YANGON UNIVERSITY OF ECONOMICS
MASTER OF DEVELOPMENT STUDIES PROGRAMME

A STUDY ON THE AWARENESS OF FARMERS IN APPLICATION OF PESTICIDES (CASE STUDY IN KALAW TOWNSHIP)

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A thesis submitted in partial fulfillment of the requirements for the Master of Development Studies (MDevS) Degree.

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ABSTRACT

Most of the farmers are easily using the several kinds of pesticides distributed by private companies in Myanmar. This study aimed to evaluate the practice in application of pesticides by the farmers, to identify the knowledge level of farmers and private companies' staffs in plant protection and to analyze the practice of private companies' staffs in agricultural extension services. Random sampling technique was used at selected 130 farmers from 10 villages of 5 village tracts and 68 staffs of private companies in Kalaw Township. Most of farmers are not able to choose the right pesticide for specific field problems and weak in plant protection knowledge. Major knowledge sources of the most of farmers on plant protection are neighboring farmers. Most of the farmers are not practice the essential correct methods in pesticide application. There are a few staffs of private companies who do not carefully share the knowledge about plant protection and handling of pesticides. This study suggests that both public and private sectors should emphasize in knowledge sharing to the farmers.

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LIST OF ABBREVIATIONS

AEC	ASEAN Economic Community
AE	Agricultural Extension
AES	Agricultural Extension Services
a.i	Active Ingredient
ASEAN	Association of Southeast Asian Nations
CPA	Certified Pesticide Applicator
CSO	Civil society organization
DOA	Department of Agriculture
EAS	Extension and Advisory Service
FAO	Food and Agriculture Organization
FAOSTA	Food and Agriculture Organization Statistical Database
FMCGs	Fast Moving Consumer Goods
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
HYVs	High Yielding Varieties
IFC	International Finance Corporation
INGO	International Non-Government Organization
IPM	Integrated Pest Management
LIFT	Livelihoods and Food Security Fund
MAS	Myanmar Agricultural Services
MCSE	Myanmar Cotton and Sericulture Enterprise
MOAI	Ministry of Agriculture and Irrigation
MOALI	Ministry of Agriculture, Livestock and Irrigation
MPCE	Myanmar Perennial Crop Enterprise
MRL	Maximum Residue Limit
MSE	Myanmar Sugarcane Enterprise
NGO	Non-Government Organization
OECD	Organization for Economic Co-operation and Development
PPD	Plant Protection division

PPE	Personal Protective Equipment
SCS	Selected Concentrative Strategy
T&V	Training and Visit System
TOT	Transfer of Technology
US	United State
USA	United State of America

CHAPTER I
INTRODUCTION

1.1 Rationale of the Study

Myanmar is an agriculturally based country and the agricultural sector is the backbone of its economy. Agricultural sector remains a key sector for the economic development of Myanmar and it contributes 23 % of GDP, 20 % of total export earnings, and employs 61.2% of the labour force in 2013-2014 (MOAI, 2014).

Nowadays, high yielding seeds are being used to improve crop yield and continuously large amount of chemical fertilizers and pesticides are used in agriculture. But, misuse and mismanagement of those chemicals results in soil and pest problems in crop growing areas.

Farmers intensively apply pesticides with little regulation or guidance and lack of information on using pesticides safely and effectively. The farmers apply chemical pesticides multiple times a week, not knowing about the recommended application rate, re-entry or harvest interval, they misuse and overuse the chemical. Over exposure to pesticides causes farmers to suffer disorders of brain and nervous and reproductive systems as well as deadly cancers. Besides, soil and crops have been damaged and locals are facing health problems. Selecting the right pesticides at the correct dosage played a vital role in the overall development of growers, consumers and crop fields. Therefore, there is a real need for education to farmers in chemical pesticides use which make not only causing crop quality reduction and high cost of cultivation but also hazard to soil health and the environment.

In Myanmar Agricultural extension service (AES) was started in 1927. Nowadays function and tasks of AES are increasingly assumed by multiple public and private organizations. Agricultural extension services are being provided by the public sector, Ministry of Agriculture, Livestock and Irrigation (DOA, MOALI), the private non-profit sector, NGO / INGO and the private for-profit sector, commercial companies (input manufacturers and distributors) in Myanmar. There are many private companies in Myanmar; they are providing the agricultural extension services

in their market areas by using their extension staffs and in overall country by using mass media (Journal, Booklet, Radio, TV, etc.). These companies distribute their agrochemical products with sharing agricultural technology, knowledge and information. Some of the companies are not always formally identified as extension services, and provide advisory and other support services to farmers. Some contact with farmers for only advertising their products.

Myanmar, it is still the fact that the food insecurity and chemical toxicity exist in some households in some part of country. Especially in the Southern Shan Region due to yearly cultivating the many kinds of vegetables which are always destroyed by several pests and the farmers are always using pesticides. These crops are usually eaten as fresh or by cooking every day. Moreover, vegetables from this region such as cabbage, tomatoes, potato, etc. are marketed to the several regions of Myanmar.

The pesticides used in fields are mainly distributed by private commercial agrochemical companies in Myanmar and these companies are also providing the agricultural extension services to the farmers by several ways and the staffs of private companies have more contact with the farmers than public sector staffs.

Hence, both the knowledge sharing of agrochemical companies and perception of the farmers in pesticides using knowledge to improve crop productivity have become an important consideration in today's agriculture. Awareness of pesticides application in that area as a case study would be a useful for situational analysis of current status of farmer perception and practice in crop production.

1.2 Objectives of the Study

The objectives of the study are: to evaluate the practice in application of pesticides by the farmers, to identify the knowledge level of farmers and the private agrochemical companies' staffs in plant protection and to analyze the practice of private agrochemical companies' staffs in agricultural extension services.

1.3 Method of Study

The study used descriptive method by using both primary and secondary data. The collected data were analyzed by using descriptive statistics method. In this study, various issues of secondary data were collected from the previous studies such as research papers, some publications, statistical year books, newspaper and other relevant sources. Primary data were collected from randomly selected respondents

who are vegetable growing farmers and private companies' staff in Kalaw Township, Southern Shan State.

1.4 Scope and Limitations of the Study

The study was conducted at 10 selected agrochemical companies in Kalaw Township, at least 5 staffs in each company, and 130 samples of farmers from 10 villages in Kalaw Township, Southern Shan State were selected as respondents. This study only focused on vegetable farmers in study area.

1.5 Organization of the Study

This study is organized into five chapters. Chapter I mainly presents the introduction of the study by indicating rationale, objective, method, scope and limitation, and organization of the study. Chapter II explores literature review on the important of pests and pesticides in crop production, health issue and environmental pollutions caused by pesticides, advantages and disadvantages of pesticides, agricultural extension service, roles and function of extension, types of extension and resources for agricultural extension. Chapter III includes overview of Agriculture Extension practice and application of pesticides by farmers in Myanmar. Chapter IV deals with analyzing on survey findings. Chapter V is conclusion.

CHAPTER II
LITERATURE REIVEW

2.1 The Importance of Pesticides in Agriculture

Pest refers to any animals or plants causing harm or damage to people or their animals, crops, or possessions (Hill, 1983). Pests belong to broad spectrum of organisms including insects, mite, mice, rats (and other rodents), slugs, snails, nematodes, fungi, bacteria, virus (and other pathogen) and weeds. Pesticide is a substance used for destroying insects or other organisms harmful to cultivated plants or to animals (dictionary.com). Pesticides, a valuable tool for agricultural production, must be used with great care, an expert warns. Pesticides help farmers grow more food on less land by protecting crops from pests, diseases and weeds as well as raising productivity per hectare. Crop quantity and quality rely on crop protection. Moreover, pesticides decrease exposure to food contaminated with harmful micro-organisms and naturally occurring toxins, preventing food-related illnesses (Gianessi *et al*. 2005). Production of major crops has more than tripled since 1960, thanks in large part to pesticides (FAOSTAT, 2012)

All farmers use pesticides, including organic farmers. All farmers are using either synthetic or natural pesticides. Organic farmers can only use pesticides from natural sources but normal farmers use both organic and synthetic or chemical pesticides. All kinds of pesticides, chemical and organic pesticides have various levels of toxicity. If pesticides would not be used in crop production, more than half of growing crops would be lost by pests and diseases. Between 26 and 40 percent of the world's potential crop production is lost annually because of weeds, pests and diseases (OECD-FAO Agricultural Outlook 2012). Without crop protection, these losses could easily double.

All of pesticides are not the same. Pesticides can be classified by target pest such as insecticides, Miticides, Molluscicides, Rodenticides, Fungicides, Bactericides, Virucides, Herbicides and etc. Food crops must compete with various species of weeds, worms and plant-eating insects. The threats cannot stop once the crop leaves

the field because the pest can cause damage in crop storage. Insecticides prolong the life of the crop and prevent post-harvest losses. Pesticides can produce safe, low-cost food.The pesticides also help farmers provide an abundance of nutritious, all-year-round foods, which are necessary for human health. Fruits and vegetables, which provide essential nutrients, are more abundant and affordable. Grains, milk and proteins, which are vital to childhood development, are more widely available because of lower costs to produce food and animal feed (CropLife International, 2018).

2.2 Integrated Pest Management (IPM) for Sustainable Agriculture

Integrated pest management (IPM) means careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep economic and ecological justice and the reduction of risks to human health and the environment. Integrated pest management emphasizes the growth and development of a plant and fruit that can least distort crops and encourages natural pest control mechanisms. IPM focuses on managing the pests and diseases by combination of cultural, physical, biological and chemical control methods. (WHO / FAO, 2014). It includes the responsibility of crop protection.

The use of pesticides made it possible to increase yields, simplify cropping systems, and forego more complicated crop protection strategies (Barzman, 2015). However, over-reliance on chemical control is associated with pollution and unwanted health effects. Now, the future of crop production is also threatened by emergence of resistance species and strange in pests, weeds and diseases and a low availability of active ingredients in pesticides. Therefore, it is necessary to design cropping systems that are less dependent on chemical pesticides. IPM seeks to reduce reliance on pesticides. When prevention and alternative control methods by themselves do no yield satisfactory results, however, selective pesticides are also used. Reductions and partial use of pesticides contribute to IPM's goal of reducing o risks to human health and the environment.

Integrated Pest Management (IPM) is an ecosystem-based strategy. A strategy based on a combination of techniques such as modification of cultural practice and the use of resistant varieties.

It is an approach to control the pest in an integrated way. Under this method, pesticides are only used according to standard established guidelines and treatment is done with a goal of removing only the target organisms. IPM method is used to solve pests and diseases problems without or at low level of harm to the people and the environment. It is an eco-friendly method of pest control. The resistance of insect pests to insecticides was a major initial driver for the development of IPM (Stern et al. 1959). Furthermore, IPM can also be considered as a pest control program that combines several methods for prevention from the pest and protection of the plants. IPM programs use information about the life cycle of the organism and its interactions with the environment. This information is then used to manage pest damage (Sandesh Adhikari, 2018).

2.3 Advantages and Disadvantages of Using Pesticides

Farmers have the advantages and disadvantages of using pesticides. Pesticides are chemicals that kill insects. For most farmers, the use of pesticides is an inevitable part of farming or gardening. This is because pesticides help plants protect against pests. Pests are dangerous insect pests and can have serious effects on crops if left unmanaged.

Pesticides help farmers to prevent crop damage due to these harmful insects. Pesticides are important to farmers, but by using pesticides, farmers, his family and animals could be endangered. However, when applied properly, pesticides do not have significant side effects on humans and animals. However, it is important for farmers to consider the advantages and disadvantages of using pesticides before using them. One of the main advantages of using pesticides is that pesticides kill the pests faster than other pest control methods. This is because pesticides are specially formulated chemicals that target certain insects. Once the pest has been managed in a pest infestation, the pesticides immediately start to affect the insect's normal biological activity. Insecticides are also easy to use. With most pesticides, a farmer is required to mix the pesticide with the specified amount of water. And then diluted pesticide is sprayed the crop. There are powder pesticides that a farmer applies to the crop directly. Therefore, it can take a few minutes or a few hours to control the pest using pesticides. There are also a variety of pesticides that can be selected by the farmer or gardener. This means that a farmer can easily find the pesticide needed to

control the single pest in their field. In addition, if a pest is able to withstand certain pesticides, a farmer can use another.

However, there are disadvantages of using pesticides. For example, pesticide resistant strains of pests can emergence by using excessive pesticides. If the traits for resistance are genetically based, the pesticide is no longer effective in controlling the pest. Some pesticides also kill beneficial insects. In addition, some pesticides have residual effects that burn the growing crops. When used in the field, pesticides carry rainwater and deposited to rivers and lakes.

Pesticides are chemical or biological substances that are used to prevent the growth of pests which are damaging the crops in an agriculture field, ornamental plants growing in a garden and food grains stored in a warehouse. The followings are the advantages and disadvantages of pesticides:

Advantages

1. Pest control: Reduces pests that feed on economically valuable crops.
2. Disease prevention: In plants it protects against diseases by killing pests.
3. Increasing yields: Useful for increasing crop production.
4. Cost effective: Pesticides are easily available at cheap prices.
5. Effective and fast: Pesticides are toxic to living organisms, and the effects of these pesticides are quick and effective to control pests.

Disadvantages

1. Loss of beneficial insect species: The use of pesticides not only kills harmful insects but also kills beneficial pollinators. Therefore interrupts in the life cycle of plants.

2. Poisonous Dangers: Pesticides are harmful to all living things. Infectious diseases include head ache, nausea and irritation related to the use of pesticides in agriculture. Headache Symptoms of rash and severe poisoning are common.

3. Responsible Pollutants: Pesticides can pollute the air. These are the pollutants that pollute the soil and water.

4. Food chain effects: The consumption of immature pesticides in the insect body by other organisms contributes to biodiversity. Large populations of organisms are affected by higher trophic levels.

5. Affects the quality of food: Pesticide residues affect crops. These pesticides contain chemicals that cause health problems for humans and animals (Shobhitrawatitf, 2018).

2.4 Pesticides Use in Southeast Asia

As the industrialization rapidly advances, there are challenges in the chemical management industry in Southeast Asia. The use of pesticides in large-scale agricultural pests is rarely controlled. The readily available pesticides in Southeast Asia are usually the broad spectrum and the most toxic. Many industrial and consumer chemicals are still not regulated in the region. The effects on public health and the environment can be devastating. In addition to significant negative effects on health and the environment, the use of pesticides and uncontrolled residuals also affect trade. Due to strict restrictions on the use of chemicals in the European Union and the United States, high levels of acceptable chemical residues have been returned to the home countries. The economic losses are considerable to farmers, industry and governments and ultimately all citizens of the affected countries.

In recent years, pesticide production has been steadily increasing in Southeast Asia. Studies have shown there is a gap in the implementation of pesticide management in regards to protecting the health and safety of agricultural workers due to continuous reports on occupational exposures. Occupational exposures within the agricultural sector in Southeast Asia continue to be reported. Across Southeast Asian countries, a high amount of pesticide usage was reported in Thailand (172,000 tons in 2013), the Philippines (22,470 tons in 2004) and Malaysia (51,066 tons in 2004). The use of pesticides varies among the 10 Southeast Asian countries, depending on the intensity of the agricultural practices, with smaller countries such as Singapore and Brunei having the least agricultural activities. The countries which use the most pesticide is Thailand, the Philippines and Malaysia (Emilia Zainal Abidin*, et al*, 2017)

China is the main exporting country of pesticides to Southeast Asia countries. From January to November 2018, a total of 1.2412 million tons of pesticides were exported from China, valued at $7.093 billion. The export volume of Chinese pesticide formulations to Southeast Asia from January to November 2018 was 215,530 tons, valued at $7.12 million. Of this, 34% went to Thailand, 21% to Vietnam, 17% to Indonesia, 10% to Philippines, 6% to Myanmar, 4% to Malaysia, 4% to Kampuchea and 3% to Singapore. For future exploration of the Southeast Asian

market, Chinese enterprises need to give priority to either the joint development of high-efficient formulations in collaboration with local strategic partners or incorporation of formulations into excellent local platforms. There were many pesticides exported from China to Southeast Asia. Among them, the largest volume of the all of the pesticides export was herbicide, for example, Glyphosate (AgroPages, 2018).

2.5 Agricultural Extension Services

In general, agricultural extension can be defined as the delivery of information inputs to farmers (Anderson & Gershon, 2007). Agricultural extension is crucial for customers to introduce new innovations or technologies. It is important to improve farmers' crop production methods and increase agricultural productivity. Agricultural extension also involves dissemination of information on innovation or new technology to the clientele (Principle of Agricultural Extension, National Open University of Nigeria).

Agricultural Extension is also regarded as "the body of knowledge which accumulates experience and research findings with respect to extension and borrows insights from other disciplines and field of endeavors which seems pertinent to extension (Rolling, 1997).

2.5.1 Nature of Agricultural Extension

Extension is a non-formal educational function that applies to any institution that disseminates information and advice with the intention of promotion knowledge, attitude, skills and aspirations. The term "extension" is associated with agriculture and rural development. Whatever the name of the system, approach or programme (e.g.; cooperative extension, advisory services, Special Program for Food Security, technical assistance or technology transfer) are used, the remaining function of extension is the transfer and exchange of practice from practical information.

At the same time, extension is a political and institutional tool used to facilitate development. Its purposes may differ, from technology transfer by companies organized around specific, usually mono-cropping farm systems to problem-solving educational approaches to participatory program aimed at alleviating poverty and advancing community involvement in the process of development. Internationally, extension's institutional systems tend to differ from country to

country. The same diversity and separation of agricultural extension activities exists in international organizations. Extension is multidisciplinary. Agricultural extension contains the combination of educational methodologies, communication and group techniques in promoting agricultural and rural development. It includes technology transfer, facilitation, and adviser services as well as information services and adult education (Diouf and Wolfensohn, 2001).

Agricultural Extension has two dimensions,

1. Educational dimension
2. Communicational dimension

Education Dimension involves the change agent (extension worker) attempting to work on the clientele's psychology through the use of effective teaching methods to improve the knowledge and develop the skill of the clientele (former) as he acquires knowledge on improved practices to enhance has production and marketing activities (Williams, *et al*. 1981).

Communication Dimension involves distributing information to clients on new technologies or innovations. It also includes exchange of ideas that respond to research or to the use of previous inventions. Individuals Communication may be limited by the use of groups or mass methods. Thus, extension involves the distribution of useful information through the appropriate means of the client (Okunlola, et al, 2005).

2.5.2 Importance of Agricultural Extension in Agricultural Development

Agricultural extension is a focus of education and communication, and is helping farmers to improve their productivity and income levels.

While living in the midst of rapid scientific and technological development, many of the farmers in the rural communities still employ traditional methods of production. In Nigeria there is a lag of over 20 years between the discoveries of new farming practice. In order to shorten or bridge this gap as well as make the rural communities' part of the dynamic social order where rapid change is characteristic, an extension service among the rural community is needed (Olayide, *et al*.).

Agricultural extension is also requires information on inputs and loans that increase the level of production and income of farmers. In order to have a cultural compatible, socially acceptable and economically feasible technology, extension services are important to guide research development. This is because; extension will

give feed back to the scientist/researcher on the development technology so as to help improve upon the earlier developed technology. Despite the fact that farmers are encouraged to increase their level of production, the issue of marketing outlet is important. Agricultural extension provides information to the farmers on marketing strategy to use to maximize their profit.

The primary role of agricultural extension is to improve the performance of key food producers, farmers. This is because it disseminates information that enhances their current practices. This involves a shift from the traditional resource-based methods of production to a new science- based methods. Specially, agricultural extension performs these important roles:

(1) The role of Educational Development: This is by educating the clienteles on how to maximize the utilization of their resources and available services. This is achieved through development of farmer's skills and attitudes in the clienteles so as to benefit from improved technology.

(2) Extension is also important in the role of vacuum supply. Most farmers rely on inputs and inputs for their products. The sources of loans and markets are unknown. These are limiting factors to farmer's cultivation practices and income. The role of extension in helping farmers to get information on sources of input and credit facilities, marketing strategies and available market for their products has gone a long way to improve farmer's production and their standard of living.

(3) Agricultural development depends on evolvement of new technologies. Technologies could be developed, but if it does not get to the end users it is useless. In national development extension provides the linkage between the farmer and researchers. Extension helps the researchers/scientists to embark on researchers that are culturally compatible, technologically acceptable and economically feasible (Okunlola *et al*, 2005).

(4) Extension is important in creating awareness leading to growing interest in concepts of sustainability and environmental management. This will go a long way in integrating sustainability elements in agriculture and material resources management. The consequence is that it helps increases economic, social and ecological risk (Kroma, 2005)

(5) One of the basic problems of farmers is in the area of decision making. Extension services focus on equipping farmers with marketing and investment information and

training them to make decisions concerning aspects of agricultural prices, management practices and social issues.

2.6. Reviews on Previous studies

General study on pesticides using practices of farmers and Agricultural Extension Services by public and private sectors were reviewed as followings.

2.6.1 Studies of Farmers' Pesticides Uses in Agriculture

Pesticides have two opposite properties: to increase income on the one side and to cause devastation of life on the other side. Because pesticides are generally less selectively toxic than would be desired, non-targets including humans and the environment must be protected from contamination by these agrochemicals.

Joko Mariyono (2014) studied about the Pesticide use in Indonesian vegetable farming and its determinants to analyze factors affecting the use of pesticides in intensive vegetable farming in Java, Indonesia. Findings in this study wear factors leading to the increase in the application of pesticides were the number of observed insect pests, prices of vegetables, use of local varieties, and use of mixed pesticides. Conversely, factors lowering the use of pesticides were the number of observed diseases, the cost of pesticides, and area planted to vegetables. The most important factor in influencing pesticide use was farmers' perception on the correct prediction of yield losses associated with pests and diseases. Suggestions in this study were, the use of pesticides can be reduced by training farmers on crop protection practices, which provide correct information on pests and diseases. Policies related to the price of pesticides would be ineffective, as farmers still highly relied on pesticides. These findings would be useful for reducing the use of pesticides in intensive vegetable farming in Indonesia, and in tropical countries in general.

Pepijn Schreinemachers, *et al*, (2016), studied about pesticide dependence of smallholder vegetable farmers in Southeast Asia", to understand farmers' knowledge, attitudes, and practices regarding agricultural pest management and synthetic pesticide use in Southeast Asia. The vegetable farmers in Laos, Cambodia and Vietnam heavily depend on pesticides for managing pests and diseases in leaf mustard and yard-long bean. Farmers were generally satisfied with the effectiveness of these products and felt that they were necessary, although farmers were aware of adverse health effects. Farmers more or less knew how to protect themselves and knew the

meaning of pesticide safety symbols on pesticide containers. It appears that raising awareness about pesticide health risks is not enough to reduce actual use, although higher awareness is associated with fewer self-reported poisoning symptoms as it may induce people to protect themselves better.

The suggestions of authors in this study were to reduce pesticide dependence by increasing farmers' knowledge about beneficial and harmful arthropods, by stimulating local knowledge sharing while regulating the role private pesticide retailers, and by promoting the use of alternative methods of pest control such as bio-pesticides. Interventions to reduce pesticide dependence must be gender-sensitive and recognize that female farmers play an important role in pest management and tend to use smaller quantities of pesticides than men.

Mustapha F.A. Jallow, *et al*, (2017) studied about "Pesticide Knowledge and Safety Practices among Farm Workers in Kuwait" to assess the levels of knowledge, attitude and practices of Kuwaiti farmers regarding the safe use of pesticides. Findings in this study were the majority of the farmers acknowledged that pesticides were harmful to their health (71%) and the environment (65%). However, farmers' level of knowledge of pesticide safety is insufficient. Over 70% of the farmers did not read or follow pesticide label instructions, and 58% did not use any personal protective equipment (PPE) when handling pesticides. Storage of pesticides within living areas was reported by 20% of farmers. When disposing of pesticide wastes, respondents adopted unsafe practices such as discarding, incinerating, or burying empty pesticide containers on-farm, or reusing the containers. Farmers also reported disposing leftover pesticide solution or old pesticide stocks on-farm or in the sewer. A significant number (82%) of the farmers reported at least one symptom of acute pesticide poisoning. Although farmers' knowledge of pesticide hazards was high, the reported safety measures were poor.

And suggestions in this study were comprehensive intervention measures to reduce the health and environmental risks of pesticides are needed, including pesticide safety training programs for farmers, stringent enforcement of pesticide laws, and promoting integrated pest management and non-synthetic methods of pest control. Training pesticide retailers to increase their knowledge of pesticides is also critical, since they are farmers' primary source of information about pesticides. Finally, intervention strategies by regulatory agencies to strengthen enforcement mechanisms of current pesticide laws, through regular surveillance and monitoring pesticide safety

compliance at the retail and farm level is a necessity in promoting safe pesticide use. In addition, the importation, sale and the use of highly hazardous pesticides should be restricted.

Naw Htet Htet Htun (2017) studied about Farmers' Behaviour and Health Awareness Regarding Usage of Pesticides to examine factors associated with the farmers' perception, handling behavior and health awareness of pesticide usage. There were many respondents who were having lack of knowledge regarding pesticides. When the respondents purchase pesticides, normally depending the information provided by the stop-keeper. Most of the respondents do not acre the product is registered or not. Even the respondents do not know the chemical name of the product, the specific problem of the crops should address so that the shopkeeper could give the right product. It is also found out from the discussion that the shopkeepers sometime do not acre to the farmers. Sometime there were pushing sales for promotion items. Regarding the storage, some of respondents think it should be no problem to keep the pesticide at any place. Although 89% of the respondents noticed the direction and cautions on the pesticide label, but applying in practical were not found fully. About one third of the 89% respondent use more than the direction dosage, the other one third use less and the rest of the respondents used according to the direction.

The author suggested in this study that the Government Agriculture Staff who must be technicians should reach to the villages as much as they can. The technician should focus on the need of farmers not on the need of difficult standard procedure and technique which farmers have difficulties to apply. Since some of the farmers do not use chemical in their farm it is great to promote IPM strategies, which can be in different for each crop and depending on local varieties used, local agronomic practices and various crop production options. As IPM can never be delivered in a package, it needs to be developed, adapted and tailor-made to fix local requirements. The supporting technician should convince to change the mind set of farmers and also need to prove them that the new technique and finding really provide better yield and profitable to the farmers.

In order to have awareness on pesticide, the agriculture staff and volunteer technician should hold campaigns about raising awareness as the first priority. Informing about basic facts to consider when the farmers want to purchase pesticide must be fundamental knowledge. Provide awareness of simple registration procedure

and ratifications of international knowledge might catch the farmers' attention. By creating awareness among farmers and their families on the risks of using pesticide, it is to ensure more informed choices on pesticide application. This could be done through the awareness raising sessions where farmers can conduct their own informal health studies. Farmers can inventory the pesticide they used by hazard levels, observe each other's hazardous pesticide handling, storage and disposal practices, and conduct simple sign and symptoms of pesticide poisoning survey among each other.

2.6.2 Studies on Agricultural Extension Services

Khin Oo (2007) studied about improving the Agricultural Extension Services; her findings were _ analyzing the general technical knowledge of extension agents, the organization highly influenced on the knowledge of the present extension approach and target yield of crops. The extension agents did not possess enough extension knowledge except MSE's staff. Knowledge of target yield of crops was found to be weak in some enterprises. Their aspirations on their extension job were negative especially among the village level extension agents as they intended to run their private enterprise instead of continuing to serve the present job.

Khin Oo and Kazuo Ando (January, 2012) studied about the views and perception of Field Extension Agents in Mandalay Division of Myanmar. In case of Myanmar extension services delivered and funded by the State, a top-down approach, no incentives for staff, poorly motivated staff and management, lack of transportation, little involvement of local people in extension planning, no suitable market and prices for farmers, too many farmers to give advice and problems with illiterate farmers were revealed in this study.

2.6.3 Emergence of Private Sector Service Providers

In most countries, private sector companies are important providers of technology transfer and agricultural development mainly by contracting with farmers (Cary and Wilkinson, 1992). The characteristics of the "privatization" extension system focus on commercial farms. Most of the private sector extension services are a commercial decision. When an extension is made public, it is a political or bureaucratic decision. Is there a business plan or extension program for small-scale agriculture and rural development? It is important to decide whether or not (Rivera and Cary, 1997).

Public sector agricultural extension organizations were confronted by highly competitive interests from the private sector. Farm input suppliers and output buyers became more active in educating the farmers in the processes and standards which were desired by particular markets. They created demonstration plots and field trials, similar to public sector extension techniques but with a view to vertical technology transfer. In some cases, "contract farmers" turned into workers for the contracting companies (Diouf and Wolfensohn, 2001).

There are many private agencies which are not usually designated as an extension service. These agencies provide advice to farmers and other support services. They include input agencies, Farmer organizations; Manufacturers, Co-operatives, Manufacturing companies; Non-governmental organizations (NGOs); Agricultural houses; consultants and consulting firms; financial institutions and media and internet services. However, the private extension program is expected to focus mainly on good regions and valuable crops (Sulaiman et al, 2005).

Myo Min Htun (2006) studied about "Towards Private Extension Trend in Myanmar: Analysis of Parallel Extension Services in Green gram Production Area, Yangon Division" for the comparative study of Myanmar Agricultural Service (MAS) and agro-chemical companies as the public and private extension services. The findings in this study were both MAS and agro-chemical companies relied on a strategy of using contact farmers. It is apparent that they selected the contact farmers biased towards the young, educated and resource-rich farmers with more participation in various organizations.

As business and profit oriented organizations, agro-chemical companies designed their extension strategies to persuade farmers to adopt their products and delivered more on plant protection technology of exportable crop. Instead of focusing on individual farmer, the private organizations assigned their agents to organize the group meeting as a primary method for dissemination of information, reasoning that group meeting attracted and reached more farmers. MAS primarily employed farm visits supplemented by group meetings. These activities were probably designed for the benefits of contact farmers. MAS delivered a package of technologies to farmers in their extension system.

The favourable views of contact farmers towards companies' extension activities and contact methods were apparent. It was found that average mean

perceived effectiveness of extension contact method was higher in companies than that of MAS.

CHAPTER III
AGRICULTURAL EXTENSION PRACTICE AND APPLICATION OF PESTICIDES IN MYANMAR

3.1 The Importance of Identifying the Pests in Growing Fields

Pest identification is the first step in any pest control program. The integrated pest management practice depends on "field study" or monitoring of the pest and crop development. This is important because the proper management methods for each pest may be significantly different. Unfortunately, pest identification can be very difficult if farmers are not familiar with the weed, insect, or disease problems present within their area. Studying weeds and diseases visually, insect surveys often require special techniques. Most insects can fly or otherwise escape detection. The plants are also closely examined and look for signs of insect feeding. It is important to record the results for future references, as this will allow farmers to better understand what conditions the pests prefer. Many observations should be recorded when scouting including the location in the field, identification of beneficial insects and pests present, density of pests, stage of pests, and distribution of pests in the field. The type of damage observed in the field and where the pest is located on the plant will also help determine which pests are present.

Many insects have chewing mouthparts and eat plant tissue. Larval of many butterflies and moths or adult stages of beetles feed on leaves, fruit, roots or other plant parts. Most plants accept one or more species of aphids, leafhoppers or plant bugs. These insects use mouthparts to penetrate plant tissues and absorb plant sap. This causes damage to leaves, flowers or fruit. Sucking insects can also cause crop losses by spreading diseases from infected to healthy plants. Typically, different species of insects will attack one crop at a specific time within a year or at a specific stage of plant growth. Information is available on printed or online guides for identifying insects affecting the specific crop.

Several types of microorganisms can cause a reduction in plant health including fungi, bacteria, virus, and nematodes. Identifying these organisms in the

field is usually very difficult and often laboratory classification is performed. Plant diseases and disorder usually occur when a regular plant function is breaks. For this reason, plant pathogen can easily mix with environmental stresses. For example, wilt symptoms occur due to water stress caused by drought or rot caused by pathogens. Although symptoms between a disease and an environmental stress are often indistinguishable, they can often be separated by the pattern in which they are distributed within the field. Environmental stresses are distributed in many plants typically, over large area of the field. Alternatively, biotic organisms occur in clusters scattered in pockets throughout the field.

Weeds are growing plants in crop growing fields and compete with desirable plants for limiting resources such as water, nutrients, and sunlight to reduce crop yield and quality. Due to this competition, weed species need to be identified and removed when they are young and have not had time to impact the crop. Weeds are classified based on morphological features of the foliage, stems, and flowers; therefore, visual inspection of the plant is all that is required for identification. A small magnifying lens may aid in the identification of small features of some plants. Weeds can be classified as annual, biennial or perennial plants. Annual plants will germinate, flower, set seed and die within one year, while biennials take two years. Perennials can grow for several years, storing energy in perennial tissue. Identification is critical as management strategies differ dramatically for annuals, biennials, and perennials. For example, perennial weeds can tolerate many management techniques such as mowing and cutting that are effective on annual and biennial weeds. While weeds can occur anywhere, infestations are common in areas that are frequently disturbed or where crop growth is suppressed. These are excellent places to begin scouting for weed populations. Weeds also tend to occur in patches and grow at various times of the season; therefore, several scouting trips through various locations in the field should be conducted. Identification of seedlings, while important, can be very difficult; several references are included to help with identification of weed seedlings and mature plants.

However, most of the Myanmar farmers are very weak in distinguishing kinds of insects, diseases, weeds and nutrient deficiency symptoms. They are often using incorrect treatments. This can cause excess cost and harmful effect to environment.

3.2 The Importance of Reading Label in Any Pesticides

One of the most important tools for safe and effective use of pesticides is the information on the product label. Labels are legal documents and are required to contain directions on how to properly mix, apply, store, and dispose of a pesticide product. These directions are designed to help ensure the safe and effective use of pesticides. Failure to comply with label directions can potentially harm humans and the environment, as well as lead to possible legal liability.

Pest problems occur in diverse settings from agricultural to commercial and residential. In Myanmar, pest control is a year-round consideration, and many times a pesticide will be chosen as part of the management plan for the problem. If a pesticide will be part of the management plan, understanding the contents of the pesticide label is essential for the product's safe and effective use.

The pesticide label is a very expensive document. The information on the pesticide label represents the research, development, and registration procedures that a pesticide must undergo before reaching the consumer at the market, frequently at a cost of millions of dollars to the manufacturer.

Properly interpreting the pesticide label is crucial to selecting the most appropriate pesticide products for use and therefore receiving maximum benefit from their use. The length of a pesticide label varies widely, ranging from one page to many pages of very fine print. While the label may seem overwhelming at first, it does not require a great amount of time to understand the information once the general format is recognized. Label content for a single product changes frequently; applicators of pesticides should review labels of products they will be using on a regular basis.

The farmers should read the pesticide label before purchasing the pesticide to ensure that it is the correct one for the job, before mixing the pesticide to ensure the proper pesticide concentration, before applying the pesticide to ensure proper use and before storing of excess chemical or disposal of the empty container.

Information contained on most labels can be divided into four major categories: safety, environmental, product, and use.

3.3 Current Situation of Using Pesticides in Myanmar

Myanmar’s Agricultural systems are diversified more than commonly thought. During the monsoon seasons most of farmers plant paddy, while during the cool and

dry season most farmers plant pulses, oilseeds and maize other than paddy. However, the low yields and high labour use keep Myanmar on the lower end of the Asian productivity spectrum. Low agricultural productivity is the results of multiple factors, many of which are associates with the undersupply of quality agricultural inputs.

In monsoon paddy, insecticides, herbicides and fungicides were used by farmers, but the uses of molluscicides or rodenticide were not reported. The percentage of insecticide users was less than 20% and herbicides were used by only 6% of growers. Compare with monsoon season, the percentage of users and average cost were higher for both insecticides and herbicides.

As the second largest crop after paddy, pulses have a shorter growing period than rice and thus more able to accommodate shorter wet period. They are grown more densely in regions with hasher climate condition and erratic rainfall regions. Pulses production constitutes an important source of revenue and the percentage of users and average cost were quite high and varied among regions.

Maize is still a minor crop in Myanmar despite the growing importance. According to Total maize area was only 10% of pulses area and 6% of rice area. Herbicide use was almost none and large amount of the labour was for weed control. Groundnut possess the largest user percentage and expenditure of the top 3 oilseeds and the percentage of insecticide users ranged from 61 in river area to 14 in dryland area for sesame.

Myanmar land area is bigger than Vietnam and Thailand, of which cultivating area is equal to Vietnam, but pesticide usage only accounts for 8-10% of Vietnam (from Myanmar ministry of agriculture data). It means Myanmar agriculture land still has big potential for developing. Lacking crop protection products is also one of main reasons for low agricultural output. Take rice for example, its output per hectare in Myanmar is 70% of Thailand and its income per hectare in Myanmar is only 1/3 of Thailand and Vietnam. The belief that insecticides must be used for rice growing and that insecticide would increase yields had been closely related to farmers' high insecticide use in many Asian countries (Heong and Escalada ,1997).

The range of insecticides used in Myanmar was narrow. Most commonly used were organophosphates and organochlorines, particularly dimethoate, phenthoate and endosulfan, which are banned or under restricted use in most countries. This might be due to the economic sanctions that have prevented imports. In addition, the insecticides and the poor spraying equipment being used were hardly effective. Many

of the chemicals also have negative impacts on human health and the environment, thus Myanmar farmers are much better off not using any insecticides at all (Nilar Aung *et al*, 2012). The high proportion of farmers with strong beliefs in the key four belief statements above that favour insecticide use is of deep concern. As Myanmar opens economically in the next few years, insecticide imports and promotions are likely to escalate. If pesticide marketing is not regulated and are allowed to be sold as FMCGs (fast moving consumer goods) it will increase the threat of overuse and misuse that can trigger pests outbreaks, like in Thailand for last 10 consecutive seasons, in Indonesia and in China. It is vitally important that Myanmar Plant Protection Services review their pesticide regulatory process, make changes to control marketing and improve its implementation to ensure that the pesticide industry comply with the FAO Code of Conduct on the Distribution and Use of Pesticides in pesticide marketing and distribution.

Myanmar's agriculture has existed since the 1960s with the availability of fertilizers, fertilizers and pesticides. Use of pesticides and farm equipment is common. However, the country's main crop is paddy. It should also be noted that the infection rate of pests is low in paddy fields. A 2008 scientific study of Myanmar rice fields noted, “Most pesticide applications are unnecessary or counterproductive. In view of their high cost and the associated health hazards especially when not applied with the proper precautions, any recommendation for their use appears unwise”. A survey conducted in 2012 with 600 rice farmers in Yangon and Naypyitaw showed that most farmers used chemical substances such as organophosphates and organochlorines which have already been banned in other countries. Pesticides used by farmers include dimethoate, phenthoate, and endosulfan. Now the economy in Myanmar is opening and the proportion of pesticides being imported to the country is increasing. This may lead to the overuse and misuse of pesticides since the knowledge of farmers on proper use of pesticides is still poor (Nilar Aung et al, 2012).

In Myanmar, pesticides are imported from Thailand, Vietnam and Myanmar-China border for a long time. In 2013, China pesticide exported to Thailand for $370 million, Vietnam for $320 million and Myanmar for $21.36 million. There is existing huge contrast. In Myanmar Pesticide usage, insecticides accounts for 60%, fungicide for 16%, herbicides for 22% and others for 2%. Due to Myanmar later opening policy, it extremely lacks plant protection knowledge, products and sales network. It is similar to Vietnam in its ten-year ago. Larger pesticide dealers in Myanmar are only

about 15. Meanwhile due to political reasons, multinational company products have not yet to enter Myanmar market. Its market competition is very low. The pesticide registration is managed by the ministry of agriculture in Myanmar. Comparing to China registration policy, it is relatively simple. According to agriculture ministry statistics, Myanmar agrochemical market is about $500 million (2th ACE-Myanmar Review, 2013).

Import of pesticides to Myanmar increased from 7,500 metric tons in 2010 to 18,000 metric tons in 2015. Myanmar Awba pesticide plant was planning to produce 3 million litres of liquid pesticides and 2000 tonnes of powder pesticides in 2017. These numbers in themselves are not particularly alarming. After all, the use in Myanmar is still around 10% of total pesticide use in Thailand or Vietnam. However, Myanmar has terrible pesticide oversight. First Rangoon's yearlong study of farming practices in Myanmar revealed that most commonly used in Myanmar are organophosphates and organochlorine compounds (dimethoate, phenthoate and endosulfan), pesticides which have been banned or under restricted use in most countries. Two most popular insecticides are methomyl and imidacloprid. Although both are tightly regulated abroad, widely used in Myanmar because methomyl is illegally being imported via the Thai border and imidacloprid is extremely affordable. The current government revised the list of banned pesticides (including methomyl) in June 2016, but enforcement remains patchy. In the market, more fruits and vegetables need to be monitored by identifying and disposing of pesticide residues. Another step is to ratify the Rhodes and Basel Agreements that control dangerous chemicals and pesticides and modernize local laws in line with international standards (First Yangon Corporation, 2016).

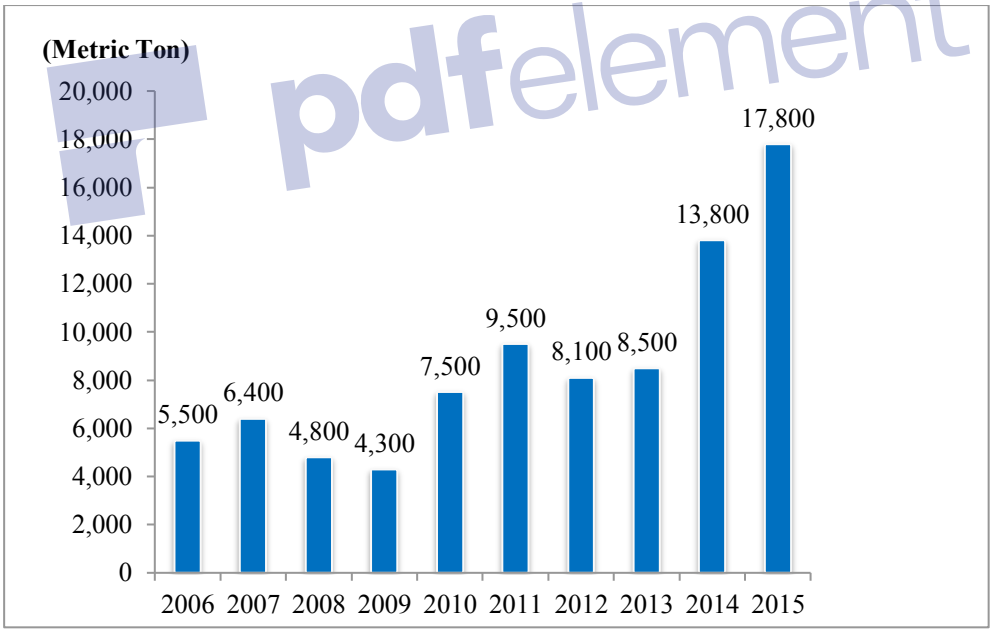
The volumes of imports of pesticides in Myanmar are shown in Table 3.1. On a total volume basis, pesticide imports increased significantly after 2009. No data were available on the values of the imported pesticides in Kyat.

Table 3.1 Amount of Pesticides Imported into Myanmar (2006 to 2015)

Sr. No	Year	Volume of Import (Metric Ton)
1	2006	5,500
2	2007	6,400
3	2008	4,800
4	2009	4,300
5	2010	7,500
6	2011	9,500
7	2012	8,100
8	2013	8,500
9	2014	13,800
10	2015	17,800

Source: Plant Protection Division, MOALI, 2016

Figure 3.1 Amount of Pesticides Imported into Myanmar (2006 to 2015)



Source: Plant Protection Division, MOALI, 2016

Various companies formulate pesticides in Myanmar, mostly on the basis of imported active ingredients such as Syngenta, Bayer Crop Science, Dow AgroSciences, Dupont and Sumitomo cooperation. In addition, several local pesticide formulators are active in the country, such as Ova. Formulated products are sold in

Myanmar itself. A considerable fraction of the pesticides that are used in Myanmar are locally formulated, but exact national figures are lacking. No data were available either on quantities or values of imports of active ingredients which are used for the local formulation of pesticides. Table 3.1 gives an overview of the amount of legally imported pesticides in Myanmar. It doesn't show the total amount of imported pesticides (the legal ones plus the illegal ones). One of the present problems is controlling the illegal pesticides crossing the border without a proper registration and some retailers selling mixed or fake ones or illegally repacked pesticides.

Chemical pesticides are essential for vegetable production, especially in developing countries where there is no high technology for vegetable crops production and it can lead to the food security. However, when people are using the chemical pesticide carelessly, many people are suffered from negative impacts both in short and long run. There are some negative impacts on agriculture economy from the importing agricultural products that are banned or de-registered. In some countries, highly toxic and banned chemical pesticides are still being used. Pesticide residues are still being detected in most of vegetables in many developing countries. People in developing countries are the most vulnerable to the effects of pesticide residues since they do not have enough knowledge on proper handling of pesticides. In addition, import of illegal pesticides to Myanmar can lead farmers to access pesticides easily and misuse them. Therefore, it is very important to do an inspection on the imported pesticides by the government because most pesticides imported from border areas are not in the local language. Consequently, farmers cannot read the instructions on the label and result in excessive use of pesticides. Farmers should have awareness on the proper use of pesticides and should use only pesticides in which have labels in the local language. When farmers use pesticides properly and use only when needed as part of an integrated pest management program, the chemical pesticide residues on vegetables potentially cannot be higher than the maximum residue limits (MRLs) and fresh vegetables are safe to consume.

Farmers did not have sufficient knowledge on safety of pesticide use since they have not received proper training from the Department of Agriculture and from the agrochemical company staff. 38% of farmers received the training on safe use of pesticides and they know well about what type of protective equipment should be worn. However, 18.33% of farmers did not wear any protective equipment, 10% of interviewees used only mask and 71.67% of interviewees used protective equipment

(i.e. mask, glove, long sleeve shirt, trouser but no glasses, hat and boots). Most farmers received information regarding safe use of pesticide from agrochemical company staff and agrochemical sellers. 30% of interviewees received information about using of pesticides from their peer farmers, (Sai Kham Thi, 2018).

According to the January 2019 data of Plant Protection Division (PPD) under Ministry of Agriculture, Livestock and Irrigation (MOALI), there are about 130 agrochemical companies and 3351 registered pesticides in Myanmar.

3.4 Agricultural Extension Services in Myanmar

Nowadays, agricultural extension services are very important to develop the knowledge and to improve practice of farmers in crop production.

3.4.1 Public Sector Extension Services

In many countries, there is a strong tendency towards the privatization of government extension agencies, because many governments got serious debt problems by spending more money than they received from their taxpayers. There are a great many private companies, and which are not always formally identified as extension services, provide advisory and other support services to farmers (Kidd *et al* ,1998). In 1976, the "Training and Visit System (T&V)" was introduced in Ayeyarwady Division (the largest rice production area) as a World Bank project. And then, the "Selected Concentrative Strategy (SCS)" was laid down in a special high yielding rice production program in 1978. After 1988, the country' economic system adopted a market oriented economic system instead of centralise planned economic system (MAS, 1999). In recent years, the SCS approach was not properly conducted as before and country moved back traditional extension approach.

The number of extension personnel is the highest in MAS. Crop area coverage per extension staff was less than 1000 ha for all institutions in the agriculture sub-sector. The ratio of agriculture technicians (including all with at least university degrees) was only 31 % of total extension staff of the MAS (Maung Mar, 2004).

The agricultural extension service was created by the State in 1906 by forming of Department of Agriculture (DOA). Although the agricultural extension services were basically the process of educating farmers by using advance technologies, the nature of extension work at that time was mainly focused on the distribution of inputs and farm implements, the standardisation of weight and volume measurement of crop

produce, and the purchasing of farm products. After 1952, the DOA was expanded and the agricultural extension services became more effective. Since that time, Myanmar has practised the "traditional extension" approach or "transfer of technology (TOT)". The village level extension agent meets with farmers at home or on farm individually or in groups for discussions or training to transfer technologies. They also arrange field visits and field demonstrations (Tin Hlaing, 2004).

The lack of a clear strategy for extension providers and agribusiness providers in the public sector is a hallmark of the centralized governance and management structure, which facilitates the initiation and implementation of extension services that meet the needs of the agricultural community. Budget constraints often go to villages and do not carry out any activities beyond the basic routine. The limited extension budget was allocated mostly for agriculture as follows: (1) MAS: 4 to 6 % of total 2000-01 and 2002-03 budget; (2) MCSE: 8 to 9 %; (3) MSE: 2 to 11 %; (4) MPCE: 0.8 to 1.5 %. The MAS received the lower extension budget per acre, (LIFT, 2015).

Extension is currently provided to facilitate the achievement of central production targets for core crops and especially for rice. To have a more significant impact on farm incomes, crop production and the alleviation of rural poverty the service requires re-orientation within a new enabling environment for farm production. Its main role should be to improve farm incomes through the development of sustainable integrated farming systems. Extension should focus on key themes including: (i) adoption of quality seeds and planting materials of new HYVs; (ii) integrated balanced plant nutrition, capitalizing on the already good work in the use of organics combined with increased use of chemical fertilizer; (iii) integrated pest management techniques for pest and disease control; (iv) integrated cropping and farming systems; (v) rainwater harvesting and water-use efficiency in irrigated systems and rain fed conditions; and (vi) support to farm enterprises and value chains such as kitchen gardening, horticulture, aquaculture and livestock production especially relevant for small and marginal farmers and the landless (FAO, 2016).

Private companies are also increasingly involved in the development of agricultural sector in Myanmar.

3.4.2 Private Sector Extension Services

The private sector increasingly participates in the sales of seed, agrochemical products, and agricultural machinery and then enters in to the transfer of knowledge on the use of their agrochemical products and new seeds which is more like as a private extension service. The government also accepts the United Nations and some international NGOs for doing agricultural and rural development programs and projects on the development of remote areas and selected dry risk-prone areas (Khin Oo 2007).

The main AES providers in the private sector are input-supply/agro shops, which mostly deal with at least two of the three product groups' fertilizer, agro-chemicals and seeds. Some of them also purchase produce from the farmers. As a rule of thumb, it has been observed that in more dynamic township centres with a higher demand of inputs, the shops/traders are normally specialised in two ways: They do not offer all three product groups any more but focus on seeds and chemicals or chemicals and fertiliser or fertiliser only.

Moreover, buying produce from farmers and selling inputs to farmers is a combination in less dynamic townships only; in the more dynamic areas the two different businesses are separated from each other. The obvious reason is that in an economically more developed environment there is also a tendency to specialize. The higher volume of business favours such specialisation.

The input sector is a very dynamic sector with a steadily increasing turnover. The main players on the market are Myanmar AWBA Group, ARMO/Capital Diamond Star Group and Golden Lion. All three companies import fertiliser and agro-chemicals, but they also import inputs and manufacture both products in the country.

During a visit to AWBA head office, the team was told, that the company employs about 600 agronomists all over the country. It has a network of 32 company-owned shops, 1,400 dealers and approximately 6,000 sub-dealers. In 2014, AWBA organised approximately 8,000 extension meetings/field days country-wide with an average attendance of about 70 farmers. At this stage, the agro-chemical sector earns the biggest share of the company's turnover, but fertiliser sales are growing fast and will soon account for the largest share. Awba has started to expand its business into the farm machinery sector with an emphasis on rice harvesters, which are partially sold on credit. It is company policy to sell a considerable share of products on credit

basis, implying that all official dealers also have to conduct some credit sales. Most likely, this policy is in place for two main reasons:

(1) High demand by clients

(2) Potential long-term attachment of clients to the company.

Interviewing a regional sales manager of Golden Lion, he is responsible for several townships in the dry zone, and in each of these townships at least two agronomists tour the villages by motorcycles provided by the company. They arrange farmer meetings/field days, mostly addressing fertiliser use and plant protection. These agronomists are not directly involved in selling the company's products, instead keeping a low profile as far as their company background is concerned. They receive a fixed monthly salary (ranging somewhere between salaries paid by the government and by NGOs), and in case the company's annual sales targets in the respective township are being met, they also receive a significant bonus payment.

It is obvious that the private sector concentrates its efforts on areas with the highest business potential. In the seven townships around Aungban, where the new LIFT/Mercy Corps project started recently, Awba employs 35 agronomists (an average five per township), whereas in other townships there are only one or two.

The professional competence and qualification of the shop-owners of most agro-input shops is critical: In most cases, they have no formal agricultural educational background, but have attended some crash-courses or have a qualified person (very often "retired" DOA staff) at hand, who is part-time available for professional advice to the customers/farmers.

With the official Awba dealers, the picture looks different; here the company seems to place a premium on qualified staff (graduated agronomists), who in some cases also have previous professional experience with DOA.

Merchants, brokers or retailers provide information mainly on market issues like varieties, quality and prices, but in most cases on an ad-hoc-basis and not systematically (LIFT, 2015).

3.5 Comparing Public and Private Agricultural Extension Services

In current situation, agricultural extension service is conducted by both public and private sectors in Myanmar. According to the Myo Min Htun's study in 2006, the conductions of public and private agricultural extension services can be seen as follows.

Public sector (Department of Agriculture, DOA, formerly named as Myanmar Agricultural Service, MAS) primarily met with their contact farmers (68.7%) whereas private agrochemical companies met with both contact and non-contact farmers (83.7%). This was indication of public extension approach which mainly focused on their contact farmers for the dissemination of technology and information.

Major discussion content in field demonstration was asked whether MAS and companies paid attention on dangerous effect of agro-chemicals to be aware for the conservation of the environmental sustainability. It was found that both organizations, gave the same weightage (about 33%) on their discussion of effectiveness, harmfulness and usage of agro-chemicals in field demonstrations with farmers.

Effectiveness of extension is directly related to the number of contacts made by extension staff with given individuals, as well as the approach used by workers (Claar and Bentz, 1989). Majorities of farmers stated that MAS staff usually used bicycle (43.9%) and public bus (or) train (47.6%). Company staff commonly used their departmental car (47%) and motor-cycle (53%). It can be assumed that transport facilities are important to have adequate and appropriate mobility for extension staff.

Agrochemical companies spent ten times expense on facilities for one technical sale officer than that of public sector MAS extension workers at the same level. Therefore, they are able to response prompt action on farmer's request in their field problems (Davidson, 2001).

Most of the farmers (60.5%) requested MAS for field observation to their farms and 74.1% of the respondents requested company for field observation during their visits to villages. It can be assumed that agrochemical company staff were better resourced and were provided with a company transport facility and a business expense account.

Half of the farmers stated that company observed farmers' field problems on their request, whereas 12.2% of contact farmers experienced the field observation done by MAS. As company staffs are sales promoters, observation of farmers' field problems may be one of their techniques for searching customers. MAS staff could not respond like company staff due to their limitations in mobility, time and workload.

3.6 Types of Pesticides Used by Farmers in Southern Shan State

There are three districts, twenty-one townships and ten sub-townships in Southern Shan state.

While agriculture plays as an important role in economy of the state, as in the central lowlands of Myanmar, due to the variety of climate types, including those with more moderate temperatures, the variety of crops is much bigger than includes, beside rice, wheat and maize, groundnut, pulses and beans, fresh fruits and vegetables as main crops. There are also cotton, coffee, tea and tobacco plantations. Livestock breeding and fresh water fisheries are also significant. Shan state is popular for its plot products of all sorts of fresh fruits and vegetables, produces of its moderate but sunny climate. Horticulture is very potential for the state economy since there is very large amount of land resources suitable for orchard, flowers and green vegetables.

At the same time, different brands of chemical pesticides with the same active ingredient are easily available in this region. Therefore, farmers do not find an alternative way for pest control and they do not know there are alternative ways to control pests apart from using chemical pesticides. Studies in many developing countries showed that farmers received the information regarding pesticides mainly from retailers and from their neighbours who do not have good knowledge about pesticide risks (Lekei *et al*, 2014).

Although farmers in the surveyed villages have some knowledge about safe use of pesticides, they did not wear protective equipment during pesticide application and some farmers did not follow the instructions in the pesticide label for mixing pesticide. Since staff from Department of Agriculture cannot access all villages in this region, farmers depend mainly the agrochemical staff as their knowledge resource. However, the Department of Agriculture is trying to conduct GAP (good agricultural practices) together with farmers in some villages. Farmers in this study had reasonably good knowledge about safe use of pesticides but had poor safety practices, especially for using personal protective equipment (Sai Kham Thi, 2017).

In Southern Shan State, 90.85% of farmers used insecticide while 50.14% of farmers used herbicides and 81.72% of farmers used fungicide. Using a lot of pesticide to prevent the pest and disease issues is not a proper way because it could negatively impact on human health, water, soil and environment. And 94.46% of farmers reported that they used the products with the Myanmar instruction (Thuta Maung Maung, 2017).

Since Southern Shan region is one of the largest vegetable production areas of Myanmar, many agrochemical companies target this region to sell their products. However, farmers have not received good training regarding safe use of pesticide. Although agrochemical company staffs arrange training occasionally, knowledge transferring is not done to all farmers. Some farmers are using insecticides in their farm even without pest infestation. This can cause the pests to become more tolerant to chemical pesticides. Many accidental poisoning, acute or chronic health effects can be caused by the improper handling of pesticides. When people are frequently exposed to pesticides, various health diseases such as dermatosis, cancer, and genotoxic, neurotoxic, and respiratory effects can result. Farmers in developing countries have a higher chance to be exposed to toxic substances due to lack of knowledge on safety use of pesticide and they seldom protect themselves from exposure (Rijal *et al*, 2018).

CHAPTER IV
ANALYSIS ON SURVEY DATA

4.1 Survey Profile

In this study, Pilot tests were done in 3 villages of Taikkyi Townships for farmers and in Taung Paw Tharr Yee Shinn (Agriculture) company for companies' staffs during June, 2019 and survey questionnaires were revised and final survey was conducted at 10 villages of Kalaw township in July,2019. Persons who helped in this survey and farmers were provided training about questionnaire before conducting the survey.

In Kalaw Township, the total area is 372,562 acres and 23% of the township area (84,076 acres) is agricultural land where the net cropped area and fallow land area are 77,266 acres and 6,810 acres. Most cultivated crops in this area are paddy, sunflower, peas and beans, maize, potato, tomato, cabbage, cauliflower, other vegetables and fruits. There are 25 village tracks and 256 villages in Kalaw Township (Annual Report of GAD, Kalaw, 2018). Among these village tracks, 10 villages from Myin ma Hti, Lamine, Wat Phyu Ye, Heho and Thar Mie Kham village tracks were selected as survey areas because there were many vegetable growing farmers and pesticides were being mostly used in this villages.

There were three respondent groups such as farmers, private agrochemical companies' staffs and government officers of agricultural sector in this study. Three sets of questionnaires were prepared for two respondent groups. For the farmers, there were three parts of questionnaires such as characteristics, knowledge and practice of farmers on field problems and application of pesticides and three parts of questionnaire were used for private agrochemical companies' staffs such as characteristics, knowledge of staffs on plant protection and practice in agricultural extension services. And five key informant interview (KII) questions were prepared for the government officers.

4.2 Survey Design

In this study, Knowledge and Practice of respondents, farmers and private companies' staffs were studied and key informant interview was done with government officers. Data were collected orally by an interviewer using a structured, standardized questionnaire. These data were analysed quantitatively or qualitatively depending on the objectives and design of the study.

The designs of the survey used in this study were systematic sampling and random sampling methods. The sampling frame i.e. 10 villages of Kalaw Township were selected by systematic sampling method. In 10 villages, there were 4628 farmers who mainly grow vegetables. Among them, the study population of 130 was selected by using of randomly sampling method. For agricultural extension service, 68 staffs of private agrochemical companies in this area were selected by using random sampling method. And 8 officers of Ministry of Agriculture Livestock and Irrigation were selected by systematic sampling method in this area for qualitative data.

Determination of Sample Size

The following formula, Yamane (1973) was used for sample size determination.

$$n = \frac{N}{1 + N(e^2)}$$

n = Sample Size

N = Total Number of Population (4628)

e = Error (0.1) (e = 0.1 means 90% level of significant)

From above vales sample size "n" was calculated as follow:

$$n = \frac{N}{1 + N(e^2)}$$

$$n = \frac{4628}{1 + 4628(0.1)^2}$$

$$n = 97.88$$

Therefore, the required total sample at the survey area is 97.88 and however, 130 farmers were selected for this study to cover the potential incomplete and missing answers.

4.3 Analysis on Survey Results of Farmers

There are four parts of analysis on survey results of farmers such as characteristics, knowledge on field problems and pesticides, practices in pesticide application, knowledge level of selected farmers in study area.

4.3.1 Characteristics of Farmers

According to the table (4.1) about 50% of respondents are primary education and only 3% are graduated. In age level of most participants, 32% are between under 30 and 30, 29% are 31 and 40, 22% are 41 and 55 and 17% are over 50. There were 74% of male and 26% of female. Among the farmers, 52% of respondent farmers own 1 to 5 acres, 14% of farmers do not have own land and these farmers are renting the land of another farmers. And the farmers who own more than 10 acres is 6%.

Table 4.1 Characteristics of Farmers

No.	Variables	Respondents	
		Frequency	Percent
1	Age (Years)		
	Under30 - 30	42	32
	31 - 40	37	29
	41 - 50	28	22
	51 - 60	23	17
	Total	130	100
2	Gender		
	Male	96	74
	Female	34	26
	Total	130	100
3	Education Level		
	Informal Education	10	8
	Primary School	67	52
	Middle School	32	24
	High School	17	13
	Graduate	4	3
	Total	130	100
4	landholding area (Acre)		
	No Land	18	14
	1 - 5 ac	67	52
	6 - 10 ac	37	28
	More than 10 ac	8	6
	Total	130	100

Source: Survey Data, July 2019.

In this study, the structured interview questionnaire included specific questions that assessed respondents' awareness on pesticides. Survey questions assessed their knowledge on pest problems and pesticides and practice on the application of pesticides.

4.3.2 Knowledge of Farmers on Field Problems

According to the survey result, most of the farmers have the knowledge on field problems. Table (4.2) shows that out of 130 respondents, 88 % of farmers know to always check the pests and diseases problems in their fields and 62% of the farmers have knowledge about differences between insect pest damage symptoms and disease symptoms. Although 71% of farmers reported that they can identify the kinds of insect pests and 93% can identify the kinds of weeds, 58% cannot diagnose the kinds of diseases in their field. Most of the farmers, 88% know about yield loss by pests, diseases and weeds, however 55% of all respondents is able to choose right pesticides for specific problem.

Table 4.2 Knowledge Status of Farmers on Pest and Disease Problems (n= 130)

Item	No. of Respondent	Percentage
Checking Pests & Diseases	114	88
Differences between pests &diseases problems	80	62
Pests identification	92	71
Diseases diagnosis	55	42
Weeds identification	121	93
Suitable pesticide for specific problem	72	55
Yield loss by pests, diseases and weeds	114	88

Source: Survey Data, July 2019

4.3.3 Knowledge of Farmers on Pesticides

Information about the knowledge of farmers on pesticide is shown in Table (4.3). The 89% of farmers accepted the importance to distinguish the kinds of pesticides Most of the farmers know the advantages and disadvantages which

contributed from 86% of farmers, however 55% of all respondents did not know about cancer may be caused by the pesticides. This table also shows that 98% of respondents answered the disposal methods of pesticides containers and bags was important and 66% of farmers know the disposal methods of pesticide container and bags before using the pesticide, 94% have knowledge not to use the expired pesticides. Although78% noticed the warning to wear the personal protective equipment (PPE), 81% have less awareness of knowing the level of toxicity show by colour code and 75% did not notice the direction for use in pesticide label. Most of the farmers know about time interval and pre-harvest interval (PHI). But the largest percentage of farmers was not the knowledge of incompatibility of pesticides and entering ways of pesticides into the human body as much as 94% and 81% respectively.

Table 4.3 Knowledge Status of Farmers on Pesticides (n= 130)

Item	No. of Respondent	Percentage
Important to distinguish the kinds of pesticides	166	89
Advantages and Disadvantages of Pesticides	112	86
Cancer caused by pesticides	58	45
Importance of pesticide disposal methods	128	98
Knowing the Methods of Disposal	86	66
Using Expired Pesticides	8	6
Pesticide label is important for farmers	121	93
Level of Toxicity by Colour Code in Label	25	19
Direction for Use in Label (Methods of Application)	32	25
Warning for Protection Equipment in Label	101	78
Important to wear the personal protecting equipment	129	99
Time Interval in Pesticide Application	96	74
PHI (Preharvest Interval)	82	63
Incompatibility of Pesticides	8	6
Pesticide Entering Ways into the Body	25	19

Source: Survey Data, July 2019

Table (4.4) shows, the spraying time of pesticides by the farmers. The respondents who spray the pesticide in the morning is 50%, and 20% of respondents in noon. There were 87% respondents did the pesticide spraying in evening. This table means the farmer are spraying the pesticides in every time only, if they think their field should be sprayed.

Table 4.4 Pesticide Spraying Time (n=130)

Time	No. of Respondent	Percentage
Morning	65	50
Noon	26	20
Evening	113	87

Source: Survey Data, July 2019

Table (4.5) shows that 85% of respondents ask the neighbouring farmers for the pest problems and pesticides should be used. It means that a lot of information source are mainly from the neighbouring farmers. According to the second information, 68% of the respondents rely on shopkeepers for pesticides related information. And, 43% of respondents sometime asked agricultural technicians when able to meet and 44% asked the people who are being believed as knowledgeable person and the less 8% of respondents sometime asked the staff of the Department of Agriculture of Kalaw Township.

Table 4.5 Information Sources of Farmers for Field Problems and Pesticides

Source of Information for Field Problems	Ask information		Not ask information	
	Frequency	Percent	Frequency	Percent
DOA (Township)	10	8	120	92
Agricultural Technician	56	43	74	57
Knowledgeable Person	57	44	73	56
Shopkeeper	89	68	41	32
Neighboring Farmers	111	85	19	15

Source: Survey Data, July 2019

4.3.4 Practice of Farmers in Plant Protection and Pesticide Using

Table (4.6) shows all of the respondents are using the pesticides, 80% of respondents read thoroughly the pesticide label and 82% used the pesticide if necessary. The 68% of respondents mixed the different kinds of pesticides in single tank. Their reason was they did not have enough time and labour resources, and they faced more than one problem i.e., both insect pests and diseases, both sucking pests and chewing pests, etc. Most of the farmers in study area know about preharvest interval (PHI). Only 14% of respondents use the pesticides in their field close to harvest.

Table 4.6 Pesticides Using Rate and Habits of Farmers in Handling of Pesticides (n= 130)

Item	No. of Respondent	Percentage
Farmers who are using pesticides	130	100
Reading thoroughly Pesticide Label	104	80
Mixing the different kinds of pesticides in single tank	89	68
Using pesticides in the field close to harvest	18	14

Source: Survey Data, July 2019

Table (4.7) shows most of the respondents, 82% used the pesticide if it was necessary to use. And 60% of respondents used the pesticides with the dosage as shown in label, 40% used more dosage than that shown in label and there is no farmer who used the pesticides with lower dosage than label. The 85% of respondents are alternately using different kinds of pesticide ai (active ingredient). The 89% of respondent are spraying the pesticides one time per day. When the pesticides are diluted, most of the respondents, 95% use bamboo stick (or) wood stick to stir the pesticide tank and only 5% are not stir the tank by hand or by stick.

Table 4.7 Pesticide Using practice of Farmers

Item	Frequency	Percentage
Using Pesticide		
If necessary	106	82
Even it is unnecessary	24	18
Total	130	100
Pesticide Using Dosage		
as shown in label	78	60
more than dosage in label	52	40
less than dosage in label	0	0
Total	130	100
Using Pesticide ai		
Single	20	15
Different	110	85
Total	130	100
Pesticide spraying times per day		
One Time	116	89
Two Times	14	11
Total	130	100
Stirring the pesticide tank		
Hands	0	0
Bamboo stick or wood stick	124	95
Not stir the tank	6	5
Total	130	100

Source: Survey Data, July 2019

Some of the farmers in this area are less awareness on health and environmental pollution. Table (4.8) shows that there are a few farmers who are using the mouth to suck the tank's nozzle when it is blocking with something and do not take a bath after spraying the pesticides in the percentage of only 3% respectively. Only 15% of respondents are eating and chewing food while spraying the pesticides. In the eating case, most of farmers are chewing betel.

Table 4.8 Dire Practice of Farmers in Application of Pesticides (n = 130)

Item	Frequency	Percentage
Using mouth to suck pesticide tank 's Nozzle	4	3
Taking bath after spraying the pesticide	126	97
Eating & chewing food while spraying the pesticide	19	15

Source: Survey Data, July 2019

In Table (4.9), most of the farmers are using herbicides from 1 to more than 5 times, fungicides from 1 to more than 11 times and insecticides from 1 to more than 21 time in the field respectively. In the application of pesticides, 66% of respondents use weedicides from 1-2 times. The 33% of respondent use fungicides 11 times and more than 11 times. The 31% uses from 1-5 times and some, 22% uses from 6 - 10 times. This condition states that there are many fungal diseases problem in Kalaw area. There are many farmers who are using large amount of insecticides in study area, 56% of respondents use insecticide from 1 to 10 time and 35% uses 11 to 20 times. Most of the farmers assume that insect pest problem is more important than diseases problem, actually this is a wrong concept.

Table 4.9 Application Times of Pesticides per Growing Season

Category	Times of Application				
Herbicide	0	1-2	3-4	5 & Over	Total
Frequency	25	85	13	7	130
Percentage	19	66	10	5	100
Fungicide	0	1-5	6-10	11 & Over	Total
Frequency	18	40	29	43	130
Percentage	14	31	22	33	100
Insecticide	0	1-10	11-20	21 & Over	Total
Frequency	2	73	46	9	130
Percentage	1.5	56.2	35.4	6.9	100

Source: Survey Data, July 2019

In Table (4.10), while spraying the pesticide, 90% of respondents wear the jacket and 64% use face mask. A few farmers wear long boots and gloves, 18% and 14% respectively, only 5% of respondents wear goggles.

Table 4.10 Wearing the Personal Protective Equipment of Farmers (n =130)

Personal Protecting Equipment	No. of Respondent	Percentage
Long boots	24	18
Jacket	117	90
Gloves	18	14
Face Mask	83	64
Goggles	7	5

Source: Survey data, July 2019

Most of the farmers are less awareness on environmental pollution because 41% of respondents do not buried the pesticide container and bags in the safe place and 50% do burning, 28% dispose in the field and only 3% dispose into the stream or river after spraying the pesticides (Table 4.11). Disposing the pesticide containers and bags in to the streams and rivers is very dangerous.

Table 4.11 Methods to Dispose the Pesticide Containers by Farmers (n =130)

Disposal of Pesticide Container	No. of Respondent	Percentage
Buried in the safe place	77	59
Dispose in the field	37	28
Dispose into the stream or river	4	3
Burning	65	50
Washing container and sell or reuse	0	0

Source: Survey Data, July 2019

4.3.5 Knowledge Level of Farmers in Plant Protection

According to the above data, knowledge levels of respondent farmers in field problems and pesticides are stated as follows. In the case of farmers' knowledge in

field problems, 8 questions and in pesticide knowledge 18 questions were used in questionnaire. Most of the respondents answered only some questions correctly. All questions were answered correctly by only a few farmers, 19 (14.6%) of respondents in field problems knowledge questions and only 2 (1.5%) in pesticides knowledge questions. However, the farmers who answered correctly all of field problems knowledge question could not answer correctly in pesticide knowledge question. Therefore, there was no respondent who could answered the questions fully 100%. As a percentage of the correct answers to the questions, the farmers were divided into 3 groups in field knowledge and groups in pesticide knowledge respectively as in table (4.12) and (4.13).

Table 4.12 Overall Knowledge Level of Farmers on Field Problems

Knowledge Level	Frequency	Percentage
Poor	26	20
Fair	48	37
High	56	43
Total	130	100
Mean	5.97	

Source: Survey Data, July 2019

According to the table (4.12), 56% of respondents relates high level of knowledge while 20% has poor knowledge and 37% has fair level of knowledge on field problems. Therefore, about half of the respondent farmers are needed to support field knowledge about mode of damage and damaged symptoms of pests, plant diseases diagnosis, weeds identification and plant nutrients deficiency symptoms, so that these farmers can correctly select the specific pesticides and control measures to solve the field problems.

In table (4.13), 9.2% of respondents are poor level of knowledge, 45.4 % of respondents have either fair or high knowledge level on pesticide knowledge. Thus, knowledge about pesticides handling and application should be supported to the farmers to use the pesticides safely.

Table 4.13 Overall Knowledge Level of Farmers on Pesticides

Knowledge Level	Frequency	Percentage
Poor	12	9.2
Fair	59	45.4
High	59	45.4
Total	130	100
Mean	12.21	

Source: Survey Data, July 2019

In this study, fifteen questions were used in pesticides application practice of farmers. There is no respondent who exactly follow the correct systems of pesticide application because 100% correct answer of pesticide application practice questions was not get in this study. As a number of the correct answers to the questions, pesticide application practice levels of the farmers were shown in table (4.14).

Table 4.14 Overall Practice Level of Farmers on Application of Pesticides

Practice Level	Frequency	Percentage
Poor	12	9.2
Fair	78	60
High	40	30.8
Total	130	100
Mean	10.55	

Source: Survey Data, July 2019

Pesticides application practice level of respondents is mostly fair (60%). Only 9.2 % is poor practice level and 40.8% is high level of practice in application of pesticides. These results show most of respondent farmers are week in correct practice of pesticide application in their growing field and poor in health and environmental awareness. Because the questions in this survey were essential and important in

pesticide application and agricultural production. The farmers who are using pesticides should have these knowledges and should follow these practices in application of pesticides.

In summary, most of the farmers in this area are week in plant protection knowledge, both field problems and pesticides. And these farmers do not exactly follow in some correct practice of pesticide application. Therefore, the farmers in this study area should be supported the knowledge and technical assistance by both government and private sectors.

4.4 Analyzing on Survey Results of Private Companies' Staffs

As Kalaw Township is an agricultural developed area and many kinds of cash crops are sown, there are many private agrochemical companies in this area to sell their product such as seeds, fertilizer and pesticides.

4.4.1 Characteristics of Private Agrochemical Companies' Staff

The characteristics of private agrochemical companies' staffs are as shown in table (4.15). All respondents are males, most of them possess Diploma in Agriculture (47%) and 35% is Bachelor of Agricultural Science (B.Agr.Sc) and then there is 18 % of other Bachelor Degree (B.A and B.Sc). Age level of 34% of participants is between 31 and 40 and 24% is 30 and under 30 and about 42% is over 40. And approximately 76% has over 8 years in working experience. Main duties of respondent are agricultural extension service (AES), marketing (MKT) and sale, most are sale men. In this study, some participants are performing more than one duty, 40% are playing in AES, marketing and sale functions at the same time.

Table 4.15 Characteristics of Private Companies' Staffs

Sr. No.	Variables	Respondents	
		Frequency	Percent
1	Age Group (Years)		
	Under 30 - 30	16	24
	31 - 40	23	34
	41 - 50	11	16
	51 - 60	18	26
	Total	68	100
2	Gender		
	Male	68	100
	Female	0	0
	Total	68	100
3	Education Level		
	Diploma in Agriculture (Dip. Agri)	32	47
	Bachelor of Agricultural Science (B.Agr.Sc)	24	35
	Master of Agricultural science (M.Agr.Sc)	0	0
	Doctor of Philosophy (Ph.D / Dr.Sc.Agr)	0	0
	Other (B.A, B.Sc)	12	18
	Total	68	100
4	Job Description		
	AES + MKT+ Sale	27	40
	AES + Sale	10	15
	MKT + Sale	6	9
	MKT	6	9
	Sale	19	28
	Total	68	100
5	Working Experience		
	1 - 3 Years	16	24
	4 - 7 Years	0	0
	8 - 11 Years	21	31
	12 - 15 Years	26	38
	> 15 Years	5	7
	Total	68	100

Source: Survey Data, July 2019.

4.4.2 Knowledge of companies' staffs on Plant protection and Agricultural Extension service

In table (4.16), most of the respondent 72% are able to distinguish pests and diseases problems, 62% of respondents well understand the action, advantages and disadvantages of pesticide. However, 29% of respondents slightly understand and only 9% do not understand about pesticides. The 82% of respondents know the relationship between climate and pests, and 75% well understand the integrated pest management (IPM) practice.

Table 4.16 Knowledge Status of Companies' Staffs on Plant Protection (n = 68)

Item	Well Understand	Slightly Understand	Not Understand
Pests identification by damaged symptoms	49	19	0
	72(%)	28(%)	0(%)
Property, action, advantages and disadvantages of pesticide	42	20	6
	62(%)	29(%)	9(%)
Relationship between climate and pests	56	0	12
	82(%)	0(%)	18(%)
Integrated pest management (IPM)	51	0	17
	75(%)	0(%)	25(%)

Source: Survey Data, July 2019

Table (4.17) shows 82% of respondents answer IPM practice is important and it is needed to carefully explain the pesticide label to farmers.

Table 4.17 Knowledge of Companies' Staffs on Importance of IPM Practice and Pesticide Label (n = 68)

Item	Frequency	Percentage
IPM practice is important.	56	82
Need to carefully explain the pesticide label to farmers	56	82

Source: Survey Data, July 2019

In this survey, all of the staffs, 100% answered that agricultural extension meeting and training of agrochemical companies are required for farmers. Their

reasons were stated as 75% of respondents said that staffs of the DOA could not able to perform the farmer meeting in everywhere, all of them said that most of the farmers were poor in agricultural knowledge, 57% said that the private companies have more facilities and 84% answered as the agricultural technicians in private companies could reach everywhere (Table 4.18).

Table 4.18 Requirement of AES by Private Companies for Farmers

Item	Require		Not Require	
	Frequency	Percent	Frequency	Percent
AE meeting or training of private companies for farmers	68	100	0	0
Reasons for Require	**Answer**		**No Answer**	
	Frequency	Percent	Frequency	Percent
DOA cannot able to perform the farmer meeting in everywhere	51	75	17	25
Most of the farmers are poor in agricultural knowledge	68	100	0	0
The private companies have more facilities	39	57	29	43
Agri- technicians in private company can reach everywhere	57	84	11	16
Other (Briefly describe)	0	0	68	100

Source: Survey Data, July 2019

4.4.3 Practice of Companies' Staff in Agricultural Extension Services and Solving the Field Problems.

For plant protection, 50% of staffs always discuss about IPM practice to the farmers, 84% discuss about different symptoms of pest, diseases and nutrient deficiency symptoms. All of the staffs advise the farmers to use pesticides only when these are necessary to use. However, 18% of respondents advise the farmers to use the pesticides before pest problems because certain pests and diseases are outbreak in near village or area. The 7% of staff advise the farmers to mix the pesticides with foliar fertilizers. All of the respondents advise the farmers to use suitable pesticides with specific problems. Although a few staffs have technical knowledge in agriculture, the respondents are deviation of agricultural technology as they studied especially in discussion with farmers in meetings (Table 4.19).

Table 4.19 Practice Status of Companies' Staffs on Sharing the Plant Protection Knowledge to the Farmers (n = 68)

Item	Frequency	Percentage
Discussing the IPM practice	34	50
Discussing different symptoms of pests and nutrient	57	84
Advising to use the pesticides only if necessary	68	100
Advising to use the pesticides before pest problems	12	18
Advising to mix the different kinds of Insecticides	53	78
Advising to mix the pesticides with foliar fertilizers	5	7
Advising to use suitable pesticides with problems	68	100

Source: Survey Data, July 2019

In table (4.20), 60% of respondents always share the knowledge about time interval of pesticide application, 23% sometime share and only 8% never share. For pre-harvest interval (PHI), 36% of respondents never share, staffs who always and sometime share about this knowledge are 32% respectively.

Table 4.20 Practice Status of Private Companies' Staffs in Sharing the Knowledge of Pesticide Safety Use to Farmers (n = 68)

Item	Always	Sometimes	Never
Discussing about time interval of pesticide application	41	22	5
	60(%)	23(%)	8(%)
Discussing about PHI of pesticide	22	22	24
	32(%)	32(%)	36(%)
Discussing pesticides safely use and disposal methods	45	12	11
	66(%)	18(%)	16(%)
Discussing to read carefully the pesticide label	46	6	16
	68(%)	9(%)	23(%)
Discussing pesticide residue problems	35	23	10
	52(%)	34(%)	14(%)

Source: Survey Data, July 2019

The 66% of respondent share the knowledge to use pesticides safely, systematically storage and disposal of pesticides packing or containers after using the

pesticide. In AE meeting, 68% of staffs always advise, 9% sometime and 23% never advise to carefully read the pesticide label. And 52% of staffs always,34% sometime and 14% never share the knowledge about chemical residue of pesticides and this may harm to soil, plants, crops, consumers, natural environment and crops growing in rent season.

In solving the farmers' field problems, 47% of respondent solve the problem according to the information from farmers, 32% by using plant sample or photo records of the problem in infected field and 21% by visiting and identifying the problem in the field (Table 4.21).

Table 4.21 Practice Status of Private Companies' Staffs in Solving Field Problems

Solving the Farmers' Field Problems	Frequency	Percentage
According to the information from farmers	32	47
By using plant sample or photo record of the problems	22	32
By visiting and identifying the problem in the field	14	21
Total	68	100

Source: Survey Data, July 2019

4.4.4 Knowledge Level of Private Companies' Staffs in Plant Protection

In this survey, six essential questions were used to study the knowledge level of private companies' staffs and fifteen important questions were used in studying the practice of these staffs in agricultural extension meeting or knowledge sharing to the farmers.

Table 4.22 Overall Knowledge Level of Companies' Staffs on Plant Protection

Knowledge Level	Frequency	Percentage
Poor	11	16
Fair	51	75
High	6	9
Total	68	100
Mean	4.35	

Source: Survey Data, July 2019

Table (4.26) shows most of the respondents 75% have fair knowledge level, 9% have high and 16% have poor knowledge level on plant protection. In this condition, most of the respondent staffs are not completely understanding in plant protection knowledge.

Table 4.23 Overall Practice Level of Private Companies' Staffs on Agricultural Extension Services

Practice Level	Frequency	Percentage
Poor	13	19
Fair	26	38
High	29	43
Total	68	100
Mean	10.37	

Source: Survey Data, July 2019

Table (4.26) states 43% of respondents have high level of practice, 385 have fair and 19% have poor practice level on agricultural extension services. This means that most of private companies' staffs could not technically perform in agricultural extension services.

Thus, the private agrochemical companies should support the improve technology to their staff and the staffs should study not only basic agricultural technology but also new ones. Moreover, government staffs and NGO / INGO staffs in agriculture sector should help to improve the plant protection knowledge of farmers.

4.5 Key Informant Interview with Government Staff Officers on Farmers and Companies' Staffs in Kalaw Area

In this survey, farmers, staff officers of MOALI in Kalaw Township were interviewed for qualitative data. Current situation of farmers, companies' staffs, major pest problems and practice of private agrochemical companies in this area were included in qualitative interview.

Table 4.24 Persons in Key Informant Interviews

No.	Position	Department
1	Staff Officer	Department of Agriculture, Taunggyi District
2	Staff Officer	Tar Yaw Rice Farm, DOA, Kalaw Township
3	Research Officer	Agricultural Research Farm, Aung Ban, Kalaw Township
4	Assistant Research Officer	Agricultural Research Farm, Aung Ban, Kalaw Township
5	Staff Officer	DOA, Kalaw Township
6	Deputy Staff Officer	DOA, Kalaw Township
7	Two Lecturers	Aung Ban Campus, Yezin Agricultural University

Source: Survey Data, July 2019

The persons who were included in qualitative interviews said that pesticide use by in this area is increasing year by year and most of the private agrochemical companies emphasized in technology and knowledge development at the beginning. Nowadays, private agrochemical companies are emphasizing in sale and marketing. Most of the companies' staffs are always selling the products the farmer wanted even if these products are not suitable for current field problems the farmers are facing. There are many illegal pesticides in Southern Shan Region which are imported through the border without registration by some private companies and some wholesale dealers.

The private companies' staffs are always saying about discount and promotion of their products in farmer meeting. Therefore, farmers deviate in choosing the pesticides, most of farmers buy the pesticides with cheap price more than the quality products and suitable products for their field problems. And the officers said that DOA count on the private companies' staffs for agricultural knowledge sharing as much as possible because these staffs are able to go everywhere by the enough

facilities of their companies. The officers advised that the companies' staff should sell their products to farmer by sharing the agricultural knowledge and the farmer should not misuse the chemicals and pesticides.

CHAPTER V
CONCLUSION

5.1 Findings

One of the major economic policies of Myanmar is "Building the modern industrialized nation through the agricultural development, and all-round development of other sectors of the economy". Agriculture sector is serving to fulfil food security of country, to generate foreign exchange earnings through agricultural products exports, and to boost development of rural area which plays an essential role in economic growth and poverty reduction scheme. The study after being conducted successfully and careful processing and analysis of the collected information put forward the following findings. According to the study results, most of the farmers are growing cash crops in Kalaw Township and seeds of these crops are mostly F1 hybrid seeds imported from other countries. As hybrid varieties always require large amount of chemical fertilizer, these crops require large amount of chemical fertilizer, these crops are not resistant to pest and disease problem because of both less and excess dosage of chemical fertilizers.

According to the results of farmers' knowledge on pest and disease problems, most of the farmers are very poor knowledge on plant disease problems, some farmers (44.62%) cannot decide to buy the suitable pesticides for their problems. In the case of information sources for field problems, most of the farmers depend on pesticides shopkeepers and neighbouring farmers.

Regarding the knowledge of farmers on pesticides, most of the farmer do not carefully read the pesticide label as a result they do not clearly know about causing cancer by pesticide, entering ways of pesticides into human body and toxicity level of pesticide shown by colour code in label. A few farmers are spraying the pesticide in noon.

According to the study results, all of the farmers are using pesticides in their fields. Although most of the farmers thoroughly read the pesticide labels, they are still mixing the different kinds of pesticides in single tank, also using more dosage of

pesticides than that shown in label, among them a few farmers are using the pesticides in the fields where the crops are close to harvest and even it is necessary to use the pesticides.

In the case of dire practice of farmers in application of pesticides a few farmers, only 3% are using mouth to suck pesticide tank's nozzle when it is blocking with something and they do not bath after spraying the pesticides. Some farmers are eating and chewing food while spraying the pesticides. In herbicides application, some of the farmers are using herbicides over 3 times per growing season. Actually, herbicide should not be applied more than two times in some crops. Application of herbicides, more than 5 times per growing season is seriously dangerous. In the case of fungicide, most of the farmers are using until 5 time, some are over 10 times and 15 times and over application of fungicides can cause the formation of resistant strain of fungi and environmental pollution. It is needed to teach the integrated diseases management practice to the farmers. In using insecticide, most of the farmers are using the most insecticides than weedicides and fungicides. They are always using insecticides even it is unnecessary and most of them believe that insect pests are needed to prevent and pesticides must always be used when they spray the foliar fertilizer.

The topic discussions about wearing personal protective equipment, most of the farmers wear the jacket and face mask while spraying the pesticide. Long boots, gloves and goggles are used by a few farmers. There is no farmer who wears the complete PPEs in spraying the pesticides in this area. The main issues are the farmers do not know complete about very harmful effects of pesticides, the ways to enter the pesticides into human body and they could not spend extra money to purchase such PPEs.

Although most of the farmers answered that they knew the disposal methods of pesticides containers and bags, the farmers did not obey these methods in their actual practices. Half of the respondents were burning the pesticide container and bags; this practice is very dangerous and they should never do like that. Some farmers disposed the container and bag in their field that can cause environmental pollution and the empty containers can be reused by another people who do not have related knowledge about pesticides.

In the case of private agrochemical companies' staff, most of the respondents are over 30 years old and holding Diploma in Agricultures and B.Agr.Sc degree. All

of them are males. Although most of the staffs understand in pest and disease problems and actions, advantages and disadvantages of pesticides, some have incomplete knowledge and a few, only 6% of respondents do not understand about pesticides.

According to the results, most of the respondents said that the staffs of DOA could not able to perform the knowledge sharing to the farmer in everywhere private companies have more facilities than Department of Agriculture and the agricultural technicians in private companies could reach everywhere.

However, 50% of respondents discuss IPM practice and 53% discusses to mix the different kinds of insecticides in AE meetings. Moreover, most of staffs never discuss about PHI of pesticides. If the farmers harvest their crops before PHI of pesticides, it is seriously dangerous for consumers. Most of the company's staffs are selling their products to solve the farmers' field problems according to the only information from the farmers; it is a bad practice because most of the farmers cannot completely know about mode of damage and damage symptoms of pests and disease symptoms.

5.2 Suggestions

As Myanmar is one of the agro-based countries in Asia, the country produces different kinds of cereals and vegetables. The farmers in Kalaw area are growing more horticultural crops than other regions. Pesticide use by farmers in this area is increasing year by year to protect their crops from pest infestation. The increased use of pesticides causes contamination to the environment and higher health risk to the growers, consumers and natural environment. Pesticide using activities of farmers and behaviour of private agrochemical staffs in their agrochemical market need to solve the issues which were found in this study.

Although most of the farmers in the study area have appropriate knowledge of pest problems, they are incomplete knowledge in pesticides application and harmful effects of pesticides on human and environment. Especially, they do not clearly understand the warning of pesticides on label even if they read the label. And they do not deeply believe the seriously disadvantages of pesticide, therefore, most of the farmers are using the large amount of pesticides unless it is necessary to use. They do

not obey methods of application, pesticide use patterns, warning to avoid misuse and disposal method. They are poor knowledge of IPM practice and they believe to use pesticides only to solve their field problems and to promote their productivity. Most of the farmers depend on pesticide shopkeepers and neighbouring farmers for field problems, plant protection and using pesticide. And they did not attend the CPA training.

In order to have awareness on pest problems and pesticides, the agricultural staffs or volunteer technician should hold campaigns about awareness rising as the first priority. The Government Agriculture staffs who must be technicians should reach to the villages as much as they can. The technician should focus on the need of farmers, not on the need of difficult standard procedure and technique which farmers have difficulties to apply. By creating awareness among farmers and their families on the risks of using pesticides, it is to ensure more informal choices on pesticide application.

By raising the farmers' knowledge on pesticide, the negative impacts of pesticides on growers, consumers and environmental pollution can be reduced. Therefore, private agrochemical companies' staffs should emphasize in knowledge sharing to farmers. Continuously, the private agrochemical companies should emphasize not only in profit and market share but also in promoting the knowledge and technology of their staffs and farmers.

The Department of Agriculture should coordinate with agrochemical companies to conduct training on the proper use and handling of pesticides for the growers. To reduce use of chemical pesticides, integrated pest management (IPM) system should be introduced to the growers. Further, knowledge about the adverse effects of pesticide on human health and the environment should be transferred to growers as much as possible since many farmers do not have enough knowledge about this. Hence, farmers can reduce the costs of pesticide use and the risks associated with their health problems. Continuous monitoring on the use of pesticides in the villages level is needed to determine whether the growers use an acceptable level of pesticides. Then, it can reduce the risk for the farmers, consumers and the environment.

It will be needed for further studies on negative impacts of pesticides on crop market, farmers' income and rural development.

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APPENDIX: 3

Survey Questionnaire

A Study on the awareness of Farmers in Application of Pesticides

MASTER OF DEVELOPMENT STUDIES PROGRAMME (YUE)

Farmers in Application of Pesticides

Village Track - ----------

Village - ----------

Name - ----------

Section (1) Characteristics of Respondents

1. Age Group

(a) Under 30 years ☐ (b) Between 31 and 40 ☐ (c) Between 41 and 50 ☐

(d) between 51 and 60 ☐

2. Gender

(a) Male ☐ (b) Female ☐

3. Education

(a) Informal Education (e.g. Monastery)

(b) Primary School

(c) Middle School

(a) High School

(b) Graduated

4. Size of landholding (acres) ( ) ac

5. Kinds of growing crops

(a) _____

(b)_____

(c)_____

(d)_____

(e)_____

Section (2) Knowledge of Farmers

(A) Field Problems

1. Is it needed to check insect pests and diseases problem in your field?

(a) Yes ☐ (b) No ☐

2. Is it essential to identify clearly the kinds of pests, diseases and weeds in your growing field?

(a) Yes ☐ (b) No ☐

3. Could you distinguish the different symptoms between pests and diseases?

(a) Yes ☐ (b) No ☐

4. Could you identify the kinds of insect pests in your field?

(a) Yes ☐ (b) No ☐

5. Could you diagnose the kinds of plant diseases in your field? (Fungal diseases, Bacterial diseases, Viral diseases, etc.)

(a) Yes ☐ (b) No ☐

6. Could you identify the kinds of weeds in your field? (Grasses, Sedges, Broad Leaves weeds)

(a) Yes ☐ (b) No ☐

7. Could you choose the suitable pesticides for your field problem? (Insecticide, Fungicide, Weedicide)

(a) Yes ☐ (b) No ☐

8. Do you know that crop yield could be lost by insect pests, diseases and weeds?

(a) Yes ☐ (b) No ☐

(B) Chemical Pesticides

1. Is it necessary to distinguish the kinds of pesticides?

(a) Yes ☐ (b) No ☐

2. Do you know the advantages and disadvantages of chemical pesticides?

(a) Yes ☐ (b) No ☐

3. Do you know that the Cancer can be caused by the chemical pesticides?

(a) Yes ☐ (b) No ☐

4. Is it important to dispose pesticide bottles or bags systematically after using the pesticides?

(a) Yes ☐ (b) No ☐

5. Do you know how to dispose the pesticide bags and bottles after using the pesticides?

(a) Yes ☐ (b) No ☐

6. Should expired pesticides be used?

(a) Yes ☐ (b) No ☐

7. Is pesticide label important for pesticide user or farmers?

(a) Yes ☐ (b) No ☐

8. Do you notice the poison level of pesticides shown by color in pesticide label?

(a) Yes ☐ (b) No ☐

9. If you notice, where is the color representing the poison level in pesticides label?

(a) Middle ☐ (b) Bottom ☐

10. Do you notice the method of application in pesticide label?

(a) Yes ☐ (b) No ☐

11. Do you notice the warning to use personal protection equipment in pesticide label?

(a) Yes ☐ (b) No ☐

12. Is it important to wear the personal protecting equipment while spraying pesticides?

(a) Yes ☐ (b) No ☐

13. Do you know the time interval of pesticide application?

(a) Yes ☐ (b) No ☐

14. Do you know the pre- harvest interval (PHI) of each pesticide?

(a) Yes ☐ (b) No ☐

15. When should the pesticides be sprayed in the field?

(a) morning ☐ (b) noon ☐ (c) evening ☐

16. Should you do eat, drinking, smoking and betel chewing while the pesticide spraying?

(a) Yes ☐ (b) No ☐

17. Do you know which pesticides are not compatible with each other?

(a) Yes ☐ (b) No ☐

18. Do you know pesticides can enter the human body by several ways?

(a) Yes ☐ (b) No ☐

19. If you could not able to distinguish the field problems and to choose the suitable pesticides, do you ask to whom?

(a) Staff of the Department of Agriculture (Township level) ☐

(b) Agricultural Technician ☐

(c) A person who has agricultural knowledge ☐

(d) Pesticide shopkeeper ☐

(e) Neighboring Farmers ☐

Section (3) Practice of Farmers

1. Do you use insecticides, fungicides and weedicides?

(a) Yes ☐ (b) No ☐

2. Do you use the pesticides,

(a) if necessary ☐ (b) even it is unnecessary ☐

3. Do you always read thoroughly the pesticide label?

(a) Yes ☐ (b) No ☐

4. Do you always use the pesticide dosage,

(a) as shown in label ☐

(b) more than dosage shown in label ☐

(c) less than dosage shown in label ☐

5. Do you spray by mixing the different kinds of pesticides in a single sprayer?

(a) Yes ☐ (b) No ☐

6. Number of spraying times (pesticides) a growing field per day. ( ) time/ s

7. Number of spraying times in a growing season.

(a) Weedicides ( ) time/ s

(b) Fungicides ( ) time/ s

(c) Insecticides ( ) time/ s

8. In using the pesticides, you always use;

(a) only one kind (ai) of pesticide ☐

(b) different kinds (ai) of pesticide (alternately) ☐

(ai = active ingredient)

9. Do you spray the pesticide close to the harvesting time?

(a) Yes ☐ (b) No ☐

10. When the pesticides are mixed with water,

(a) Stir the tank by hand ☐

(b) Stir the tank by using bamboo stick or wood stick ☐

(c) Not stir the tank ☐

11. Do you suck the pesticide sprayer nozzle by mouth when the nozzle is blocking with something?

(a) Yes ☐ (b) No ☐

12. Do you always take a bath after pesticide spraying?

(a) Yes ☐ (b) No ☐

13. Do you eat during the spraying time of pesticides?

(a) Yes ☐ (b) No ☐

14. Do you always wear the following equipment when you are spraying the pesticides?

(a) Long boots ☐

(b) Jacket ☐

(c) Gloves ☐

(d) Face mask ☐

(e) Goggles ☐

15. After using the pesticides, empty pesticide bottles or bags are destroyed by

(a) Burying in the safe place ☐

(b) disposing in the field ☐

(c) disposing into the stream or river ☐

(d) Burning ☐

(e) Washing the container and selling or reusing ☐

Survey Questionnaire

A Study on the awareness of Farmers in Application of Pesticides

MASTER OF DEVELOPMENT STUDIES PROGRAMME (YUE)

Staffs of Private Agrochemical Companies

Name_____ No. _____

Section (1) Characteristics of Respondents

1. Age

(a) Under 30 years ☐ (b)Between 31 and 40 ☐ (c)Between 41 and 50) ☐

(d) Between 51 and 60 ☐

2. Sex

(a) Male ☐ (b) Female ☐

3. Education

(a) Diploma in Agriculture (Dip. Agri) ☐

(b) Bachelor of Agricultural Science (B.Ag / B.Agr.Sc) ☐

(c) Master of Agricultural science (M.Agr.Sc) ☐

(d) Doctor of Philosophy (Ph.D / Dr.Sc.Agr) ☐

(e) Other (B.A, B.Sc) ☐

4. Duty (You can select one or more than one)

(a) Agricultural Extension ☐

(b) Marketing ☐

(c) Sales ☐

(d) Research and Development (R & D) ☐

(e) Other ☐

(Please describe your obligation) _____

5. Working Experience

(a) Under 3 Years ☐ (b) Between 4 and 7 ☐ (c) Between 8 and 11 ☐

(d) Between 12 and 15 ☐ (e) Over 15 Years ☐

6. Companies which you worked.

	Company' name	Years
(a)	_____	( )
(b)	_____	( )
(c)	_____	( )
(d)	_____	( )
(e)	_____	( )

Section (2) Plant protection knowledge of private agrochemical companies' staffs

1. Could you identify the kinds of insect pest by damage symptoms?

   (a) Exactly ☐ (b) Fair ☐ (c) Could not ☐

2. Do you understand the property, action, advantages and disadvantages of Pesticides?

   (a) Well understand ☐ (b) Slightly ☐ (c) Don't understand ☐

3. Do you understand correlation of weather, plant nutrient, plant pests and diseases?

   (a) Well understand ☐ (b) Slightly ☐ (c) Don't understand ☐

4. Do you understand about integrated pest management (IPM)?

   (a) Well understand ☐ (b) Slightly ☐ (c) Don't understand ☐

5. Is integrated pest management practice (IPM) important?

   (a) Yes ☐ (b) No ☐

6. Is it necessary to explain the pesticide label to farmers?

   (a) Yes ☐ (b) No ☐

7. Do you believe that the agricultural extension meetings of the companies are needed for farmers?

(a) Yes ☐ (b) No ☐

8. If No, what are the reasons of NO? (You can choose one or more answer.)

(a) these meetings are doing by Department of Agriculture (DOA). ☐

(b) the farmers are understanding the agricultural technology. ☐

(c) the cost of meetings perhaps will be added to the product price ☐

(d)the farmer meetings by private companies emphasize the advertising of their products. ☐

(e) Other (Briefly describe)

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9. If Yes, what are the reasons of YES? (You can choose more than one answer.)

(a) DOA cannot able to perform the farmer meeting in everywhere. ☐

(b) Most of the farmers are poor in agricultural knowledge. ☐

(c) Most of the private companies have more facilities (Like time, human resources material and required equipment) than DOA. ☐

(d)Agricultural technicians in private company can reach Everywhere for knowledge sharing. ☐

(e) Other (Briefly describe)

Section (3) Practice of private agrochemical companies' staffs in Agricultural Extension Service

1. Do you specifically share knowledge about plant nutrients to farmers ?

(a) Yes ☐ (b) No ☐

2. Do you seriously share knowledge to farmers to use organic fertilizer?

(a) Yes ☐ (b) No ☐

3. Do you always discuss about integrated pest management (IPM) technology to the farmers?

(a) Yes ☐ (b) No ☐

4. Do you share the knowledge and technique to the farmers to distinguish the different symptoms caused by pests, diseases and plant nutrient deficiency symptoms?

(a) Yes ☐ (b) No ☐

5.Do you advise the farmers to use pesticides only when these are necessary to use?

(a) Yes ☐ (b) No ☐

6. Do you advise to use the pesticides before the pest problems as a prevention practice?

(a) Yes ☐ (b) No ☐

7. Do you advise to mix more than one kind of insecticides in a single tank?

(a) Yes ☐ (b) No ☐

8. Do you advise to mix insecticides, fungicides and weedicides in a single tank?

(a) Yes ☐ (b) No ☐

9. Do you indicate the farmers to use the specific pesticides according to the problems?

(a) Yes ☐ (b) No ☐

10. Do you share the knowledge about time interval in pesticide application?

(a) Always ☐ (b) Sometime ☐ (c) Never ☐

11. Do you share the knowledge about Pre-harvest Interval (PHI) in pesticide application?

(a) Always ☐ (b) Sometime ☐ (c) Never ☐

12. Do you share the knowledge to use pesticides safety, systematically storage and disposal of pesticide packing (bottles or bags) after using pesticides?

(a) Always ☐ (b) Sometime ☐ (c) Never ☐

13. Do you advise the farmers to always read the pesticide label carefully?

(a) Always ☐ (b) Sometime ☐ (c) Never ☐

14. Do you share the knowledge about chemical residue of pesticides and this may harm to soil, plants, crops, consumers, natural environment and crops growing in next season?

(a) Always ☐ (b) Sometime ☐ (c) Never ☐

15. When the farmers request to solve their field problem, you always give an instruction or advice to solve these problems;

(a) According to the information from farmers ☐

(b) By using plant sample or photo record of the problems in the field. ☐

(c) By visiting and identifying yourself the problem in the field. ☐

Questions for Key Informant Interview

A Study on the awareness of Farmers in Application of Pesticides

MASTER OF DEVELOPMENT STUDIES PROGRAMME (YUE)

Name –

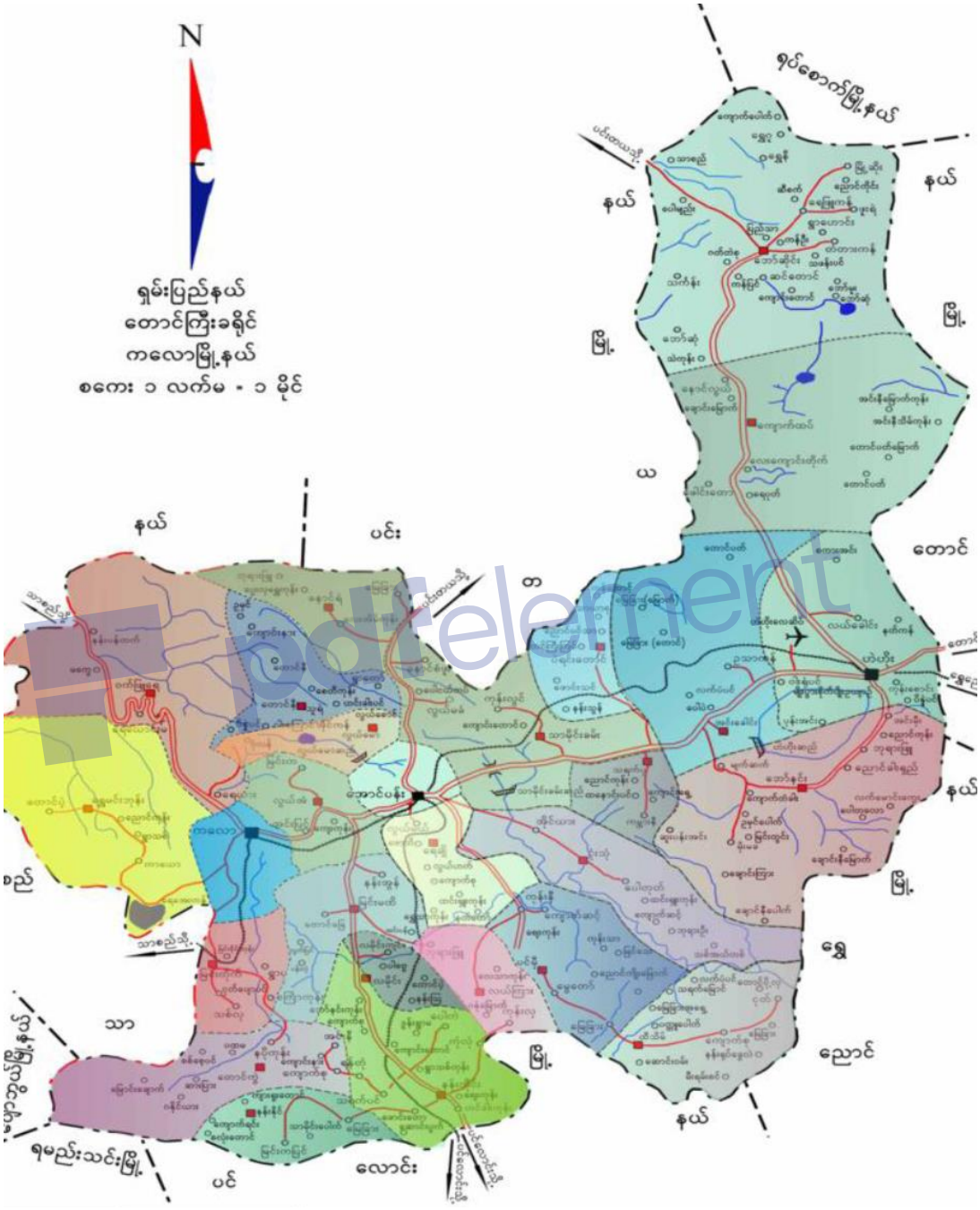
Position _

Department _

1. What do you think of the use of pesticide farmers in the Kalaw area?
2. Could you tell me your opinion on pesticide companies?
3. Could you tell me your opinion on the sales patterns of company staffs in the pesticide market?
4. What do you think of the pesticides on the market in Shan State?
5. Could you tell me your opinion on the extension services of company staffs?
6. I would like to know the activities of the Department of Agriculture in the field of pesticide application of pesticide extension technology.
7. What advice would you give to agricultural company staffs and farmers?

APPENDIX (1)

Fig. Map of Kalaw Township, Southern Shan Region



Source: Department of Agriculture, Kalaw Township.

APPENDIX (2)

Vegetables Fields in Kalaw Area

Survey at La Mine Village, Kalaw Township

Survey at Myin Ma Hti Village, Kalaw Township

Survey at Myin Oakthar Kan Village, Kalaw Township

Survey at Inn Gaung Village, Kalaw Township

Survey with Private Company's Staffs at Kalaw Township

Interview with Staff Officer of DOA, Kalaw Township

Mixing Various Kinds of Pesticides without Wearing Gloves, Kalaw Township

Spraying Pesticide without Personal Protective Equipments, Kalaw Township