YANGON UNIVERSITY OF ECONOMICS

MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY OF KNOWLEDGE AND PRACTICES ON CHEMICAL USAGE IN BEANS AND PULSES CULTIVATION OF YANGON REGION

(CASE STUDY OF THREE VILLAGES IN THANLYIN TOWNSHIP)

KHWARNYO LWIN

MPA - 6 (18th BATCH)

JULY, 2019

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This thesis submitted as a partial fulfillment towards the requirement for the degree of Master of Public Administration (MPA)

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ABSTRACT

Chemical substances play a key role in cultivating beans and pulses of Myanmar's agricultural sector. The objectives of the study are to assess the knowledge and practices of farmers in using chemical substances for beans and pulses cultivation and to examine the reasons of increasing chemical usage in cultivating beans and pulse. The study was carried out in three villages of Thanlyin Township, which are Bot Thapyay Kan, Thahtay Kueen, and Bagan Taung. Descriptive method with quantitative approach was used for this study. The structure questionnaire was used to collect information from respondents. Respondents in the study hold the belief that the usage of chemicals in beans and pulses production can upgrade high yields. The study found that only 55% of beans and pulses growers have ever attended trainings on systematic usage of chemicals for the agricultural processes. Among the farmers, 95% of farmers have to use increased amount of chemicals yearly in beans and pulses production because of poor knowledge, unsystematic handling processes of chemicals, and climate change. Therefore, beans and pulses growers of Myanmar require updated knowledge of chemicals and the farmers have to apply modern agronomic practices to reduce the usage of these chemical substances in agricultural sector.

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LIST OF ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
CC	Cubic Centimeter
CDZ	Central Dry Zone
DDT	Dichlorodiphenyltrichloroethane
EU	European Union
FDI	Foreign Direct Investment
FIL	Foreign Investment Law
FTC	Fertilizer Technical Committee
G to G	Government to Government
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
HA	Hectares
INGOs	International Non-Governmental Organizations
IPMS	Integrated Pest Management System
LNGOs	Local Non-Governmental Organizations
MIL	Myanmar Investment Law
MOALI	Ministry of Agriculture, Livestock and Irrigation
MPBSMA	Myanmar Pulses, Beans, and Sesame Seeds Merchants Association
MRLs	Maximum Residue Limits
MT	Metric Ton
NGOs	Non-Governmental Organizations
NPK	Nitrogen, Phosphorus, Potassium
OP	Organophosphate
PHI	Pre-Harvest Interval
PPE	Personal Protective Equipment
PPP	Private-Public Partnership
R&D	Research and Development
SPS	Sanitary and Phytosanitary Measures
WTO	World Trade Organization

CHAPTER I
INTRODUCTION

1.1 Rationale of the Study

Myanmar has a diverse and favorable range of agro-ecological zones with varying climatic conditions, land quality and suitability for agricultural activities. Total land areas of Myanmar are about 70 million hectares and most are engaged for agricultural sectors. As the agricultural sector plays an important role for Myanmar, economy of the nation has been traditionally based on agricultural sector. Agriculture is the main stream of the country and 70 percent of the population depend on it for survival. As the development in agricultural sector will enhance the economic development of the country, the government has designated the sector as the main pillar of the economy and is dedicating tremendous efforts to achieve greater progress in it.

During the early 1960s, Myanmar was also the world's largest producer of rice, a position, which, the country is now striving to regain through planned initiatives. So also, Myanmar is one of the largest global exporters of beans and pulses. The 2010 Myanmar Census of Agriculture showed that between 2003 and 2010, the area cultivated with beans and pulses increased from 6 to 15 million acres. In Myanmar, beans and pulses are sown mainly in the Central Dry Zone (CDZ), followed by Delta, hilly and coastal regions in that order. Several types of beans and pulses are grown and the major varieties are chickpea, butter bean, green gram, pigeon pea, black gram, kidney bean, cowpea, lab lab bean, sultani and sultipya, while major exportable varieties are black gram, green gram, pigeon pea, soybean, cow bean and kidney bean.

Beans and pulses are main sources of protein for most of the people and play essential role for the worldwide consumption of food supplies. Even in processed foods and canned foods, beans and pulses indirectly involve as protein. There is great

demand for beans and pulses in the form of raw materials and value-added products. Beans and pulses are important exports of Myanmar. Since the liberalization of the pulses trade in the early 1990s, the production and export of beans and pulses increases year by year. More than one million tons of beans and pulses are annually exported to foreign markets and the sector yearly generates a total value of foreign income around US$ 1 billion.

As the cultivation and production of beans and pulses increase, the use of agricultural inputs becomes wider and wider. The inevitable use of inputs for beans and pulses cultivation are agrochemicals including chemical fertilizers and pesticides. Not only in Myanmar but also in other agricultural countries, the use of agrochemical is unavoidable in every stage of cultivation and production. In Myanmar, the imports and distribution of chemicals used for agricultural sector are undertaken by the private sector after the initiation of market-oriented economy in 1998. Since then, the agrochemical market of Myanmar has been enlarging. There are undesirable consequences due to the excessive usage of agrochemicals. From the viewpoints of environmental conservation, the fertility rate of soil becomes less along with soil depletion, which leads to more agrochemical usage year by year. Contamination of water sources and damage of ecosystem are caused by the usage of chemicals in agriculture. Unsafety agricultural products with chemical residues are prominent disadvantages of using agrochemical in the farming processes.

Since the usages of chemicals are inseparable in agricultural processes, farmers require good practices in handling these agrochemicals. How much extent of farmers systematically apply agrochemicals in beans and pulses production depends on the level of knowledge possesses by these farmers. The study is aimed to examine the knowledge and practices of agrochemical usage in beans and pulses production and the reasons of increasing agrochemical usage in beans and pulses production.

1.2 Objective of the Study

The objectives of the study are:

(1) To assess the knowledge and practices of farmers in using chemical substances for beans and pulses cultivation.

(2) To examine the reasons of increasing agrochemicals usage in cultivating beans and pulses.

1.3 Method of Study

Descriptive method is mainly used as research methodology in the study. Both primary data and the secondary data are used for this study. For the collection of primary data, three villages in Thanlyin Township are selected and total of 200 random samples are chosen in proportion from the three villages. The secondary data are obtained from research papers, websites and some publications. The structured questionnaire is used to conduct the study of knowledge and practices on chemical usage in beans and pulses cultivation.

1.4 Scope and Limitation of the Study

This study focuses on beans and pulses growers in three villages from Thanlyin Township of Yangon Region. Among twenty eight villages of Thanlyin Township, the three sampling locations of the study are Bot Thapyay Kan Village, Thahtay Kueen Village, and Bagan Taung Village. According to the simple random sampling method, the survey is undertaken from 200 farmers of traditional farming method users from the three villages. Present investigation for the analysis of knowledge and practices on chemical usage in beans and pulses cultivation of these three villages from Thanlyin Township was conducted from March to May, 2019.

1.5 Organization of the Study

The thesis is organized into five chapters. Chapter 1 is the introduction, including rationales, objectives, scope, method and structure of the study. Chapter 2 outlines literature undertaken to review on the closely related studies. Chapter 3 describes the usage of chemicals in beans and pulses cultivation in Myanmar. Chapter 4 presents the knowledge and practices of farmers in using growers in using chemicals for beans and pulses cultivation. Chapter 5 is conclusion with findings and recommendations.

CHAPTER II
LITERATURE REVIEW

2.1 The Role of Chemical Substances in Modern Agricultural Processes

Modern agriculture is characterized by the use of relatively large amounts of chemical inputs. The generic name given to the chemicals used in agriculture to facilitate plant growth and protection is known as agrochemicals, which includes insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, fertilizers, plant growth regulators and others. A large number of these chemicals, with a wide range of different physical and chemical properties, are currently used in agriculture to increase crop yields. The world would produce only about half of staple foods without the usage of agrochemicals. The roll of agrochemicals is important to fulfil the main goal of agriculture, which is to sufficiently produce crops and livestock for people.

The developed countries have started the usage of chemicals in agriculture since 1880s. Ready-to-use various agricultural chemicals or agrochemicals are formulated and prepared by large multinational corporations. Chemical substances commonly used in agriculture are fertilizers and pesticides. Fertilizer means chemical fertilizer, bio-fertilizer, natural fertilizer, which consist of material that can help ensure chemical change in the soil or other means for plant nutrition for the growth of fruits, flowers, crops and plants. Pesticides can be defined as substances or mixture of substances intended for preventing, destroying, or controlling any pest that can damage crops in agriculture or occur vectors of diseases for public health. The term “Pesticide” covers insecticides, fungicides, and other related chemical compounds.

Production and consumption of agrochemicals gradually increases around the world. The application rates of the agrochemicals reached to the highest levels in the developed world during the years of 1960s. Starting from the early years of 1980s, the aggregate chemical application rate, which is measured by quantity applied per acre, has declined moderately in agricultural sector of the developed countries. A large part of the reason for the decline is due to the higher intensity of agrochemical quality

(potency, toxicity, and persistence). Agricultural sectors of developing world started touching the agrochemicals only in 2000s. Since then, the trend of agrochemical usage in developing countries has been increasing.

The primary reasons of the usage of agrochemicals are just to protect crops from insects or pests, to enhance the growth rate of crops, and to remove unwanted plants, weeds, the control of insects, and fungal pathogens. The usage of agrochemicals includes even in organic technology of farming for producing crops. Due to the elevated use of agrochemicals, open-access externalities to agricultural sector occur in the forms of soil depletion and pesticide resistance. When the evolution of pesticide resistance and soil productivity loss become the regional phenomenon, linked to overall usage rates of agrochemicals, the income of a certain farmer depends on what the other farmers choose to do. Under a normal circumstance, a farmer has to face with just two choices: to use agrochemicals in a small quantity or to use these substances in a large quantity (Field, 2001).

Regardless of what the other farmers do, a certain farmer is better off choosing a high application level. The high usage rate is a dominant strategy to all the farmers and it is individually the best under both circumstances, particularly when there are same incentives to all the farmers for low agrochemicals usage. Although there are lots of controversies over the usage of chemical substances, worldwide agricultural production depends on increase usage of agrochemical in order to solve critical concerns over the amount of food production and consumption of the global population, which will be nearly 10 billion by the middle of the 21st century.

2.2 Advantages and Disadvantages of Using Chemical Substances in Agricultural Sectors

It is impractical to completely abandon the use of fertilizers and pesticide compounds in agriculture. It is important to consider advantages and disadvantages of using the chemical substances in agricultural sectors. The advantages of agrochemicals can be classified into primary benefits and secondary benefits.

The primary benefits of the agrochemicals are the direct gains expected from the usage. These primary benefits are being inexpensive and easy to transport, supporting the growth of plants, growing crops fast and big, helping farmers to produce more agricultural products with less land, providing a predictable and efficient source of nutrients, ensuring bountiful harvests, reducing water borne and

insect transmitted diseases, alleviating the difficulties due to hand removal of pests and preventing huge post-harvest losses from pests and diseases.

Generally, agrochemicals are inexpensive to purchase and easier to transport than organic soil additives such as animal manure and other natural extracts. Chemical fertilizer, which is a form of agrochemical, contains necessary nutrients in specific ratios that are tailored for the specific growth requirements of specific crops. The nutrients from chemical fertilizers allow crops to be grown even in depleted soils. As fertilizers provide the primary nutrients needed for plant growth, plants are able to grow more quickly with large sizes for increase of yields.

Application of agrochemicals can reduce the amount of time required to manually remove weeds, diseases and pests, which can damage the harvestable produces. Pesticides can also be used in storage buildings of agricultural products for the prevention of termites and other pests. In addition to protecting crops from pests and diseases, the agrochemicals have also direct benefits to human health. The use of pesticides can kill pests and insects, which carry or transmit diseases. The use of pesticides can prevent some diseases, such as bubonic plague carried by rat flees, and typhus transmitted by fleas and body lice.

The secondary benefits of agrochemicals are subtle and less immediate than the primary benefits. Abundant harvest of crops enhance food productivity and consumers can have foods with affordable prices. The higher yields of crops bring additional revenue that can be put towards children's education and medical care leading to healthier and better educated population. Economic and labor benefits to farmers can be achieved through the usage of agrochemicals by means of saving additional labor costs and obtaining improved yields. Without the usage of chemicals in agriculture, there can be considerable economic losses (Webster, 1999).

Beyond the advantages of agrochemicals, there are two major problems associated to the increase use of chemicals in agriculture. These are bio-accumulation and biological magnification. When a chemical substance builds up in the body, the synthetic compounds do not easily break down. This is because the body is lack of proper mechanisms to remove these chemicals. Once the substances enter the body of an organism, these can be permanently stored in the body tissue. This process is called bio-accumulation.

The chemical compounds of pesticides accumulate in each organism's body and these can be passed on to other predators. Organisms in the food chain will have

increased concentrations of pesticides by consuming many lower level organisms and receiving the pesticides stored in those organisms. Biological magnification, also known as bio-magnification, is the term used to describe when chemicals increase in concentration with each level of the food chain.

A famous example of bio-magnification is with the pesticide known as DDT, Dichlorodiphenyltrichloroethane. Starting in the 1950s, DDT was used to kill mosquitoes and sprayed on crops to kill pests. DDT got into the water supply and was integrated into bodies of zooplankton, small animals and immature stages of larger animals. Then, zooplanktons are consumed by small fish and then larger fish. Eventually, the larger fish were eaten by predatory birds, and then the whole ecological system is gradually overwhelmed by the bio-magnification process.

Other serious disadvantages of agrochemicals are burning users, plants and soil with acidic chemicals, reducing quality of seeds, increasing the susceptibility of certain plants to diseases, killing directly or indirectly to non-target organisms, producing toxicity to surrounding environment, contamination of surface and ground water and interfering the system of natural soil ecology.

No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects. Disproportionate burden of these undesirable consequences of agrochemicals are shouldered by the people of developing countries and some groups with potential risks in each country. Certain groups of people with exposure to agrochemicals include production workers, formulators, sprayers, mixers, loaders and agricultural farming workers. The worldwide deaths and chronic diseases due to pesticide poisoning reach about one million per year.

Therefore, it is really necessary to consider the disadvantages of agrochemicals while enjoying the advantages of these substances in the agricultural sector.

2.3 Maximum Residue Levels of Chemicals in Agricultural Products

As agricultural commodities take the major role for daily consumption processes of human being, these are subject to regulations. When crops are cultivated with agrochemicals, especially chemical fertilizers and pesticides, the residues of these chemical remain in agricultural products. The agrochemical residues causing food contamination have become increasingly frequent in recent years raising concern

for food safety issues and public health. Therefore, worldwide regulatory bodies limit the maximum residue levels (MRLs) for the types and amount of residues that can be legally present on farming products.

MRLs (Maximum Residue Levels) are defined as the Maximum Concentration of Agrochemical Residues and it is expressed as milligrams of residue per kilogram of food and animal feeding stuff. It is legally fixed maximum concentration for a particular active ingredient in a particular crop. MRLs are not toxicological safety limits, but are a commercial standard for the trading processes, indicating the legally allowed maximum amount of an active ingredient which may be present as a residue in or on an unprocessed raw product such as an unpeeled banana or orange. In other words, MRLs serve to verify whether crop protection products or agrochemicals have been correctly applied or not.

There are altogether six factors that influence the residue levels of agricultural products. These are properties of the different active ingredients and formulations, regional cultivation and site conditions, period of time, type of crop, pest infestation and plant health. All crop protection products degrade with time. Different active ingredients and formulations lead to different degradation rates. Factors like hours of sunlight, temperature and rainfall in agricultural zones influence degradation and residue levels of chemical substances.

Period of time between the application of crop protection products and the harvest usually require more time for degradation resulting in reduced residue levels. The type of crop is also an important factor. For example, the roots of sweet potatoes and carrots are protected from direct spraying as these crops are below the surface of the soil. The rate of agrochemical application is also determined by pest infestation. Depending on the health of plants, usage of chemicals will be different. Higher chemical residues are likely to occur when the crops do not develop properly due to natural disasters, climate conditions and other reasons.

Generally, agricultural products with MRL exceedances can occur due to recent changes in a large number of agricultural practices, environmental contamination, and change of regional MRLs standard. Excessive amount of agrochemical residues are found when the food product was imported from a country outside the region and the use is not covered by a suitable MRL or import tolerance in the region. Unregistered agrochemicals are illegal products and the usage of these products can exceed the MRLs. When farmers do not use agrochemicals according to

label instructions, the residue levels of the agricultural products cannot meet the standards of MRLs.

Standards of MRLs vary from country to country depending on the geographic location, the availability of agrochemicals, the crops being treated and the way the agrochemicals are used. As there are significant MRL differences in the worldwide, import tolerances have been established to overcome the problem of non-harmonized MRLs. “Import MRLs” or import tolerances is the form of seeking approval from the importing economy to allow the importation of goods that contain agrochemical residues at a level not covering in the domestic standard of a certain country.

The nature of the request for import MRLs varies in the ways with an importing economy was asked to accept or adopt either a Codex or exporting economy's MRL or amend the domestic standards to align with either internationally-established Codex MRLs or regional MRLs. Such requests contain specific information to enable the importing economy to undertake any required assessments. When an import MRL request is approved by the relevant authorized bodies of the importing economy, transparency is to be ensured for the food safety of the consumers and then other economies are to be informed for the decision via the notification pursuant to the WTO SPS Agreement.

2.4 Systematic Usage of Chemicals for Agricultural Production

When different compounds of pesticides and fertilizers are used as a common practice in agriculture, systematic usage is important. The excessive use of the agrochemicals can damage the natural process of soil fertility and cause undesirable consequences. It is very crucial to use the appropriate agrochemicals, and farmers need knowledge of when and how to use these chemicals in agricultural processes so that it can get the best produce and best return on investment. The main purposes of using fertilizers are to increase the soil fertility, the quantity and quality of agricultural products. Pesticides of various chemical substances are to limit losses in crop yields, to increase the comfort of farmers, and to make slow down or destroy undesirable plants or parts of plants.

When determining the quantity of fertilizers, a soil balance sheet approach is carried out depending on requirements of the crop, past cropping history and current nutrient status of the soil through the soil analysis records. Only reputable suppliers are suitable for the choice of chemical or inorganic fertilizers. There are also

systematic ways of using pesticides when farmers choose chemical substances for preventing pests and diseases. The factors to consider in selecting pesticide are efficacy of safe formulations with quality ingredients, safe mode of action, resistance of pests and diseases.

The amount of the pesticide usage in fields is decided after carrying out field scouting, checking for pests, diseases and natural enemies. Badly maintained or leaky sprayers is dangerous to the users and the right choice of nozzle for spraying the pesticides is important. Before the start of the pesticide usage, the sprayer is to be calibrated to spray the right amount of pesticides and water. Correct form of pesticide application is spraying down winds of the body and moving up winds in the crops to avoid touching or breathing the spray, and make the pesticide spread at a steady speed.

When agrochemicals are used, Personal Protective Equipment must be worn. Personal hygiene after the application of agrochemicals is indeed necessary. Usage of agrochemicals during periods of heavy rain, waterlogging or unusual climatic conditions is really ineffective for the agricultural processes.

To prevent undesirable chemical reactions and contamination, the storage facility is properly identified being away from children, animals, all water sources, direct sunlight, rain, foodstuffs, animal feed and other articles such as clothing, tobacco, medicines, cosmetics, etc. The storage of fertilizer is separated from pesticides. Agrochemicals are grouped according to the hazard category such as flammable, combustible, corrosive, toxic, oxidizing agents, etc. This can reduce the risks of fire and its consequences to a minimal extent.

As most of the cases of suffering for chemical toxicities are related to pesticides, the storage of pesticides demands great care from users. Pesticides always have to be kept in original containers instead of using empty beverage or oil bottles. Storage of pesticides is avoidable for a long time as these become obsolete due to the expired dates. Posting clearly a warning sign with words or with a skull and crossbones symbols can obviously mark the storage of pesticides.

To systematically dispose empty packages and containers of agrochemicals is an important issue of agriculture. Certain amount of chemical residues still remain in the packages and containers, which are made of paper or plastic. Farmers of developing countries normally burn or bury for disposal of agrochemicals. Burning is not always safe as there can be explosion of pressurized or aerosol containers of

agrochemicals. In European countries, Triple-rinsing method with the diluted rinse material and clean water is used for the recycling processes of unused packages and containers when the residues of agrochemicals are considered as non-dangerous domestic waste according to the origin and composition of chemicals.

No matter how systematic usage is applied to the agrochemicals, the residue of these substances is unavoidable. To control the residue level in the agricultural products, the European Crop Protection sets guidelines for correct and safe use of agrochemicals. These are: to observe the crops for timely detection of any problem, to carefully read the label instructions of the crop protection products and use accordingly to the labels, to consult with a technician for obtaining the recommendation of suitable types of agrochemicals for certain crops, to check that the agrochemicals are registered or not with the country, to consult with an expert in case of doubt that the current usage of agrochemicals will or will not cover by suitable MRLs in the potential countries of destination, to verify expiration date of agrochemicals, to respect the waiting time between applications, to take care of the Pre-Harvest Interval (PHI), the date of making the last application before the harvest, not to enter the plantation immediately after the application and to keep an accurate record of the application of agrochemicals.

Following the above instructions can help every farmer in to enjoy long-term economic benefits from the agricultural products.

2.5 Integrated Pest Management System for Sustainable Agriculture

Global agricultural sectors of previous decades were driven by industrialized methods excelled with scientific innovations. In response to the problems of industrial agriculture, the concept of sustainability has arisen. The role of IPMS, Integrated Pest Management, is not negligible for the sustainable agriculture. FAO defines IPMS as: A pest management system that in the socio-economic context of farming systems, the associated environment and the population dynamics of the pest species that utilize all suitable techniques in as compatible a manner as possible and maintains the pest population levels below those causing economic injury. All available pest control methods are in IPMS and these are to optimize a crop's ability to resist the pest with the least hazard to human and the environment (Jay, 2000).

In this situation, it is rather interesting why it is called IPM. I stands for integrated which means mixing different methods together to get the best solution.

The word Pest loosely refers to things that damage the crop and in this way includes plant diseases, insect pests and weeds. The word, management is used rather than control, because it is to manage the pest numbers at low level, rather than killing all the pests. If all the pests are killed, there will be no food for beneficial insects (i.e. farmer's friends), and then more and more chemicals each time is used when the insect pests appeared.

IPMS is beneficial as it can make effective control of pests, lower costs, safer to farmers and families and protection to the environment. IPMS is useful to prevent the build-up of pesticide resistance, where farmers need much higher doses of pesticides because pests are becoming harder to kill. Among other plant protection measures, IPMS is also an alternative for sustainable agriculture. To help the growth of a healthy crop with the least possible disruption to agro-ecosystems and to encourage natural pest control mechanisms are the emphases of IPMS. IPMS poses the least risks while maximizing benefits and reducing costs (Naw Thet Thet Htun, 2017).

IPMS uses many different methods together to control pests and diseases. These are cultural methods, biological control, physical methods, and chemical methods. The cultural methods involve farming practices that prevent problems such as crop rotation, sowing date, plot selection and layout, association crops, destruction of crop residue, tilling, reasoned fertilization, resistance varieties. The biological control includes the use or promoting natural enemies, which are predators and parasitoids. The physical methods are used where pests are killed or prevented from reaching the crops by physical means (i.e. planting maize on the edge of cabbage field, maize acts as physical barrier to cabbage pests). The chemical methods with manufactured pesticides or natural extract from plants such as neem and pyrethrin are applied where chemicals are used to kill the pests. In integrated pest management system, the use of chemical control is the last solution when no other control method has proven effectiveness (Suslow, 2008).

2.6 Importance of Technology for Cultivation of Beans and Pulses

The decision to adopt improved beans and pulses technology by farmers is significantly influenced by yield, farming experiences, education and extension contact while subsistence pressure discourages adoption. Amount of cultivable land, fertilizers, mechanical power, pesticides and labor are the significant determinants of

improved beans and pulses productivity. Technological assistance to agricultural production mainly comes from the policy implications of the government for the sector including investments in R&D and extension services by involving farmers in R&D endeavors, enhancing farmer-based seed production, distributing schemes to develop, disseminating improved beans and pulses technology and improving farmers' knowledge, especially for good agricultural practices and safety issues related to usage of agrochemicals.

Raising beans and pulses is a biological activity. Plant growth is function of ecological environment within certain limits. Management of agronomical practices with improved technology can promote an eco-system conducive for optimum yields of beans and pulses. Technical packages for efficient beans and pulses production include systematic field preparation, the use of high yielding variety seed, sowing method and time, seed treatment, fertilizer and manures application, the use of bio-fertilizer and micro nutrient, inter-culture operation, insect-pest control, irrigation and harvesting processes. (Sanzidur, 2018).

For higher cultivation of the beans and pulses, the utilization of high yielding variety seed is essential proven quality of the end products. Seed treatment in beans and pulses is most important to protect the crop against pest and diseases lowering cost of inputs for agrochemicals with haphazard consequences. The productivity per unit of area and total production can be increased by the application of improved agricultural technologies. Modernized agricultural technologies have established the superiorities over traditional system. The utilization of improved technologies by farmers will lead to socio-economic development of rural regions.

The quantity of recommended technological inputs and practical usage per unit of area are generally having wide gap. Although farmers often reject an innovation in agricultural processes, non-adoption of a certain technology does not necessarily mean rejection. Even though the farmers have mentally accepted the importance of technology in agricultural production, farmers are sometimes unable to adopt the technology because of economic and situational constraints, which is attributed to crop management, labor management and infrastructure constraint (Dasgupta, 1989).

2.7 Reviews on Previous Studies

Wilfred L. Mushobozi and Pilar Santacoloma (2010) studied Good Agricultural Practices (GAPs) on horticultural production in Tanzania. The study emphasized on promoting GAPs in production and harvesting including the guidance to safe usage of agrochemicals. Adoption of GAPs in agricultural processes is important to in order to ensure food safety and to gain competitive export market. In this situation, it is needed to assess potential benefits and challenges in relation to the processes of GAPs. It was also found that different aspects are needed to take into considerations when implementing Good Agricultural Practices (GAPs) by extension agents, the private sector and policy makers.

In association to agricultural policies, Kay Thi Win (2012) studied on agricultural policy changes on socio-economic conditions of farmers (Case Study: Thanlyin and Kyauktan Township). It was found that the policies reform can promote the production of crops and the economic conditions of the peasants. This is because there is poor knowledge in implementing to the agricultural methods. In this case, training is essential to promote efficiency, increase knowledge and build the capacity of the rural populace. Additionally, the supports in the forms of agricultural inputs such as agrochemicals, quality seeds, irrigation and credit are also necessary.

Regarding the study on Good Agricultural Practices in Myanmar, Khin Thu Thu (2012) analyzed on Adopting Good Agricultural Practices in Mango Production of Sagaing Region (Case study: Three villages), and the study shows that application level can be increased by promoting awareness to farmers. It was also found that the prices of production increase along with higher application levels of GAPs. It was found that there are other constraints for adoption GAP such as labor and equipment requirement, transportation facilities and market conditions.

Ye Maung Swe (2016) studied on Good Agricultural Practices (GAP) Adoption by Monsoon Paddy Farmers (Case Study: Hmawbi Township, Yangon Division), that was found that the majority of farmers have low level of education and most of them are still relying on the traditional cultivation method on agricultural production.

Naw Thet Thet Htun (2017) studied on Farmers' Behavior and Health Awareness Regarding Usage of Pesticides (Case Study: Taikkyi Township), that was found that the farmers have lack of knowledge and awareness for safety practices even they are using pesticide daily. Most of the respondents do not care the product is

registered or not. In order to have awareness on safety of pesticides, campaigns are to be raised by agricultural staff or volunteer technicians. On the other hand, the general public must have awareness on the safety of foods due to the residues of chemical compounds from pesticides.

Sanzidur Rahman, Md. Abdul Matin, and Md. Kamrul Hasan (2018) studied the Joint Determination of Improved Variety Adoption, Productivity and Efficiency of Pulses Production, and it was found that there is a need to supply improved technology of agricultural practices for the enhancement of beans and pulses productivity. It is also important to eradicate irregularities in marketing system by assuring remunerative price to beans and pulses growers to improve the agricultural sector.

CHAPTER III
USAGE OF CHEMICALS IN BEANS AND PULSES CULTIVATION OF MYANMAR

3.1 Overview of Agricultural Sector in Myanmar

Myanmar possesses rich soil and water resources for agriculture. The geographical situation of Myanmar can be divided into three agro ecological zones and these are the delta and coastal zone, the dry zone and the hilly regions. The delta and coastal zone is the most densely populated and monsoon rainfall, which contributes the cultivation of rice and fishery production. The central part of Myanmar lies in the dry zone and there is very few amount of rainfall in the area. Therefore, the farmers of the region principally operate productive agriculture in river valleys, where rain-fed upland crops and paddies are grown. Less intensive farming suits to the hilly regions where abundant horticultural crops can be seen.

Agriculture sector is the backbone of the economy. The agricultural sector contributes to 37.8 percent of gross domestic product (GDP), accounts for 25 to 30 percent of total export earnings and employs 70 percent of the labor force. Myanmar has established 12 political, economic and social objectives in its efforts to establish a peaceful modern and developed country. One major economic objective is "Development of agriculture as a base and all round development of other sectors of the economy as well."

There are eleven agricultural policies for the nation-wide extent. These include: to emphasize production and utilization of high yielding and good quality seeds, to conduct training and education for farmers and extension staff on advanced agricultural techniques, to implement research and development activities for sustainable agricultural development, to protect farmers' rights and benefits, to assist farmers to get fair price on their produce, to assist in lowering production costs, increasing high quality crop production, developing and strengthening markets, to encourage transformation from conventional to mechanized agriculture, production of

crops appropriate with climate and extension of irrigated area, to undertake renovation and maintenance works on old irrigation, pumping and underground water systems, to support rural development and poverty reduction activities through development of agriculture sector, to encourage local and international investment in agriculture sector for the development of advanced agricultural technology and commercial agricultural production, and to justify and amend existing agricultural laws and regulations in line with current economic situations.

When implementing the above agricultural policies, Ministry of Agriculture, Livestock and Irrigation (MOALI) plays in the leading role. It also has its own basic objectives that are linked with the overall agricultural policies. These are: to ensure food and nutrition security and food safety, to safeguard the rights of the farmers and to enhance their welfare and livelihood, to advance and upgrade the agricultural sector by organizing farmers' association and cooperatives inclusive of small holders and subsistence farmers with promotion of gender role, to attain sustainable rural development and to upgrade socio-economic conditions of rural people and farmers by improving rural infrastructure, accessing to markets establishing small scale enterprises and designing participatory land use plans and management, to seek technical assistance and mobilize the financial resources from local and international agencies in support of crops, livestock, fisheries and rural development in the agriculture sector, to promote domestic and foreign direct investment in agriculture sector, to promote competitiveness and value-added production of exportable commodity complex, to encourage the development of agro-based industry, small scale enterprises, cottage industries and other income generating activities including ten traditional arts and crafts, to improve the livelihood and income generation of the rural people through the development of cooperative enterprises and systems, to develop effective linkages of production, trading, processing, services and consumer segments along the value chains of agricultural commodities, to improve the coordination mechanism of inter-government agencies, to foster public-private partnership, to establish collaboration and connectivity among all stakeholder including public agencies, academia, farmers' associations, civil societies, and private sector with a view to enhancing rural development and reducing poverty. (Source: Agricultural in Brief, 2016)

Myanmar government is dedicating efforts for the achievement of sustainable development with the objectives of enhancing the export sector and the agricultural industry. The development of the Agricultural Development Strategy Plan is concrete and the government reveals its commitment to improve the sector with access to finance, trade facilitation and logistics, and trade information and promotion initiatives. The National Export Strategy on increasing production and value-added of certain agricultural products including beans and pulses has already been developed.

It can be seen that the agricultural sector in Myanmar has great potential to expand as the country has rich in natural resources, high land and labor ratio, and growing domestic market. With correct policies and investment, the agriculture sector of Myanmar has lots of potential to expand although it faces many challenges including access to technology, capital, markets and land tenure issues.

Meanwhile, the government has also been attempting to improve the economic environment by enacting regulatory reforms to attract investors. The new Myanmar Investment Law (MIL) was signed in October 2016 and has been effective since April 1, 2017. The law combines the Foreign Investment Law (FIL) 2012 and the Citizens Investment Law 2013. The new investment law was enacted to attract both foreign and local investors by simplifying the application process and offering tax breaks, incentives, rights and protections for business.

It is necessary to invite FDI and local private companies to invest the resources in the agricultural sector. Private-Public Partnership (PPP) or contract farming system will be possible approaches to reduce constraints on the agricultural related supply chain processes such as inefficient resource mobilization, poor market access. There are opportunities for foreign and local investors to engage in agricultural sector for the diversification of value-added products to meet market demands and export targets.

Moreover, investment in the sector remains minimal and currently, foreign investment into the sector is only 0.5% of total foreign investment. The agricultural industry is deprived of improved seed varieties, modern warehousing, distribution and logistics facilities, packaging and branding. Therefore, investors can focus on the sector by doing business activities in input industries for seed, fertilizers, agrochemicals, farm industry, machineries, irrigation system, and facilities. Another one is production and processing industries for crop production, research and

development for value-added production. Investing in wholesale market industries, service industries for credit, insurance, service support for supply chain and aquaculture can bring benefits not only for the investors but also for the local people including farmers.

3.2 Varieties of Crops Cultivated in Myanmar

Under the prevalence of different agro-ecological zones, Myanmar's farmers can grow over more than 60 different crops. Agricultural production takes place about 12.4 million hectares or 18% of Myanmar's total land area of about 68 million hectares. Cultivable land areas of Myanmar are under the trend of multiple cropping system, which was expanded significantly during the decades from 1960 to 1980. During these periods, intensive resources are fulfilled in the form of farm mechanization, irrigation water and large-scale dam. With the inception of favorable price incentives for some crops, multiple cropping becomes popular remarkably from 1992-1993 and onwards.

A wide variety of Myanmar's agricultural products are under the trend of multiple cropping systems, and these can be classified as: growing a pre-monsoon crop before the main crop in rice growing area (eg. Jute, cotton, sesame), growing of some suitable crops after rice (summer paddy, groundnut, sunflower, peas and beans), growing of two suitable crops in succession on dry land with or without irrigation (sesame, peas and beans, maize, etc.), and mixed cropping of two crops with different life periods in the same field (sesame and pigeon pea, groundnut and maize, etc.)

Farmers of Myanmar generally grow staple crops such as paddy, pulses and oilseeds on relatively large areas with an average of 1.5-2.0 hectares per holding. Cereal crops are the most important with the area constituting more than 52% of the total crop sown area of 12276 thousand hectares.

Among the cereal crops, rice is widely grown in 47 percent of the total crop sown area throughout the country. Smallholder paddy production dominates Myanmar's agricultural economy. Wheat, maize and sorghum are other cereals grown in Myanmar. In recent years, maize production has grown far more rapidly than rice due to the rapidly growing demand for poultry feed and emerging regional export markets.

Oilseed crops, especially grown in the Central Dry Zone, are the second most important group next to cereals. The production of the oilseeds is insufficient to meet national demand and about 200,000 tons of palm oil are imported annually. The major varieties of oilseeds are groundnut, sesame, sunflower, oil palm and mustard. Beans and Pulses take the ranking of third among other crops and have recently become crucial export crops.

Farmers of beans and pulses growers can earn more and more profit through the increasing demand of domestic and overseas markets. The fourth rank of commonly grown crops in Myanmar are industrial crops including cotton, rubber, sugarcane and jute. The rest of the rankings are for food crops, horticultural crops and plantation crops.

Both of the culinary crops and horticultural crops are particularly prominent in the hilly zones of Shan State and other border regions. Potato, onion, chilly, garlic, ginger and turmeric are food crops or culinary crops and these are grown about 0.8 million hectares of the total cultivable land. Majority of vegetables and fruits grown in Myanmar are Cabbage, Cauliflower, Lettuce, Mustard (Leaf), Tomato, Carrot, Radish, Gourd, Asparagus, Mango, Lemon, Orange, Pomelo and Sweet Lime, Durian, Pineapple, Custard apple, Lychee, Crapes, Watermelon and Apple. Fresh fruits, vegetables and flowers are horticultural products and provide income for about 15% of rural households in Myanmar. (Source: Horticultural and Plant Biotechnological Division, 2018)

3.3 Beans and Pulses Production in Myanmar

When beans and pulses production is considered along, Myanmar ranks as one of the biggest producers on the world. Beans and pulses in Myanmar are normally grown immediately after the harvest of the main rice crop in the delta region. The cultivation of beans and pulses can also be seen as a monsoon crop in the central plain areas and Shan State, which is in the east part of the country.

Favorable climatic conditions of Myanmar are credited to the high production of beans and pulses. About 70% of all beans and pulses are grown during the winter as the leftover moisture of the monsoons still exists, not requiring additional artificial irrigation facilities in the absence of rain. This makes the cultivation processes undemanding and cost effective with no additional allocation of resources required. Moreover, the short growing period of just 3-4 months from plantation to harvest is

also an additional advantage to farmers.

The land acreage under beans and pulses has been constantly increasing. The 2010 Myanmar Census of Agriculture showed that between 2003 and 2010, the area cultivated with beans and pulses increased from 6 to 15 million acres, or by 147 percent, compared to 70 percent growth for other crops. Major varieties of beans and pulses currently being cultivated in Myanmar are chick pea, pigeon pea, black gram, green gram, golden gram, mung bean, cow pea, black eyed bean, butter bean, lima bean, sultani, sultapya, lab lab bean, soy bean, garden pea, lentil rice bean, red bean, kidney bean, haricot bean, red flat bean, red bamboo bean, winged bean, haricot bean and so on.

Among them, Black matpe (Black gram), Green mung bean (Green gram) and Toorwhole (Pigeon pea) are the most significant and accounted for 70-75 percent to total beans and pulses production, and these are over the 80% of total beans and pulses exports. Indian market is the biggest for the Myanma beans and pulses. There are also ready markets in the countries like UAE, Thailand, Bangladesh, Japan, China, Korea and other 49 countries.

During 2014-2015 and 2015-2016, Myanmar's beans and pulses production increases in response to the high prices. Similarly, the exports also increase during these years. In 2016-2017, the production of beans and pulses increased according to attractive domestic prices.

Table (3.1) Myanmar's Beans and Pulses Production (2014-2019)

Year	Harvested Area (Thousand Hectare)	Production (Thousand Metric Ton)	Yield (Thousand Metric Ton)
2014-2015	4400	5060	1.15
2015-2016	4600	5290	1.15
2016-2017	4650	5348	1.15
2017-2018	4430	4430	1.00
2018-2019	3800	3800	1.00

Source: Global Agricultural Information Network, 2019

From 2017 to 2019 January, the yields of Myanmar's beans and pulses per unit area are expected to decrease and this is because farmers shift to other crops such

as dry season paddy, corn, sesame and others. The other prominent reasons of the fall of production of the beans and pulses are that farmers used less inputs in line with the lack of price incentive and anticipation of continued poor export demand due to import restriction India for the beans and pulses. As most of the exports of Myanmar's beans and pulses go to India, certain changes in the Indian market affect the extent of production for beans and pulses.

In 2017 August, the exports of pigeon peas, mung beans and black gram from Myanmar were restricted due to the trade policy changes placed by the Indian government. The loss of "free" status for the beans and pulses exports of Myanmar led to the plunge in prices for domestic pulses. However, India lifted the ban on the import of beans and pulses in 2018 May. So also, Myanmar and India signed (G to G) government to government contract for the beans and pulses trading in the 2018-2019 fiscal year. The contract can be able to control fluctuations of prices and it can protect beans and pulses growers of Myanmar not to experience sudden drop of prices for the crops.

Although most of the exports of beans and pulses from Myanmar rely on the Indian market, there are more extended markets including the EU. Currently, beans and pulses cultivated with the GAP system are exported to the EU. To attain the good reputation for beans and pulses in the global market, innovative research programs and quality upgrading procedures are being performed with the co-operations of government, private sector, LNGOs, INGOs and other related associations.

In relation to the quality control of beans and pulses, department of trade promotion under the ministry of commerce has released the standard specification. The quality status of the beans and pulses is divided into (3) types: fair average quality, first quality and special quality. Regarding to the quality grade, the extent of the consist of foreign matters, weevil seeds, damaged situations, unequal size of seeds and moisture content are different according to the maximum limited percentage.

Beans and pulses are the important crops for farmers of Myanmar and these mainly generate the foreign income for the country. Annually, Myanmar exports more than one million tons of beans and pulses, at a total value of around US$ 1 billion. (Source: Ministry of Commerce, 2014)

3.4 Agrochemical Usage in Agricultural Sector of Myanmar

National food security and rural economy of Myanmar rely heavily on the agriculture sector. The structure of agriculture sector is being transformed with increased emphasis on agribusiness. The sector has to experience with rapid expansion in use of agricultural technologies and inputs including agrochemicals, which are fertilizers and pesticides.

Chemical fertilizers were first introduced to Myanmar in 1956, but widespread use did not occur until 1978, when the government encouraged fertilizer usage by subsidizing fertilizer prices. The fertilizer prices were heavily subsidized by the government before 1990s. Since then, the government removed all the subsidies. Subsequently, the market prices have risen to international level and the private sector has allowed to import and distribute fertilizers. Then, the fertilizer market in Myanmar has become totally free market price based on the international fertilizer price, logistic costs and exchange rate.

The supply of fertilizer is based on the domestic manufacture of ammonia and urea by government-owned factories and imports, which accounting for about 80-90% of the supply. The participation of private sector in the Myanmar fertilizer market has grown rapidly with the enactment of the Fertilizer Law in 2002. The law was revised in 2015 to stimulate private sector investment and protect the interests of Myanmar farmers.

During the past decade, the fertilizer market in Myanmar has grown at the rate of 10-15% per year. The value of the imports of fertilizer imports in 2016 is more than US $300 million. On the other hand, “unofficial” fertilizer imports from neighboring countries sometimes occur. Despite the recent growth in demand, the intensity of fertilizer use in Myanmar is only about 25% of global fertilizer usage.

Types of fertilizer products currently applied in Myanmar are Urea of domestic produces and imports, Ammonium Sulfate, Calcium Ammonium Nitrate, compounds of NPK (Nitrogen, Phosphorus, Potassium), Diammonium Phosphate, Triple Superphosphate, Muriate of Potash, and others.

Table (3.2) Utilization of Fertilizers in Myanmar

Year	Fertilizer Usage (Metric Tons)
2010-2011	5,707
2013-2014	74,968
2014-2015	28,442
2015-2016	2,427,473
2016-2017	3,167,342
2017-2018	3,483,797

Source: Myanmar Statistical Yearbook, 2018

Farmers of Myanmar also apply pesticides including insecticides, herbicides and fungicides for protection of crops from pests and diseases. Although Myanmar possesses most of similarities with other ASEAN countries in arable land, crop variety, cultivation patterns and weather conditions, pesticide usage is still comparatively lower than these countries. Currently, approximately 10,000 metric tons of pesticides are legally imported per year. During 2006 and 2009, the amount of legally imported pesticides varied between 4,000 and 6,000 metric tons per year.

Since 2010, imports of pesticides became quite stable and the new government of 2011 allowed the tax exemptions of the importation of agricultural inputs to support agricultural development. 90% of the pesticides are imported by local Myanmar companies and 10% of the products are imported by multinational agrochemical companies including Syngenta, Bayer Crop science, Dow Agro Science, Dupont and Sumitomo. Foreign products of pesticides are 30-40% more expensive than products of local companies.

There are illegal pesticides of poor supervision and without a proper registration. These pesticides mainly come from China through the illegal massive importation. Beyond the registered pesticides, the illegally imported pesticides are widespread in Myanmar market and these are organophosphates (OP) and organochlorine compounds, particularly dimethoate, phenthoate and endousulfan, which are internationally banned or under the strict registered usage in other countries.

Myanmar possesses an array of legislation and standards that directly or indirectly regulate pesticide distribution and use. The enactment of the Pesticide Law was done in 1990 and it is replaced by the new pesticide law of 2016. The formation

of the Pesticide Board was declared by the Government in 1992. Under the new pesticide law, the Pesticide Registration Board has been making serious and periodical inspections of the whole pesticide supply chain processes in Myanmar.

Table (3.3) Pesticides Utilization for Plant Protection

Year	Usage of Pesticides (In Gallon)
2010-2011	1,283,183
2011-2012	1,527,083
2012-2013	1,121,715
2013-2014	1,161,840
2014-2015	1,113,634
2015-2016	3,160,986
2016-2017	5,814,480
2017-2018	12,662,605

Source: Myanmar Statistical Yearbook, 2018.

The agricultural sector of Myanmar will likely increase the usage of more and more agricultural inputs in the near future in order to produce quality products. Consequently, the market of agrochemicals become enlarged. The Myanmar Fertilizer, Seed and Pesticide Entrepreneurs Association was established in 2013 and it handles the orderly development and functions of the markets for fertilizers and pesticides.

3.5 Laws and Regulatory Systems for the Usage of Agrochemicals in Myanmar

Laws and regulatory systems take part in the crucial role for the safe usage of agrochemicals. The fertilizer law of 2015 and the pesticide law of 2016 were enacted to ensure the proper usage of chemical substances in the agricultural processes. The fertilizer law has already been in Myanmar since 2002. The Phyidawngsu Hluttaw enacted the fertilizer law of 2015 after the amendment of the law of 2002. The Fertilizer Law and its 2015 Amendment address the key elements, which are typical of fertilizer legislation and regulations in a market-oriented fertilizer industry.

Under the purview of the Ministry of Agriculture, Livestock and Irrigation (MOALI), the Law provides for the policy and regulatory-related environment that underpins the Myanmar fertilizer market. The Law is administered through the

Fertilizer Committee, chaired by the Deputy Minister of MOALI. Functioning under the authority of the Fertilizer Committee, the Fertilizer Technical Committee (FTC) serves to provide the technical expertise on fertilizer-related matters. FTC is comprised of eight members, with five representatives of the Department of Agriculture, two representatives of the Department of Agricultural Research and one representative of Yezin Agricultural University. Under the supervision of the Fertilizer Committee and the Fertilizer Technical Committee, more than 5,000 dealers have been issued authorized licenses for operating in domestic fertilizer market.

In general, provisions of the Law have been effective in stimulating private sector investment and protecting the interests of Myanmar farmers. The law provides a set of guidelines that are applicable to fertilizer trade and quality control in Myanmar, mainly registration of fertilizer products, registration of businesses for importing, manufacturing, or exporting fertilizer and licensing of businesses for storage or distribution and sales of fertilizers. According to the supervision of the fertilizer law, there are co-operations with governments and organizations including international, local and non-governmental organizations regarding the fertilizer business in Myanmar.

Beyond the fertilizer law, the pesticide law is also essential for the systematic usage of agrochemicals. The new pesticide law of Myanmar was enacted in 2016 January 20 after the cancellation of the old pesticide law of 1990. In relation to the handling of chemical substances and the safety of foods, the Republic of the Union of Myanmar enacted the factories act of 1951, the public health law of 1972 and the national food law of 1997. The amendments were done to the factory act in 2016 and to the national food law in 2013.

Under the governance of the Ministry of Agriculture, Livestock and Irrigation (MOALI), the pesticide law of 2016 regulates the transactions of pesticide market in Myanmar. As similar to the fertilizer law, the pesticide law is administered through the pesticide registration board. It is formed by the responsible personnel of the ministry and the technical experts. Based on the advices of international specialists, the pesticide registration Board declare instructions for the formulation, handling, transportation, storage, sales, disposal of empty bottles and packages and the destruction of expired products. The board of pesticide registration issue the following types of registrations or use permits for the qualified applicants. These are:

Experimental Registration, Provisional Registration, Full Registration, Special Use permit.

According to the approval of the MOALI, the board establishes the Pesticide Technical Committee and then allocate tasks to the committee. With the support of the Pesticide Technical Committee, the meetings of the Pesticide Registration Board were launched. Starting from 1992 to 2019, 29 Board meetings have been held and the Pesticide Registration Board has already issued licenses to nearly 290 distributors with a total of 3500 registered products. So also, the Board has announced the lists of banned pesticides based on the researches and findings. According to the notification numbers (05 /2018) and (06 /2018) of the Pesticide Registration Board, 41 active ingredients are banned for formulation of pesticides and 7 types of pesticides are restricted for the specific usage as fumigant and rodenticide.

The new pesticide law of 2016 mentions detailed of defining terms, the formation of the Pesticide Registration Board and its responsibilities, the process of paying the taxes for applying registration and licenses, the responsibilities of Region or State Officer in-charge, inspectors, holders of registration certificates and holders of licenses for authorized dealing transactions. The law also includes actions to be taken by administrative means, prohibitions, offences and penalties for those who violate the rules and regulations. Conditions for Compliance by Pesticide Users are in the law for the safe usage of pesticides. The new law of pesticide becomes stricter making competitive edges in the market. However, it will ensure better quality products for the sustainable development of Myanmar's agricultural sector.

3.6 Agrochemical Usage in Beans and Pulses Cultivation of Myanmar

In Myanmar, beans and pulses are the second largest crop after paddy. Beans and pulses have shorter growing period than paddy and it is a great advantage to farmers. As pulses can also accommodate in wet period, these are grown more densely in regions of hasher climate and erratic rainfall conditions. Myanmar belongs to export markets for beans and pulses and this can generate important source of revenue for farmers.

The usage of agrochemicals for beans and pulses cultivation can be varied depending on the regions. For high yield and vegetative growth, fertilizers are applied. Types of the fertilizers used by beans and pulses growers of Myanmar are Nitrogen, Phosphorus, Potassium, Sulfur, Urea and Boron. These fertilizers are used

when the plants of beans and pulses start to bloom and reach the growth stage with little fruits inside.

Pesticides are also used for beans and pulses cultivation in order to prevent certain pests and diseases. Normally, usage of fungicides and insecticides are common for beans and pulses cultivation. Before planting, seeds of beans and pulses are treated with fungicides. During the growth periods of the plantation, insecticides are used for preventing the fall of pests and diseases. Types of pests that usually fall on the beans and pulses plantation are Blue Butterfly, Armyworm, Striped bean flea beetle, Bean Stem Fly, Green stink bug, Aphids, Thrips, Cricket, Green Semilooper, Plume Moth, Lepidopteran Defoliators, American Bollworm, Pod Borer, and The Bruchid.

Diseases that usually occur in beans and pulses are Wilt, Dry Root Rot, Collar Rot, Stunt, Sterility Mosaic, Anthracnose, Powdery Mildew, Rust, Dirty Root Nematode and Root-knot Nematode. Types of compounds for pesticides used in preventing certain diseases for beans and pulses are Tebuconazole, Hymexazol, Thiofanate Methyl, Benomyl, Kerosoxim Methyl, Chlorothalonil, Azoxystrobin, Propiconazole, Trifloxystrobini, Validamycin, Difenoconazole, Iprodione, Kocide, Homai, Captan, Profenofos, Phenthoate, Dimethoate, and Diazinon.

Table (3.4) Usage of Pesticides for Beans and Pulses

Year	Pesticide Usage (Gallon)
2013-2014	300,409
2014-2015	429,804
2015-2016	587,292
2016-2017	791,407
2017-2018	1,322,032

Source: Myanmar Agricultural Statistic, 2018.

According to the table, it can be seen that the utilization of pesticides increases along within the decade. For controlling pests and diseases, beans and pulses growers mostly rely on pesticides. To achieve the purpose of obtaining high yield for exports is also a matter for higher level of pesticide usage year by year.

3.7 Opportunities and Challenges for Beans and Pulses Production in Myanmar

Beans and pulses have historically been one of Myanmar's most important export products, playing a key role in international trade throughout centuries past. The production and trading of pulses and beans has been rooted in the early periods of British rule, which catalyzed the migration of Indian growers to Myanmar. These Indian farmers brought not only the tradition of pulse and bean production but also a connection to the Indian market.

After the socialist period of 1987, the trading of pulses and beans was gradually liberalized with the introduction of market-oriented policies. Myanmar Pulses, Beans, and Sesame Seeds Merchants Association (MPBSMA) was formed in 1992 and Bayinnaung Market, the only legal wholesale center for beans and pulses was established in 1990. The liberalization of market has resulted in impressive gains in yields, sown area, production of beans and pulses.

Being stimulated by the market-oriented policy, more resources were dedicated to the famers for beans and pulses cultivation. The production of beans and pulses become crucial for employment generation, contribution to gross domestic product (GDP) and export potential. Generally, beans and pulses of Myanmar only undergo primary processing and dry packaging. Inadequate equipment and limited capacities can be seen as the constraints for further product development.

Currently, Myanmar's enterprises engage in selling bagged whole and split pulses for animal feeds. However, a number of product developments remain unexploited. A multitude of opportunities exist for enterprises to enlarge the beans and pulses sector through product development and value addition. There are wide variety of processed products, that are overlooked, and these include whole processed pulses as canned pulses, micronized pulses, toasted pulses, extruded pulses as pastas, meat substitutes, fractionated pulses as starches and proteins and so on.

There are a number of opportunities to diversify into emerging import markets such as the Philippines, Indonesia, Malaysia, Thailand, Japan and Chinese Taipei by increasing the quality and processing content of products from beans and pulses. Myanmar enjoys a strategic location in the heart of emerging Asia, bordering on some of the largest target markets. Large domestic population and geographic proximity to major beans and pulses importers imply great advantages to the development of the sector. Being one of the global exporter of beans and pulses, Myanmar is well-

positioned to meet the wider demand throughout the improvements of agro-food sector and food safety standards.

Beans and pulses are staple foods in many markets and consumer preferences for different species vary significantly depending on regional tastes and traditions. Indian market is particularly important for the beans and pulses. Japan, Pakistan and Indonesia also have traditional market for beans and pulses. Consumption also takes place in non-traditional markets such as the United States and the United Kingdom, where consumers have a growing appetite for ethnic foods and a rising awareness of the nutritional benefits associated with beans and pulses. Beans and pulses are also increasingly recognized as valuable ingredients for processed foods. This is because the nutritional value of beans and pulses can improve product positioning with enhanced health and sustainability claim.

Although Myanmar's existing exports of beans and pulses are highly concentrated within a handful of markets, new markets of beans and pulses can also be expanded through the collaboration of leading international agricultural commodity exporters such as Cargill and Alliance Grain Traders, which have been proactively exploring growth opportunities in the Myanmar. In order to seize the opportunities from the global market, the production of Myanmar's beans and pulses require significant strategic institutional investments for quality value added products.

The ability of beans and pulses production to adapt to different foreign regulatory environments and consumer preferences are necessities to seek further opportunities in the existing markets and potential markets. Facilitating market entry through targeted foreign and local investments can also quickly leverage the capital, global distribution networks, technical capacity and marketing expertise of established industry leaders while boosting the overall competitiveness of beans and pulses sector.

The primary challenge of producing beans and pulses in Myanmar is the lack of improved seed varieties, which are resistant to pests, diseases and uncertain weather conditions. Being able to stand sudden changes of weather, pests and diseases means that a certain plantation of beans and pulses need a few usage of agrochemicals. The less usage of agrochemicals implies the reduction of chemical consistence of MRL rates. Quality improvement of Myanmar's beans and pulses is directly related to MRL rates of agrochemicals. For the systematic usage of agrochemicals to lessen the residue levels, GAP certified growers of beans and pulses are really needed.

There are four types of challenges for beans and pulses of Myanmar according to National Export Strategy. These are supply-side challenges, business environment challenges, market entry challenges and development-based challenges. The supply-side challenges of beans and pulses production are rooted from lack of quality seed supply, scarce finance mechanisms, limited production planning and support, low uptake of modern cultivation techniques, inadequate harvest and post-harvest techniques and low value addition.

The business environment of beans and pulses production is challenged by high and volatile transport costs, poor management of container depots, limited contractual knowledge, inconsistent procedures, limited resources and competencies of supporting institutions and inadequate sector organization. Similarly, the process of market entry of beans and pulses is constrained by inadequate export finance mechanisms, inefficient promotion, lack of trade information and limited structured investment promotion. Limited access to key services to rural farmers of beans and pulses also make difficult for overall socioeconomic development of the sector.

The opportunities and challenges of the beans and pulses production lies in the two sides of the same coin. When the challenges are overcome, the scope of opportunities become more and more ample and extend along the entire value chain. Improved performance of the sector requires either strengthening certain links of the value chain and making structural modifications to the links. The enhancement of the sector value chain will lead to increased market penetration, product development, market development and full diversification of Myanmar's beans and pulses (National Export Strategy of Beans and Pulses).

CHAPTER IV
SURVEY ANALYSIS

4.1 Survey Profile

Yangon Region lies within the Ayeyarwady Delta Region of Myanmar and it is between North Latitude of 16˙ 48' 19.01" and East Longitude of 96˙ 9' 22". It shares borders with Ayeyarwady Region to the west, Bago to the north-east and the rest areas on the Andaman Sea to the south. The region covers 10,171 square kilometers and it is administratively divided into 4 districts composed of 45 townships.

Thanlyin is a district city of the southern part of Yangon Region. It is between North Latitude 16˙ x 40' and 16˙ x 59' and East Longitude 96˙ x 13' and 96˙ x 25'. Thanlyin lies on the eastern bank of the Bago River and the township is bounded by Hlegu Township in the north-west, Yangon River in the south-west, Kyauktan township in the south-east, Thonegwa township in the east and Khanyan township in the north-east.

There are 17 wards and 28 villages in Thanyin. The total area of the township is 383.16 square kilometers. It is 38.62 kilometers long from the north to the south and 20.92 kilometers wide from the east to the west. The area of the town is 15.16 square kilometers and the areas of villages are 357.52 square kilometers. Population of Thanlyin has been annually increasing. The estimated population in 2010 is 201267 people and it becomes 241421 people in 2019 June. As Thanyin is an intermediate city besides to the city of Yangon, the population of the town is likely to grow more due the availability of upgraded transportation modes, location of universities, job opportunities of Thilawa Special Economic Zone, which is between the border of Thanyin township and Kyauktan township.

Agriculture, manufacturing and commerce are crucial economic activities of Thanyin. Foreign investment flows to Thilawa Special Economic Zone in the form of joint venture making employments mostly for the manufacturing sector. On the other hand, agriculture is still the mainstream economy of Thanlyin as 80% of the

population in rural areas and work in the sector. The income of the farmers depends on the yields of crops and the market prices of the crops. There are 10 kinds of crops mainly cultivated in Thanlyin and these are paddy, peanut, seasame, sunflower, blackgram, greengram, peagon peas, cotton, sugarcane and maize. Among these crops, cultivation of paddy is the most in Thanlyin township. The cultivation of beans and pulses including blackgram, greengram, peagon peas are the second most important for farmers of Thanlyin township. The following table shows cultivation and production of beans and pulses in Thanlyin township.

Table (4.1) Cultivation and Production of Beans and Pulses in Thanlyin Township

Year	Area (acre)	Yield Per Area (ton)	Total Production (ton)
2013-2014	42531	0.650	27666
2014-2015	42542	0.664	28259
2015-2016	42597	0.670	28561
2016-2017	42807	0.672	28778
2017-2018	43188	0.627	27076

Source: Agricultural Department of Thanlyin Township, 2019.

To get high yields of beans and pulses, agrochemicals including fertilizers and pesticides are mainly used as essential inputs in Thanlyin Township. In Thanlyin, the supply of agrochemicals has been operated by 22 fertilizer shops and 18 pesticide shops of registration certificate holders.

4.2 Survey Design

The survey was conducted from March to May, 2019. The study was conducted in three villages of Thanlyin Township, namely Thahtay Kueen, Bagan Taung and Bot Thapyay Kan, where the cultivated acreage of beans and pulses are the most in Thanlyin. The cultivated areas of these three villages for beans and pulses cultivation are in acres of 1720, 2529 and 3383 respectively. The purpose of choosing Thanlyin Township is due to the fact that the numbers of sown acreage for beans and pulses become increased year by year to compare with other townships of Yangon Region, which are Kyauktan, Thawngywa, and Kayan, where these townships are supposed to be agricultural hubs of the region.

There are 5150 growers of beans and pulses in 28 villages of Thanlyin Township. There are 409 farmers in Bot Thapyay Kan village, 225 farmers in Thahtay Kueen village, and 275 farmers in Bagan Taung village. A total of 200 random samples were chosen proportionately among the villages. The study used 22 percent of total population from each village for the required sample size. The following table (4.2) describes how the simple size is determined for the study.

Table (4.2) Selecting Sample Size

Village Name	Number of Beans and Pulses Growers	Selected Sample Size	Coverage of Survey (%)
Bot Thapyay Kan	409	90	45
Thahtay Kueen	225	50	25
Bagan Taung	275	60	30
Total	909	200	100

Source: Survey Data, 2019

The structured questionnaire was used for the data collection processes. The questionnaire consists of demographic characteristics, knowledge and practices for handling agrochemicals and knowledge about pests and diseases of beans and pulses cultivation. The farmers were willing to describe the status of knowledge and practices of agrochemical usage for beans and pulses cultivation. Knowledge about pests and diseases in beans and pulses cultivation was also asked to the farmers. The answers from the farmers help a lot to assess the knowledge and practices of agrochemical usage and to examine the reasons of increasing usage of agrochemicals in beans and pulses cultivation.

4.3 Survey Results

The analysis of survey results and findings are based on the data collected from respondents. To assess the knowledge and practices of using agrochemicals and to examine the reasons of increasing agrochemical usage, this section includes descriptive information, which cover the characteristics of respondents, purchasing behaviors of farmers for agrochemicals, the extent of knowledge and the ways farmers use to handle pests, diseases and chemical substances, which are pesticide and fertilizer compounds.

4.3.1 Demographic Characteristics of Respondents

The respondents' demographic information were collected at the beginning of the questionnaire. The demographic factors include respondents' age, gender and education.

Table (4.3) Demographic Factors of Respondents

No	Factors	Respondents	
		Frequency	**Percentage**
1.	Age Distribution (Years)		
	20-30	20	10
	31-40	37	18.5
	41-50	69	34.5
	51-60	46	23
	Over 60	28	14
	Total	**200**	**100**
2.	Gender Distribution		
	Male	180	90
	Female	20	10
	Total	**200**	**100**
3.	Educational Attainment		
	Never Attended School	55	27.5
	Primary School	100	50
	Middle School	33	16.5
	High School	10	5
	Graduate	2	1
	Total	**200**	**100**

Source: Survey Data, 2019

Table (4.3) shows demographic factors of respondents. The majority of the respondents are in the age range of 41-50 and this is 34.5% of the total respondents. Beans and pulses growers of 51-60 years old are 23% and 31-40 years old are 18.5%. Farmers of over 60 years old are 14% while the least age range of 20-30 years are only 10% of the respondents. It can be seen that very few young people involve in beans and pulses production.

Although agribusiness is mostly done by male in Myanmar, the survey gave chance female farmers to involve in the procedures. It was found that 90% of beans and pulses growers are male farmers and only 10% are female farmers. All

respondents who took part in the survey are farmers who yearly grow beans and pulses. Among the respondents, only 20 farmers or 10% of the farmers have the ownership of land for beans and pulses cultivation.

The educational profile of farmers shows that 50% of farmers attended primary education and 16.5% also attended the middle school till the end. Only 5% of farmers reached the high school. The graduated farmers are only 2 people among the 200 respondents. 55% of farmers have never attended schools. However, these farmers are able to read and write in simple conditions. Detailed verbal explanations have to be used for these farmers.

Almost all the farmers believe that it is really difficult to produce crops without the usage of chemical substances. Agrochemicals such as chemical fertilizers, insecticides and fungicides are essential inputs for beans and pulses cultivation.

Table (4.4) Usage of Agrochemicals for Beans and Pulses

Types of Agrochemicals	Use		Do not Use	
	Respondents	Percentage	Respondents	Percentage
Pure natural wastes as fertilizers	0	0	200	100
Chemical Fertilizers	200	100	0	0
Mixture of Chemical Fertilizers and natural wastes as fertilizers	124	62	76	38
Insecticides (Pesticides)	200	100	0	0
Fungicides (Pesticides)	200	100	0	0

Source: Survey Data, 2019

Table (4.4) shows the usage of agrochemicals for beans and pulses cultivation. In cultivating beans and pulses, there are no farmers who use pure natural wastes as fertilizers. In this case, the natural wastes include animal manure and plants. All the farmers use insecticides and fungicides as pesticide products for protecting pests and diseases for beans and pulses plantation. All the farmers use chemical fertilizers for beans and pulses cultivation. The study found that there are two different forms of chemical fertilizer usage. The first one is the usage of chemical fertilizers with natural wastes. The second form is the pure usage of chemical fertilizers.

When the farmers grow beans and pulses, 62% of farmers use natural wastes as additives in chemical fertilizers. The rest of the farmers apply only chemical

fertilizers. Each farmer answers that the average of 25 kg of chemical fertilizers and 350 CC of pesticides are used for one acre for beans and pulses plantation. All farmers say that fertilizer is used only for one time before the seeds are sown. NPK compounds, Sulphur and Boron are used as chemical fertilizers. Pesticides are used for ten times during the season of beans and pulses plantation.

There is a common pattern for usage of pesticides by beans and pulses growers. The seeds of beans and pulses take four months to produce mature grains. Within the first month and the second month, the pesticides are used for five times to prevent the leaflets and little buds from fall of pests. In the third month, the pesticides mixed with plant growth regulator are sprayed for three times in the plantation to prevent pests and to encourage the enlargement to leaves, flowers and grains. In the fourth month, the pesticides are used for twice to protect the grains from the pests. The usage of fungicide is totally different from the way the pesticides are applied. 100% of beans and pulses growers answered that fungicides are applied at least two or three times depending on the humidity of the soil and weather conditions.

4.3.2 Purchasing Behaviors of Farmers for Agrochemicals

According to the schedule of structured interview, specific questions were asked to beans and pulses growers related to the purchasing behaviors to identify from which locations farmers buy agrochemicals. Each of farmer who produce beans and pulses has certain portion of expenditure for agrochemicals. Before the purchase of agrochemicals, experts of district or township agricultural department, neighboring farmers, shopkeepers and dealers of agrochemicals can give advice to farmers for the most suitable choice. Price and quality are the two factors that farmers consider before the choice of fertilizers and pesticides.

Table (4.5) Sources of Information to Purchase Agrochemicals

Sources of Information	Ask Information		Not Ask Information	
	Respondents	Percentage	Respondents	Percentage
Agricultural Experts	20	10	180	90
Neighboring Farmers	108	54	92	46
Shopkeepers	60	30	140	70
Others	12	6	188	94

Source: Survey Data, 2019.

Table (4.5) shows the sources of information for farmers to purchase agrochemicals. Only 10% of farmers consult with agricultural experts for usage of suitable fertilizers and pesticides. The agricultural experts are mostly from township agricultural office and agrochemical companies. Nearly 54% of farmers discussed with neighboring farmers to choose agrochemicals and to attain information related to agrochemical usage. However, 30% of farmers obtain information from shopkeepers to purchase agrochemicals. These farmers answered that shopkeepers can give advice related to the agrochemicals. The remaining 6% of farmers seek information from other sources including TV advertisements and advertorial leaflet.

Table (4.6) Sources of Purchasing Agrochemicals for Beans and Pulses

Sources of Purchasing Agrochemicals	Respondents	Percentage
Road Side Shops	116	58
Registered Shops	68	34
Others	16	8
Total	**200**	**100**

Source: Survey Data, 2019

Table (4.6) shows the sources of purchasing agrochemicals for beans and pulses cultivation. In Thanlyin township, roadside shops and registered shops are just retailed sales centers, which are distributed by whole sales centers, agrochemical companies and dealers. In order to buy fertilizers and pesticides, 34% of farmers go to authorized shops within Thanlyin township. However, 58% of the farmers buy agrochemicals from roadside shops near villages as there is great friendship between famers and these shopkeepers due to several business interaction. Moreover, it is easy and convenient for farmers to go to these shops. The rest of 8% of farmers go to Bayinnaung Whole Sales Centre or agrochemical dealers of other townships. The reason is that these farmers have good communication network with wholesale centers and dealers of agricultural commodities and input.

Table (4.7) Portion of Expenditure on Usage of Agrochemicals

Portion of Total Cost	Respondents	Percentage
Half of total cost	20	10
One third of total cost	68	34
One fourth of total cost	112	56

Source: Survey Data, 2019

Table (4.7) shows portions of expenditure on usage of agrochemicals by farmers to grow beans and pulses. Farmers have to incur costs on seedlings, rental fees of farming machineries, fertilizers, pesticides, labor and rental costs of land. Among farmers, 10% of farmers answer that half of total cost go to the purchase of fertilizers and pesticides. These 10% of farmers have land ownership and do not have to incur the cost of rental fees for land while the 90% of farmers rent land for the cultivation of beans and pulses plantation. Therefore, 34% and 56% of beans and pulses growers respectively answered that nearly one third and one fourth of total costs are used for buying agrochemicals.

4.3.3 Managing Pests and Diseases of Beans and Pulses Cultivation by Farmers

The usage of chemicals in beans and pulses cultivation is directly linked to the fall of pests and diseases. Farmers' knowledge and practices are important to properly manage these pests and diseases, and then it will lead to lessen the usage of agrochemicals.

Table (4.8) Respondents' Knowledge and Practices on Pests and Diseases of Beans and Pulses Cultivation

Knowledge on Pests and Diseases	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Know types of pests & diseases	56	28	144	72
Know pathogenic agents & associating crops	8	4	192	96
Know life cycle of enemy pests	43	21.5	157	78.5
Know Integrated Pest Management System	20	10	180	90
Use physical method to control pests (Hand Removal)	20	10	180	90
Use crop rotation to prevent pests and diseases	180	90	20	10
Consider the period of plant development cycle & fall of pests and diseases	104	52	96	48
Remove plants destroyed by pests & diseases	64	32	136	68
Use chemical method to control pests and diseases	200	100	0	0
Use some pesticides & fungicides for successive years	168	84	32	16
Use improved variety of seeds for pesticide resistance	20	10	180	90
Always notice the changing conditions of the plantation	136	68	64	32

Source: Survey Data, 2019

Table (4.8) shows that farmers' knowledge and practices on pests and diseases of beans and pulses. Related to the types of pests and diseases fall in beans and pulses plantation, 72% of farmers do not have the knowledge. Only 4% of farmers know pathogenic agents and associating crops that make beans and pulses plantation advantageous. Although these farmers have knowledge about pathogenic agents and

associating crops, the knowledge is not applied in farmers in practical ways. Among the farmers, 21.5% of farmers answered that the knowledge about life cycle of pests is obtained through the farming experiences. Nearly 10% half of the farmers know well about the Integrated Pest Management System.

Hand removal of pests is used as physical method by 10% of farmers. The rest of 90% answered that hand removal method is difficult to apply due to labor costs and other additional investment. However, these farmers said that the chemical methods of controlling pests are also applied while the usage of physical method is in certain extent. To prevent the development of pests and disease, 90% of farmers practice crop rotation system that is the cultivation beans and pulses after the paddy. The farmers said that the crop rotation system is beneficial as it can make extra income and prevent certain types of pests and diseases. Over half of farmers or 52% of farmers consider the period of plant development cycle of beans and pulses, which include the seedling stage, germination, growth, maturity of rods and fall of pests in beans and pulses plantation. Among the respondents, 32% of farmers make regular removal of plants destroyed by pests and diseases. Nearly 68% of respondents answered that removing destroyed plants is not too much necessary.

To prevent pests and diseases, 100% of farmers rely on usage of agrochemicals as chemical method and 84% of farmers use same pesticides for successive years while 16% use pesticide compounds alternatively. Only 10% of farmers use improved variety of seeds that are released by Yezin Agricultural Research Centre. The improved varieties of beans and pulses have short life-span and resistance to pests and diseases to certain extent. These are also designated to obtain high yields and to reduce the usage of agrochemicals. However, 90% of farmers prefer to use regular variety of because the improved variety of seeds are vulnerable to weather conditions. When farmers were asked about the question related to the awareness of the fields, 68% of farmers always notice in details of changing conditions of the plantation, which are plant development cycle of beans and pulses plants and the fall of pests and diseases. However, the rest of 32% answered that changing conditions are obvious and do not need special attention.

4.3.4 Handling Chemicals in Beans and Pulses Cultivation by Farmers

In order produce safe products and protect from health hazard, farmers' knowledge is important to have good practices in handling processes, which are usage, storage and disposal of agrochemicals for beans and pulses cultivation.

Table (4.9) Respondents' Knowledge on Usage of Agrochemicals

Knowledge & Practices on Usage of Agrochemicals	Yes		No	
	Respondents	%	Respondents	%
Knowledge				
Have attended training on systematic usage of agrochemicals	110	55	90	45
Know the agrochemicals are registered or not	106	53	94	47
Know the active ingredients and formulae of agrochemicals	100	50	100	50
Know safe and qualified ingredients of agrochemicals	94	47	106	53
Know signs for toxicity of agrochemicals	160	80	40	20
Know undesirable consequences for health due to unsystematic usage of pesticides	150	75	50	25
Know inorganic substances cause chemical residues in agricultural products	140	70	60	30
Know unlimited usage of agrochemicals occurs environmental pollution	138	69	62	31
When poison of pesticide is suffered, it is necessary to the nearest clinic	184	92	16	8
Need to bring the bottle of pesticide to the clinic in case of pesticide poisoning	10	5	190	95
One must wash eye with clean water for 15 minutes when pesticide splashed into eye.	190	95	10	5

Source: Survey Data, 2019

Table (4.9) describes respondents' knowledge on usage of agrochemicals. Among the farmers, 55% of respondents have ever attended trainings and seminars on

systematic usage of agrochemicals. These trainings and seminars are held by the department of agricultural office of Thanlyin township, agrochemical companies or co-operations between government offices and companies. It was found that 53% of farmers know that agrochemicals are registered or not. Half of the farmers, 50% have knowledge of banned active ingredients of agrochemicals and 47% of farmers know very well about the safe and qualified ingredients of agrochemicals. These farmers asked agricultural experts, shopkeepers and neighboring farmers to check about the safety and quality of agrochemical ingredients.

Nearly 80% of farmers have awareness to the signs for toxicity of agrochemicals and 75% of farmers know well about the undesirable consequences for health due to unsystematic usage of pesticides. Moreover, 70% of farmers also know that inorganic substances cause chemical residues in agricultural products. However, these farmers said that the usage of chemical substances is a common practice of today's agricultural sector. In relation to the unlimited usage of agrochemicals, 69% of farmers hold the knowledge that overdose of chemicals in agricultural processes occurs environmental pollution including soil depletion and contamination of water sources.

If in case the poison of pesticide is suffered, 92% of farmers answered that it is really necessary to go to the nearest clinic. Only 5% of farmers know well that it is necessary to bring the bottle of pesticide to the clinic when the poisoning of pesticide is occurring. Physicians can give effective treatment to the patient when the facts about chemical compounds in the pesticide is known. About 95% of farmers answered that it is indeed necessary to wash eyes with clean water for 15 minutes when pesticides splashed into one's eyes.

Table (4.10) Respondents' Practices on Usage of Agrochemicals

Practices on Usage of Agrochemicals	Yes		No	
	Respondents	%	Respondents	%
Practices				
Apply more agrochemicals year by year	190	95	10	5
Use agrochemicals (fungicides) only in necessary conditions	168	84	32	16
Read the labels before the usage	98	49	102	51
Use agrochemicals according to the instructions	96	48	104	52
Use agrochemicals which labels are written in foreign languages	108	54	92	46
Give awareness to the expired date of pesticides	124	62	76	38
Change the type of pesticides to prevent pesticide resistance	32	16	168	84
Use pesticides mixed with different types	152	76	48	24
Use more than one type of chemical fertilizers	200	100	0	0
Use Personal Protection Equipment during the usage of agrochemicals	190	95	10	5
Spray pesticides moving up the wind and down the body	160	80	40	20
Prepare water to rinse spilled pesticide to the skin	96	48	104	52
Take care of personal hygiene after spraying pesticides	184	92	16	8

Source: Survey Data, 2019

Table (4.10) describes respondents' practices on usage of agrochemicals. 95% of farmers apply more agrochemicals year by year. These agrochemicals are especially pesticides and fertilizer compounds. All the farmers answered that climate change is the major challenge for beans and pulses cultivation and that leads to higher usage of agrochemicals. When natural disasters such as unexpected rainfall and storm occur during the period of beans and pulses season, the fall of pests and diseases become too much and famers have to apply more and more pesticides. Chemicals

fertilizers are added more and more year by year because farmers do not repair with organic fertilizers and this results soil depletion. Among the farmers, 84% of farmers use fungicides as agrochemical compounds only in necessary conditions of beans and pulses plantation. The rest of 16% use fungicides in normal condition in order to protect fungi related diseases. Before the usage, 49% of farmers read the labels of agrochemicals. Over half the farmers, 52% answered that usage of agrochemicals are regular processes and there are certain deviations between instructions and practical situations. These 52% of farmers apply agrochemicals depending on the farming experiences and conditions of the fields rather than the instructions of labels.

It was found that 54% of farmers answered that there is usage of agrochemicals which labels are written in foreign language, especially form Thailand and China. These farmers believe that such kinds of agrochemical products have good quality and help for high yields of beans and pulses. Before that usage of chemical products in beans and pulses plantation, 62% of farmers give awareness to the expired date of agrochemicals. To prevent pesticide resistance, only 16% of farmers change types of pesticides within the availability of many pesticide products. Among the farmers who grow beans and pulses, 76% usually mixed different types of pesticide compounds before the usage. These farmers assume that mixed pesticides are more effective in combating pests and prevention of diseases. All the beans and pulses growers of 100% answered that more than one type of fertilizers are applied and these are NPK compounds, Boron and Sulfur.

When farmers are asked about Personal Protection Equipment (PPE), 95% use during the usage of agrochemicals. It is found that gloves are used when fertilizers applied and other types of PPEs are used for spraying pesticides. When pesticides are used, 80% of farmers spray moving up the wind direction and down of the body. These farmers know well that such kind of action can help to avoid touching or breathing the spray of pesticides. However, 20% of farmers answered that the action is not given attention but the farmers try to avoid the touch of pesticides. There can be spilled of pesticides to the skin accidently during the usage. Only 48% of farmers prepare water ready to rinse spilled pesticides to the skin. If in case the pesticides spilled to the skin, these farmers always use water and clean the skin immediately. However, 52% of farmers thought that preparing water is not really necessary and the spilled pesticides are clean when all the work in the field are finished. Related to personal hygiene, 92% of farmers take care to have a bath after the spray of pesticides.

Table (4.11) Usage of Personal Protection Equipment (PPE) During the Usage Agrochemicals

Type of PPE	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Gloves	190	95	10	5
Goggles	0	0	200	100
Apron	132	66	68	34
Hat	136	68	64	32
Long boots	120	60	80	40
Masks	40	20	160	80
The whole protective suit	0	0	200	100

Source: Survey Data, 2019

Table (4.11) shows the types of Personal Protection Equipment (PPE) that famers used during the handle of agrochemicals. Among the farmers, 95% of farmers use gloves and 66% use apron when agrochemicals are used. Long boots are used by 60% and hats are used by 68% of farmers. When the pesticides are sprayed, 20% of farmers wear masks not to take the breath of pesticides. There is no farmer who uses goggles and whole protective suits when spraying pesticides. The farmers said that goggles and protective suits that can cover the whole body are not available in shops.

Table (4.12) Choice of Time for Spraying Pesticides and Using Fertilizers

Time for Spraying Pesticides	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Early Morning	10	5	190	95
At Noon	6	3	194	97
Evening	184	92	16	8
During the Rain	0	0	200	100

Source: Survey Data, 2019

Table (4.12) shows the choice of time for usage of agrochemicals by farmers. Actually, the best choice of time for spraying pesticides and using fertilizers is the evening period. This is because the dosage of agrochemical compounds can avoid the daytime's sunshine before the effects of chemicals start working. For the cultivation of beans and pulses, 92% of farmers commonly use pesticides and fertilizers in the evening. Only 5% of farmers use agrochemicals in the early morning. There is no

farmer who uses fertilizers or pesticides during the rain. According to the experiences, farmers know well that usage of agrochemicals in the rain is totally ineffective.

Table (4.13) Handling Blocked Nozzle Head for Spraying Pesticides

Ways of Handling	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Renew the nozzle head	60	30	140	70
Use water and brush	88	44	112	56
Blowing air to the blocked nozzle head	20	10	180	90
Use sticks, nails and knives	32	16	168	84
Suck the nozzle	0	0	200	100

Source: Survey Data, 2019

Handling blocked nozzle for spraying pesticides is very important for farmers. This is because users can easily get poison if the handling process is unsystematic. How farmers handle blocked nozzles can be known from table (4.13). Among the farmers, 30% change the blocked nozzle heads with new one while 44% of farmers use water and brush to make nozzle unblocked. Only, 10% of farmers just blow air to the blocked nozzle head and 16% of farmers use sharp sticks, nails and knives to clean the nozzles. There is no farmer who sucks the nozzle by mouth. This is because the farmers have ever heard that the action can cause pesticide poisoning and kill one's life.

Table (4.14) Respondents' Behavior While Spraying Pesticides and Using Fertilizers

Respondents' Behavior	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Eating	0	0	200	100
Smoking	12	6	188	94
Drinking Water	92	46	108	54
Drinking Alcohol	4	2	196	98
Chewing Betel	4	2	196	98
Do nothing	88	44	112	56

Source: Survey Data, 2019

Respondents' behavior while using agrochemicals can be observed with table (4.14). Among the farmers, 44% of respondents do nothing when the agrochemicals are being applied. However, 46% of farmers drink water during the usage of fertilizers or pesticides. Moreover, 6% of farmers smoke, 2% of farmers drink alcohol and 2% of farmers chew betel while spraying pesticides and using chemical fertilizers.

Table (4.15) Respondents' Consideration on Usage of Pesticides for PHI

Respondents' Considerations	Respondents	Percentage
1 week before the harvest	0	0
2 weeks before the harvest	150	75
3 weeks before the harvest	50	25
4 weeks before the harvest	0	0

Source: Survey Data, 2019

Consideration for Pre-Harvest Interval (PHI) can be known by table (4.15). Normally, labels of pesticide compounds give instructions on suitable Pre-Harvest Interval. Majority of farmers, 75% keep 2 weeks between the last usage of pesticide and the harvest while 25% take 3 weeks as PHI. There is no farmer who takes 1 week or 4 weeks as PHI. However, all the farmers answered that even cloudy weather can affect beans and pulses plantation and early harvest will probably have to be made in order to protect wastes and save costs for additional usage of agrochemicals.

Table (4.16) Respondents' Knowledge and Practices on Storage of Agrochemicals

Storage Condition	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Keep away from children	192	96	8	4
Keep away from animals	172	86	28	14
Store away from foods and stuffs	190	95	10	5
Keep in a certain area	180	90	20	10
Have a board to warn the storage area	20	10	180	90
Store in empty bottles	90	45	110	55
Store away from fire, sunlight & rain	60	30	140	70

Source: Survey Data, 2019

Table (4.16) shows respondents' knowledge and practices on storage of agrochemicals. It was found that 96% of farmers keep agrochemicals, especially pesticides away from children. For the safe storage, 86% of farmers keep agrochemicals away from animals. Nearly 95% of beans and pulses growers store agrochemical away from foods and stuffs. Among the farmers, 90% answered that agrochemicals are kept in a certain area. However, these fertilizers and pesticides are stored together. Only 10% of farmers have a board to warn the storage area of pesticides and fertilizers. Nearly 30% answered that the storage area is away from fire, sunlight and rain. For the storage of agrochemicals for beans and pulses, 45% of farmers responded that pesticides are stored in empty bottle. These farmers have knowledge that the action is taboo but it is continued as the experiences of pesticide poisoning have not occurred yet. Over half of the farmers, 55%, strongly agree that storage of pesticide in empty bottles should be avoided.

Table (4.17) Respondents' Practices on Disposal of Agrochemical Containers

Disposal of Agrochemical Containers	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Burning	38	19	162	81
Dispose in the field	116	58	84	42
Dispose in bags	26	13	174	87
Streams and Rivers	10	5	190	95
Wash the containers and reuse	10	5	190	95

Source: Survey Data, 2019

Disposing empty bags and bottles of agrochemicals needs systematic ways. Table (4.17) shows respondents' practices on disposal of agrochemical containers. It was found that 19% of farmers burn empty agrochemical containers in the fields and 58% of farmers dispose agrochemicals in the fields while 13% collect agrochemical bags and containers in large bags. Among the farmers, 5% answered that the agrochemical containers are disposed in streams and rivers which are near the fields. Only 5% of farmers use soap and water to wash the containers and then reuse.

CHAPTER V
CONCLUSION

5.1 Findings

The objectives of the study are to make assessment of knowledge and practices on usage of chemical substances in beans and pulses cultivation and to examine the reasons of increasing usage of these chemical substances. To reach the targets, the survey analysis was done based on the farmers' answers related to agrochemical usage, storage, disposal and the ways of handling pests and diseases. The study reveals that the agrochemicals are one of the primary inputs of agricultural processes in Myanmar.

The demographic characteristics of respondents were firstly asked and it can be seen that the farmers who grow beans and pulses are the most in the age range of 41-50. The age range of 20-30 are the least and it means that there are few people who choose the career in the farming business. It is interesting to know that rural people do not want the children to be farmers. Most of the youths are willing to work in the urban areas and foreign countries. The trend is likely to continue in future and there will only be handful of farmers. Beans and pulses producers of Thanlyin Township said that the agricultural sector starts experiencing the insufficient supply of labor. As the harvest of beans and pulses plantation is labor intensive process, the production costs of beans and pulses go up in line with the high wages of farming workers.

The 10% of respondents were female while the 90% of respondents were male. Among these farmers, only 10% of farmers have ownership of land for cultivation of beans and pulses. All the respondents in the survey are growers, who yearly operate in plantations of beans and pulses. Concerning the educational level, half of the famers attended the primary school. 27.5% of farmers have never gone to schools although 16.5% and 5% of farmers reached middle schools and high schools respectively. Only 1% of farmers are graduated. It can be said that most of the farmers have low level of educational attainment. However, it is interesting to find that

farmers are eager to know about Good Agricultural Practices (GAPs) and other new technologies of agriculture.

Farmers, who grow beans and pulses, totally assume that chemicals substances, especially, fertilizers and pesticides, are really necessary in order to improve yields, to protect pests and diseases. The usage of pure natural extracts as fertilizers and pesticides is not absolutely found. There is a common belief among farmers that higher usage of agrochemicals can make better yields. Farmers will use more and more chemical substances in beans and pulses cultivation when the prices of these chemicals become lower than the current prices. Although 55% of farmers know well registered products, only 34% go to the registered shops. Over half of the farmers purchase agrochemicals from roadside shops, where illegally imported agrochemicals can be found. These shops have ease of access to farmers rather than the registered shops.

Farmers obtain the information source related to the agrochemicals mostly from the neighboring atmosphere. Some farmers also ask shopkeepers to help the choice of agrochemicals. Only 10% of farmers get information from agricultural experts to purchase agrochemicals. It can be known that there is continuous flow of information within the farmers and other peer groups of agricultural sector.

When farmers are asked about the ingredients of the agrochemicals, nearly half of the farmers know the active ingredients and formulae of the pesticides and fertilizers, which are currently used for beans and pulses cultivation. Farmers hold the knowledge that quality agrochemicals can improve yields of beans and pulses killing unwanted pests and preventing diseases. There is little consideration about the safety of ingredients when determining the quality of agrochemicals.

Pests and diseases are the problems of agricultural sector and the choice of suitable practices to handle pests and diseases depends on famers' knowledge. Most of the famers do not know about enemy pests and diseases. Over half of the farmers do not know about life cycle of the enemy pests. Farmers need to know more about the period of plant development cycle and fall of pests and diseases in beans and pulses plantation. Only 10% of farmers have ever heard about Integrated Pest Management System (IMPS). Apart from the chemical method, alternatives of IPMS are less well-known.

Negligence of IPMs makes the lack of beneficial pests and crops in beans and pulses plantation to control the population of pests and various forms of diseases. All

the farmers use chemical substances to combat pests and diseases. The total reliance on chemicals rather than the other forms of IPMS enhances the more usage of agrochemicals year by year. Little knowledge of pests and diseases occur increasing usage of agrochemicals, especially pesticides. Very often, fungicide have to be used due to left over moisture in the plantation caused by unsystematic land preparation before sowing the seeds of beans and pulses. On the other hand, most of the farmers use same types of pesticides and fungicides for successive years and it improves the resistance in certain types of pests and diseases. Much more application of agrochemicals is required to overcome the level of resistance.

Natural disasters come along with climate change which poses a great challenge to Myanmar's agricultural sector. An obvious consequence of irregular weather conditions is the fall of pests and diseases to beans and pulse plantation. Farmers have to use more agrochemicals not to damage the yields of beans and pulses plantation. The harvest of beans and pulses plantation is also affected by the processes of weather in the way that the last usage of agrochemicals and the harvest would be close.

Among the farmers, 55% of beans and pulses growers have attended trainings on systematic usage of agrochemicals. Most of the farmers still need to know more about registered products and safe ingredients of chemical substances used in the agricultural sector. Over 50% of farmers hold the knowledge that the usage of chemicals in agricultural processes can cause health related problems and environmental pollution, especially the contamination of soil and water resources. The soil is not repaired with natural ways to improve fertility. Farmers have to use more fertilizers yearly as a result of soil depletion. Too much use of inorganic fertilizer remains chemical residues in the agricultural products.

Most of farmers' practices come from experiences and advices of neighboring farmers rather than from knowledgeable personnel or agricultural experts. Nearly half of the farmers do not read label and instructions of agrochemicals. Some farmers neglect the expired date of chemical substances used in agricultural processes. Pesticides with the labels of foreign languages are popular among farmers. This shows the exist of illegal pesticides in Myanmar agrochemical market.

Most of the farmers know that Personal Protection Equipment (PPE) have to be used while handling agrochemicals. PPE that are commonly used by farmers are gloves, hats, apron and long boots. The usage of goggles and the whole protective

suits are not found among farmers. Related to the emergency cases of pesticide poisoning, 92% of farmers answered that it is really necessary to go to the nearest clinic. However, there are weak preparations of farmers to prevent from the poisoning cases. Some of the farmers do not hold the common sense to take care personal hygiene and cleanliness of the surrounding environment after the usage of chemicals in beans and pulses plantation. Today's farmers always have to handle chemical substances and much more detailed knowledge are continuously needed for the safety of practices including systematic handling, storage and disposal.

5.2 Recommendations

Massive production of beans and pulses totally free from chemicals is indeed a rare occasion. This thesis proves that farmers' knowledge is important to have secure practices in handling chemicals and to reduce the usage of these chemical substances in beans and pulses cultivation. Even though most of the farmers have very few schooling years, these farmers are deserved to possess wide extent of agricultural knowledge.

Safe practices will be rooted when farmers have concrete knowledge about the chemicals substances of agricultural production. All possible approaches should be considered to raise the level of knowledge about agrochemicals. Through the co-operations of government sector, private sector and NGOs, farmers should be educated for systematic techniques of using chemicals in agricultural sector. Trainings, seminars and demonstrations for correct usage, storage and disposal of chemicals should be held by agricultural experts and technicians.

To promote the farmers' knowledge of agrochemicals, the participation of media sector and public health sector will be beneficial not only for farmers but also for consumers. Creating edutainment programs and posters campaigns for usage of agrochemicals should be arranged in rural areas. An effective communication channel should be established to convey timely information about agricultural knowledge to all participants in the sector. Immediate checking procedures are needed to be sure that farmers apply knowledge in practical ways.

Responsible bodies should cleverly persuade farmers to have systematic practices in using chemicals for cultivation of beans and pulses. In this situation, newly educated generations should be encouraged to take part in agricultural sector by

cultivating interest about the agriculture and discovering prospective opportunities in agribusiness.

In order to alleviate the increasing usage of chemical substances in beans and pulses cultivation, farmers should keep in touch with modern agronomics practices like organic farming, Good Agricultural Practices (GAPs), and Integrated Pest Management System (IPMS). Reengineering programs for the depleted soil should also be implemented according to the nationwide extent. Local practices of farmers have to be tailored with new technologies for efficient production of beans and pulses. Developing organic market and offering incentives will be helpful for farmers to use less chemicals in farming products.

Agricultural researches have to be undertaken related to the chemicals. By giving chances for farmers to take part in these researches, new messages about chemicals have to be declared for the whole agricultural sector of Myanmar. Meanwhile, agrochemicals in Myanmar should be controlled with high quality standard. Unbiased investigation procedures have to be applied to eliminate the circulation of illegal agrochemicals in the market. Laws and regulations must cover all chemical substances of agricultural sector under the strict supervision.

Myanmar's agricultural sector is in urgent condition to tackle with climate change. Government and civil societies have to draw policies to protect farmers from losses due to natural disasters and other similar conditions. To prevent the increased usage of chemicals due to abnormal weather processes, farmers should be taught about detailed knowledge of pests and diseases. Improved varieties of seeds should be delivered to beans and pulses growers. These seeds have to be ensured for the resistance to weather, pests and diseases.

For the time being, zero level of chemical usage is impossible for all the farmers. It will take some years for reduction of chemicals in agricultural sector of Myanmar. High standard of knowledge and systematic practices of these chemical substances by farmers can only guarantee for safe foods. Having serious attentiveness to all the aspects of agrochemicals is a great requisite for all farmers and relevant personnel to achieve the purpose of sustainability in Myanmar's agricultural sector.

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Appendix (A)

A Study of Knowledge and Practices on

Chemical Usage in Beans and Pulses Cultivation of Yangon Region

(Case Study of Three Villages in Thanlyin Township)

Questionnaires for Survey (Farmers)

The information you provide will be strictly confidential and only for the research of knowledge and practices on usage of chemicals in beans and pulses production.

No :

Date :

Name of Farmers	:
Age	:
Gender	:
Educational Level	:
Types of Cultivating beans and pulses	:
Name of Village	:
Township	:
Region	:

Part I

Choosing and Buying Agrochemicals for Beans & Pulses

1. Do you use agrochemicals for Beans & Pluses Cultivation?

   ☐ Yes ☐ No

2. Which type of fertilizer do you use?

   ☐ Pure natural wastes as fertilizers

   ☐ Chemical fertilizers

   ☐ Mixtures of chemical fertilizers and natural wastes as fertilizers

3. Which types of pesticides do you use for beans and pulse production?

   ☐ Insecticides

   ☐ Fungicides

   ☐ Pesticides made from natural extract

4. From which do you buy agrochemicals?

   ☐ Read side shop

   ☐ Authorized shop

   ☐ Others (……..…)

5. Have you ever read that the agrochemicals, which you are using, are registered or not in Myanmar?

   ☐ Yes ☐ No

6. When choosing and buying agrochemicals, you discuss with the following people.

   ☐ Agricultural expert

   ☐ Other farmers

   ☐ Authorized distributors

   ☐ Others (……..…)

7. When buying agrochemicals, you consider the following points.

   ☐ Price is the main concern.

   ☐ Quality is the most important

   ☐ Both price and quality are to be considered.

8. Do you buy and use agrochemicals only when it is necessary?

☐ Yes ☐ No

9. If No, why? (the reason please)

……

10. Before using agrochemicals, do you read the labels?

☐ Yes ☐ No

11. Do you use agrochemicals, which labels are written in foreign languages?

☐ Yes ☐ No

12. If yes, why? (the reason)

……..

13. When buying pesticides, do you check for the expired date?

☐ Yes ☐ No

14. Do you know the corers and signs for toxicity of pesticides?

☐ Yes ☐ No

15. When buying agrochemicals, do you take emphasis on safe formulations with active ingredients?

☐ Yes ☐ No

16.Do you change regularly the type of pesticides to prevent pesticide resistance?

☐ Yes ☐ No

17.How much extent of the investment for the agricultural processes goes to fertilizers and pesticides?

☐ $\frac{1}{2}$ of the investment

☐ $\frac{1}{3}$ of the investment

☐ $\frac{1}{4}$ of the investment

☐ Others (……..…)

Part II

Storage and Disposal of Agrochemicals

1. Do you store agrochemicals away from children?
   ☐ Yes ☐ No
2. Do you store fertilizers and pesticides together?
   ☐ Yes ☐ No
3. Do you store agrochemicals away from foods and other stuffs?
   ☐ Yes ☐ No
4. Do you store agrochemicals away from animals?
   ☐ Yes ☐ No
5. Do you store agrochemicals in a certain area?
   ☐ Yes ☐ No
6. In agrochemical storage area, do you post warning signs with the wards?
   ☐ Yes ☐ No
7. Do you store pesticides in plastic bottles and other empty bottles?
   ☐ Yes ☐ No
8. Do you keep or store agrochemicals away from fire and out of direct sunlight and rain?
   ☐ Yes ☐ No
9. After the wage of pesticide, how do you dispose the residue of pesticides empty bottles and bags?
   ☐ Burying away from the field
   ☐ Within the field
   ☐ In the rivers and streams
   ☐ Burning
   ☐ Washing the empty bags and bottles for recycle

Part III

Handling Agrochemicals for Beans & Pulses

1. Do you use agrochemicals more and more yearly?

   ☐ Yes ☐ No

2. If you say "Yes", please specify your reasons?

   ……..

3. When cultivating beans and pulses, do you use agrochemicals according to the instructions on the labels?

   ☐ Yes ☐ No

4. How often do you use inorganic or chemical fertilizers?

   ……..

5. At what stage of plantation, nursery, growth and development, do you use fertilizers?

   ……..

6. How often do you use pesticides for beans and pulses?

   ……..

7. At what stage of plantation, nursery, growth and development , do you use pesticides?

   …….

8. Do you use more than one type of pesticides?

   ☐ Yes ☐ No

9. Do you use more than one type of fertilizers?

   ☐ Yes ☐ No

10. Do you use the chemical fertilizer by mixing with organic fertilizer or other kind of chemical or inorganic fertilizers?

    ☐ Use ☐ Do not use

11. Do you use the pesticides by mixing with different kinds of other pesticides?

    ☐ Use ☐ Do not use

12. Have you ever attended trainings on systematic usage of agrochemicals?

    ☐ Have attended ☐ Have never attended

13. Do you know unsystematic usage of agrochemicals can cause undesirable consequences for health?

    ☐ Know ☐ Do not know

14. Do you spray pesticides moving up the wind and down the body?

☐ Yes ☐ No

15. Do you know that the usage of agrochemicals can cause chemical residues in agricultural products?

☐ Know ☐ Do not know

16. Do you know that unlimited usage of agrochemicals can occur environmental pollution?

☐ Know ☐ Do not know

17. Do you know that the pesticide law of 2016 gives instructions to users for systematic application?

☐ Know ☐ Do not know

18. Do you know that you have to go to the nearest clinic when the pesticide poisoning occurs?

☐ Know ☐ Do not know

19. Do you know that you have to bring the bottle of pesticide when going to the clinic due to the pesticide poisoning?

☐ Know ☐ Do not know

20. Do you know that you have to wash eyes with clean water for 15 minutes when pesticide splashed into the eyes?

☐ Know ☐ Do not know

21. Do you take care of personal hygiene after spraying pesticides?

☐ Take care ☐ Do not take care

22. Do you use pesticide when the beans and pulses are about to be harvested?

☐ Yes ☐ No

23. When using pesticides how many days do you take for PHI? (Pre – Harvest Interval)

……..……

24. Do you use Personnel Protection Equipment (PPE) during the application of agrochemicals?

☐ Yes ☐ No

25. When using agrochemicals, you use the following personnel protection equipment (PPE). Please tick if you use the following.

☐ Gloves

☐ Goggles

- ☐ Apron
- ☐ Long Boots
- ☐ A hat
- ☐ The whole protective suit
- ☐ Masks

26. Do you take soap and water near your for cleaning spilled pesticide off the skin?
    - ☐ Yes ☐ No
27. What do you do when nozzles are blocked for applying pesticides?
    - ☐ Use water or soft brush
    - ☐ Blow into the nozzles
    - ☐ Use the sharp stick, nail or knife
    - ☐ Suck the nozzles with the mouth
    - ☐ Renew the head
28. When do you normally apply pesticides?
    - ☐ Early in the morning
    - ☐ At the noon
    - ☐ In the evening
    - ☐ During the rain
29. During the usage of the pesticides, do you do the following actions?
    - ☐ Eating
    - ☐ Smoking
    - ☐ Drinking water or alcohol
    - ☐ Chewing Betel
    - ☐ Nothing

Part IV

Questions related to handling pests and diseases for beans and pulses production

1. Do you know which types of pests and diseases fall on the beans and pulses?
   ☐ Yes ☐ No
2. If you answer "Yes," please specify the types of pests and diseases.
   ……..……..
3. Do you know Integrated Pest Management (IPM)?
   ☐ Yes ☐ No
4. Do you know the life cycle of enemy pests for beans and pulses plantation?
   ☐ Yes ☐ No
5. Which types of natural barriers, pathogenic agents or associating crops, do you have for the protection of beans and pulses from pests and diseases?
   ……
6. Do you use crop rotation system?
   ☐ Use ☐ Do not use
7. Do you use the same pesticides and fungicides for successive years?
   ……
8. Do you consider the period of plant development cycle and fall of pests and diseases?
   ☐ Yes ☐ No
9. Do you normally pull out and destroy and plants that are badly affected by pests?
   ☐ Yes ☐ No
10. Do you use technologically improved varieties of beans and pulses for increased production and disease tolerant?
    ☐ Yes ☐ No
11. Do you know the natural enemies of the pests that usually fall on Beans and Pulses Plantation?
    ……
12. Do you use nets or other physical of pests?
    ☐ Yes ☐ No
13. Do you always check for the problems and conditions in the field?
    ……
14. Which kind of problems and conditions do you generally find in beans and pules cultivation?
    ……

Appendix (B)

ရန်ကုန်တိုင်းဒေသကြီး၊ သန်လျင်မြို့နယ်ရှိ ပဲစိုက်ပျိုးသော တောင်သူလယ်သမားများ၏ လယ်ယာသုံးဓာတုပစ္စည်းများ ကိုင်တွယ်အသုံးပြုမှုနှင့် ပတ်သက်၍ အသိပညာရှိမှု အခြေအနေများကိုဆန်းစစ်လေ့လာခြင်း

အမှတ်စဉ် ----------

နေ့စွဲ ----------

ဤမေးခွန်းလွှာတွင် မေးခွန်းပါ အကြောင်းအရာများသည် ပဲစိုက်ပျိုးသော တောင်သူလယ်သမားများ၏ လယ်ယာသုံးဓာတုပစ္စည်းများ ကိုင်တွယ်အသုံးပြုမှုနှင့် ပတ်သက်၍ အသိပညာရှိမှု အခြေအနေများကိုဆန်းစစ်လေ့လာသော သုတေသန လုပ်ငန်းအတွက်အသုံးပြုရန်ဖြစ်ပါသည်။တောင်သူတစ်ဦးချင်းဖြေဆိုသောအချက်အလက်များကို လျို့ဝှက်ထားရှိမည် ဖြစ်ပါသည်။

တောင်သူအမည် - ----------

တောင်သူ၏အသက် - ----------

ကျား/ မ - ----------

ပညာအရည်အချင်း - ----------

စိုက်ပျိုးသည့်ပဲအမျိုးအစား - ----------

ကျေးရွာအုပ်စု - ----------

အပိုင်မြို့နယ် - ----------

တိုင်းဒေသကြီး - ----------

အပိုင်း (က)

ပဲစိုက်ပျိုးမှုအတွက်လယ်ယာသုံး ဓာတုဗေဒပစ္စည်းများရွေးချယ်ဂယ်ယူသုံးစွဲမှုနှင့် ပတ်သက်သောမေးခွန်းများ

၁။ ပဲစိုက်ပျိုးမှုအတွက် လယ်ယာသုံးဓာတုပစ္စည်းများကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုပါ။

၂။ ပဲစိုက်ပျိုးမှုအတွက် မည်သို့သော မြေဩဇာအမျိုးအစားကို အသုံးပြုပါသလဲ။

☐ သဘာဝဩဇာနှစ်မြေဩဇာ ☐ ဓာတုမြေဩဇာနှင့်သဘာဝမြေဩဇာ

၃။ ပဲစိုက်ပျိုးမှုအတွက် မည်သို့သော ပိုးသတ်ဆေးများကို အသုံးပြုပါသလဲ။

☐ ဓာတုပိုးသတ်ဆေး ☐ ဓာတုမှိုသတ်ဆေး ☐ သဘာဝတမာပိုးသတ်ဆေး

၄။ ပဲစိုက်ပျိုးမှုအတွက် လယ်ယာသုံးဓာတုပစ္စည်းများကို မည်သည့်နေရာမှ ဂယ်ယူပါသလဲ။

☐ လမ်းဘေးရှိလယ်ယာသုံးဓာတုပစ္စည်းအရောင်းဆိုင်

☐ တရားဝင်အရောင်းဆိုင်များ

☐ အခြားဆိုင် (ကျေးဇူးပြု၍ ရေးသားဖော်ပြပေးပါရန် .....)

၅။ သင်ယခုသုံးစွဲနေသော လယ်ယာသုံးဓာတုပစ္စည်းများသည် မြန်မာနိုင်ငံတွင် တရားဝင် မှတ်ပုံတင် ထားခြင်း ရှိမရှိက ကောင်းစွာ သိရှိပါသလား။

☐ ကောင်းစွာသိပါသည်။ ☐ သိရှိခြင်းမရှိသေးပါ။

၆။ လယ်ယာသုံး ဓာတုပစ္စည်းများကို ပဲစိုက်ပျိုးမှုအတွက် ရွေးချယ်ဂယ်ယူရာတွင် အောက်ဖော်ပြပါ လူများကို မေးပါသည်။

☐ စိုက်ပျိုးရေးပညာရှင် ☐ တောင်သူအချင်းချင်း

☐ အရောင်းကိုယ်စားလှယ်များ ☐ အခြားသူ (.....)

၇။ လယ်ယာသုံးဓာတုပစ္စည်းများကို ဂယ်ယူရာတွင် အောက်ဖော်ပြပါ အကြောင်းအရာများကို အဓိက စဉ်းစားပါသည်။

☐ ဈေးနှုန်းချိုသာမှုသည် အဓိကဖြစ်သည်။

☐ အရည်အသွေးကောင်းမှုသည် အဓိကဖြစ်သည်။

☐ ဈေးနှုန်းသင့်တင့်ပြီး အရည်အသွေးကောင်းမွန်မှုသည် အဓိကဖြစ်သည်။

၈။ လယ်ယာသုံးဓာတုပစ္စည်းများကို မည်သို့သုံးစွဲပါသလဲ။

☐ လိုအပ်သည့်အခါမှသာသုံးစွဲပါသည်။

☐ ကြိုတင်၍သုံးစွဲထားတတ်ပါသည်။

၉။ လယ်ယာသုံးဓာတုပစ္စည်းများကို အသုံးမပြုမီတွင် အညွှန်းစာကို ဖတ်ရှုပါသလား။

☐ ဖတ်ရှုပါသည်။ ☐ မဖတ်ရှုပါ။

၁၀။ နိုင်ငံခြားဘာသာစကားများဖြင့် အညွှန်းစာကို ရေးသားထားသော လယ်ယာသုံးဓာတုပစ္စည်းများ ကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ အသုံးမပြုပါ။

၁၁။ အကယ်၍ အသုံးပြုပါက မည်သည့်အကြောင်းကြောင့် အသုံးပြုသည်ကို ဖော်ပြပေးပါရန်။

.....

၁၂။ ပိုးသတ်ဆေးများကို ဂယ်ယူသုံးစွဲသောအခါ သက်တမ်းကုန်ဆုံးရက်ကို သတိပြုပါသည်။

☐ သတိပြုပါသည်။ ☐ သတိမပြုမိပါ။

၁၃။ အသုံးပြုမှုအတွက် လယ်ယာသုံးဓာတုပစ္စည်းများကို အသုံးပြုရာတွင် ၎င်းတို့၏ ပါဂင်ပစ္စည်းများနှင့် အကျိုးအာနိသင်များကို ကောင်းစွာသိရှိထားပါသည်။

☐ ကောင်းစွာသိရှိပါသည်။ ☐ သိရှိခြင်းမရှိသေးပါ။

၁၄။ ပိုးသတ်ဆေးပုလင်း၏ အညွှန်းစာသားတွင် အဆိပ်ဖြစ်ကြောင်းဖော်ပြရန် အသုံးပြုသောသင်္ကေတများနှင့် အရောင်ခွဲခြားသတ်မှတ်မှုများကို ကောင်းစွာသိရှိပါသလား။

☐ ကောင်းစွာသိရှိပါသည်။ ☐ ကောင်းစွာသိရှိခြင်းမရှိသေးပါ။

၁၅။ လယ်ယာသုံးဓာတုပစ္စည်းများကိုဂယ်ယူရာတွင် ပါဂင်ပစ္စည်းများနှင့်ဘေးကင်းလုံခြုံမှုရှိသော ဆေးဖော်စပ်မှုကို အလေးထားပါသလား။

☐ အလေးထားပါသည်။ ☐ အလေးမထားမိပါ။

၁၆။ ပိုးမွှားများ၏ ပိုးသတ်ဆေးဒဏ်ခံနိုင်ရည်ရှိလာမှုကို ဟန့်တားရန် ပိုးသတ်ဆေးအမျိုးအစားကို ပုံမှန် ပြောင်းလဲသုံးစွဲပါသလား။

☐ သုံးစွဲမိပါသည်။ ☐ မသုံးစွဲဖြစ်ပါ။

၁၇။ ဓာတ်မြေဩဇာနှင့် ပိုးသတ်ဆေး ဂယ်ယူသုံးစွဲမှုအတွက် စိုက်ပျိုးရင်းနှီးစရိတ်မှ မည်သည့် ပမာဏ လောက်ကို ကျခံရသလဲ။

☐ စိုက်ပျိုးရင်းနှီးစရိတ်၏ တစ်ဂက်

☐ စိုက်ပျိုးရင်းနှီးစရိတ်၏ သုံးပုံတစ်ပုံ

☐ စိုက်ပျိုးရင်းနှီးစရိတ်၏ လေးပုံတစ်ပုံ

အပိုင်း (ခ)

လယ်ယာသုံးဓာတုပစ္စည်းများ သိုလှောင်ခြင်းနှင့် စွန့်ပစ်ခြင်းနှင့် ပတ်သက်သောမေးခွန်းများ

၁။ လယ်ယာသုံးဓာတုပစ္စည်းများကို ကလေးငယ်များနှင့် အလှမ်းဝေးသောနေရာတွင် ထားရှိ ပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၂။ ပိုးသတ်ဆေးနှင့်ဓာတ်မြေဩဇာကို အတူတကွသိုလှောင်ထားရှိပါသလား။

သိုလှောင်ထားရှိပါသည်။ ☐ မသိုလှောင်ထားပါ။

၃။ လယ်ယာသုံး ဓာတုပစ္စည်းများကို စားသောက်ဖွယ်ရာများနှင့် အခြားသောအသုံး အဆောင်ပစ္စည်းများနှင့်ဝေးသောနေရာတွင် ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၄။ လယ်ယာသုံးဓာတုပစ္စည်းများကို တိရစ္ဆာန်များနှင့်ဝေးသောနေရာတွင် သိုလှောင် ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၅။ လယ်ယာသုံးဓာတုပစ္စည်းများကို သီးသန့်နေရာတွင်ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၆။ လယ်ယာသုံးဓာတုပစ္စည်းများကို သိုလှောင်သောနေရာတွင် ဘေးအန္တရယ်ကင်းရှင်း ရေးအမှတ်အသားများကို စိုက်ထူထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၇။ ပလတ်စတစ်ပုလင်းခွံအလွတ်များနှင့်အခြားသောပုလင်းခွံအလွတ်များတွင် ပိုးသတ် ဆေးများကို သိုလှောင်ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၈။ လယ်ယာသုံးဓာတုပစ္စည်းများကို မီး၊ တိုက်ရိုက်ကျသောနေရောင်ခြည်နှင့် မိုးရေ အစရှိသည်တို့၏ အပေးတွင် ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၉။ ပိုးသတ်ဆေး အသုံးပြုမှုပြီးစီးပါက ဆေးအကြွင်းအကျန်များပါရှိနေသော ပုလင်း အလွတ်နှင့် အိတ် အလွတ်များကို မည်သို့ စွန့်ပစ်ပါသလဲ။

☐ လယ်ကွင်းထဲတွင် မီးရှို့ပြီးနောက် ကျင်းတူး၍ မြေမြှုပ်စွန့်ပစ်သည်။

☐ လယ်ကွင်းထဲတွင် ပုလင်းအခွံ၊ အိတ်အခွံများ အတိုင်းစွန့်ပစ်သည်။

☐ အမှိုက်ပုံး၊ အမှိုက်အိတ်များတွင်း စွန့်ပစ်သည်။

☐ မြစ်၊ ချောင်း၊ အင်း၊ အိုင်များတွင်း စွန့်ပစ်သည်။

☐ ပုလင်းအခွံနှင့် အိတ်အခွံများကို ဆေးကြောပြီးပြန်လည်အသုံးပြုသည်

အပိုင်း (၈)

ပဲစိုက်ပျိုးမှုအတွက် လယ်ယာသုံးဓာတုပစ္စည်းများကို သုံးစွဲခြင်းနှင့် ပတ်သက်သောမေးခွန်းများ

၁။ လယ်ယာသုံးဓာတုပစ္စည်းများကို နှစ်စဉ်ပိုမိုသုံးစွဲပါသလား။

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၂။ အကယ်၍သုံးစွဲသည်ဆိုပါက အကြောင်းရင်းကိုဖော်ပြပေးပါရန်။

.....

၃။ ပဲစိုက်ပျိုးသည့်အတွက် လယ်ယာသုံးဓာတုပစ္စည်းများကို အညွှန်းစာပါ ဖော်ပြချက်များအတိုင်း သုံးစွဲပါသလား

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၄။ ပဲစိုက်ပျိုးမှုအတွက် ဓာတ်မြေဩဇာကို ဘယ်နှစ်ကြိမ်လောက် အသုံးပြုပါသလဲ။

.....

၅။ ပဲစိုက်ပျိုးမှုအတွက်ပိုးသတ်ဆေး ကို ဘယ်နှစ်ကြိမ်လောက် အသုံးပြုပါသလဲ။

.....

၆။ ပဲစိုက်ပျိုးမှုအတွင်း အပင်ပေါက်ကာလ၊ ရှင်သန်သည့်ကာလနှင့်ကြီးထားဖွံ့ဖြိုးသည့် ကာလအနက် မည်သည့်ကာလအတွင်း မြေဩဇာကိုအသုံးပြုသလဲ။

.....

၇။ ပဲစိုက်မှုအတွင်း အပင်ပေါက်ကာလ၊ ရှင်သန်သည့်ကာလနှင့် ကြီးထားဖွံ့ဖြိုးသည့် ကာလအနက် မည်သည့်ကာလအတွင်း ပိုးသတ်ဆေးကိုအသုံးပြုပါသလဲ။

.....

၈။ ပဲစိုက်ပျိုးမှုအတွက် ပိုးသတ်ဆေးအမျိုးအစားကို တစ်ခုထက်ပို၍ သုံးစွဲပါသလား။

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၉။ ပဲစိုက်ပျိုးမှုအတွက်ဓာတ်မြေဩဇာကို အမျိုးအစား တစ်ခုထက်ပို၍ သုံးစွဲပါသလား။

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၁၀။ ပဲစိုက်ပျိုးမှုအတွက် ဓာတ်မြေဩဇာသုံးစွဲရာတွင် သဘာဝမြေဩဇာနှင့်ရောနှော၍ ဖြစ်စေ၊ အခြား သောဓာတ်မြေဩဇာ တစ်မျိုးမျိုးနှင့်ဖြစ်စေ ရော၍သုံးစွဲပါသလား။

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၁၁။ ပဲစိုက်ပျိုးမှုအတွက် ပိုးသတ်ဆေးသုံးစွဲရာတွင် မတူညီသော အမျိုးအစားများ အချင်းချင်း ရောနှော၍ သုံးစွဲပါသလား။

☐ သုံးစွဲပါသည်။ ☐ မသုံးစွဲပါ။

၁၂။ လယ်ယာသုံးဓာတုပစ္စည်းများကို စနစ်တကျ ကိုင်တွယ်သုံးစွဲမှုနှင့် ပတ်သက်သော သင်တန်းများကို တက်ရောက်ဖူးပါသလား။

☐ တက်ရောက်ဖူးပါသည်။ ☐ မတက်ရောက်ဖူးပါ။

၁၃။ ပိုးသတ်ဆေးများကို စနစ်တကျ ကိုင်တွယ်သုံးစွဲခြင်းမရှိပါက မလိုလားအပ်သော နောက်ဆက်တွဲကျန်းမာရေးဆိုးကျိုးများဖြစ်ပေါ်နိုင်သည်ကိုသိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၁၄။ ပိုးသတ်ဆေးသုံးစွဲရာတွင်ဆေးဖျန်းတံကိုခန္ဓာကိုယ်အောက်ဘက်ကိုစိုက်၍လေညာဘက်ကိုမျက်နှာမူကာပတ်ဖျန်းရသည်ကို သိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၁၅။ လယ်ယာသုံးဓာတုပစ္စည်းများကိုအသုံးပြုခြင်းကြောင့်စိုက်ပျိုးရေးထွက်ကုန်များတွင် ဓာတုဓာတ်ကြွင်းများဖြစ်ပေါ်နိုင်သည်ကိုသိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၁၆။ လယ်ယာသုံးဓာတုပစ္စည်းများကို အကန့်အသတ်မဲ့အသုံးပြုခြင်းကြောင့် သဘာဝပတ်ဝန်းကျင်ထိခိုက်ညစ်ညမ်းမှုဖြစ်ပေါ်သည်ကို သိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၁၇။ ၂၀၁၆ ခုနှစ်တွင် ပြခဲ့သော မြန်မာနိုင်ငံပိုးသတ်ဆေးဥပဒေတွင် အသုံးပြုသူများအတွက်ညွှန်ကြားချက်များပါရှိသည်ကို သိရှိထားပါသလား။

☐ သိရှိထားပါသည်။ ☐ မသိရှိထားပါ။

၁၈။ ပိုးသတ်ဆေးအဆိပ်သင့်မှုဖြစ်ပေါ်ပါက နီးစပ်ရာကျန်းမာရေးဆေးခန်းသို့အမြန်ဆုံးသွားရောက်ရမည်ကို သိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၁၉။ ပိုးသတ်ဆေးအဆိပ်သင့်မှု ဖြစ်ပေါ်ပါက နီးစပ်ရာ ကျန်းမာရေးဆေးခန်းသို့သွားရောက်ရာတွင် သုံးစွဲခဲ့သောပိုးသတ်ဆေးပုလင်းနမူနာကိုပါ တစ်ပါးတည်းယူဆောင်သွားရမည်ကိုသိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၂၀။ ပိုးသတ်ဆေးပတ်ဖျန်းစဉ် မျက်လုံးထဲသို့ဆေးရည်စဉ်ပါက ၁၅မိနစ်ကြာအောင် ရေကြည်ရေသန့်ဖြင့်ပြန်လည်ဆေးကြောရမည်ကိုသိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၂၁။ ပိုးသတ်ဆေးပတ်ဖျန်းပြီးနောက် တစ်ကိုယ်ရည်သန့်ရှင်းမှုကို ဂရုတစိုက်ပြုလုပ်ပါသလား။

☐ ပြုလုပ်ပါသည်။ ☐ မပြုလုပ်ပါ။

၂၂။ ပဲနတ်ခါနီးကာလတွင် ပိုးသတ်ဆေးကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုပါ။

၂၃။ ပဲနတ်ခါနီး ဘယ်နှစ်ရက်အလိုတွင် နောက်ဆုံးအကြိမ်အဖြစ် ပိုးသတ်ဆေးကို သုံးစွဲပါသလဲ။

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၂၄။ လယ်ယာသုံးဓာတုပစ္စည်းများကိုအသုံးပြုစဉ်တွင် တစ်ကိုယ်ရည်သုံးအကာအကွယ်ပစ္စည်းများကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုပါ။

၂၅။ လယ်ယာသုံးဓာတုပစ္စည်းများကို သုံးစွဲနေစဉ်တွင် အောက်ပါတစ်ကိုယ်ရည်သုံးအကာအကွယ်ပစ္စည်းများကို အသုံးပြုပါသည်။ (အသုံးပြုသောပစ္စည်းကို အမှတ်ခြစ်၍ ဖော်ပြပေးပါရန်။

☐ လက်အိတ် (သို့မဟုတ်) လက်ကိုဖုံးအုပ်နိုင်သော ပလတ်စတစ်အိတ်အရှည်များ

☐ မျက်လုံးအကာအကွယ်ပစ္စည်း

☐ ခန္ဓာကိုယ်တစ်ခုလုံးကို ကာကွယ်သော ရေစိုခံအေပရွန် (သို့မဟုတ်)

☐ ပလတ်စတစ်အစများ (သို့မဟုတ်) အဖြူရောင်ချည်သားဂတ်စုံ

☐ ဦးထုပ်

☐ ခြေထောက်ကိုဖုံးအုပ်သော ဘွတ်ဖိနပ် (သို့မဟုတ်) ရှူးဖိနပ်များ

☐ မျက်နှာဖုံး (သို့မဟုတ်) အောက်စီဂျင်ပါသော အသက်ရှူကိရိယာ

၂၆။ ပိုးသတ်ဆေးသုံးစွဲနေစဉ်တွင် မတော်တဆ အရေပြားပေါ် သို့ပိုးသတ်ဆေးဖိတ်စဉ်မှု အတွက် ဆေးကြောရန်ရေနှင့် ဆပ်ပြာကို အသင့်ထားရှိပါသလား။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၂၇။ ပိုးသတ်ဆေး ဖျန်းသောပိုက်ခေါင်း ပိတ်ဆို့နေပါက မည်သို့ပြုလုပ်ပါသလဲ။

- ☐ ရေနှင့် ဘရက်ရှ်ကို အသုံးပြု၍ ဆေးကြောသည်။
- ☐ ပိုက်ခေါင်းအတွင်းသို့ ပါးစပ်ဖြင့် လေမှုတ်ထည့်သည်။
- ☐ ချွန်ထက်သော တုတ်ချောင်း၊ လက်သည်း (သို့မဟုတ်) မားကိုအသုံးပြုသည်။
- ☐ ပိုက်ခေါင်းကို ပါးစပ်ဖြင့် စုပ်လိုက်သည်။
- ☐ အသစ်လဲလှယ်သည်။

၂၈။ ပိုးသတ်ဆေးကို ပုံမှန်အားဖြင့် တစ်နေ့တာ၏ မည်သည့်အချိန်ကာလတွင် သုံးစွဲသလဲ။

- ☐ မနက်စောစော
- ☐ နေ့လယ်ခင်း
- ☐ ညနေခင်း
- ☐ မိုးရွာနေစဉ်

၂၉။ ပိုးသတ်ဆေးသုံးစွဲနေစဉ် အောက်ပါ အပြုအမူများကို လုပ်ဆောင်ပါသလား။

- ☐ အစာစားခြင်း
- ☐ ဆေးလိပ်သောက်ခြင်း
- ☐ ရေသောက်ခြင်း
- ☐ အရက်သောက်ခြင်း
- ☐ ကွမ်းစားခြင်း
- ☐ ဘာကိုမှမလုပ်ဆောင်ပါ။

အပိုင်း (ဃ)

ပဲစိုက်ပျိုးထုတ်လုပ်မှုတွင်ကြုံတွေ့ရလေ့ရှိသောပိုးမွှားရောဂါများကိုကိုင်တွယ်ဖြေရှင်းမှုနှင့် သက်ဆိုင်သောမေးခွန်းများ

၁။ ပဲစိုက်ပျိုးရာတွင် ကျရောက်တတ်သောပိုးမွှားများနှင့် အခြားသောရောဂါအန္တရာယ် အမျိုးအစားများ ကို ကောင်းစွာသိရှိပါသလား။

☐ ကောင်းစွာသိရှိပါသည်။ ☐ သိရှိခြင်းမရှိသေးပါ။

၂။ အကယ်၍ သိရှိပါက မည်သည့်ပိုးမွှားအမျိုးအစားနှင့်မည်သည့် ရောဂါအန္တရာယ် အမျိုးအစား ဖြစ်ကြောင်း ရေးသားဖော်ပြပေးပါရန်။

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၃။ ဘက်စုံသုံးပိုးမွှားရောဂါနှိမ်နင်းကာကွယ်ခြင်းကိုသိရှိပါသလား။

☐ သိရှိပါသည်။ ☐ မသိရှိပါ။

၄။ ပဲစိုက်ပျိုးရာတွင် ကျရောက်သော ရန်သူပိုးမွှားများ၏၊ ဇီဝသံသရာလည်ပတ်ပုံကို သိရှိထားပါသလား။

☐ သိရှိထားပါသည်။ ☐ မသိရှိထားပါ။

၅။ ပဲစိုက်ပျိုးရာတွင် ကျရောက်သောပိုးမွှားအန္တရာယ်များကိုကာကွယ်ရန် အကျိုးပြုဇီဝ ပိုးမွှားဖြစ်စေ၊ အကျိုးပြုသီးနှံဖြစ်စေ မည်သည့်သဘာဝအရံအတားမျိုးကို ထားရှိပါ သလဲ။

☐ ထားရှိပါသည်။ ☐ မထားရှိပါ။

၆။ ပိုးမွှားနှင့်ရောဂါအန္တရာယ်များကို ကာကွယ်ရန် စပါးပြီးဆောင်းသီးနှံအလှည့်ကျ စိုက်ပျိုးသောစနစ်ကိုအသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုဖြစ်ပါ။

၇။ ပဲစိုက်ပျိုးရာတွင် အသုံးပြုသော ပိုးသတ်ဆေးနှင့် မှိုသတ်ဆေးများကို နှစ်စဉ် ဆက်တိုက် အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုဖြစ်ပါ။

၈။ ပဲစိုက်ပျိုးသောရက်ကို သတ်မှတ်ရာတွင် ပဲပင်များကြီးထွားဖွံ့ဖြိုးချိန်နှင့် ပိုးမွှား အန္တရာယ်များ ကျရောက်တတ်ချိန်တို့ကို ထည့်သွင်းစဉ်းစားပါသလား။

☐ စဉ်းစားပါသည်။ ☐ မစဉ်းစားဖြစ်ပါ။

၉။ ပဲစိုက်ပျိုးရာတွင် ပိုးမွှားအန္တရာယ်များကြောင့် ဆိုးဝါးစွာပျက်စီးသွားသော ပဲပင်များကို ဖယ်ရှားပစ်ပါသလား။

☐ ဖယ်ရှားပစ်ပါသည်။ ☐ မဖယ်ရှားဖြစ်ပါ။

၁၀။ ပဲစိုက်ပျိုးရာတွင် အထွက်နှုန်းတိုးတက်ရန်နှင့် ပိုးမွှားအန္တရာယ်ကို ခံနိုင်ရည်ရှိရန် နည်းပညာ အဆင့် မြှင့်ထားသော ပဲမျိုးစိတ်များကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ အသုံးမပြုဖြစ်ပါ။

၁၁။ ပဲစိုက်ပျိုးရာတွင် ကျရောက်လေ့ရှိသော ပိုးမွှားများ၏ ဆန့်ကျင်ဘက်ရန်သူ ပိုးမွှားအမျိုးအစားကို ကောင်းစွာသိရှိပါသလား။

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၁၂။ ပဲစိုက်ပျိုးရာတွင် ကျရောက်လေ့ရှိသောပိုးမွှားများကို ဖယ်ရှားရှင်းလင်းရန် ပိုက်ကွန် (သို့မဟုတ်) အခြားသောနည်းလမ်းတစ်ခုခုကို အသုံးပြုပါသလား။

☐ အသုံးပြုပါသည်။ ☐ မသုံးပြုဖြစ်ပါ။

၁၃။ ပဲစိုက်ခင်းတွင် ပြောင်းလဲဖြစ်ပေါ်နေသော အခြေနေအရပ်ရပ်ကို အမြဲလေ့လာစောင့်ကြည့်ဖြစ်ပါ သလား။

☐ လေ့လာစောင့်ကြည့်ဖြစ်ပါသည်။

☐ မလေ့လာဖြစ်ပါ။

၁၄။ ပဲစိုက်ပျိုးရာတွင် ပုံမှန်အားဖြင့် မည်ကဲ့သို့သော အခက်အခဲမျိုးကို နှစ်စဉ်ကြုံတွေ့ရလေ့ရှိသလဲ။

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Appendix (C)