

CHAPTER II

LITERATURE REVIEW

This chapter will review some literature dealing with the harmful effects of pesticides in vegetables and flowers production and socio-economic factors that effect the awareness of the farmers. Attempt will be made the research methods dealing with awareness studies, especially the use of Tobit model to determine the awareness.

2.1 Vegetable and flower production

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

Consumers generally demand for better quality vegetables. Quality vegetable to them means healthy, succulent and fresh looking vegetables with no visible rashes or holes caused by pests or diseases. To satisfy this demand, have to tackle pest and disease problems by all means. The use of agrochemicals including pesticides has been found to be the immediate and cheaper way to produce unblemished vegetables and increased farm productivity. This practice has unfortunately created numerous problems associated with pesticide abuse such as accidental poisoning to man, upset of natural environmental balance and toxic residues that is hazardous to health in the

environment (Tay, E. B *et al.*, 1984). According to Jipanin (2001), commercial vegetable farms are usually much larger in size than the small-scale farm and are often with better irrigation facilities. Vegetable production in commercial farms is complimented with small machinery, and use high level of external inputs (fertilizers and pesticides). Most farms practice continuous mono-crop with poor field sanitation. This has created an environment conducive for build-up of pest and disease incidence. The situation is further worsened with continuous application of chemical fertilizers and improper usage of pesticides.

Rapid growth in horticultural production has been accompanied by heavy use of pesticides and by heightened concern over health effects associated with pesticide use and abuse. Heavy pesticide use occurs, in part, because numerous pests attack horticultural crops, including the fruit itself, reducing market value and yield on high-value crops. Pesticide use raises safety concerns for agricultural workers who apply pesticides. Concern is particularly high in flower production because of heavy spraying in with high frequency. Potential food safety risks from pesticide residues are also a significant issue for importers of fresh fruits and vegetables and a market-risk factor for exporters who may have shipments detained or rejected if residues exceed allowable limits ([http:// www.mtnforum.org/rs/ol/rowse.cfm](http://www.mtnforum.org/rs/ol/rowse.cfm). Reducing Pesticides Residues on Horticultural Crops).

Myanmar has huge recourses on exotic flowers and not only exotic tropical flowers but also flowers of a temperate environment; either tropical flowers like orchid or flowers growing in a more temperate environment like lilies etc. Due to the moderate temperature on the Shan plateau and the tropical environment on most of the other part of the country a wide variety of beautiful flowers are available or could

be grown (<http://www.allmyanmar.com/new/allmyanmar.com/Myanmar/Flower.html>. Exotic Flowers from Myanmar Burma Brima, Flowers from Myanmar).

Farmers are increasing their efforts to make a living on crops other than the traditional crops like wheat, sunflower, and rice. One alternative crop that can return a large profit on a small tract of land is fresh cut flowers. Despite the short growing season in the upper Midwest, growing flowers and foliage for the fresh market can be profitable. Market farmers (those that grow products for roadside stands, farmers markets or to sell directly to the consumer) in Kansas, Texas, and Oklahoma have realized the potential profit that this crop can bring. Studies have shown potential gross earnings of \$10,000 or more could be realized on a half-acre tract of cut flowers. On the basis of a two-year study at North Dakota State University, it was found that certain fresh cut flowers can be successfully marketed locally (Brab and Smith, 2000)

Jennifer (2001) stated that colorful flowers could brighten a room and warmed the heart of its recipient. But the effects of some freshly cut flowers on the workers who grew them, and on the environment weren't nearly so sweet. While the impact of pesticides used in the cut-flower industry was just as deleterious as it was in other forms of agriculture, the hazards that lurk inside flowers hadn't received nearly as much attention.

Dalel (1979) indicated that chemicals could help keep buds fresh over the long journey, and the major flowers-producing countries spray away. Imported flowers frequently received heavy pesticide application prior to shipment. Many of the pesticides applied were fat-soluble and could be absorbed through skin contact. Thus,

individuals handling large numbers of pesticide contaminated flowers may be at risk of increased pesticide absorption.

There are no regulations in the U.S. governing the use of pesticides on cut flowers, and therefore, importers are not required to monitor, pesticides levels. In fact, the demand for unblemished, pest-free flowers actually encourages growers to use excessive amounts of highly toxic chemicals (<http://www.naturalnews.com>. Think that your Gift is Pesticides free?).

2.2 Pesticides and its effects

Pesticides were defined as substances or mixture of substances used to prevent, destroy, or control lives that harm humans, animals, and plants such as carriers of diseases in men or plants; weeds; or animals that might cause damages of food and agricultural products; wood and wood products on the production process, in the store, on the delivery process, and distribution; including chemicals to speed up the growth of plants or to prevent fruits to be ripe before the proper time (<http://en.wikipedia.org/wiki/Pesticides>. Pesticides).

Concon (1988) defined pesticides as substances used to control and eliminate plants or animals that might harm human's health or economic system such as herbicides, plant growth regulators, fungicides, insecticides, miticides, nematocides, and rodenticides, etc.

Pesticides might be chemicals used to control animals' ectoparasites. They were also referred to substances used to control the plant growth, to make leaves fall, to make fruits fall, to stop the growth of saplings, including other substances used for fruits before or after harvesting to prevent the rottenness during harvesting and

delivery process. The above chemical uses have not yet included fertilizer, food substances for plants and animals, chemicals put into food and drugs for animals.

Meanings or definitions of pesticides referred by academics can be concluded that pesticides are substances synthesized from nature or chemicals with purposes of preventing, eliminating, and controlling pests such as insects and weeds that trouble or stop the plant growth, and affect human' living.

Pesticides use on flowers is meant to kill pests and diseases that might destroy the beauty and benefit these plants can provide. But pesticide use on flowers is not without danger to the plant itself, insects and animals that pollinate it or eat it and even humans who enjoy them as cut flowers in their homes. Flowers are pollinate by bees, butterflies and birds. People enjoy benefits from flowers, plants and crop pollination in the form of food (eg. sunflower seeds) and other items like medicine and clothing. But when flowers have too much pesticides on them, or a type of pesticide is used that is detrimental to the bee that will pollinate it, negative effects can occur. (<http://www.ehow.com/> The effects pesticides on flowers).

Donohoe (2006) explained that flowers were the most pesticide-intensive crop, grown near the living house and with high ambient levels of pesticides. One-fifth of the pesticides used in floriculture in developing countries were banned or untested in the United States; many were known carcinogens. Flowers carried up to 50 times the amount of pesticides allowed on foods. Over 50 per cent of workers reported at least one symptom of pesticide exposure, including excessive salivation and tearing, blurred vision, nausea, vomiting, abdominal cramps, cough, wheezing, and sweating.

There are four main pesticide groups that widely use now are insecticides, fungicides, herbicides and biological pest control agent. Litsinger (1989), Pimentel *et*

al. (1992) and Teng (1990) showed that pest infestations affecting agricultural production were a common occurrence. Increases in pesticide used to control pests that easily attack commercially grown high yielding varieties had led to an increase in the virulence of many species of crop pests due to the destruction of non-target species, which included natural predators of pests and parasites.

Pimentel *et al.* (1992) pointed out that honeybee, which were vital for the pollination of crops including fruit and vegetables, were affected by most of the insecticides used. There were also agricultural losses due to reduction in insect pollination of crops due to pesticide use. Crops are also lost when pesticides drift into neighboring farms, even several kilometers away (Barnes *et al.*, 1987).

Pesticides that easily find their way into soils become toxic to arthropods, earthworms, fungi, bacteria, and protozoa which are vital to ecosystems because they dominate both the structure and function of natural systems (Pimentel *et al.*, 1992).

No one knows for certain the extent of the damage done to wildlife from the use of pesticides. However, there is evidence to show that many species of mammals (Mason *et al.*, 1986), insects (Murray, 1985) and birds (Lundholm, 1987) have been affected. An example of wildlife being affected is the death of 1200 Canada Geese killed in one wheat field that was sprayed with a mixture of parathion and methyl parathion at a rate of 0.8 kg / hectare in the USA (White *et al.*, 1982).

In addition to the damage caused to the environment and to agricultural land, pesticides impact directly on other production processes. Kegley and Wise (1998), based on many studies that have been conducted on sample extracts, report that many vegetables (for example, cucumbers, carrots, turnips, radish, tomatoes) and fruits (for

example, strawberries) exceed the allowable tolerance limits of pesticide residues (organochlorines, organophosphates, carbamates) in the USA.

The use of pesticides has not only influenced the level of agricultural production and its sustainability but has also affected the health of users (mainly farmers), those living near farms and consumers of food products. Deaths from exposure to pesticides are not uncommon. Each year tens of thousands of farmers, especially in developing countries, are affected by exposure to pesticides. Recent estimates quoted by Food and Agricultural Organization (2000) from Pesticide Action Network (PAN) show that approximately three million people are poisoned and 200,000 die from pesticide poisoning use each year. The largest numbers of deaths are in developing countries. For example, hospital statistics in Sri Lanka show that on average 14,500 individuals were admitted to government hospitals and around 1,500 individuals a year died from pesticide poisoning during the period 1986–1996 (National Poisons Information Centre, 1997).

Forget (1991) believed that in developing countries the incidence of pesticide poisoning might even be greater than reported due to under-reporting, lack of data and misdiagnosis.

The incidence and severity of ill health from pesticide-use are far greater in developing countries than in developed countries due to many reasons. Farmers (who are largely small scale farmers) in developing countries are used hand sprayers, thus increasing the incidence of direct contact with pesticides. Furthermore, as noted by WRI (1998) farmers in the developing world use more insecticides use them more frequently and also apply insecticides that are more toxic than those used in developed countries.

Inadequate education (many farmers are functionally illiterate and cannot understand instructions printed even in their own language), training and pesticide regulations in the use of pesticides lead to accidents, haphazard application and over-use. Access to medical treatment is limited and most farmers rely on home made remedies thus increasing the severity and duration of illnesses. Poor health and diet are other factors that are believed to increase the incidence of illnesses from exposure to pesticides in developing countries (WRI, 1998). Inadequate or non-existent storage facilities, poor living conditions and water supplies contaminated with pesticides also affect the health of families.

2.3 Why do farmers continue to use pesticides?

Chaisson *et al.* (1991) stated that farmers used pesticides unless their potential benefits such as improved quality, increase production, aid in harvesting and prevention of crop loss-outweigh their cost of application.

Wilson (2000) argued that farmers in developing countries would continue to use pesticides at increasing quantities because of (i) ignorance of sustainability of pesticide use, (ii) lack of alternatives to pesticides, (iii) underestimation of short and long-term costs of pesticide use and (iv) weak enforcement of laws and regulation: thus agricultural pest control systems have locked farmers in pesticides technology.

Farmers not using pesticides may be forced to use it to avoid economic losses. Defensive use of pesticides becomes necessary by nonusers so as to ensure their economic survival. Once the new technique is used, it may be impossible to revert to the previous process, except at a high cost, even when the cost of production employing the new technique eventually rises above that of the old.

According to the Tisdell *et al.* (1984), without the used of pesticides, high yields might not be sustained. Furthermore, chemical companies selling the pesticides had an incentive to push their used by advertising and promotion and this may create a bias in favour of their used. Thus, the use of chemicals in agriculture may be encouraged in preference to the use of natural ingredients available to farmers on farms (Tisdell, 1999). The market failure problem can result in the use and development of agricultural techniques which lack sustainability and which reduce long-term economic welfare (Tisdell, 1999). Loans obtained by farmers for the purchase of inputs (eg, pesticides and fertilizers) may also be a barrier to switching to other strategies. Damage to agricultural land from the use of pesticides occurs over a period of time. Hence, costs arising may not initially look serious.

Lack of medical facilities in developing countries makes the problem more complicated. As a result, lack of diagnosis attributed to pesticide exposure often ignores the dangers of pesticide use. The long-term relationship between dose and effect is complicated and because of the time involved is less easy to prove (Pimentel and Greiner, 1997). Another reason is that farmers in developing countries have no easy alternatives to subsistence farming. Subsistence farming on the other hand requires very little capital and skill. Furthermore, subsistence farmers use some of their produce for home consumption, thus covering a large part of the family expenditure. Hired laborers using pesticides may not know the true health impacts of pesticide use until severely affected. According to these literature farmers continue to use pesticides without having the awareness on harmful effects of pesticides. There may be so many factors influencing on awareness of the farmers.

The recent rapid growth of the agriculture sector within the township has created a greater demand for pesticides. More shops are involved in selling of pesticides and farmers have easy access to these chemicals (Jipanin, 2001).

2.3.1 Pesticides utilization in crop production

The use of pesticides began in the late 1960s as one of the measures taken to increase production in the agricultural sector in Myanmar. About 277 mg of powdered pesticides and 121,000 liters of liquid pesticides were utilized in 1988-89 (Myint, 2005).

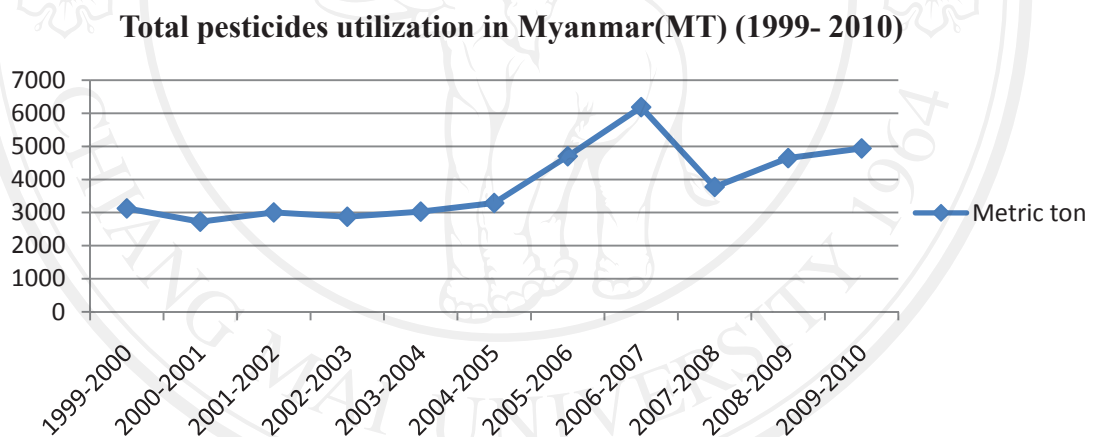


Figure 2.1 Total pesticides utilization in Myanmar (MT)

Source: Plant Protection Division, Ministry of Agriculture and Irrigation (2010)

(Pesticides= insecticides, fungicides, herbicides, fumigants and others)

Lwin (2006) explained that the rate of agrochemicals utilization was going up in a rapid speed in Myanmar. To meet the objective of increasing the foreign income, the state had issued national policy to implement intensive productivity by increasing the cropping area, increasing the cropping frequencies, promotion the use of

agricultural inputs and adoption of modern technology. Myanmar is also trying to follow the higher production by the use of higher inputs. The utilization of agrochemicals in Myanmar is increased about 500 metric ton (1992-1993) to over 2,500 metric ton (1998-1999) (Lwin, 2006). However the consumption increased about over 3000 metric ton (1999-2000) to over 6000 metric ton in (2006-2007). The use of agrochemicals on food crops is estimated about 80% of the total (Thwin and Mar, 2002). The utilization of pesticides in Myanmar is shown in Figure 2.1.

Myint (2005) described that the consumption of unsafe food could damage public health, which could increase the cost of medical care. Thus, the government had a crucial role in ensuring that food does not endanger consumer health through chemical, biological and other contaminants. In order to have safe fresh produce, a variety of measures such as laws, regulations and standards, and a system of effective inspection and laboratory analysis were still needed in Myanmar.

Some resource-poor farmers use banned pesticides which are cheaper compared with legal pesticides. A few farmers follow good agricultural practices (GAP) but most are not fully aware of pesticide residues issues. Some farmers use mixtures of pesticides; although the dosage may be sub-lethal initially, mixing several chemicals may double the concentration of noxious components (Myint, 2005).

Farmers or growers in main surplus-producing areas need to follow GAP. By doing this, farmers' supplies should not exceed maximum residue limits (MRLs) of pesticide. To be widely adopted, a GAP extension education program needs to be carried out by extension workers and plant protection staff. With regard to pesticide spraying, the following key points are important to adopt among farmers and vegetables growers which are: to observe the economic threshold level, to avoid

frequent pesticide application, to follow recommended periods between last pesticide application and harvest, to abstain from using banned pesticides, to respect dosage recommendations, to be aware of incorrect mixing of pesticides.

Some extension workers have limited knowledge of food safety issues and some farmers or growers in main surplus-producing areas are not aware of chemical and biological hazards. Quality Assurance Systems for ASEAN Fruit and Vegetables Project conducted training for extension workers in August 2005 in the country. Extension services should arrange to carry out training for farmers on GAP to manage produce quality and food safety (Myint, 2005).

Farmers overuse pesticides to ensure their crop products without considering the side effects and only emphasis on their earning. Through over use and misuse there is considerable waste, adding to the cost and contributing to the adverse environmental and health consequences. Koop (1995) stated that inappropriate application of pesticides affected the whole ecosystem by entering the residues in food chain and polluting the soil, air, ground and surface water. Improperly used or stored, pesticides could potentially be harmful to human wildlife and the environment.

Human health hazards vary with the extent of exposure. Moderate human health hazards from the misapplication of pesticides include mild headaches, flu, skin rashes, blurred vision and other neurological disorders while rare, but severe human health hazards include paralysis, blindness and even death (ICAR, 1967).

According to Aspelin (1997), the worldwide consumption of pesticides has reached 2.6 million metric tons. Of this, 85% is used in agriculture. Although the largest volume of pesticide use is in developed countries, its use is growing rapidly in developing countries. The quantity of pesticides used per acre of

land has also increased (WRI, 1998). In addition to the increase in quantity of pesticides used, farmers use stronger concentrations of pesticides, they have increased the frequency of pesticide applications and increasingly mix several pesticides together to combat pesticide resistance by pests (Chandrasekara *et al.*, 1985 and WRI, 1998). These trends are particularly noticeable in Asia and in Africa.

Wilson and Tisdell (2001) pointed out that the initial use of pesticides had been very effective in reducing pest infestations and increasing agricultural production and productivity. However, over time targeted pests had developed resistance to pesticides necessitating increasing applications or resulting in rising populations of pests or both. After a point, resistance of pests might grow to such an extent that application of pesticides was no longer economic. Once application was stopped, the population of pests climbed to levels in excess of those predating the use of pesticides. They remained permanently above levels prior to the use of the pesticides. This occurred because the pesticides had eliminated the beneficial predators of pests.

Pest infestations affecting agricultural production are a common occurrence.

Increases in pesticide use to control pests that easily attack commercially grown high yielding varieties have led to an increase in the virulence of many species of crop pests due to the destruction of non-target species, which include natural predators of pests and parasites (Litsinger, 1989; Pimentel *et al.*, 1992 and Teng, 1990). 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 (Pimentel *et al.*, 1992).

According to the National Academy of Science (NAS) (1993), improvements in public health can in part be attributed to pesticides. Pesticides have increased crop yields and the availability and affordability of fruits and vegetables year-round (International Food Information Council, 1995). But a Vietnam News Journalist quoted reports stating that the number of people poisoned by contaminated fruits and vegetables had increased by 34% in 1988 (Moustier *et al.*, 2000).

2.3.2 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 that 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 workers paid little attention to advice on proper and safe usage, such as:

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

b. Strictly following directions on labels like dosage, application frequency and pre-harvest interval (PHI).

4) Most farmers prefer to use insecticides in the organophosphorus (OP) group, such as; Chlorpyrifos, 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 by 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 vegetable market price also plays an important role. Some farmers tend to harvest and supply on demand when prices are higher without taking into consideration the date of pesticide application that he goes against the pre harvest interval requirement. Quality, untarnished vegetables are graded higher and fetch a better price amongst the consumer.

In flower production pesticides residues are often found on produce, if flowers are important part of our life, then we should worry. Pesticides help make flowers more affordable by saving them from early damage. But research shows that pesticides contribute to a wide range of health problems, including cancer (http://organicfairtrade.blogspot.com/pesticide-in_flowers. Fair Trade Flowers and Products). In this study area almost all of the farmers grow not only vegetables but also flowers in the year round growing season. Although some kinds of pesticides used were different, most of the farmers used same pesticides to control the pest and diseases infested in both vegetables and flowers. So factors leading to pesticide residues contamination in the flowers nearly the same with vegetables.

2.4 Factors influencing the Awareness of farmers

“Awareness” is defined as a psychological feature of knowingness or undifferentiated consciousness. It may be knowledge based on one’s experience or perception (<http://www.wonderference.com>. 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 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. Consideration of mind to achieve awareness of that phenomenon or event, and awareness has 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.

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.

Isin (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 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.

Lwin (2006) 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.

That author also 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.

Some farmers who have exposure to extension agents from Myanmar Agriculture Service (MAS) and those who have attended the short course on EM (effective microorganism) are found to be quite aware.

2.5 Use of Tobit regression model in others related studies

Tobit models refer to regression models in which the range of the dependent variable is constrained or limited in some way (Amemiya, 1984 and Greene, 1997). In econometrics literature, this model is called the 'Tobit model' which is an extension of probit analysis developed by Tobin (1958) (Goldberger, 1964). In statistics literature (where the model also appeared in the 1950s), this model is called the censored normal regression model.

Tobit models have been frequently used within the agricultural sciences, for example in environmental and agriculture pollution studies (Vermersch *et al.*, 1993) and investigations of farmers' willingness to participate in different programmers or to

adopt new methods (Akinola and Young, 1985; Adesina and Zinnah, 1993). The Tobit model is an efficient method for estimating the relationship between an explanatory variable and truncated or censored dependent variable. Its derivation is based on the hybrid of probit analysis and multiple regression analysis.

According to the Liewenlyn and Williams (1996), the linear Tobit regression model was used to analyze the effect of certain socio-economic factors on the technical efficiency of the farmers. The model was used because the dependent variable technical efficiency scores are censored having values ranging between 0 and 1.

Ghorbani and Hamraz (2009) stated that Tobit model was used in determining the factors influencing on consumer's potential willingness to pay for organic products in Iran. A regression model is useful to understand the effect of one variable on an outcome when all other explanatory variables are held constant.

Tobit analysis was also used to identify the propensity of farmers to discontinue adoption of agricultural technology using evidences from two arable crops technology in Nigeria (improved varieties of cowpea and maize) (Oladele, 2005). This study showed that the lack of extension visits to farmers who had adopted the improved varieties of maize would lead to discontinuance. Among the limited dependent variable models widely used to analyze farmers' decision making processes, Tobit analysis had gained importance since it uses all observations, both those are at the limit, usually zero (e.g. non adopters) and those above the limit (e.g. adopters) to estimate the regression line, as opposed to other techniques that uses observations which are only above the limit value (McDonals and Moffit, 1980).