d) Above (3) times ( )

11.4.2 What kind of demonstration takes place by extension agents?

(a) Methods demonstration ( )
(b) Result demonstration ( )
(c) Others (specify)……

Adoption of Improved Varieties

12. Did you grow the improved varieties in (2007-08) growing season?

12.1 If 'yes' what kinds of varieties did you grow?

(a) SB 45 ( )
(b) SB 60 ( )
(c) GM 91-18 ( )
(d) China ( )
(c) Others (specify)……

13. If you are cultivate the improved varieties why did you decided to do so?

(a) Increase yields ( )
(b) Profitable ( )
(c) Better response to fertilizer ( )
(d) Matured in time ( )
(e) Better than local varieties ( )
(f) Others (specify) ……

13.1 For how long have you been growing improved varieties such as SB45, SB60 varieties? …….. Years

13.2 From where did you get these improved varieties?

(a) Another farmers ( )
(b) Seed selling shop ( )
(c) Demonstration Plot ( )
(d) Extension agent ( )
(e) Others (specify) ……

14. Have you stop to grow improved varieties and changed other varieties?

Yes ( ) no ( )

14.1 If 'Yes' Why?

(a) Poor yield ( )
(b) High cost of cultivation ( )
(c) High fertilizers requirement ( )
(d) More pest and diseases occur ( )
(e) No market ( )
(f) Others (specify) ……

15. If you are still local high yield varieties why do you use it?

(a) Good yield ( )
(b) Suitable for soil ( )
(c) Less pests and diseases ( )
(d) Ensure the Market ( )
(f) Others (specify) …….

16. If you are still local varieties why do you grow up to now?

(a) Good yield ( )
(b) Low cost of cultivation ( )

(c) Less pests and diseases ( )
(d) Suitable for soil ( )
(c) Others (specify) ……..

Adoption of soil fertility improvement

17. Did you do for soil fertility improvement?

Yes ( ) no ( )

If ‘yes’ what did you applied?

(a) Straw and burnt ( )
(b) Green manure ( )
(c) Cow dung ( )
(d) Poultry manure ( )
(e) Burnt paddy husk ( )
(f) Liming ( )

18. How do you practice for good land preparation?

(a) Summer ploughing ( )
(b) Deep ploughing ( )
(c) Harrowing and leveling ( )
(d) Hoeing ( )
(e) Others ……

19. Have you been doing the soil fertility management yearly?

Yes ( ) no ( )

If ‘yes’ How long have you practice soil fertility management?

……..years

19.1 If you did not practice any soil fertility management why?

(a) No change in yield ( )
(b) Costly ( )
(c) Do not know how to use ( )
(d) Scarcity of organic manure ( )
(e) No time ( )
(f) Others ……

19.2 From whom did you know about soil fertility management?

(a) Extension agent ( )
(b) From training ( )
(c) From demonstration ( )
(d) Mass media ( )
(e) Other farmers ( )
(f) Other (specify)……..

Adoption of nutrient management

20. Do you know what type of soil in your soybean growing land?

Soil type	With excess Acid soil (pH low)	Without excess Acid (pH high)
Red sandy soil		
Yellow sandy soil		
Loan sandy soil		

21. Do you apply chemical fertilizers when you grow soybean?

Yes ( ) no ( )

If ‘yes’ how long have you been using fertilizers?

…… years

21.1From whom do you get knowledge on fertilizers recommendation?

(a) Neighboring farmers ( )
(b) Fertilizer sellers ( )
(c) Demonstration ( )
(d) Mass media ( )
(e) Extension agent ( )
(f) Others……..

22. Did you use chemical fertilizers in (2007-08) growing season?

Yes ( ) no( )

If 'yes' (a) Urea fertilizer only ( )

(b) Urea and Tsuper ( )

(c) Urea, Tsuper and Potash ( )

(d) Mixed fertilizers ( )

22.1 How many times do you use the fertilizers application? (Check one)

(a) One time (Basal, growing after 30 days, growing after 45 days)

(b) Two times (Basal, growing after 30 days, after 45 days)

(c) Three times (Basal, growing after30 days, after 45 days)

22.2 If you use the fertilizers, how much do you applied?

Application time	Urea	Tsuper	Potash	Compound
Basal				
Growing after (30) days				
Growing after (45) days				
Total				

22.3 If basal is not apply why?

(a) Not enough money ( )

(b) Enough soil fertility ( )

(c) Not available in time ( )

(d) Not affect in use ( )

(e) Do not know about it ( )

(f) Others (specify) ……..

22.4 If top dressing not applies why?

(a) No money ( )

(b) Enough soil fertility ( )

(c) Not available in time ( )

(d) Not increase in yield ( )

(e) Increased weeds ( )

(f) Others (specify) ……

23. If you not use chemical fertilizers why?

(a) Do not know about it ( )

(b) No money ( )

(c) No yield increase ( )

(d) Pests and diseases occur ( )

(e) Increased weeds ( )

(f) Others (specify …….

24. Do you use the foliar spray?

Yes ( ) no ( )

If ‘yes’ how many times do you use?(Check one)

(a)One time (growing after15 days,30 days, 45 days, 60 days,75days)

(b) 2-3 times(growing after 15 days,30days, 45 days, 60 days,75days)

(c) 4-5 times (growing after 15 days, 30 days, 45 days,60days, 75 days)

(d) Above 5 times

24.1 From whom do you get about this knowledge?

(a) Extension agent ( )
(b) Friendly farmers ( )
(c) Training ( )
(d) Mass media ( )
(e) Demonstration ( )
(f) Others (specify ……..

24.2 If you do not use foliar fertilizers why?

(a) Expensive ( )
(b) Not available ( )
(c) Not affect in use ( )
(d) Do not know how to sue ( )
(e) Others (specify)…….

25. Do you apply rhizobium for seed treatment?

Yes ( ) no ( )

If ‘yes’ where do you get rhizobium?

(a) Extension agent ( )
(b) Research station ( )
(c) Fertilizer seller ( )
(d) Others (specify) ……

25.1 From whom do you get about this knowledge?

(a) Extension agent ( )
(b) Training ( )
(c) Mass media ( )
(d) Demonstration ( )

(e) Friendly farmers ( )

(f) Others (specify) …….

Adoption of Improved cultural practices

26. Did you practice improved cultivation methods for soybean production?

Yes ( ) no ( )

26.1If 'yes' how much do you use seed rate for one acre?

(a).10 Kg ( )

(b) 11-15kg ( )

(c) 15-20 kg ( )

(d) 20-25 kg ( )

(e) Above 25 kg ( )

26.2 Do you grow right time for 2007-08 growing season?

Yes ( ) no ( )

26.2.1 If 'no' why do not grow right time?

(a) Not enough moisture ( )

(b) Lack of labor ( )

(c) Not get improved seeds in time ( )

(d) Others (specify) …….

26.3 What cultivation methods do you use in (2007-08) growing season?

(a) Broadcasting ( )

(b) Line sowing ( )

(c) Hill sowing ( )

26.4 How many do you get plants per unit area (plant population)?

(a) 50000 plants and less than 50000 plants/acre ( )
(b) 50000-75000 Plants/acre ( )
(c) 75000-100000 plants/acre ( )
(d) Above 100000 plant/ acre ( )
(e) Do not about it ( )

26.5 When do you irrigate the water for enough moisture?

(a) Before sowing ( )
(b) Flowering times ( )
(c) Seeds setting times ( )
(d) No need for irrigation ( )

27. From where did you learn improved cultivation methods?

(a) Extension agent ( )
(b) From training and demonstration ( )
(c) Mass media ( )
(d) Other farmers ( )
(c) Others (specify) ……..

Adoption of plant protection methods

Weed control

28. Did you weeding for your soybean field in (2007-08) growing season?

Yes ( ) no ( )

28.1 If 'yes' how many times do you do the weeding?

(a) Land preparation time ( )
(b) Land preparation time, 15 days after planting ( )

(c) Land preparation time, 15 days after planting, 30 days after planting ( )

(d)Land preparation time, 30days after planting ( )

28.2 What methods do you practice so?

(a) Hand weeding ( )

(b) Hoe weeding ( )

(c) Chemical weeding ( )

(d) Cultural methods ( )

(e) Others (specify) …….

28.3 If ‘no’ what are reason for doing so?

(a) No money ( )

(b) Lack of labor ( )

(c) No weeds in field ( )

(d) Weedicides not available ( )

(e) Others (specify)…….

29. What are the cultural and preventive measures used in (2007-08) growing seasons to control of weeds?

Practicing methods	Use of clean seed	Proper land preparation	Weed free bands/levees	Proper cultivar selection	Crop rotation
Done					
Not done					

30. From where did you know importance of weeding?

(a)Extension agent ( )
(b) Another farmers ( )
(c) Pesticide sellers ( )
(d) Training / demonstration ( )
(e) Media ( )
(f) Others (specify) ……

31. Give the name and usage of weedicides?

Weedicide name	Age of crop	Amount	Amount of water

Pests and diseases

32 Did you take the any pests and diseases control in (2007-08) growing season?

Yes ( ) No ( )

32.1 If 'yes' what kinds of pests damage to your soybean field?

(a) Army worm ( )

(b) Bean stem fly ( )

(c) Spotted pod borer ( )

(d) Green stink bug ( )

(e) Others (specify)……..

32.1.2 What methods do you use for pests control in 2007-08 growing season?

(a) Hand control ( )

(b) Chemical control ( )

(c) Integrated Pest management (IPM) ( )

(d) Others (specify) ……

32.1.3 How do you practice pests monitoring in your field?

(a) Check the field before planting ( )
(b) Check within two weeks after planting ( )
(c) Daily visual inspection ( )
(d) Occasional inspection of field ( )
(e) Random inspection of few places as time permits ( )

32.1.4 How do you decide to spray insecticides to control insect pests in your soybean field?

(a) As soon as damage is observed ( )
(b) After the damage is serious ( )
(c) After discussing the another persons ( )
(d) By consider the economic injury level ( )
(e) Others (specify) ……..

32.2 What kinds of diseases occur in your soybean field in (2007-08) growing season?

(a) Rust disease ` ( )
(b) Downy mildew disease ( )
(c) Charcoal rot disease ( )
(d) Others (specify) ……..

32.2.1 How do you control when diseases occur?

(a) Local Methods ( )
(b) Chemical control ( )
(c) Integrated disease control ( )
(d) No control ( )
(e) Others (specify) …….

33. Did you take any controls when pests and diseases occur?

Action	Deep summer tillage	Use appropriate varieties	Time and collective cultivation	Control plant density	Balance fertilizers application	Proper outside /inside weeds control
Done						
Not done						

34. From whom do you obtain this knowledge about the insect pests control and insecticides you use now?

(a) Extension agents ( )
(b) Another farmers ( )
(c) Pesticide sellers ( )
(d) Training / demonstration ( )
(e) Media ( )
(f) Others (specify)……..

35. Production and selling data of (2007-08) growing season?

Productivity			Consumption	Seeds	Selling	Income
Grown(acres)	Yield	Production	(basket)	(basket)	(basket)	(kyats)

36. What are the problems faced by farmers to concerning the adoption of improved soybean production technology?

(a)……

(b)……...

(c)……

(d) ……...

(e)……

37. What are your suggestions and solutions to overcome the adoption of improved soybean production technological problems?

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……
……
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BIOGRAPHICAL DATA

NAME	:	Mr. Naing Kyi Win
BIRTH DATE	:	May 10, 1963
BIRTH PLACE	:	Bago, Myanmar
EDUCATION	:	**YEAR INSTITUTION DEGREE**
		1985 University of Agriculture (Yezin) B.Ag.
POSITION	:	Deputy Division Manager
WORK PLACE	:	Myanma Agriculture Service (Tanintharyi Division)
SCHOLARSHIP	:	Oil Crops Development Project (Myanmar)