FARMERS' ENVIRONMENTAL AWARENESS AND WILLINGNESS TO ACCEPT THE ORGANIC VEGETABLE FARMING IN PYIN OO LWIN TOWNSHIP

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JUNE, 2015

FARMERS' ENVIRONMENTAL AWARENESS AND WILLINGNESS TO ACCEPT THE ORGANIC VEGETABLE FARMING IN PYIN OO LWIN TOWNSHIP

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A Thesis Submitted to the Post-Graduate Committee of the Yezin Agricultural University as a Partial Fulfillment of the Requirements for the Post Graduate Diploma of Agricultural Science (Agricultural Economics)

Department of Agricultural Economics
Yezin Agricultural University

JUNE, 2015

The thesis attached here to, entitled **"Farmers' Environmental Awareness and Willingness to Accept the Organic Vegetable Farming in Pyin Oo Lwin Township"** was prepared and submitted by Myo Sabai Aye under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and board of examiners as a partial fulfillment of requirements for the **Post Graduate Diploma of Agricultural Science (Agricultural Economics).**

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This thesis represents the original work of the author, expert where otherwise stated; it has not been submitted previously for a degree or any other University.

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DEDICATED TO MY BELOVED PARENTS,

DR. MYO KYWE AND DAW AYE AYE MU

ACKNOWLEDGEMENT

I would like to express my special gratitude to Dr. Myo Kywe, Rector, Dr. Soe Soe Thein, Pro-Rector (Academic) and Dr. Nangh Seng Hom, Pro-Rector (Admin), Yezin Agricultural University (YAU) for their permission to attend my post graduate diploma and their review comments, invaluable suggestions and kind administrative support in the completion of my thesis. I wish to express my highly gratitude to Dr. Cho Cho San, Professor and Head, Department of Agricultural Economics, YAU, for permission to attend the post graduate program and constructive comments to improve this dissertation and throughout my study.

I wish to extend my sincere thanks to my external examiner, Dr. Tin Ohanmar Win, Assistant Director, Department of Agriculture, Nay Pyi Taw for her professional guidance, suggestions and invaluable comments in this manuscript.

I would like to express my deepest appreciation and immense gratitude to my supervisor Dr. Theingi Myint, Associate Professor, Department of Agricultural Economics, YAU for her inspiring guidance and suggestions, invaluable overall supervision, generous helps, motherly concern, encouragement and understanding to me throughout my study.

I wish to extend my utmost thanks to the supervisor committee member, Daw Nang Ei Mon The, Assistant Lecturer, Department of Agricultural Economics, YAU for her encouragement and kind contributions during the survey and understanding to me throughout the research during my study. My special thanks are also to my supervisor committee member, Daw Tin May Yu Aung, Lecture, Department of Horticulture and Agricultural Biotechnology, YAU for her intensive reading, suggestions and comments on this manuscript.

My special thanks go to U Kyaw Maung Maung, Manager, Department of Agriculture, Pyin Oo Lwin Township and Daw May Thet Hlaing, Deputy Supervisor, Department of Industrial Crop Development, Pawe Taung, Pyin Oo Lwin for very kind assistance and for accompanying me to the sites. My sincere thanks and appreciation go to all respondents and local leaders of villages in Pyin Oo Lwin Township for their understanding and assistance during my survey period.

My thanks are due to all of teachers from the Department of Agricultural Economics, YAU and also to my colleagues in my department and my beloved friends for their supports, kindness, valuable suggestions and assistance throughout my study period.

Lastly but not the least, my deepest and greatest dedication is to my beloved parents, Dr. Myo Kywe and Daw Aye Aye Mu for their understanding, encouragement, endurance, a lot of help and generous financial support whatever I need.

ABSTRACT

Most of the vegetables are grown in the central part of Myanmar, mainly dry zone areas and Shan State. The large amounts of vegetables are produced in Pyin Oo Lwin, Mandalay Region. Having the limited size of the plots, vegetable growers are using large amount of pesticides in the expectation of high yield. The study was attempted to observe farmers' existing knowledge on soil conservation measures and cultural practices, environmental awareness index and the willingness to accept (WTA) the organic farming of vegetable production and the constraints of using organic materials and practicing organic farming in Pyin Oo Lwin. For the required primary data, 55 vegetable farmers and farm labors were interviewed in 2 sample villages out of 156 villages in Pyin Oo Lwin Township on December 2013. Among the sample respondents, 49% were male and 51% were female. Descriptive analysis and environmental awareness index calculation were done to fulfill the research objectives. According to research findings, the average education level of sample respondents was middle education level. It was found that the farm experience was not different in gender of household head and the average farm size was about 2 acres. Major occupations of sample respondents were farmers (49%) and agricultural labors (51%). Among the samples, 27% attained secondary job. Based on the gender of sample respondents, the existing knowledge on soil conservation measures and cultural practices was more in male respondents than in female. Nearly 80% of farmers used contour bunds method for soil conservation. For the point of organic farming, the sample farmers thought that it is not an effective technique for protection of pests and diseases and it will reduce their income. However, half of the sample respondents had higher environmental awareness index. One third of sample respondents had fully environmental awareness index. Regarding to farmer's willingness to accept (WTA) the organic farming, male respondents had higher knowledge and willingness than female. The price premium would be at least twice of conventional crop price which farmers expected. Based on the findings, environmental conservation education program would be emphasized by extension services and agricultural policy makers' concerning for agricultural farm labor and female farmers. Moreover, consumers' preference and willingness to pay for the organic products would be set up as future research items for development of organic product market in Myanmar.

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ABBREVIATIONS

ACT	Agriculture Certification Thailand
˚C	Degree Celsius
DoA	Department of Agriculture
FAO	Food and Agriculture Organization
FiBL	Forschung Institute Fur Biologischen Landbau (Research Institute of Organic Agriculture)
FYM	Farm Yard Manure
Ha	Hectare
HDRA	Henry Doubleday Research Association
HNV	High Nature Value farming system
IFOAM	International Federation of Organic Agriculture Movements
MFVPA	Myanmar Fruits and Vegetable Producers Association
MMK	Myanmar Kyat
MOAG	Myanmar Organic Agriculture Group
MOAI	Ministry of Agriculture and Irrigation
MOECAF	Ministry of Environmental Conservation and Forestry
MT	Metric ton
No.	Number
SLRD	Settlement and Land Record Department
USDA	United States Department of Agriculture

CHAPTER 1

INTRODUCTION

1.1 Overview on Agriculture and Environmental Relation

Agriculture has changed dramatically especially since the end of World War II. The scientific development in agricultural technology has led to the drastic changes in socio-economic and environment in a few decades. The changes include both physical and biological environment. The adoption of modern agricultural technology i.e., substituting the indigenous varieties with modern hybrid varieties (High Yield Varieties), application of synthetic agro-chemicals, mechanization and irrigation, is still being viewed by different people from different background. The comparison of pros and cons of the modern farming technology has been debated for several years, yet the best reliable solution for that problem has not been discovered (Bo Bo Lwin 2006).

However the adoption of intensive agriculture through increased use of fertilizers, pesticides and other inputs, directly or indirectly, has been brought some adverse impacts. Three of the most serious impacts are the degradation of the soil, the use and management of water and the long-term impact of the use of agricultural chemicals. Worldwide trends in the loss of top soil, soil degradation, and decline in the quality of water and a steady decline in the genetic base support the view expressed by many scientists that the present modern agriculture system, with its emphasis on higher yields through high external inputs is ultimately non-sustainable (Leong 2000).

There have been published a lot of research papers finding the weakness of modern agriculture, its inconsistency with the ecosystem and negative impacts on environment and natural resources. On the other hand, the conventional agriculturists can point out the importance of the technology and its necessity with the adequate proves of increased population and the world food security. FAO estimated that up to 35% of the losses in annual crop production worldwide are due to pests – insects, weeds, plant diseases, rodents, and birds. Combining these losses with the post-harvest losses, world food losses would amount to 45%. This is almost one-half of the world's potential food supply. Various countries try to increase their agricultural production by means of various intensive ways of policies like expending the farm area, and relying on higher inputs (Bo Bo Lwin 2006).

Pesticides have substantially contributed to the controlling of pests and increasing crop yields in meeting the food demand of escalating population and control of vector-borne diseases. Exposure to pesticides is one of the most important occupational risks among farmers in developing countries (Konradsen et al. 2003; Coronado et al. 2004). One of the major factors of pesticide contamination or poisoning in developing countries is the unsafe use or misuse of pesticides. Past researchers have identified the elements of unsafe use of pesticides as; lack of attention to safety precautions, environmental hazards, and information about first aid and antidotes given by the label, the use of faulty and proper maintenance of spraying equipment, and lack of the use of protective gear and appropriate clothing during handling of pesticides (Damalas et al. 2006; Ajayi and Akinnifesi 2008; Sosan and Akingbohungbe 2009).

In view of the adverse environmental effects from the unsafe pesticide use, lack of awareness of the adverse health consequences of pesticides by some farmers; it therefore becomes imperative to identify farmers' pest management practices in vegetable cultivation by investigating farmers' awareness and perceptions about the effects of pesticides use on the environment (Adeola 2012). Adverse effects of agriculture on environment include atmospheric emissions, soil degradation, biodiversity loss and chemical residues and waste. Positive effects from agriculture include the preservation of the landscape, environment and water resources, flood prevention and resource cycling (Ito 2000).

The economic development of developing countries depends on the performance of the agricultural sector, and the contribution of this sector depends on how the natural resources are managed. Unfortunately, in the majority of developing nations, the quality and quantity of natural resources are decreasing resulting in more severe droughts and floods (Fikru 2009).

According to Wegayehu (2003), among the various forms of land degradation, soil erosion is the most important and an ominous threat to the food security and development prospects in developing countries. It induces on-site costs to individual farmers, and off-site costs to society. That coupled with poverty, fast growing population and policy failure; poses a serious threat to national and household food security.

1.2 Modern Agriculture and Impacts of Agro-chemical Use

Modern agriculture depends on high input of chemical fertilizer and pesticides for crop production. Although such technology-based agricultural practice has increased agricultural productivity and abundance, the resulting ecological and economic impacts have not always been positive. Environmental pollution and food safety due to chemical contamination have become a great concern worldwide. In order to cope with this problem, the Food and Agriculture Organization (FAO) proposed "The World Food Summit Plan of Action (1999)" in recognition of the importance of developing alternative sustainable agriculture practices such as organic farming. The goal of the action plan was to reduce environmental degradation while creating income from the farming operation. Organic farming is an integrated farming system which involves both technical aspects (soil, agronomy, weed, and pest management) and economic aspects (input, output, and marketing) as well as human health.

Farmer's misunderstanding of pesticide usage came from their habitual practices in using pesticides wrongly. Also, they had never received pesticide effect on themselves directly. So, they did not pay attention to and were not aware of hazard of using pesticides which were dangerous to humans, animals and environment. It made common farmers using pesticides as the main factor of cultivation was not aware that they could be harmful.

The most important thing that can solve these problems is that farmers are necessarily aware of hazard of pesticide used, because farmers themselves must be modified as they are pesticides users. They must be activated to be aware that pesticides are harmful materials that can harm humans and environment directly and indirectly. If unaware, it seems that both farmers and consumers are unsafe unavoidably.

In addition, long persistence of some agrochemicals in the environment sets in a series of undesirable effects through contamination of food and feed (Hanak et al. 2002). Improperly used or stored pesticides can potentially be harmful to human wildlife and the environment (Koop 1995). Pesticides also contaminate drinking water and food crops, especially fruits and vegetables receiving the highest dosages of pesticides, thus posing a possibly serious health hazard to consumers (Pimentel et al. 1992).

1.3 Organic Farming and Environmental Awareness of Farmers

Organic farming has been in existence since man began utilizing agricultural practices. Over the years, organic methods gave way to "conventional" methods, characterized by the use of synthetic chemical inputs. Today, however, there is renewed interest in organic farming and it is being termed by many the "alternative" method of farming. This renewed interest is a direct result of high energy prices, increased fertilizer costs, and concerns about health, pesticide residues and the environmental impacts of chemicals.

Many views of organic farming as a primitive, inefficient method but today's organic farmer utilizes some of the latest technologies including genetically superior plants, biological pest controls and advanced mechanization. In some situations organic farmers may be less vulnerable to natural and economic risks than conventional farmers since their systems are usually more diversified. Some claim that the widespread adoption of organic farming methods could result in rural revitalization, regional self-sufficiency in food production and changes in the existing "capital-intensive structure of agriculture."

Organic farming does not mean going 'back' to traditional methods. Many of the farming methods used in the past are still useful today. Organic farming takes the best of these and combines them with modern scientific knowledge. Organic farmers do not leave their farms to be taken over by nature; they use all the knowledge, techniques and materials available to work with nature. In this way the farmer creates a healthy balance between nature and farming, where crops and animals can grow and thrive (HDRA 1998).

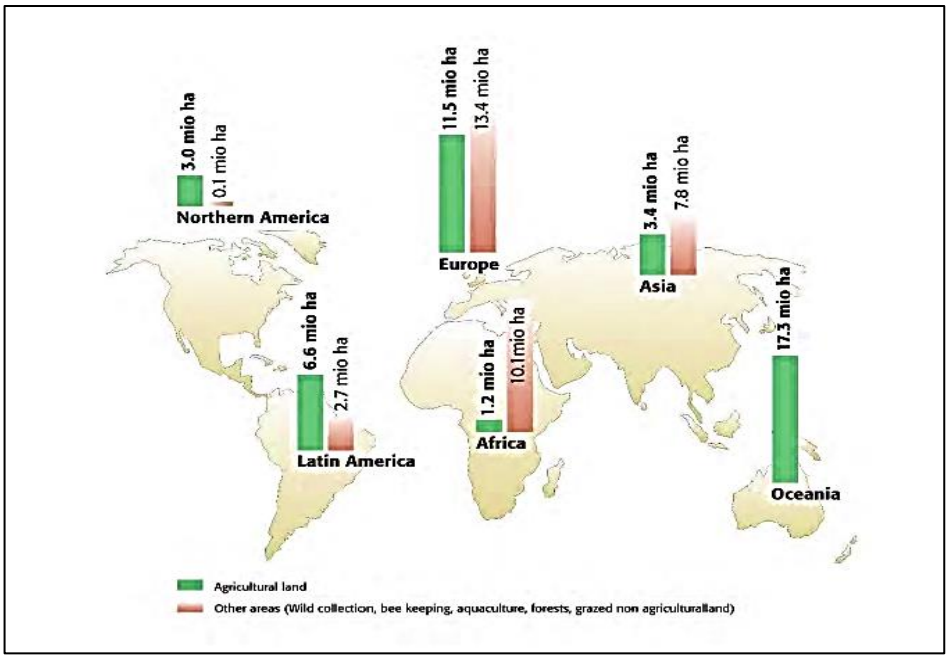
The development of organic farming depends on the willingness of individual conventional farmers to convert to organic farming practices. In turn, this willingness depends to a large extent on the institutional system in which the farm is embedded (Michelsen et al. 2001). Some systems contain adequate institutions to promote the development of organic farming, others do not. Michelsen et al. (2001) have shown that the continuous development of the organic sector depends on institutions from three societal domains: civil society, market and state. The concept of civil society is perceived in opposition to the concept of the state and comprises all the institutions and organizations that are not government controlled (Baylis & Smith 2001). It includes producers' associations, informal farming practice guidelines, and non-state organizations that participate in lobbying,

research and education. The market domain includes supply and demand rules, marketing initiatives, consumers, and food chain actors, such as processors and retailers. The state includes agricultural regulations, standards for organic certification and labeling and different kinds of support. The establishment of those institutions necessary to promote the wide conversion to organic farming is highly influenced by the action taken by the state, which is in turn dependent on the state willingness to promote organic farming. In other words, a state that shows a high level of involvement in the development of the organic sector can be said to have a high willingness.

1.4 Background of Organic Agriculture

1.4.1 Organic agriculture in worldwide

According to statistics and emerging trends in 2015**,** there were 43.1 million hectares of organic agricultural land in 2013.The regions with the largest areas of organic agricultural land are Oceania (17.3 million hectares, 40 percent of the world's organic agricultural land) and Europe (11.5 million hectares, 27 percent). Latin America has 6.6 million hectares (15 percent) followed by Asia (3.4 million hectares, 8 percent), North America (3 million hectares, 7 percent) and Africa (1.2 million hectares, 3 percent). There were almost 2 million producers in 2013. Thirty-six percent of the world's organic producers are in Asia, followed by Africa (29 percent) and Europe (17 percent). About a quarter of the world's agricultural land (11.7 million hectares) and more than 80 percent (1.7 million) of the producers are in developing countries and emerging markets (FiBL & IFOAM 2014).



Map 1: Organic agricultural land and other organic areas in 2012
Source: FiBL – IFOAM (2014)

1.4.2 Organic agriculture in Asia

The total organic agricultural area in Asia was 3.4 million hectares in 2013. This constitutes nine percent of the world's organic agricultural land. Compared with 2001 (400,000 hectares), the organic land has increased almost tenfold. The country with the largest organic agricultural area is China (2.1 million hectares), and the country with the most producers is India (650,000 producers). The countries with the highest share of organic agricultural land are Timor-Leste (6.6 percent) and Mongolia (4.7 percent). The ten countries with the largest organic area in 2012 and development of organic agricultural land during 2000 to 2013 in Asia are shown in Figure 1.1 and 1.2 (FiBL & IFOAM 2014).

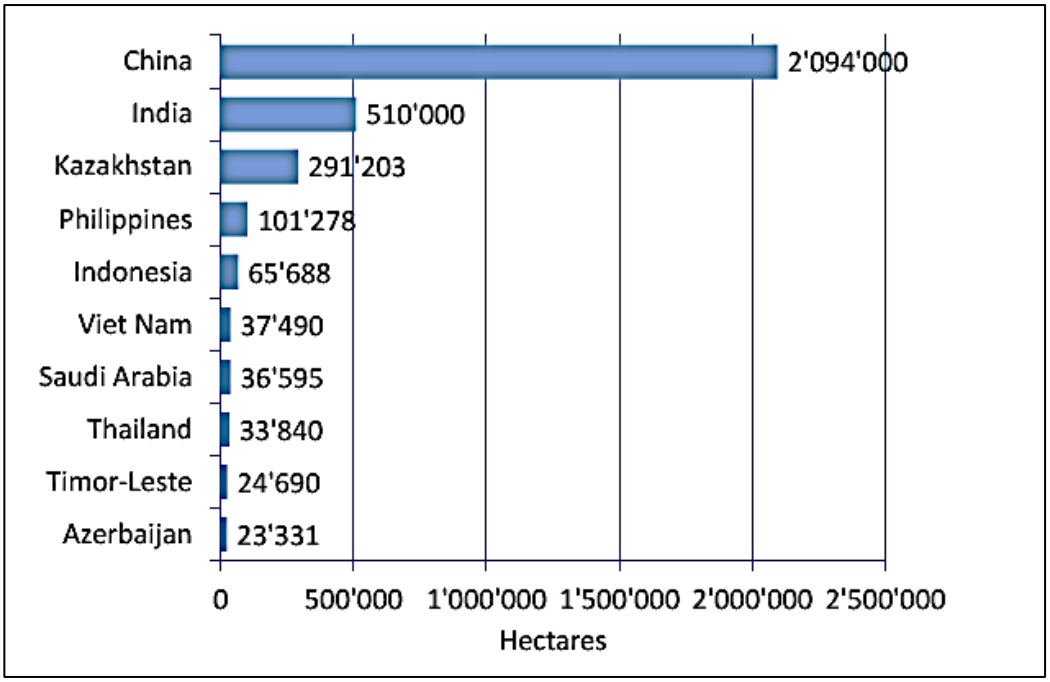


Figure 1.1 Ten countries with the largest organic agricultural land 2013
Source: FiBL – IFOAM (2015)

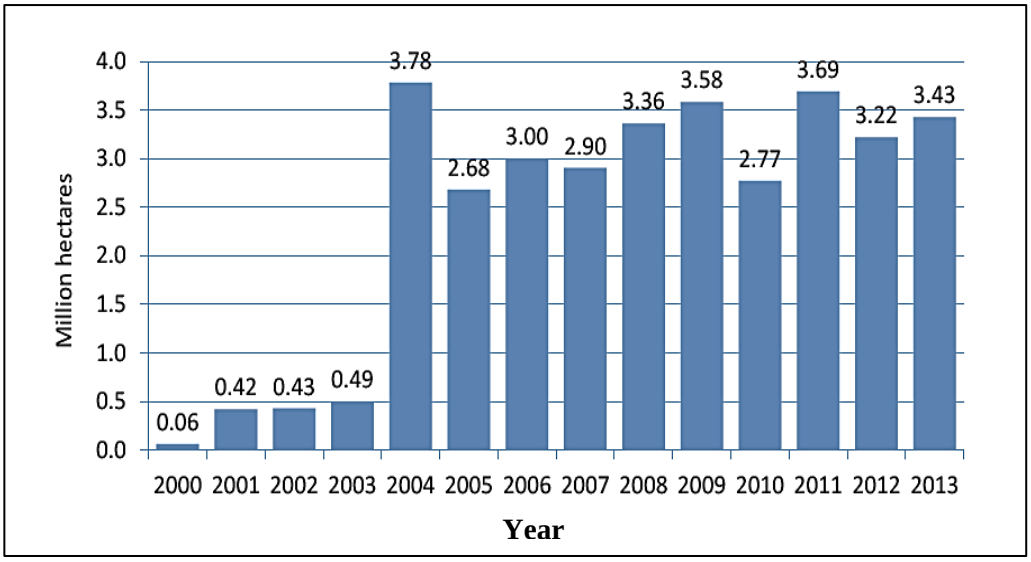


Figure 1.2 Development of organic agricultural land 2000 to 2013 in Asia
Source: FiBL – IFOAM (2015)

The Standard for organic agriculture of the Association of Southeast Asian Nations (ASEAN), which is likely to become a very influential development for the region in the future, is expected to be approved by the ASEAN Ministers on Agricultural and Forestry in June 2014. The data of organic agricultural land and number of producers 2013 in ASEAN countries are described in Table 1.1 (FiBL & IFOAM 2014).

Table 1.1 Organic agricultural land and number of producers 2013 in ASEAN countries

Country	Area (ha)	No. of producers
Cambodia	9,889	6,753
Indonesia	65,688	5,700
Lao People's Democratic Republic	6,442	1,342
Malaysia	603	119
Myanmar	897	15
Philippines	101,278	3,008
Thailand	33,840	9,279
Vietnam	37,490	6,829

Source: FiBL-IFOAM (2015)

1.4.3 Organic agriculture in Myanmar

Myanmar possesses plentiful natural resources of land, water, fauna, flora and a favorable climate, which forms the basis for the development of agriculture sector. The total cultivated area under various crop cultivars is about 167 million acres (17.4 percent of the total area) (MOAI 2010). Most of vegetables are grown in the central part of Myanmar, mainly dry zone areas and Shan State. Shan State produces rainy season tomato, potato, garlic and cool-season crops (crucifers) these are considered as priority crops (Naing, 2010). Total vegetables growing area, Harvested area, total yield and total production from 2007 to 2013 in Myanmar are shown in Table 1.2 (SLRD 2013).

Table 1.2 Vegetable sown areas and production in Myanmar, 2007-2013

Item	2007/08	2008/09	2009/10	2010/11	2011/2012	2012/13
Sown area (ha)	481,281	507,752	524,842	541,698	537,995	541,265
Harvested area (000 ha)	481,265	507,752	517,642	541,696	537,472	541,230
Yield (MT/ha)	106.21	105.84	116.74	105.54	104.14	104.18
Production (MT)	2,976,687	3,096,204	3,490,630	3,282,403	3,236,293	3,324,416

Source: SLRD (2013)

As early as mid-1990s, several foreign investors had tried to initiate organic agriculture projects in Myanmar, hoping to utilize the clean environment and good soil fertility in various parts of the country to produce organic foods. But most of these foreign-private projects did not last long. However, they helped to raise awareness within the country, especially among the private sector. Also, many representatives from both the public and private sectors have been exposed to the concept of organic farming and the market opportunities when travelling overseas, e.g. attending regional and international workshops and conferences. These activities helped to incubate the local organic agriculture movements in Myanmar (Green Net Cooperative 2001).

The Myanmar private sector started to take initiative since late 2000 to sell self-claim organic products in local supermarket, e.g. the Nara tea, a local brand. In 2009, the Myanmar Fruits and Vegetable Producers Association (MFVPA) set up the Myanmar Organic Agriculture Group (MOAG) as private sector association to support organic agriculture development in the country. MOAG has around 100 members (as of December 2011); most of whom are individuals and only 4 are private companies. Besides providing being forum for experience-sharing, MOAG also provides technical advices to interested producers and organic certification services. A private sector national organic standards were developed and certification services were initiated in the late 2010 (Green Net Cooperative 2001).

Currently, there are 6 organic farms in Myanmar, covering 59.89 hectare of crop farmlands, certified by MOAG and ACT (Thailand). Two fertilizer companies are approved by MOAG for organic inputs. The organic products certified by MOAG are currently sold in domestic markets, mostly as conventional products as local organic markets are yet to be established (Green Net Cooperative 2001).

Total organic agricultural land and number of producers from 2013 to 2014 in Myanmar are shown in Table 1.3 (MOAG 2014). The total organic agricultural land in Myanmar during 2013 to 2014 was around 1000 ha and the total number of producers was increased up to 22. Among the location of organic farming in Myanmar, Ayeyarwady region was the largest organic farming areas. Mandalay has had the second largest organic farming area and the producers.

Table 1.3 Organic agricultural land and number of producers in Myanmar (2013-2014)

Location of Farms (Region/ State)	Cultivated Area (ha)	No. of Producers
Ayeyarwady	898.8	9
Mandalay	30.7	3
NayPyi Taw	20.2	1
Chin	20.2	1
Sagaing	8.9	1
Bago	8.5	2
Mon	8.1	1
Yangon	5.1	3
Shan	4.0	1
Total	**1004.6**	**22**

Source: MOAG (2014)

1.5 Rationale of the Study

The modern agricultural techniques such as use of synthetic fertilizers and pesticides are continuing to destroy stable traditional ecosystems and the use of high yielding varieties of crops has resulted in the elimination of thousands of traditional varieties with the concurrent loss of genetic resources. The introduction of high yielding varieties changed the agricultural environment leading to numerous pest problems of economic importance. In the process of intensive farming, the environment has been treated in an unfriendly manner. The intensive production systems have led to depletion of major and minor nutrients from the soil apart from damaging the soil health, productivity and also sustainability. Intensive farming

systems warrant the use of high doses of chemical fertilizers. Non-availability of organic forms of plant nutrients has also forced the increased use of chemical fertilizers (Reddy 2010 b).

The process of intensification in agricultural production has increased soil pollution in agricultural systems up to a point in which it is a main agricultural externality and a main threat for agricultural sustainability, as it reduces the potential for agricultural production. Apart from its physical and climatic causes, there are frequently both social and economic factors behind the problem of soil pollution that have often been neglected in many technical studies. Regarding the failure to incorporate long term soil benefits, there are many factors that cause farmers not to care about soil pollution.

Farmers' responses to soil erosion and pollution will depend on many diverging factors, both technical (cropping patterns, slope, type of soil, etc.) and socio-economic (age, skill, wealth, etc.). One option is to do nothing, maintain the same technology, practices and level of input use, which leads to a continued soil loss and a decline in agricultural production. A second option is to intensify production substituting other inputs (such as fertilizers) for topsoil depth, which generally worsen soil loss and increases production costs. A third option is to adopt new practices to conserve soil, which may have a negative economic effect on the short run but a positive overall economic effect in the long run, although ambiguous evidence exists in this sense. The last option is to regenerate topsoil, which incurs even larger costs (Calatrava et al. 2007).

To overcome the soil fertility problem, farmers should use mainly chemical (inorganic) fertilizer and organic manure. Although soluble inorganic fertilizer give rapid results in term of correcting immediate deficiency of nutrients from the environmental view point, their use is becoming less desirable. The increasing cost of inorganic fertilizer and their adverse effects on soil productivity, farmers are being encouraged to increase use of available organic waste and crop residues as organic or bio-fertilizer. Application of livestock manure refers to the use of livestock wastes on the plot by way of scattering on the surface of the plot or placing manure in seed holes at the time of planting. This is important in maintaining soil organic matter levels, a critical factor in soil health.

Moreover, the level of soil organic matter can be restored or maintained through the application of green manure, compost and farmyard manure. These can release nutrient

earlier than the other organic materials that are more resistant to decomposition. Organic matter can absorb considerable amount of water, often 5 to 6 times of its own weight. Soil fertility problems remain a high priority for agricultural development in Myanmar and the role of scientific information is important to improve this situation. However, in most cases, a scientific point of view can only partially reflect the farmers' point of view in terms of agricultural development. The complexity of farmers' society creates a gap between the scientist and the farmer. This gap should be bridged in order to facilitate mutual understanding on the problems to be tackled.

Additionally, increased agricultural productivity may require application of pesticides to combat pests and diseases, but their use must be controlled and users must be aware of possible undesirable effects on human health and the natural environment. Incorrect use of pesticides on the one hand reduces agricultural sustainability by causing environmental problems such as underground and surface water pollution, destruction of beneficial organisms and acquirement of resistance by pests, and on the other hand can have harmful effects on the health of both farmers and consumers. In developed countries, there is greater awareness of the harmful effects, and this had led to better regulation of pesticides and in some countries compulsory training of spray operators and/or routine checks on spraying equipment.

Increasing pesticide use in regions with intensive agriculture, adverse effects will inevitably arise, as producers who are unaware of the negative effects of pesticides on human and environmental health may use excessive amounts and incorrectly. In contrast farmers' awareness of the harmful effects of pesticides is expected to behave differently with better selection of pesticides, amounts used and application practices. However, for various reasons, producers are sometimes unable to translate their level of awareness on this subject into their practices, that is, they may not behave consistently. Apart from pests developing resistance to pesticides, there are other harmful effects of pesticides that affect agricultural sustainability, the environment and the health of farmers as well as those living near farms.

Vegetable farmers use a wide range of pesticides at different levels to reduce losses from pests and diseases. However, despite the contribution of pesticides to agricultural production, evidences in the last few decades have shown that they could also be detrimental to human health and the ecosystem (Tadesse A. and Asferachew A. 2008). National economic and agricultural policies are major forces that directly and indirectly shape a

variety of agricultural health and environmental problems. Major component of agricultural policy for the past several decades have enhanced increasing size, intensity, and specialization of farming with decreasing human resources. The results include a series of agrarian conditions that have negative effects on the health of the farmers, farm family members, and farm workers. For examples, increasing use of farm chemicals results in a potentially increased hazard for acute occupational and environmental exposures to pesticides and greater probability for the contamination of surface and ground waters. As economy of scale associated with profit driven production grow, each farm is pressured into enhancing production in order to maintain annual incomes level in the face of shrinking profit margins (Hawk C. and et al 1989).

In Myanmar, many different vegetable crops are grown for the domestic market in backyard gardens, commercial plots and fields where are subject to a range of insect pests and diseases. Farmers commonly use pesticides for controlling insect pests because chemicals have an immediate knock-down effect and are easily available in the local market. Spraying of inappropriate chemicals, excessive application, inappropriate timing, the wrong combination of chemicals and spurious chemicals lead to insecticide resistance which causes farmers to spray even more pesticides. Therefore, Myanmar agricultural sector is tried to turn round the organic farming to maintain the natural environment, human health as well as to earn more foreign exchange by exporting organic products to international market.

Most of vegetables are grown in the central part of Myanmar, mainly dry zone areas and Shan State. Pyin Oo Lwin and Inle Lake Areas produce varieties of vegetables such as cabbage, cauliflower, kale, tomato, etc. while Bago area specializes in growing okra, cabbage, cauliflower and roselle leaves. Many kinds of kitchen crops like chili, onion and garlic are grown in Mandalay and Sagaing areas (Aye 2007).

The large amount of vegetables is produced in Pyin Oo Lwin, Mandalay Region. Having the limited size of the plots, vegetable growers are using large amount of pesticides in the expectation of high yield in a unit area. People without proper use of pesticides and many of those who do know about it continue to indulge in unsafe application and cultural practices (Wai 2005).

Therefore, this study is aiming towards a strategic research for the development of organic farming practices concerned with the sustainable agricultural production, environmental protection and food safety for human health and environmental conservation.

1.6 Objectives of the Study

1. To determine farmers' existing knowledge on soil conservation measures and cultural practices by gender in the study area,

2. To identify constraints of using organic materials and organic farming by sample farmers,

3. To investigate the environmental awareness and index of respondents by gender and occupation and

4. To estimate the willingness to accept (WTA) the organic farming by gender of selected farmers.

CHAPTER 2

LITERATURE REVIEW

2.1 Organic Agriculture and Environmental Awareness

2.1.1 Concepts of organic agriculture

The organic agriculture was variously defined by many authors and organic organizations. Organic Agriculture is a productive system which largely excludes or avoids the use of synthetically compounded fertilizers, pesticides, growth regulators, preservatives and livestock feed additives. The Organic Agriculture practices rely to the maximum extent on crop residues, animal manures, crop rotations and green leaf manures, off-farm organic wastes and bio-fertilizers to supply plant nutrients and adopt biological control methods to control pests, diseases and weeds (Reddy 2010 a).

Organic agriculture is defined as a production system that sustains the health of soils, ecosystems and people. It relies on ecosystems and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (http://www.ifoam.bio/en/organic-landmarks/definition-organic-agriculture).

Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony (USDA 2006).

Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system (FAO 1999).

Organic farming is a method of crop and livestock production that involves much more than choosing not to use pesticides, fertilizers, genetically modified organisms,

antibiotics and growth hormones. Organic production is a holistic system designed to optimize the productivity and fitness of diverse communities within the agro-ecosystem, including soil organisms, plants, livestock and people. The principal goal of organic production is to develop enterprises that are sustainable and harmonious with the environment (http://www.omafra.gov.on.ca/english/crops/facts/09-077.htm).

2.1.2 Characteristics and institutional development of organic farming

The key characteristics of organic farming have been considered in the regulations of the IFOAM basic standards. These usually consist of three levels of 'regulations':

(1) minimum requirements or restrictions which exclude the use of certain substances or practices;
(2) general rules describing necessary practices in general, or demanding more detailed rules by certifying bodies which outline strategies of avoidance and preventive measures; and
(3) recommendations of how to achieve the objectives of these general rules.

The main objectives of organic farming outlined in the IFOAM standards are as follow:

(a) Organic management is long-term, ecological and systems-based.
(b) Soil fertility is long-term and biologically-based.
(c) Synthetic inputs at all stages of the organic product chain and exposure of people and the environment to persistent, potentially harmful chemicals are avoided/ minimized.
(d) Pollution and degradation of the production/ processing unit and surrounding environment from production/ processing activities are minimized.
(e) Certain unproven, unnatural and harmful technologies are excluded from the system.
(f) Animals are treated responsibly.
(g) The natural health of animals is promoted and maintained.
(h) Organic integrity is maintained throughout the supply chain.
(i) Organic identity is provided in the supply chain.
(j) Fairness, respect and justice, equal opportunities and non-discrimination is afforded to employees and workers.

Maintaining or increasing fertility on a long-term basis is to be achieved by:

- returning sufficient quantities of organic material to the soil;
- increasing or maintaining biological activity;
- only introducing material which is specified for use in organic farming;
- providing restrictions by certification bodies for the use of inputs which contain relatively high contents of unwanted substances so as to maintain the natural conditions of the soil with respect to, for example, pH values and heavy metal contents;
- having requirements declared by certifying bodies for the rotation of non-perennial crops in a manner that maintains or increases soil, organic matter, fertility, microbial activity and general soil health; and
- recommending that the certification programs insist upon specific rotations, including legumes.

Michelsen et al. (2001) also concluded that the institutional development of organic farming proceeds along six steps in Western European countries:

(1) Establishment of organic farming communities
(2) Development of the political recognition of organic farming, initiated through the creation of a formal regulatory framework
(3) Development of financial schemes to support organic farmers
(4) Establishment of non-competitive relationships between the organic sector and general agricultural institutions (from both civic and state domains)
(5) Development of a domestic organic food market
(6) Establishment of a discussion and coordination arena

The first three are seen as essential for the initial growth of the sector, while the last three are seen as essential for the continuous growth of the sector. The steps can be undergone multiple times, a process that lead to further development. All the steps do not need to have been completed before a step is repeated (Michelsen et al. 2001, Moschitz et al. 2004).

2.1.3 Organic farming system and usage of natural resources

Organic growers prefer ecofriendly farming system due to the following aspects: (1) keeping and building good soil structure and fertility, for examples, by using recycled and composted crop wastes and animal manures, green manures and legumes and by practicing

the right soil cultivation at the right time, crop rotation, and mulching on the soil surface. (2) Preventing the incidence of pests, diseases and weeds by careful planning and crop choice, the use of resistant crops, good cultivation practice, crop rotation, encouraging useful predators that eat pests, increasing genetic diversity and using natural pesticides. The organic farming was also involved careful use of water resources and good animal husbandry (HDRA 1998).

In organic production, farmers will be chose not to use some of the convenient chemical tools available to other farmers. Design and management of the production system are critical to the success of the farm. Select enterprises that complement each other and choose crop rotation and tillage practices to avoid or reduce crop problems. Yields of each organic crop vary, depending on the success of the manager. During the transition from conventional to organic, production yields are lower than conventional levels, but after a three to five year transition period the organic yields typically increase (Martin 2009).

Soil organic matter is one of the most important components of the soil. Various organic manures like FYM, compost, green manure, etc. that are added to the soil from time to time further add to the store of organic matter. The decomposition of added organic manures would finally get converted into humus. The continued farming was practiced on the same land by intercropping, crop rotation, fallowing, composting and manual practices for more than 2000 years without drop in yields. Further, the crops were relatively free from pests. Soil health and pest control were achieved using practices like shifting cultivation, conservation, the use of animal manures and farm wastes and the introduction of legumes in crop rotations. Organic farming is thus considered as a movement directed towards the philosophy of "Back to Nature". It aims at low input farming thus reducing dependence on inorganic fertilizers, plant protection chemicals and weedicides (Reddy 2010 b).

Organic agriculture is seen as the most environmentally friendly farming system. It favors renewable resources, recycles nutrients, uses the environment’s own systems for controlling pests and diseases, sustains ecosystems, protects soil, reduces pollution, while it promotes animal welfare, the use of natural foodstuffs, product diversity, prevention of waste, etc. (European Commission 2002).

2.2 Concept of Environmental Awareness

Environment means surrounding and everything that affect an organism during its lifetime. It includes all the physical and biological surrounding and their interactions. Environmental studies provide an approach towards understanding the environment of our planet and the impact of human life upon the environment. Thus environment is actually global in nature, it is a multidisciplinary subject including physics, geology, geography, history, economics, physiology, biotechnology, remote sensing, geophysics, soil science and hydrology etc. (www.newagepublishers.com/ sample chapter/001773.pdf).

Enormous increase in human population raised the demand for development and increased the consumption of various natural resources resulting in environmental deterioration. The term environment describes the sum total of physical and biotic conditions influencing the organisms. More specifically, the sum of those portions of the hydrosphere, lithosphere, and atmosphere into which life penetrates are the biosphere (www.mu.ac.in/.../M.A.Part%20-%20II%20-%20Paper%20VII.pdf).

Environmental awareness also refers to environmental attitudes, concerns, values and beliefs with lax terminological distinction (Eden 1993). Anyhow, the awareness of the farmers plays a vital role in their environmental management. The study hypothesized that the farmers directly contribute to the environment and their attitudes might affect their behavior to some extent. And the study also aims to test the hypothesis that the awareness of the farmers is influenced by socio-economic factors.

Ethically, antecedent or reward strategies are the most effective and desirable techniques, but these would need to be implemented consistently. This is the most effective way to address the problem society wide, in that it would receive the necessary publicity and attention. In USA, voluntary adoption of safety practices and hazard reduction is of central importance to agricultural injury prevention and control programs. The Rural Youth Disability Prevention Project (RYDP) was an educational intervention program in which farm families and community organizations worked together to develop and implement injury prevention and control activities (Hawk and et al. 1989).

2.2.1 Factors impacting the awareness

Awareness is an emotional or affective behavior that is so similar to knowledge, which is the bottom stage of cognitive domain. The emotional or affective factors always relate to the cognitive factor. Knowledge is gained by facts or experience, touches and consideration of mind to find out reasons but awareness concerns opportunities: it is gained by touching the stimulus or environment unintentionally. Consideration of mind to achieve awareness of that phenomenon or event has a little relation to memory or recall; it is just consciousness, distinguishing and recognition of that stimulus to see its characteristics. Felling is also included in evaluating it.

"Awareness" is the relationship of consciousness and attitudes. Awareness is the state of mind that could not be definitely separated to be either emotion or thought. Awareness is an emotional or affective behavior that is so similar to knowledge, which is the bottom stage of cognitive domain. The emotional or affective factor always relate to the cognitive factor. Knowledge is gained by facts or experience, touches, and consideration of mind to find out reasons, but awareness concerns opportunities: it is gained by touching the stimulus or environment unintentionally. Considerations of mind to achieve awareness of that phenomenon or event, and awareness have a little relation to memory or recall; it is just consciousness, distinguishing, and recognition of that stimulus to see its characteristics. Feeling is also included in evaluating it (Aksornsri 2005).

Isin and Yildirim (2006) stated that in relation to the age, education, and growing experience of farmers, those who consider pesticides as being harmful were younger, better educated and had less experience in fruit growing.

Rahman (2002) stated that land holding was significantly and positively associated with pesticide use indicating that large farm households use more pesticides, consistent with expectation. The availability of cash was significantly positively related with pesticide use, indicating that the greater liquidity increase use rates. Also, farmers' awareness of the harmful effects of pesticides is not very strong, as they fine that beneficial effect out weight any harmful ones.

Some farmers who have exposure to extension agents from Department of Agriculture (DOA) and those who have attended the short course on EM (effective microorganism) are found to be quite aware (Bo Bo Lwin 2006).

In social studies, it could be found that many factors could result and relate to awareness, whether personal factors (such as sex, age, educational level), economic and social factors (such as career, income, information learning, etc.). These are important variables leading to the analysis of awareness. Consequently, the researcher took these factors to be important components of this study and reviewed researches relating to these variables as described below:

2.2.1.1 Age

Age can be a factor determining individuals' differences because age relates to past experiences, which make them have wider maturity and thought. Many studies reveal the relationship between the environmental concern and age. It says that in general, younger generation tends to be more concerned about environmental quality than older generation. Mohai and Twight (1987) discovered the dominant relationship between age and environmental concern from a survey of Minneapolis. The extensive literature survey of Van Liere and Dunlap (1981) also stated 'age' as a dominant factor in determining the degree of environmental concern.

2.2.1.2 Gender

Gender is an important component to differentiate individuals' emotion. In the past, economic and social status made females' conditions and roles were placed under males. The relationships between gender and environmental concern were studied by Dietz et al. 1998. It is generally believed that women were more concerned about environment than men because "women are potentially more environmentalist than men due to biosphere orientation" (Stern et al. 1993).

Nevertheless, other empirical investigations showed inconsistent results on this hypothesis. For instance, one of the earlier studies done by Van Liere and Dunlap 1981 showed that men were more concerned about environment than women due to their higher level of education and involvement with the communities and political issues. However, other studies showed that women were more concerned about environment than men because men were much more concerned about economic growth and economic stability (Passino and Lounsbury 1976 quoted in Van Liere and Dunlap 1981) and consider environment as constraint to the economic growth.

2.2.1.3 Educational Level

Education is a basic factor leading the individual's different knowledge. Levels of knowledge of each person will affect his/her interest in surroundings. The higher education is associated with higher concern since it is directly related to the access to information on environment and ability to process the information into knowledge.

However, caution is needed to directly link the educational level to high level of environmental concern since educational level also involves other social factors. For instance, better education generally means better job, thus having more economical "surplus" which may allow individuals to pay more attention to the "luxury good." Also, the social background that permits individuals to have better education could have some effect on their thinking process (ECLAC 2000).

2.2.1.4 Experience

Experience is another factor directly affecting awareness because experience of each person must depend on time. Events in the social environment make people perceive and evaluate them to be their awareness, emotions and thought as studies below:

Paleerat Aksornsri (2005) studied on farmers' behavior towards the use of pesticides in growing pepper; farmers' experience in using pesticides was significant that could result in farmers' behavior towards the use of pesticides. This type of data was analyzed to see how years of experience in using pesticides could result in the behavior towards the use of chemicals. Regarding farmers' behavior towards the use of pesticides before mixing chemicals, it was found that most farmers with each level of experience in using chemicals selected chemicals as per chemical efficiency, which was the wrong practice. In addition, it was found that most farmers at each level of experience in using chemicals would read labels before mixing chemicals and would check spraying tools before each spraying, which were the right practice.

2.2.2 Factors leading to pesticide residue contamination in vegetables and flowers

Vegetables are the fresh and edible portions of herbaceous plants. They are important food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. Vegetables are valuable in maintaining alkaline reserve of the body. They are valued

mainly for their high carbohydrate, vitamin and mineral contents. There are different kinds of vegetables. They may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way (Robinson 1990).

Jipanin et al. (2001) stated the factors for the presence of high pesticide residue in the vegetables. These factors were:

(1) Generally, local farmers were ignorant of the biological aspects of insects and microbial agents (i.e. fungi, viruses etc.) as well as their importance. To most of them, the presence of any of these agents was considered as the 'enemy' or vegetable pests and should be eradicated with pesticide. These farmers did not realize that some pests were actually beneficial insects such as pollinating agents or biological control agents.

(2) Apart from using chemical control, most farmers were not aware of the role of other techniques of vegetable pest control concepts like cultural control, biological control and integrated pest management (IPM).

(3) In using pesticides, most vegetable farm labors don't pay attention for proper and safety usage, such as:

(a) choosing the correct type of active ingredient with regards to the pest problems.

(b) strictly following instruction on labels such as dosage, application frequency and pre-harvest interval (PHI).

(4) Most farmers prefer to use insecticides in the organophosphorus (OP) group, such as; Chlorpyriphos, Triazophos, Phenthoate etc. regardless of their toxicity and longer persistence in the environment because these chemicals are highly effective in knocking off the pests and are cheaper.

(5) In some farms, where the financier-workers relationship existed, the on-farm workers used whatever pesticides purchased by the absentee financier without proper information.

(6) Some major insects like diamondback moth and leaf miner are more persistent. These insects were polyphagous and with high population density. Under such

circumstances, frustrated the farmers resorted to using high dosages and more frequent application.

(7) Some farmers confronted certain complicated pest problem caused by combined effect of pest and disease from wrongfully mixing a few active ingredients or trademarks to produce a cocktail. They believe that such mixture will save time by doing one application; also that mixture is stronger which make it more powerful and effectively kill the pests.

(8) Fluctuating market price of vegetable also plays an important role. Some farmers intend to harvest and supply on demand when prices are high without considering pre-harvest interval. Quality, untarnished vegetables are graded higher and fetch a better price amongst the consumer.

2.2.3 Review of environmental education in Myanmar

In Myanmar, only a few number of universities and institutes offer degree and diploma courses specialized in environmental sciences and technology. Now the government tries to raise the environmental awareness of the public. They established the National Commission for Environmental Affairs. The mass media like radio and television is also used for dissemination of information on environment and development. In addition, some ministries present environmental training program. However, the extent what they have attempted is not enough to meet the goals and there are still occurring the environmental degradation and impacts due to the lack of environmental awareness of the people. There are not so much efforts to survey the awareness level of the farmers in terms of agricultural impact on environment. Moreover, curriculum of environmental education for school education is not yet prepared. An education and awareness program is needed to inform decision-making bodies and local communities about the importance of healthy wetlands in maintaining water quality and preserving fish stocks (Bo Bo Lwin 2006).

In Myanmar, the trainings for the farmers on pesticides awareness and soil and nutrient management awareness have been conducted, yet the numbers of participants are just a tiny portion of the farmers in the whole country. The rapid development of agro-chemicals trades and private companies is accelerating the potential to use more chemicals by the farmers due to their advertisement and persuasion (Bo Bo Lwin 2006).

2.3 Concept of Sustainable Agriculture

"Sustainable agriculture" is a topic which has received considerable attention in recent years from environmentalists, agriculturalists, and consumers. Sustainable agriculture has been given a number of different definitions, but the term implies three basic values: sustainable agriculture is ecologically sound, economically viable, and socially just and humane (Aiken 1983, Dahlberg 1986).

Buttel et al. (1986) launched the term reduced-input agricultural systems in order to describe systems whose use of chemical fertilizers and pesticides is modest but significantly reduced in comparison to conventional systems. Modern agricultural practices, like intensive cropping and use of chemical fertilizers and pesticides, coupled with deforestation for arable farming are having adverse impacts on the physical, biological and human components of the environment (Tajima 2000). Sustainable agriculture has emerged in the last 10 years as the most agreed-upon term to describe the varied field of agricultural practices that differ from conventional concepts of modern agricultural production (Bidwell 1986).

Conway (1987) identified at least seven conceptualizations of sustainable agriculture and farming systems:

1. A sustainable farming system is a system in which natural resources are managed so that crop yields do not decline over time.
2. A sustainable farming system is a system in which natural resources are managed so that the stock of natural resources does not decline over time.
3. A sustainable farming system is one that satisfies minimum conditions of ecosystem stability and resilience over time.
4. A concept related to sustainable farming systems is HNV farming systems, which are likely to be of importance from a nature-conservation point of view.
5. Sustainable agriculture is organized so that the necessary support services (credit, extension, and input supply) are guaranteed.
6. Sustainable agriculture is a system guaranteeing equality, i.e. distributional and welfare aspects are given due attention through institutions that make farmer participation possible, that are concerned about the poor and that are administered with a bottom-up approach.
7. A sustainable farming system is not unduly constrained by the socio-cultural environment or the policy-institutional environment.

Sustainable agriculture has been given a number of different definitions, but the term implies three basic values: sustainable agriculture is (i) ecologically sound, (ii) economically viable, and (iii) socially acceptable. Sustainable agriculture may be defined as an agricultural system which gives farmers a profitable livelihood while conserving agricultural resources and environmental quality. It makes efficient use of resources produced on the farm, reducing the need for commercially produced inputs (Haynes and Lamer 1983). Ecological soundness refers to that it must be environmentally safe by the management and conservation of natural resource base.

According to USDA (1990), the term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will

- satisfy human food and fiber needs;
- enhance environmental quality and the natural resources base upon which the agriculture economy depends;
- make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- sustain the economic viability of farm operations and
- be socially acceptable and enhance the quality of life and for farmers and society as a whole.

USDA's Sustainable Agriculture Research and Education (SARE) Program (1990) stated that the primary goals of sustainable agriculture include:

(a) Providing a more profitable farm income
(b) Promoting environmental stewardship, including:
    i. Protecting and improving soil quality
    ii. Reducing dependence on non-renewable resources, such as fuel and synthetic fertilizers and pesticides, and
    iii. Minimizing adverse impacts on safety, wildlife, water quality and other environmental resource
(c) Promoting stable, prosperous farm families and communities

The concept of sustainable agriculture is "agro-food systems that are economically viable, and meet society's need for safe and nutritious food, while conserving and enhancing natural resources and the quality of the environment for future generations" (Science Council of Canada 1992).

According to Zamora (1990), environmental stewardship is included one of the characteristics of sustainable agriculture. Environment should not be severely damaged by any agricultural activity. Maintenance of environmental quality essentially means preservation of the productive capacity of the land resource, no pollution of surface and ground water, loss of species habitat.

To be sustainable, it must produce adequate food of high quality, be environmentally safe, protect the soil resource base, and be profitable (Reganold et al. 1990). Sustainable agriculture and rural development has been defined by FAO as follow as: "The management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in agriculture, forestry, and fisheries sectors) conserves land, water, plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable" (FAO 1991).

Many scientific meetings have been organized to discuss about organic farming and sustainable agriculture for more than a decade. It appears, however, that up until now the results have been more rhetorical than practical. Hundreds of papers have been published on the potential damage which chemical fertilizers can do, while the mass media have been warning the public that the continued heavy use of chemical fertilizers and pesticides will lead to catastrophe. However, there is no sign that the use of chemical fertilizers has declined. This may reflect the fact that as far as these issues are concerned, there seems to be a big gap between the ideal situation people talk about and what can be done in practice (Food and Fertilizer Technology Center 1994).

2.4 Environmental Awareness of Farmers and Others Related Studies

Environmental awareness of the farmers has been studied by some researchers in various ways. Most environmental studies claim that there is a direct relationship between environmental awareness and some socio-economic factors. Common among them are

studies that relate environmental awareness and behavior with the level of income, level of education and occupation. Some researches pointed out that the level of education also affects the level of environmental awareness and behavior.

Bo Bo Lwin (2006) has been studied about environmental awareness and farming behavior of farmers in Inle Lake, Nyaung Shwe Township, Myanmar. In his study, the environmental awareness of the farmers was calculated by using the Aggregated Weighted Awareness Index (AWAI) based on the scores got from questionnaires interviews and farming behavior was also expressed as Aggregated Weighted Behavioral Index (AWBI). He stated that in his study area the people were still working even when they are 70 years old and therefore the old people were not mostly put in the dependent list. It can be assumed that the farmers from extended families were much more aware because they can have much more information exposure to outside. On the other hand, the farmers with dependent children might have more awareness and care about the use of agrochemicals. And then he described that if the farmers had high income, they can probably improve the awareness level. The people with high income can have facilities like TV, Radio and newspapers and they can have much more exposure to information. They can spend more money and time than the poor farmers to visit urban area where they can meet people in the market and share the news and experiences.

Theint Theint Aung (2011) has been studied for her master thesis about vegetable and flower growers' awareness on harmful effects of pesticides and the relationship to application practices in Pyin Oo Lwin Township, Myanmar. In her study, the data were collected using questionnaires through formal survey and to determine farmers' awareness on harmful effects and their pesticides practices, Tobit regression model, factor analysis and descriptive statistics analytical procedures were used. And then the awareness of the farmers on harmful effects of pesticides was estimated using Awareness Index (AI) based on the scores got from questionnaires interview. This study also estimated farming behavior which expressed as Behavioral Index (BI). The result of the Tobit regression proved that there were a positive relationship between some socio-demographic contexts and the awareness on harmful effects of pesticides of the farmers. The statistical results from the analysis pointed out that the four components: wealth and extension contact, community supports, education and commercialization were the main factors associated with the awareness of the farmers. Indices of the farmers' behaviors were also influenced by their awareness index.

Sanzidur (2003) has studied the farmers' perceptions and their determinants concerning with the environmental impacts of modern agricultural technology in Bangladesh. He used "The Tobit Analysis" to measure the change in the elasticity of intensity of awareness (change in awareness) for farmers who already are aware and changeable in the elasticity of awareness (change in the probability of becoming aware). He also applied the empirical model show the relationship between the explanatory variables with the dependent variable (environmental awareness index). To get the awareness index of the farmers, he took 12 indicators of environmental impact which were obtained from the pretest-focus group discussion. From his study, the level and duration of involvement with modern technology are the two most important determinants, which directly influence farmers' awareness of its ill effects thereby, supporting the maintained hypothesis. Both education and extension contact significantly increase awareness, as expected.

Mccann (1997) compared the environmental awareness of the organic farmers and conventional farmers in Michigan, USA. They used the formula to calculate the farming operation's overall sustainability based on the procedure adopted by Dick (1992). Their findings supported the hypothesis that organic farmers would, in general, use conservation practices with greater frequency than ordinary farmers.

Paleerat Aksornsri (2005) has studied the farmers' awareness of danger caused by pesticide use in growing Hua Rue pepper in Ubon Ratchathani Province. It was found that, most farmers had appropriate behavior in using pesticides and had a high level of awareness of danger caused by pesticides. And then farmers' awareness involved using pesticides safely when they had to touch or deal with them directly, such as in the process of mixing, holding or spraying chemicals; dressing body and cloth clean-up after the spraying process and when farmers felt sick and would observe health conditions and remedy them. Farmers did not have such awareness after spraying pesticides because they did not touch pesticides directly or stay close to them, as a result, they did not pay attention to drawbacks to the society and environment.

Adeola, R. G. (2012) has studied perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. In his study, frequency, means and percentages were used to describe the data and Chi-square was employed to test the relationships between some selected farmers' characteristics and their perception. This study clearly shows that farmers in the study area quite aware of the risks associated with use of

pesticides and its effects on the environment. Their favorable attitudes were towards the risks of pesticides usage. Farmers' age, education and contacts with extension agent had positive and significant associations with perceived effects of pesticides on the environment.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Description of the Study Area

3.1.1 Study area

Field survey was conducted in Pyin Oo Lwin Township which is located in the Shan highland, 67 kilometers (42 miles) east of Mandalay, and at an altitude of 1070 meters (3510 ft.). That township is famous for her producing vegetables and flowers and transport to other townships annually. Sweater knitting, flower and vegetable gardens, strawberry and pineapple orchards, coffee plantations and cow rearing are the main local businesses. The city is a resort town for visitors from Myanmar's major cities during the summer time and a popular stop for foreign tourists during the winter season. In addition, Pyin Oo Lwin is the center of the country's principal flowers and vegetables production. Pyin Oo Lwin Township of Mandalay Region was selected as the study area based on vegetables grown areas. The study area has humid subtropical climate and annual maximum average temperature is about 23.8˚C and minimum average temperature is about 13.39˚C. The month of May is the hottest month with the average temperature of 27.89˚C and January is the coolest month with an average temperature of 5.11˚C. Average annual rainfall is 1,524 mm and average total rainy days are 90. The highest rainfall occurs in August and the lowest rainfall is in January (Theint Theint Aung 2011).

Total number of population was 216,000. There are 58 village tracts and 156 villages in Pyin Oo Lwin Township. The total number of cultivated area was 42959 acres and the number of including vegetable cultivated area was 5964 acres in Pyin Oo Lwin Township. The total vegetable cultivated farmers were about 4000. General description of Pyin Oo Lwin Township is shown in Table 3.1.

Table 3.1 General description of Pyin Oo Lwin Township

Item	Unit	Pyin Oo Lwin Township
Village Tracts	No.	58
Villages	No.	156
Population	No.	216000
Total Cultivated area	Acres	42959
Vegetable Cultivated area	Acres	5964
Vegetable Cultivated Farmer	No.	4000

Source: DoA, Pyin Oo Lwin (2013)

3.1.2 Land use pattern in Pyin Oo Lwin Township

A wide range of crops such as rice, pulses, oil seed crops, vegetables, perennial crops, culinary crops and other crops are being planted in these areas. Approximately, 17.75 % of land area with rice, 6.37% of land area with pulses, 14.65% of land area with oil seed crops, 13.88% of land area with vegetables, 23.97% of land area with perennial crops, 2.82% of land area with culinary crops and 20.56% of land with other crops are being utilized out of total arable land area of 42959 acres in Pyin Oo Lwin. Agricultural Land Utilization in Pyin Oo Lwin Township is shown in Figure 3.1. Figure 3.2 demonstrates location and map of Pyin Oo Lwin Township.

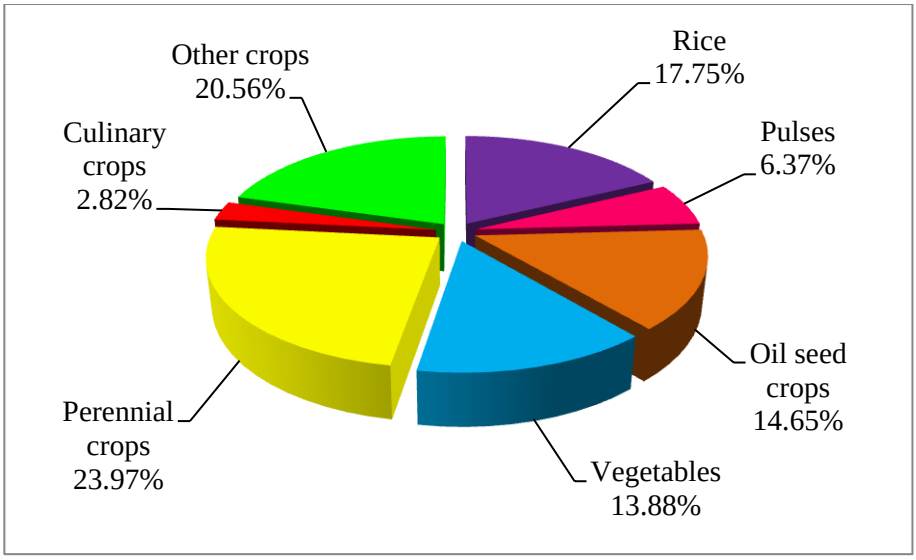


Figure 3.1 Agriculture land utilization in Pyin Oo Lwin Township (2013-2014)
Data source: DoA, Pyin Oo Lwin (2013)

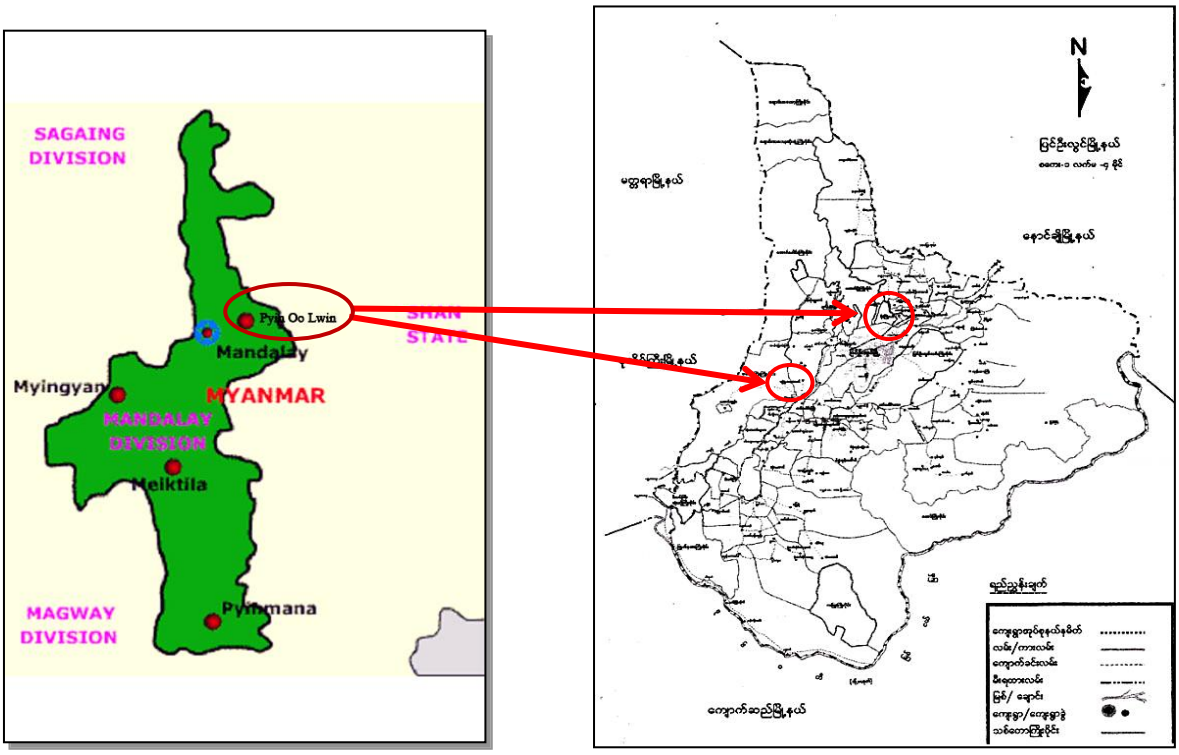


Figure 3.2 Map of the survey area of the Pyin Oo Lwin Township

3.2 Data Collection and Sampling Procedure

Both primary and secondary sources of data were used in this study. The primary data were gathered by household interview. Field survey was conducted at December 2013 in two villages of Pyin Oo Lwin Township. The household level survey was carried out in two

villages which were randomly selected from total villages of two village tracts (Moegyoepyint and Kywe Nahtauk) in Pyin Oo Lwin Township. The general description of selected village tracts and villages are shown in Table 3.2 and 3.3. To obtain the primary data, 55 sample households from two sample villages were interviewed.

Table 3.2 General descriptions of selected village tracts

Item	Unit	Moegyoepyint	Kywe Nahtauk
Villages	No.	7	7
Population	No.	8399	8055
Number of households	No.	1905	1706
Land area	Acres	1229	1379
Cultivated area	Acres	393	394

Source: DoA (2013)

Table 3.3 General description of sample villages

Item	Unit	Moegyoe (San Pya) Village	Kywe Nahtauk Village
Population	No.	1627	2161
Number of households	No.	550	430
Cultivated area	Acres	153	117

Source: Village General Administration Department (2013)

The secondary data was initially collected from the local township and village tract level government and non-government organizations related to agriculture and administration. These data were revealed the prior information of survey areas and support the information provided by the survey respondents.

Exploratory survey research design was conducted to collect the following information.

1. Demographic factors: age, gender, education level, farm experience, household size and ethnic group etc.
2. Economic factors: farm income, off farm income, farming status, land tenure, cattle own, etc.
3. Bio-physical factors: soil fertility, soil type, farm size, soil erosion, etc.

4. Technological factors: farmers' knowledge and awareness of organic farming, cropping intensity, types of crop, use of fertilizers and manure, pesticides and other chemicals, willingness to produce organic farm products, etc.
5. Problems and constraints of the farmers for applying the organic farming practices, etc.

3.3 Method of Analysis

3.3.1 Sampling method

A simple random sampling method was used to select households for questionnaire survey. In order to identify the total sample household population, the names of households were taken from the registration books of the respective villages. After identification of the households, they were numbered and the sample households were determined using a simple random sampling method.

3.3.2 Statistical methods

Descriptive statistics methods such as frequency, percentage, and mean were used to explore the farmer's socio-economic condition, farmer's practices in soil conservation and crop protection. Also the problems and constraints faced by the farmers in using organic materials for soil conservation measures and crop protection practices were described by descriptive statistics methods.

3.3.3 Developing environmental awareness index

The modern agricultural and increased population exerts heavy pressures on the capacity of the local ecosystem. The sustainability of the land productivity is mainly depending on the farmer's behavior. The farmer's behavior is regulated by their awareness and it can vary based on many factors. The environmental awareness and attitudes towards the organic farming practices by the local farmers were investigated. The data included socio-economic and demographical contexts.

Environmental awareness was calculated as index score by using a set of questionnaire based on their knowledge on environmental conservation (10 questions). These statements are mentioned in Table 3.4.

The level of agreement on each given statement was scored accordingly to the orientation of the questions. For instance the option, "Strongly Agree" is scored as "5 point"

for the positive question while “1 point” for “Strongly Disagree”. The option "Neutral" is scored as “3 point” and it is supposed to be the midway of agreement (neither agree nor disagree) or the condition that the respondent does not have any idea about the given statement is shown in Table 3.5.

Table 3.4 Environmental awareness of vegetable growers based on their knowledge

No.	Impact
1	Organic materials are very effective and essential in crop protection and production.
2	Organic materials can reduce serious environmental pollution.
3	Organic materials should be used more in the future for the sake of hazard control.
4	Organic materials are very effective to health as well as natural environment.
5	Organic materials should be used to reduce growers’ health harmful effects.
6	Organic materials should be used to protect the consumers’ health harmful effects.
7	Soil conservation by using organic materials is very effective for sustainable crop income.
8	Organic materials should be used to maintain the natural resource for future generation.
9	Organic materials should be used to maintain local ecology.
10	Environmental conservation is needed to reduce the effect of climate change in Myanmar.

Table 3.5 Scoring system by the orientation of the statement

Level of agreement	Scores for positive statement
Strongly agree	5
Agree	4
Neutral	3
Disagree	2
Strongly disagree	1

Then the scores were summed and the awareness index was calculated by using the following formula (Bo Bo Lwin 2006).

$$\text{AI} = \frac{\text{SS} - \text{min. possible scores}}{\text{difference between max. and min. possible scores}}$$

AI = Awareness Index

SS= Sum of Scores

3.3.4 Willingness to accept of farmers for organic farming

The contingent valuation method (CVM) was used to place economic values for ecosystem and environmental services by direct asking people to state their willingness-to-accept (WTA) or willingness-to-produce for organic farming through changes in their farming practices. CVM is a survey-based approach. Through a very carefully constructed questionnaire, a hypothetical market will be created in which the non-marketed good in question can be traded (Mitchell and Carson 1989). A random sample of farmers was then directly asked their maximum willingness to pay for a hypothetical change in the level of the provision of the good to be valued. For this study the non-marketed good in question will be their environment and health, on which important local ecosystem is dependent and protection from agro-chemicals. Farm households were directly asked their maximum WTA for the implementation of a new management plan which would insure the provision of a wide range of environment and health currently under threat (and thus defined the hypothetical change in the provision of the good). Acceptance ladder approach was used to estimate the range of WTA. This WTA is a measure of the economic value of the service and is influenced by several factors including environmental awareness index, WTA amount and mode of payment.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Demographic Characteristics of the Sample Farmers

This chapter firstly presents the detail socio-economic characteristics of sample households such as demographic characteristics, farm and household assets, land assets, livelihood diversification and income composition.

4.1.1 Description of the sample villages and sample size

In Moegyoe (San Pya) village and Kywe Nahtauk village, the respondents were both male and female. The number of respondents interviewed in each village is shown in Table 4.1. The number of randomly selected respondents was 32 respondents in Moegyoe (San Pya) village, male respondents were 22% and female were 36% and 23 respondents in Kywe Nahtauk village, male respondents were 27% and female were 15%.

Table 4.1 Sample respondents and gender ratio of the study (n = 55)

Village	Gender of Sample Households					
	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
Moegyoe (San Pya)	12	22	20	36	32	58
Kywe Nahtauk	15	27	8	15	23	42
Total	**27**	**49**	**28**	**51**	**55**	**100**

Average age of the sampled grower in the study areas was around 43 years, ranging from the youngest as 22 years to the eldest as 65 years. Average growing experience was around 23 years in vegetables production within the range from 1 to 40 years. Most of the sample growers have had middle education level as average schooling year was 7.51 years. The minimum education level was primary education levels, 2 years and the maximum level was graduated (Table 4.2).

Table 4.2 Socio-demographic characteristics of the sample respondents (n = 55)

Item (Year)	Farm households			
	Mean	Maximum	Minimum	Standard Deviation
Age	43.33	65	22	9.87
Experience	23.47	40	1	10.92
Education	7.51	14	2	3.02

This study measured the awareness of sample respondents. The target respondents were the head of the households who made decision for the farming activities. Table 4.3 shows socio-demographic characteristics by the gender of sample respondents. The average age of male farmer was around 44 years and female farmer was around 43 years.

On average, the male respondents had been engaged in vegetables production for 23.78 years (standard deviation 9.5) with a minimum of 1 year and maximum of 40 years. The average experience of female had been engaged in vegetable production for 23.18 years (standard deviation 12.31).

The average numbers of years of education received by the male farmers was 8 years and females was 7 years (secondary education). The maximum education level of both male and female respondents were graduated and the minimum education level of male and female vegetable growers were primary education. Among the sample respondents, it was found that the average education level of male respondents was greater than that of female respondents.

Table 4.3 Socio-demographic characteristics by gender of sample respondents (n = 55)

Gender of Head	Item (Year)	Mean	Maximum	Minimum	Standard Deviation
Male	Age	43.56	60.00	30.00	8.23
	Experience	23.78	40.00	1.00	9.50
	Education	8.04	14.00	2.00	2.82
Female	Age	43.11	65.00	22.00	11.37
	Experience	23.18	40.00	2.00	12.31
	Education	7.00	14.00	2.00	3.17

4.1.2 Family size and farm size of the sample farmers

Family size and farm size of sample respondents are shown in Table 4.4. Family size ranged from 2 to 8 persons and average family members was 5 persons. Average farm size (own) of sample respondents from those sample households was 2 acres and ranged from 0 to 20 acres. Average farm size (rent) of sample households was 0.15 acre and ranged from 0 to 3 acres.

Table 4.4 Family size and farm size of the sample respondents (n = 55)

Item	Farm Households			
	Mean	Maximum	Minimum	Standard Deviation
Family Size (No.)	4.64	8.00	2.00	1.27
Farm Size owned (acre)	2.00	20.00	0.00	3.03
Farm Size rent (acre)	0.15	3.00	0.00	0.53

4.1.3 Farm and household assets of the sample respondents

The possession of farm and household assets such as tractor, plough & harrow, water pump, sprayer, well, TV, EVD, Motorcycle, car are shown in Table 4.5. The sample

households possessed tractor (13%), plough and harrow (45%), water pump (75%), sprayer (93%), well (78%), TV (89%), EVD (89%), motorcycle (82%) and car (9%). It was found that the sample respondents more possessed sprayer than other farm and household assets.

Table 4.5 Farm and household assets of the sample respondents (n = 55)

Item	Percentage of sample respondents
Tractor	13
Plough & Harrow	45
Water pump	75
Sprayer	93
Well	78
TV	89
EVD	89
Motorcycle	82
Car	9

4.1.4 Livelihood condition and distribution of livelihood status

The types of primary occupation of the sample households in the study area were crop cultivation and agricultural labor (Table 4.6). Among the sample households, 76% were farmers and 24% were agricultural labors. Among the sample household, 27% have had secondary job such as merchant (or) small shop (15%), operator (or) driver (4%) and other activities (9%).

Table 4.6 Occupational statuses of the sample respondents in the study area (n=55)

Occupations		Quantity	Percent
Primary	Crop cultivation	42	76
	Agriculture labor	13	24
Total		**55**	**100**
Secondary	Merchant (or) Small shop	9	16
	Operator/ Driver	1	2
	Others	5	9
Total		**15**	**27**

Table 4.7 shows occupational status of the sample households by gender issue. In this study, 42% of male and 35% of female respondents involved in crop cultivation and 7% of male and 16% of female respondents engaged in farm labor for their major livelihoods. About 9% of male and 18% of female respondents have had secondary occupation.

Table 4.7 Occupational statuses of sample respondents by gender of head (n=55)

Gender of Head		**Male**		**Female**		**Total**	
Occupations		**No.**	**Percent**	**No.**	**Percent**	**No.**	**Percent**
Primary	Crop cultivation	23	42	19	35	42	77
	Farm labor	4	7	9	16	13	23
Secondary	Merchant (or) Small shop	1	2	8	14	9	16
	Operator/ Driver	1	2	0	0	1	2
	Others	3	5	2	4	5	9

4.1.5 Kind of cultivated vegetables and source of income

The sample vegetable growers were cultivated various sorts of vegetables in study area. The names of cultivated vegetables in study villages are shown by percentage in Figure 4.1. In the study villages, the main crops cultivated were Chinese kale, Carrot, Chayote, Cauliflower, Lettuce, Cabbage, Mustard, Potato and Tomato. Chinese chive and Fennel were cultivated with small percentage in the study areas.

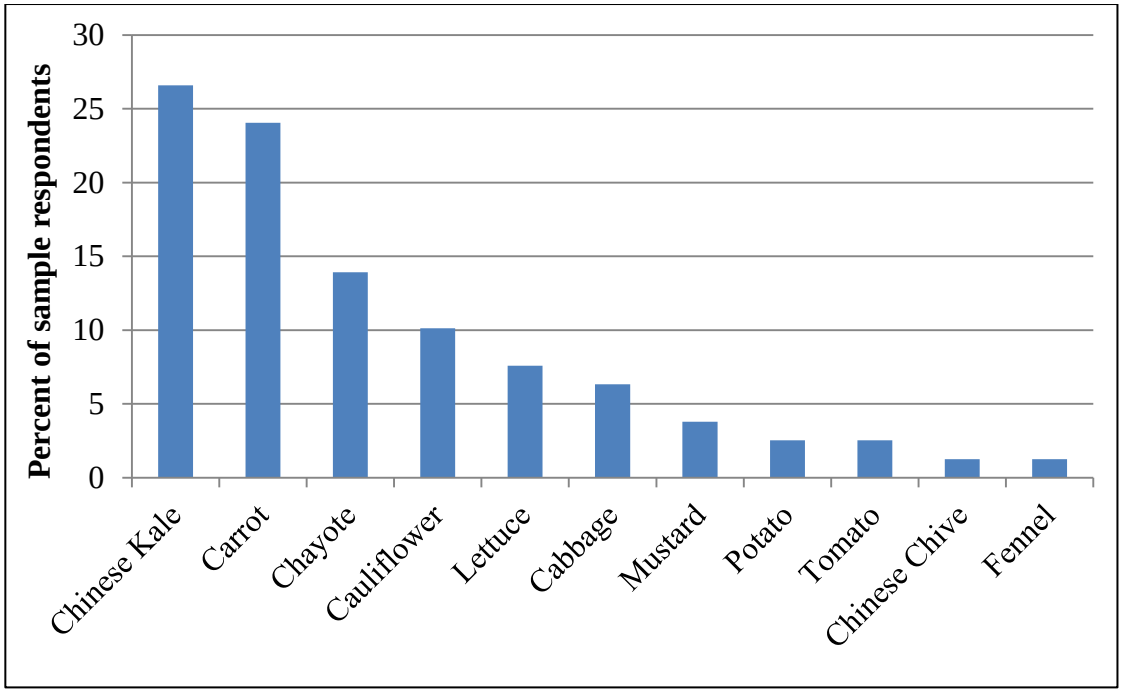


Figure 4.1 Vegetable grown by percentage of sample farmers (n = 42)

The sources of income for sample respondents are shown in Table 4.8. The incomes for sample respondents were earned from cultivated vegetables, farm labor, petty trade and others. The highest income of sample respondents had earned from cultivated vegetables with 2.7 million kyats per annum.

Table 4.8 Income of sample households in the study area (n = 55)

No	Type of Income	Income from crop (MMK '000 per annum)			
		Mean	Maximum	Minimum	Percent
1	Income from crop production	2,767	8,000	200	60
2	Income from petty trade	212	300	150	5
3	Income from farm Labor	733	900	720	16
4	Income from others	918	5,000	50	20
	Total income	**4,630**	**14,200**	**1,120**	**100**

4.2 Farmers' Existing Knowledge on Soil Conservation Measures and Cultural Practices

Awareness of soil conservation practices by selected vegetable growers is shown in Figure 4.2. Awareness of soil conservation practices was found by 82% of selected farmers and the rest 18% of vegetable growers did not aware about soil conservation practices in their crop production. Table 4.9 explains the awareness of soil conservation practices by gender of sample respondents. Among the sample respondents, 42% of male respondents and 40% of female respondents were observed in this study.

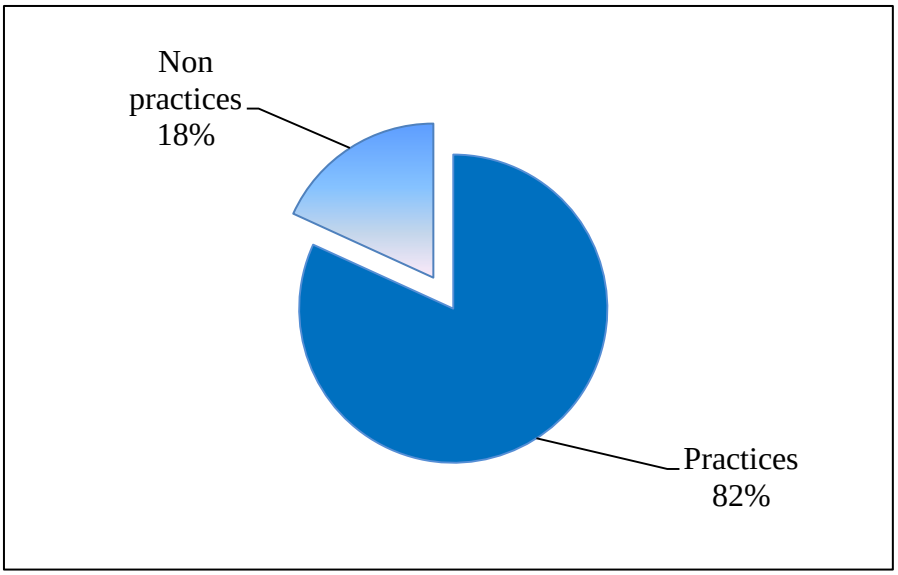


Figure 4.2 Adoption of soil conservation practices by sample respondents (n = 55)

Table 4.9 Adoption of soil conservation practices by gender of sample respondents (n = 55)

Gender	Practices		Non practices	
	No.	Percent	No.	Percent
Male	23	42	4	7
Female	22	40	6	11
Total	**45**	**82**	**10**	**18**

There were five different types of soil conservation practices, use of contour bunds stands the first position by 76% of all respondents and terrace takes the second largest

percentage (11%). The practices used for soil conservation by sample respondents are shown in Figure 4.3.

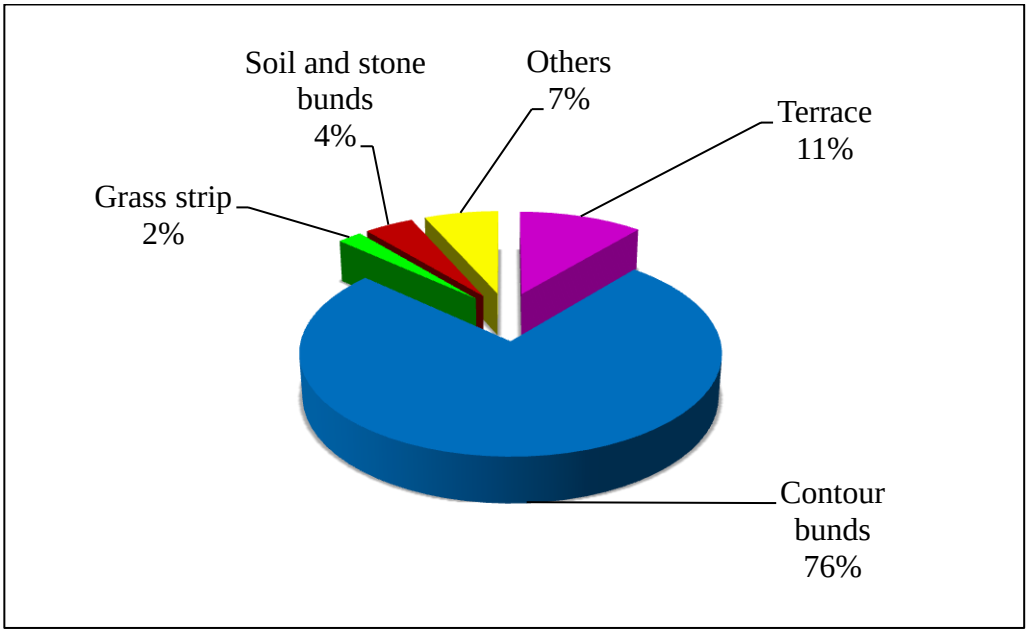


Figure 4.3 Types of soil conservation practice by sample respondents (n = 45)

4.3 Constraints of Using Organic Materials and Organic Farming

4.3.1 Farmers' current usage of organic materials and constraints

Most of the selected farmers (98%) used cow dung for their vegetable production in study area. Figure 4.4 shows the percentage of sample respondents who faced constraints in using organic materials and types of constraints are shown in Figure 4.5. In this study, only 15% of sample respondents have had constraints by using organic material such as insufficient amount of organic manure (75%), high cost (13%) and concern for pest and disease control (12%).

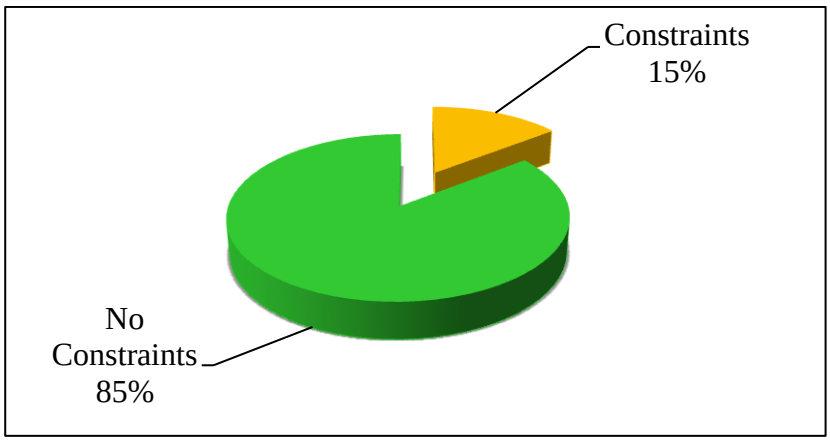


Figure 4.4 Percent of constraints by using organic materials of sample respondents (n = 55)

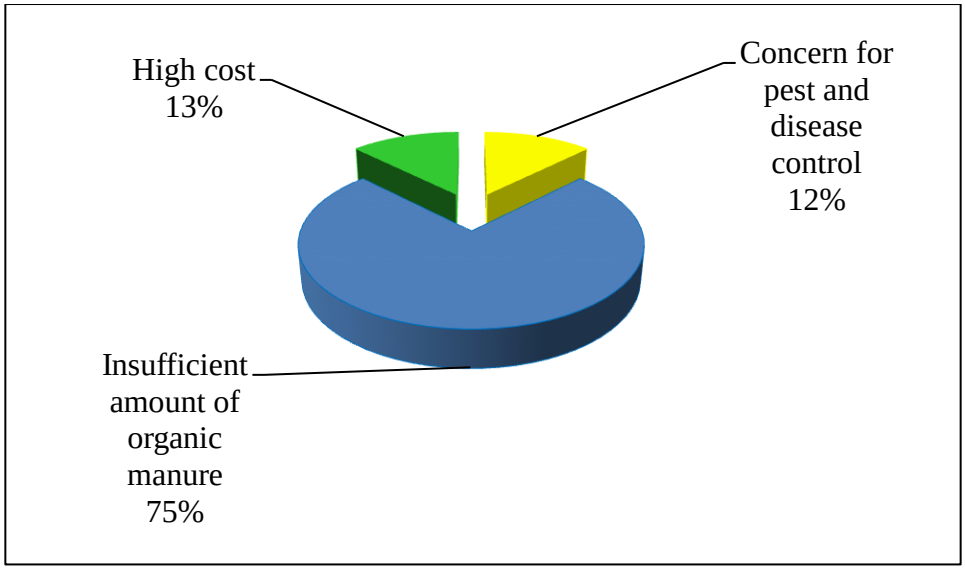


Figure 4.5 Type of constraints of sample respondents using organic material (n = 8)

4.3.2 Constraints for producing organic farming of sample respondents

In the study area, most of sample farmers have constraints to produce organic vegetables. The constraints of sample respondents are shown in Figure 4.6. The constraint encountered by more than half of sample respondents in producing organic product was the problem of pests and diseases. And then 25% of sample respondents thought that crop yield will be reduced due to organic farming. Other constraints for producing organic products were not sure market demand (10%), not income stable (6%) and other problems (4%).

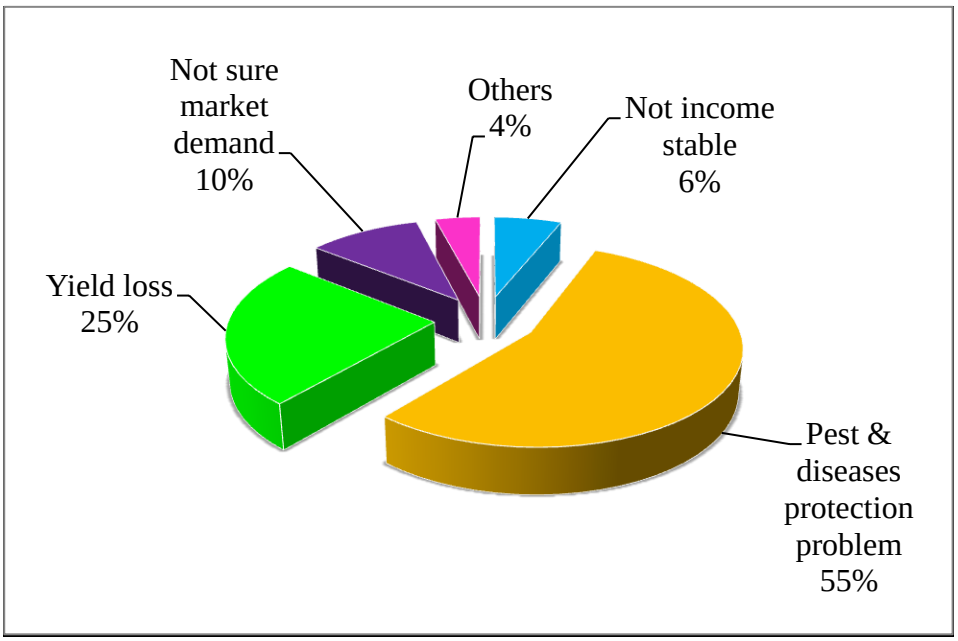


Figure 4.6 Constraints for producing organic farming of sample respondents (n = 49)

4.4 Environmental Awareness and Index of Sample Farmers by Gender and Occupation

4.4.1 Awareness of chemical residues on vegetables

Farmers' awareness of chemical residues on their corps is shown in Figure 4.7. Most of sample respondents were awareness of chemical residues and only 13% of sample respondents were not aware of it. Figure 4.8 states the awareness of chemical residues by gender of head. Male respondents have more awareness than female respondents in the study area.

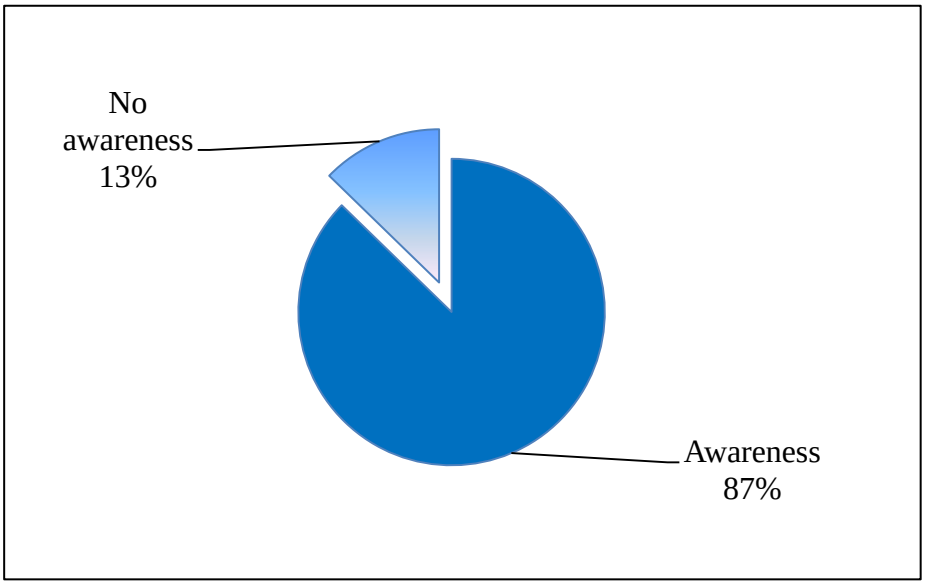


Figure 4.7 Awareness of chemical residues of sample respondents (n = 55)

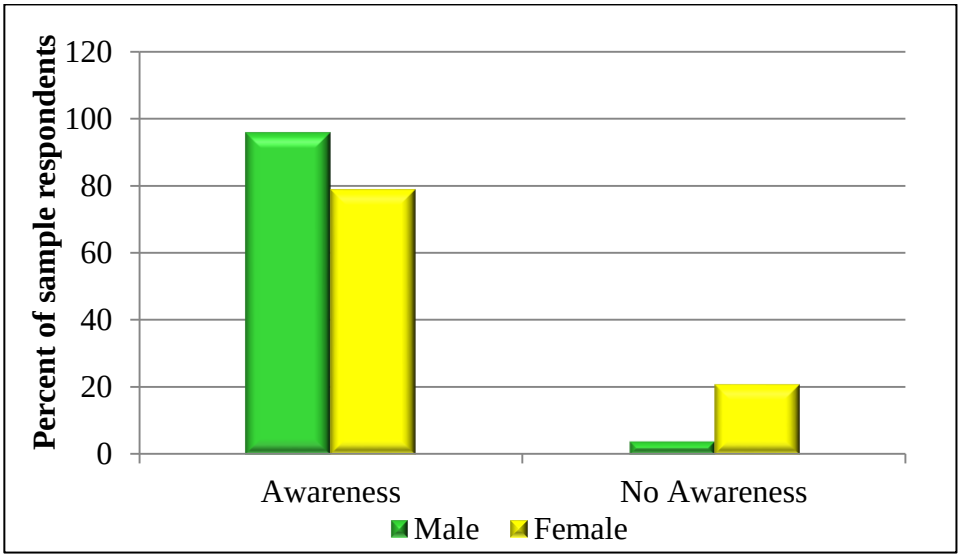


Figure 4.8 Awareness of chemical residues by gender of sample respondents (n = 55)

4.4.2 Awareness of adverse effect on environment from usage of chemical materials

Awareness of adverse effect on environment from usage of chemical materials by selected vegetable growers is shown in Figure 4.9. Awareness of adverse effect on environment was found by 76% of selected farmers and the rest 24% of sample respondents did not aware adverse effect on environment even though they used chemical fertilizers in their crop production. Farmers' awareness of adverse effect on environment by gender issue is shown in Figure 4.10. In respect of gender issue, the awareness of male farmers was higher than that of female farmers.

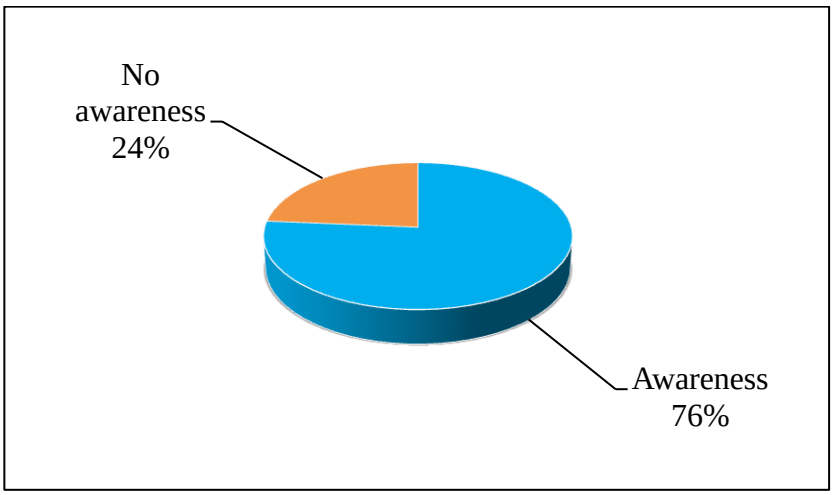


Figure 4.9 Awareness of adverse effect on environment of sample respondents (n = 55)

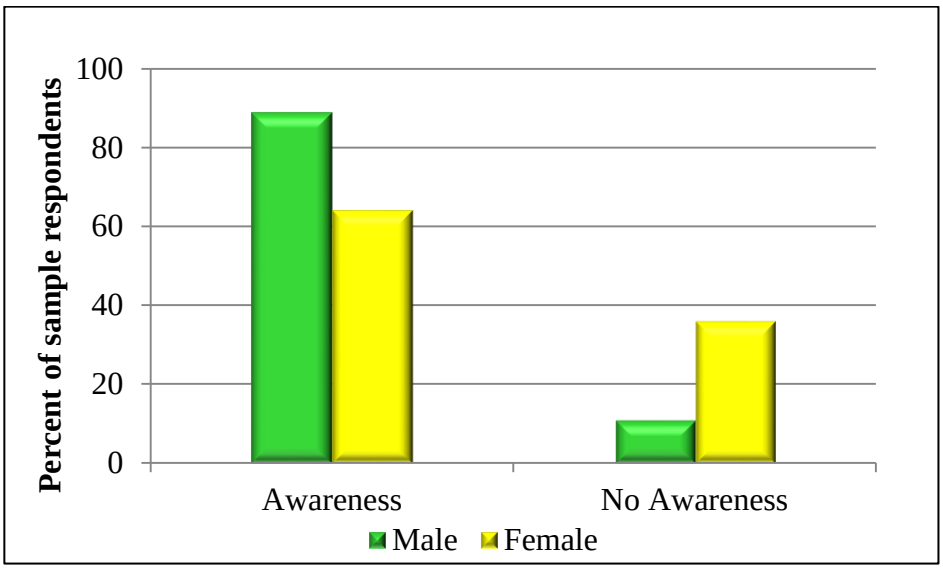


Figure 4.10 Awareness of adverse effect on environment by gender issue (n = 55)

4.4.3 Environmental awareness of sample respondents by gender and occupation

This is the main chapter of the study and it is to find the farmers' environmental awareness by measuring their attitudes and perceptions based on their agricultural knowledge. The purpose of the study is to find out the factors or situations which might have a relationship with their environmental awareness.

Table 4.10 explains average, minimum and maximum scores of sample respondents' environmental awareness in Pyin Oo Lwin Township. The average awareness scores of sample respondents was 2.98 about the organic materials are very effective and essential in crop protection and production. It explained that sample respondents in Pyin Oo Lwin Township did not agreed that point.

The average score for statement number (2) that the organic materials can reduce serious environmental pollution was 4.13. They had knowledge about sustainable agriculture and maintain the natural resources for future generation. The average score concerning the organic materials should be used more in the future for the sake of hazard control (statement number 3) was 4.11. It stated that the sample respondents in Pyin Oo Lwin Township had knowledge whether chemical inputs should not be used more in the future for the sake of protecting the environment.

The average score for statement number (4) that the organic materials are very effective to health as well as natural environment was 4.15. It means that the sample respondents understood this statement concerning with the effectiveness of farmer and consumers' health as well as the natural environment.

Regarding the organic materials should be used to reduce growers and consumers' health harmful effects (statement number 5 and 6); the average scores of sample respondents were 4.35 and 4.38. It explained that most of sample respondents agreed these statements. And then they had knowledge that the chemical inputs should not use for their adverse effects on human health.

The average score was 2.51 in statement (7) that soil conservation by using organic material is very effective for sustainable crop income. The sample respondents thought that soil conservation by using organic materials isn't very effective for assurance of income by organic production.

Concerning the organic materials should be used to maintain the natural resource for future generation and to maintain local ecology, the average scores of sample respondents were 4.13 and 4.11. It described that the sample respondents in Pyin Oo Lwin Township had high awareness to conserve the natural resources and ecosystem for their future generation.

The average scores was 3.96 in statement number 10, most of sample farmers had aware that the environmental conservation is needed to reduce the effect of climate change in Myanmar (Table 4.10). The detail data responded by the sample farmers to each statement is shown in Appendix 1. All detail responses of sample farmers for each statement by gender and occupational status are described in Appendix 2 and Appendix 3.

Table 4.10 Environmental awareness scores by sample respondents

No.	Statement	Mean	Minimum	Maximum
1.	Organic materials are very effective and essential in crop protection and production.	2.98	1	5
2.	Organic materials can reduce serious environmental pollution	4.13	2	5
3.	Organic materials should be used more in the future for the sake of hazard control	4.11	2	5
4.	Organic materials is very effective to health as well as natural environment	4.15	2	5
5.	Organic materials should be used to reduce growers' health harmful effects	4.35	2	5
6.	Organic materials should be used to reduce the consumers' health harmful effects	4.38	3	5
7.	Soil conservation by using organic materials is very effective for sustainable crop income	2.51	1	5
8.	Organic materials should be used to maintain the natural resource for future generation	4.13	3	5
9.	Organic materials should be used to maintain local ecology	4.11	3	5
10.	Environmental conservation is needed to reduce the effect of climate change in Myanmar	3.96	3	5

Table 4.11 shows awareness index of sample respondents by range. Higher awareness index means higher knowledge of environmental degradation and conservation by sample respondents. Three different ranges of awareness index were separated with frequency distribution. According to the response of sample respondents, the highest awareness index was 0.98 and the lowest index was 0.35. Average index of 0.68 that means there was high awareness of environmental knowledge by sample respondents. Majority of sample respondents (53%) have the range of 0.57 to 0.78 of awareness index. Maximum awareness index (0.79 -1) was found in responses of 33% of sample respondents. There were 15% of sample respondents who had limited environmental awareness.

Table 4.11 Environmental awareness index of sample respondents (n = 55)

Range of Awareness Index	Definition	Percent of respondents
0.35-0.56	Limited Awareness	**15**
0.57-0.78	High Awareness	**53**
0.79-1	Fully Awareness	**33**
	Total	**100**

4.4.3.1 Environmental awareness of sample farmers by gender of head

In this study, it involved farmers' awareness of environment by gender of head. Table 4.12 and Figure 4.11 state the comparison of environmental awareness index and the average awareness index by gender. Based on the gender of head, the maximum awareness index was 0.98 in male respondents while 0.93 in female respondents. In addition, the minimum awareness index of male respondents and female respondents were 0.35 and 0.40 respectively. Regarding the data received from the studied area, the average awareness index of male respondents (0.79) was higher than female respondents (0.66).

Table 4.12 Comparison of environmental awareness index by gender (n = 55)

Environmental Awareness Index	Gender	
	Male	Female
Mean	0.79	0.66
Maximum	0.98	0.93
Minimum	0.35	0.40
Standard Deviation	0.14	0.14

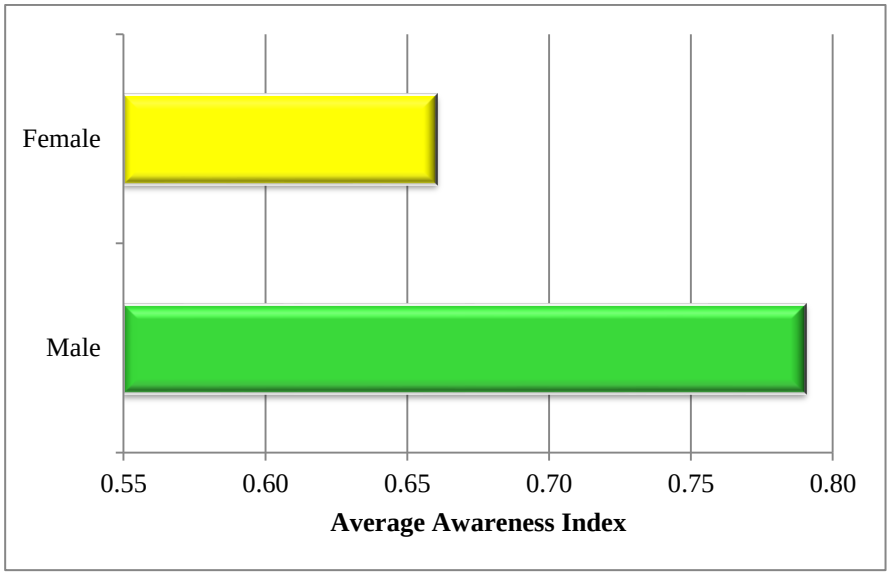


Figure 4.11 Average awareness index by gender of head (n = 55)

4.4.3.2 Environmental awareness of sample farmers by occupational status

This study observed the environmental awareness by occupation of sample respondents. Table 4.13 shows average, maximum and minimum environmental awareness index shown by occupational status. Based on the occupation of sample respondents, the maximum awareness index was 0.98 in the vegetable grower while 0.80 was in farm labor. In addition, the minimum awareness index was 0.35 in vegetable grower, 0.48 in farm labor respectively. By comparing the mean of the environmental awareness, vegetable growers have higher awareness (0.74) than agricultural labor (0.66). It is shown in Figure 4.12.

Table 4.13 Comparison of environmental awareness index by occupations (n = 55)

Environmental Awareness Index	Occupation	
	Vegetable Grower	Farm Labor
Mean	0.74	0.66
Maximum	0.98	0.80
Minimum	0.35	0.48
Standard Deviation	0.17	0.08

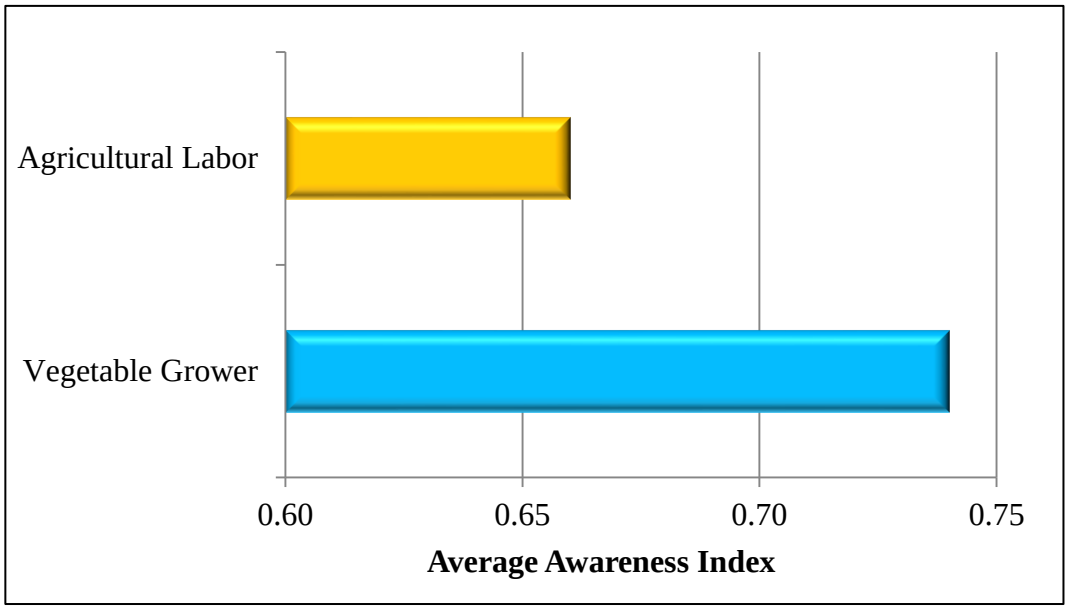


Figure 4.12 Average awareness index of occupational status (n = 55)

4.5 Awareness and Willingness to Accept (WTA) Organic Farming

4.5.1 Awareness of sample respondents to perceive the organic farming

Figure 4.13 shows the awareness of sample respondents on perceives of organic farming. Among the sample respondents, 60% have known about the organic farming practices and 40% of respondents did not have any knowledge about organic farming. According to the response of sample respondents, male respondents had more awareness than female respondents about the organic farming practices. The awareness on perceive of organic farming by gender issue is shown in Figure 4.14.

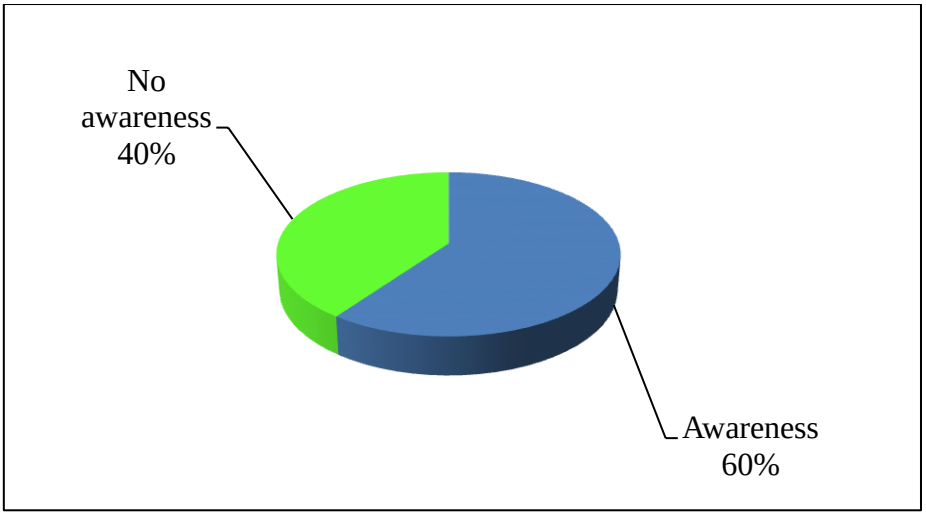


Figure 4.13 Awareness on perceive of organic farming (n = 55)

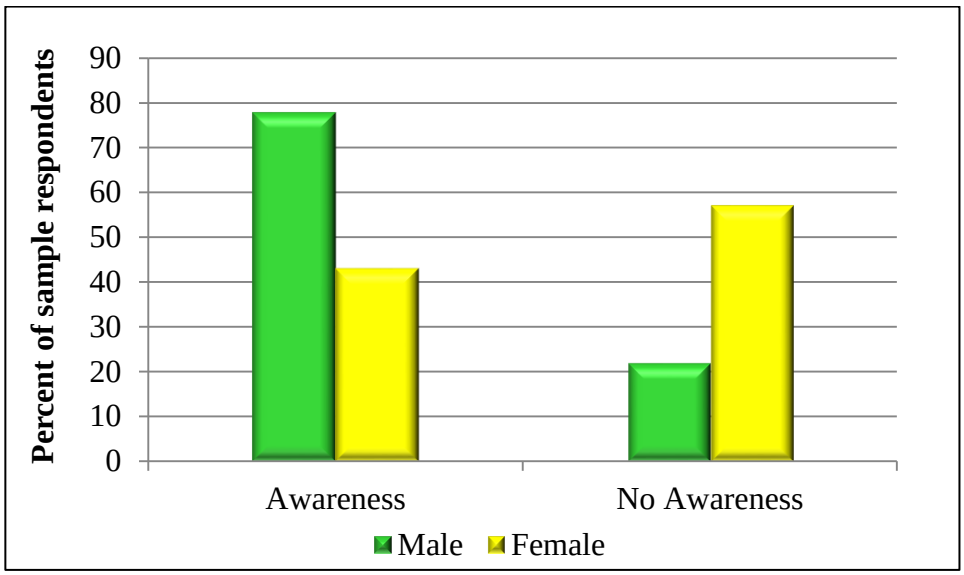


Figure 4.14 Awareness on perceive of organic farming by gender (n = 55)

4.5.2 Information receipt and source of information for organic farming

Figure 4.15 describes the status of information receipts by sample respondents about the organic farming. Among the sample respondents, 60% have got the organic farming information and 40% of farmers do not it. In this study, there were different in genders of sample respondents to get information receipts. The condition of received information about organic farming by gender of head is shown in Figure 4.16.

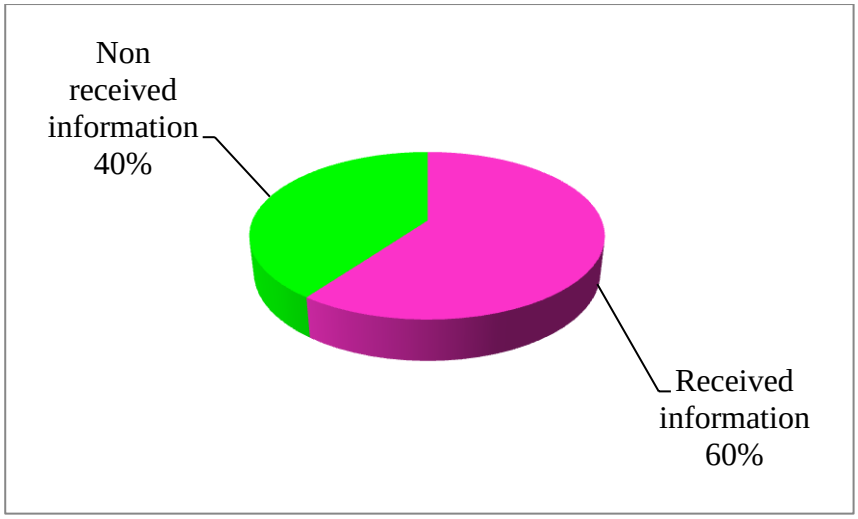


Figure 4.15 Information receipts of organic farming of sample respondents (n = 55)

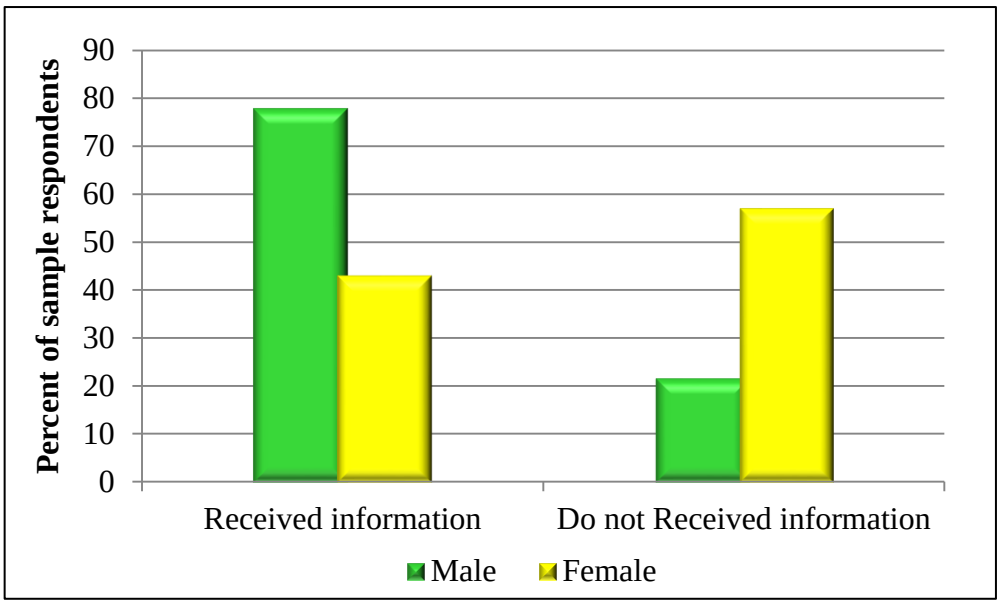


Figure 4.16 Information receipts of organic farming by gender (n = 55)

Different sources of information for organic farming are shown in Figure 4.17. The results of the study revealed that about 70% of the total respondents got the information from ally farmers, 12% from non-government organization and 6% from TV, 3% of each from government organization and journals and the rest 6% from other sources.

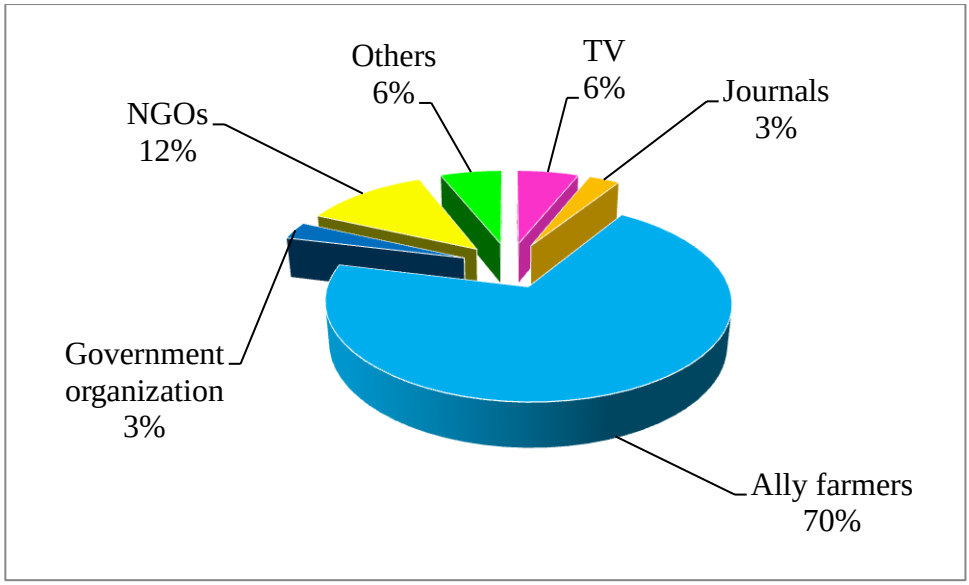


Figure 4.17 Sources of organic farming information of sample respondent (n = 33)

4.5.3 Willingness of sample respondents to grow organic vegetables

Willingness to grow organic farming by sample respondents is shown in Figure 4.18. Most of sample respondents (80%) wanted to do organic farming and the only 20% of sample respondents did not organic farming practices in their crop production. Farmers' willingness to grow organic farming by gender of head is described in Figure 4.19. Regarding the result of data, it was found that male respondents have had more willingness to accept of organic farming practices than female.

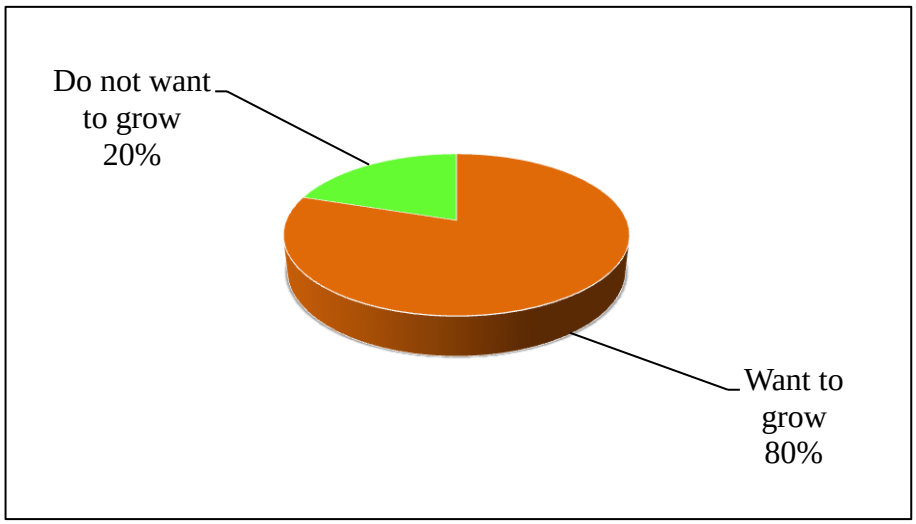


Figure 4.18 Willingness to grow organic farming of sample respondents (n = 55)

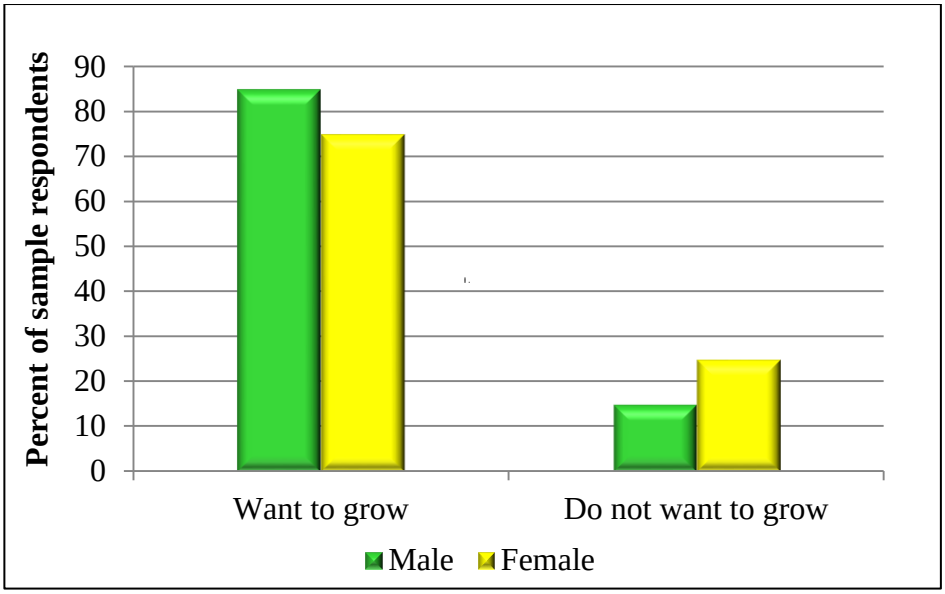


Figure 4.19 Willingness to grow organic farming by gender issue (n = 55)

4.5.4 Willingness to receive technical training for organic farming practices

Farmers' willingness to receive technical training of organic farming system is stated in Figure 4.20 and that by gender issue in Figure 4.21. Half of sample respondents wanted to get training of organic farming system. The rest of sample respondents did not want to get such training because they thought it will be waste of their time. According to the response of sample respondents, male respondents had more willing to receive training than female respondents.

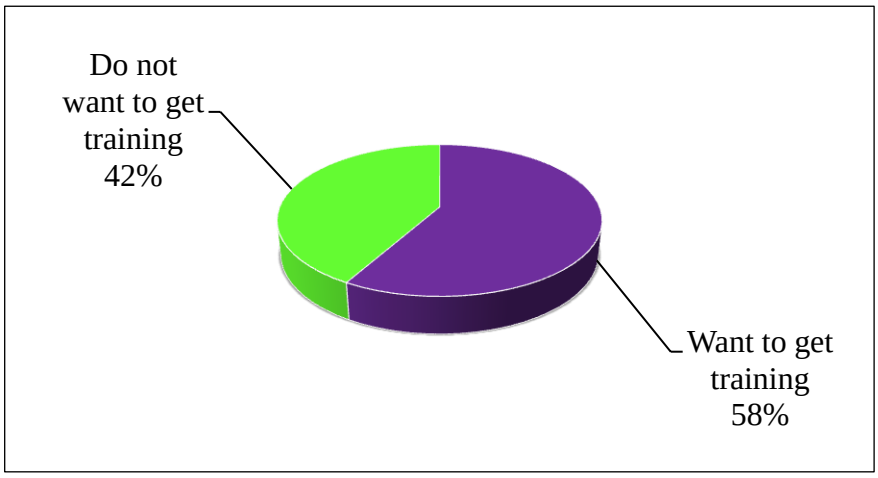


Figure 4.20 Willingness to receive training of organic farm practices (n = 55)

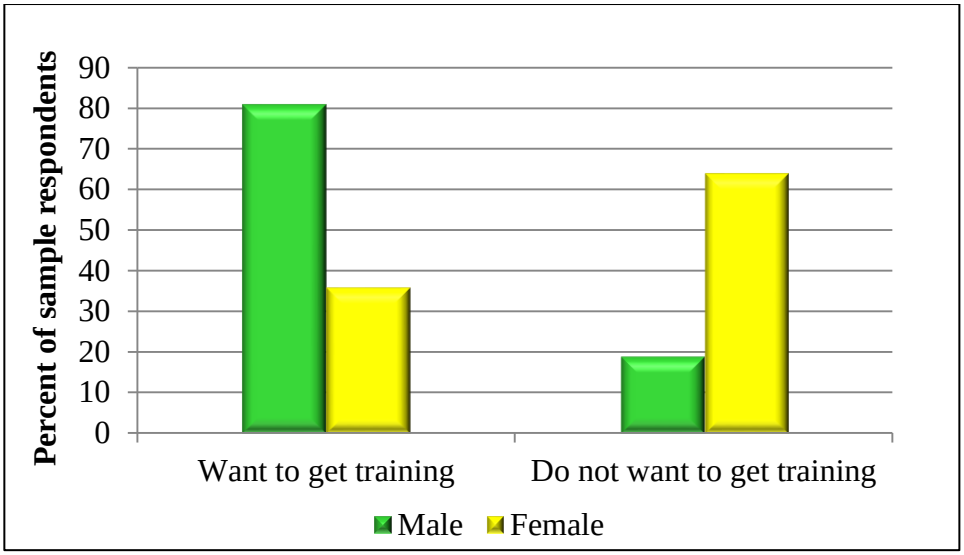


Figure 4.21 Willingness to receive training of organic farm practices by gender (n = 55)

4.5.5 Farmers' willingness to receive the price premium to grow organic product

Farmers' willingness to get price premium of their organic products is shown in Figure 4.22. Among the selected farmers, 67% want to get twice of current price as a price premium for organic vegetables. If it is getting the same price as conventional vegetables, 24% of farmers will grow organic vegetables in their farm. However, 9% of farmers want to get three times of conventional vegetable price as a price premium.

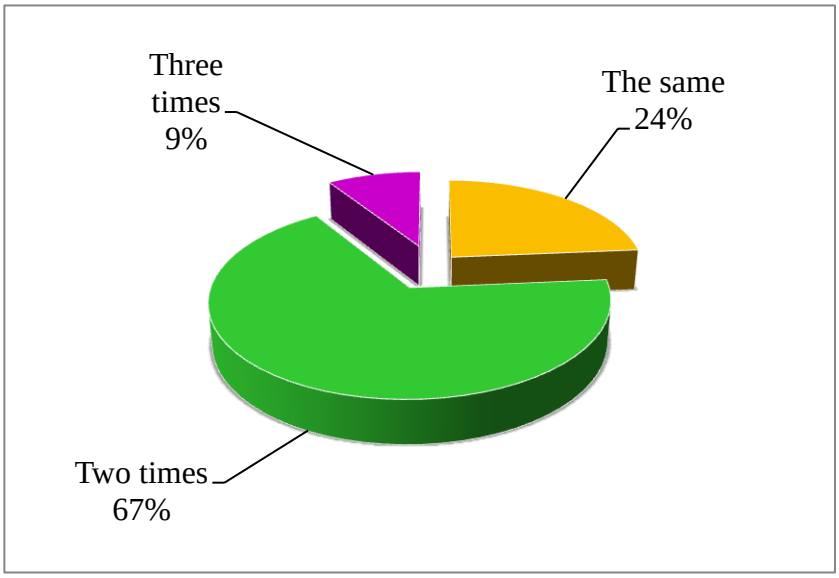


Figure 4.22 Expectation of price premium to grow organic farming of sample respondents (n = 55)

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This section highlights the main findings and makes conclusion drawn from the study, as well as the recommendations and policy implications that would promote sustainable vegetable production, improve the crop production methods and future conservation of Pyin Oo Lwin Township.

5.1 Summary of Findings

In conducting the social science studies, there are several factors affecting the awareness of respondents. They are personal factor such as gender, age and level of education, economic and social factor such as career, income and information learning. These factors are used in the leading to the analysis of awareness, which is taken as components in this study. Gender was an important factor indicating different characteristics between male and female farmers regarding to physical appearance and mind. In this study, it was found that 49% of sample respondents were male and 51% was female.

Most of sample respondents (93%) possessed sprayer and 89% possessed TV and EVD. Major occupations of sample respondents were crop cultivation (49%) and agricultural labor (51%), most of male respondents were farmers and female respondents were agricultural labor. Among the sample respondents, 27% of sample respondents have had secondary job, among them 9% were male and 18% were female. Chinese kale and Carrot were most cultivated vegetables by sample farmers. In this study, households' annual income was categorized into four groups; income from crop cultivation, petty trade, agricultural labor and other activities.

In this study, four issues such as sample farmers' knowledge and current practices of soil conservation, constraints of using organic materials and doing organic farm, farmers' environmental awareness and index by gender and occupation and the willingness to accept (WTA) the organic farming by gender of sample farmers were studied.

Based on the farmer's knowledge and current practices of soil conservation, most of sample farmers (82%) had soil conservation practices. Among the respondents, male respondents had more awareness than female respondents about the soil conservation practices. Contour bunds and terrace were mostly used soil conservation methods by sample farmers.

Regarding the constraints of using organic materials and producing organic products, it was found that 85% of sample respondents had no constraints and 15% of sample respondents had constraints about using the organic materials. There were three types of constraints for the usage of organic materials. Insufficient amount of organic manure was the biggest problem for the sample farmers in the study area. In the study area, farmers' constraints for producing organic farming were discovered five categories. Among the sample households, half of sample respondents had concerned for pest and disease protection problem and reduced crop yield was second constraint of sample respondents.

According to the results of environmental awareness and index of sample respondents, it was found that the majority of sample farmers had awareness of chemical residue effects on their crops and adverse effect on their environment. The farmers' environmental awareness index results stated that over the half of sample farmers had high awareness and one third of sample respondents had fully awareness of environment. Regarding the comparison of environmental awareness index by gender and occupation of household head, male respondents and vegetable growers were more awareness than female respondents and agricultural labors.

Based on the farmers' willingness to accept the organic farming, over the half of sample respondents had been perceived of organic farming and they got the information about organic farming. In this study, male respondent had more awareness about organic farming and their received information was more than female. There were six sources of information for organic farming, ally farmers, non-government organizations, television, journals, government organization and others source. According to all responses of sample farmers, most of sample farmers had got information from ally farmers. After that most of sample respondents wanted to grow organic products and to receive technical training of organic farming. It was found from the study area, male respondents had more willingness than female respondents. Regarding the farmers' attitude for the market of organic products, most of sample respondents wanted to get price twice of conventional vegetables.

In this study area, the people were still working even when they are 65 years old but the average age of sample respondents was 43 years. The average family member in the sample household was 5. In this study, the maximum ownership of farm area by sample respondents was 20 acres and the average ownership of farm area was 2 acres. In the study area, it was found that some farmers had no farm area and were growing crops with rented

farms. The average experience of sample respondents was 23 year in growing vegetable. The average age and experience of male and female respondents were not significantly different in this study.

Education was a basic factor differentiating an individual's knowledge. Each person's level of knowledge resulted in interest in surroundings. In this study, the maximum education level of sample respondents was graduated and the minimum education level was primary. But the average education level of sample respondents was middle. So, the education standard was not too low in the study area. According to the collected data, it was found that the average education of male and female respondents were middle education levels. But the average schooling year of male respondents was more than that of female respondents.

5.2 Conclusions and Recommendations

The study was done by using almost equal gender ratio. Most of respondents were young about 40 years old with 23 years' experience. Among the sample respondents, all were in middle education level; the education level of male was higher than female. About half were male farmers and others were female agricultural labors as major occupation and one fourth had second job. Major income was from crop production and labor, they had other sources too. Income had diversified and male farmers had high education level are notable points.

Majority of sample respondents had knowledge of soil conservation, common practice was contour bund. Male respondents had more knowledge than female respondents because it might be higher education level. Most of sample farmers had no constraints; only 15% of sample respondents had constraints for using organic materials. Farmer's opinions about the organic production were that it cannot be protected pests and diseases. And then they thought organic farming will reduce their income. Farmers have some indigenous knowledge but still need some specific training of plant protection for organic farming.

Most of the farmers had high awareness and the only 15% of sample farmers had limited awareness on the relationship of environmental impact and agriculture in the study area. Male respondents had more knowledge on environment than female. However, some had very low awareness of environment. Vegetable growers had higher awareness than agricultural labors about the environment. Environmental conservation education program would be emphasized by extension services because the awareness and behaviors of farmers

are the most important as they are direct resource user and their actions directly affects the environment. Moreover, a future research for organic farming should be done on consumer preference and willingness to pay for the organic product market in Myanmar.

More than half of sample farmers had knowledge, received information and willingness to grow organic farming. Male respondents had higher knowledge and willingness than female respondents about organic farming. Major source of organic farming information can be getting from ally farmers and non-government organizations. Most of sample respondents had some level of willingness to grow organic crops but they still need technical information by formal trainings which would be arranged by concerned institutions such as MOAI and MOECAF.

Over the half of sample farmers wanted to get training and male respondents were more willingness to receive training. The educational program would be highlighted for female and it would be attractive and incentive for rural community. According to farmers' expectation of price premium for organic products, it is needed for market study. The expected price premium of organic crops would be at least twice of conventional crop price. Otherwise, organic farming will not be successful.

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APPENDICES

Appendix 1 Percent of sample respondents in environmental awareness score

(n=55)

Question No.	Percent of Respondents				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	10.9	18.2	41.8	20.0	9.1
2	0.0	1.8	16.4	49.1	32.7
3	0.0	5.5	12.7	47.3	34.6
4	0.0	1.8	20.0	40.0	38.2
5	0.0	3.6	7.3	40.0	49.1
6	0.0	0.0	14.6	32.7	52.7
7	10.9	38.2	43.6	3.6	3.6
8	0.0	0.0	16.4	54.6	29.1
9	0.0	0.0	14.6	60.0	25.5
10	0.0	0.0	21.8	60.0	18.2

Appendix 2 Percent of sample respondents by gender of head in environmental awareness score

(n=55)

Question No.	Percent of Respondents									
	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	7.4	14.3	11.1	25.0	33.3	50.0	29.6	10.7	18.5	0.0
2	0.0	0.0	0.0	3.6	11.1	21.4	33.3	64.3	55.6	10.7
3	0.0	0.0	3.7	7.1	7.4	17.9	33.3	60.7	55.6	14.3
4	0.0	0.0	3.7	0.0	7.4	32.1	33.3	46.4	55.6	21.4
5	0.0	0.0	3.7	3.6	3.7	10.7	22.2	57.1	70.4	28.6
6	0.0	0.0	0.0	0.0	7.4	21.4	25.9	39.3	66.7	39.3
7	0.0	21.4	40.7	35.7	48.1	39.3	7.4	0.0	3.7	3.6
8	0.0	0.0	0.0	0.0	7.4	25.0	48.1	60.7	44.4	14.3
9	0.0	0.0	0.0	0.0	7.4	21.4	51.9	67.9	40.7	10.7
10	0.0	0.0	0.0	0.0	14.8	28.6	51.9	67.9	33.3	3.6

Appendix 3 Percent of sample respondents by occupational status in environmental awareness score

(n=55)

Question No.	Percent of Respondents									
	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
	Farmer	Farm Labor	Farmer	Farm Labor	Farmer	Farm Labor	Farmer	Farm Labor	Farmer	Farm Labor
1	11.9	7.7	14.3	30.8	38.1	53.8	23.8	7.7	11.9	0.0
2	0.0	0.0	2.4	0.0	16.7	15.4	40.5	76.9	40.5	7.7
3	0.0	0.0	7.1	0.0	14.3	7.7	38.1	76.9	40.5	15.4
4	0.0	0.0	2.4	0.0	19.0	23.1	33.3	61.5	45.2	15.4
5	0.0	0.0	4.8	0.0	7.1	7.7	31.0	69.2	57.1	23.1
6	0.0	0.0	0.0	0.0	16.7	7.7	23.8	61.5	59.5	30.8
7	11.9	7.7	56.2	76.9	52.4	15.4	4.8	0.0	4.8	0.0
8	0.0	0.0	0.0	0.0	11.9	30.8	52.4	61.5	35.7	7.7
9	0.0	0.0	0.0	0.0	14.3	15.4	54.8	76.9	31.0	7.7
10	0.0	0.0	0.0	0.0	21.4	23.1	54.8	76.9	23.8	0.0