Factor Influencing Chemical Pesticides Use among Fruits Vegetable (*Solanaceous* crops) Farmers in East Coast Economic Region (ECER)

Siti Nurul Fatihah Ainnie Binti Sharifudin

F15A0218

A report submitted in fulfillment of the requirements for the degree of Bachelor of Applied Science (Agrotechnology) with Honours

Faculty of Agro-Based Industry

Universiti Malaysia Kelantan

2019

DECLARATION

I hereby declare that the work embodied in this report is the result of the original research and has not been submitted for a higher degree to any universities or institutions

---

Student's Signature

Name: Siti Nurul Fatihah Ainnie Binti Sharifudin

Date:

Approved by:

Supervisor's Signature

Name:

Date:

ACKNOWLEDGEMENT

Alhamdulillah, first of all I would like to praise to Allah the Almighty for giving me this opportunity and conferring me such amazing ability in completing this study. This thesis would not be completed without such deep guidance and supervision from certain person, especially my supervisor, Madam Tengku Halimatun Sa'adiah bt Tg Abu Bakar and my fellow final year project mates, Maizatul Vanisha Masril and Nur Farhana Othman. Thousands of appreciation and thank you to all of them for their guidance, suggestions and constant support for me until I got to complete this study and produced such an excellent outcome from the study. The completion of this thesis could not be done correctly without their valuable guidance and persistent help. I am also very thankful to University Malaysia Kelantan for giving me chance to learn and pursue my study by conducting this final year project for about one year. Last but not least, I would like to express my thankfulness towards my beloved parents and family who always giving full support and help for me to complete the study. They never give up in giving my advices in order to not let me down and depressed.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURE

LIST OF ABBREVIATION

ECER	East Coast Economic Region
TPB	Theory of Planned Behaviour
FAO	Food and Agriculture Organization
WHO	World Health Organization
EFSB	Eggplant Fruit and Shoot Borer
SPSS	Statistical Package for Social Science Software
PPE	Personal Protective Equipment

LIST OF SYMBOL/UNIT

%	Percentage
&	and
ha	hectare
sq	square
kg	kilogram
°C	Degree celcius

Faktor Yang Mempengaruhi Penggunaan Racun Perosak Kimia Dalam Kalangan Petani di Wilayah Ekonomi Pantai Timur (ECER)

ABSTRAK

Peningkatan terhadap permintaan makanan yang pesat di Malaysia telah menyebabkan banyak petani sayuran buah meningkatkan penanaman sayuran buah mereka bagi memenuhi permintaan dengan meningkatkan penggunaan racun perosak kimia bagi mengawal perosak yang menyerang tanaman mereka. Isu-isu berkaitan kesan sampingan racun perosak kimia yang semakin meningkat telah mencetuskan kebimbangan petani untuk mencari alternatif lain bagi melindungi tanaman mereka daripada perosak. Objektif kajian ini adalah untuk mengenalpasti faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani sayuran buah di ECER. Soal selidik kajian telah diedarkan dengan menggunakan kaedah persampelan secara terpilih terhadap 105 orang petani sayuran buah. Kaedah analisis deskriptif dan korelasi Spearman digunakan untuk mencapai tujuan kajian. Dapatan kajian menunjukkan bahawa faktor yang paling mempengaruhi penggunaan racun perosak kimia dalam kalangan petani sayuran buah adalah sikap. Pada umumnya, terdapat hubungan yang signifikan antara faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani dengan sikap, norma subjektif dan kawalan tingkah laku. Untuk kajian di masa hadapan perlu lebih fokus terhadap semua petani tanpa mengira jenis tanaman untuk menentukan faktor yang mempengaruhi penggunaan racun perosak kimia. Kemudian, kajian ini juga boleh ditambahbaik dengan menambahkan pemboleh ubah baru seperti pengetahuan untuk melihat sama ada ia mempunyai hubungan atau tidak dengan faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani.

Kata kunci: sayuran buah, racun kimia, sikap, norma subjektif, kawalan tingkah laku

Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in East Coast Economic Region (ECER)

ABSTRACT

The rapid growth of food demand in Malaysia have caused many fruits vegetable farmers to improve production to meet the demand by using chemical pesticides to control pests attacked towards their crops. The growing issues on effect of chemical worried people and caused them to find another alternatives way for crop protection from pests. The objective of this study is to identify factor influencing chemical pesticides use among fruits vegetable farmers in ECER. The questionnaires were distributed by using purposive sampling method to 105 fruits vegetable farmers in ECER. Descriptive analysis and Spearman correlation were used for analysis methods to achieve the purpose of study. The findings indicated that the most influencing factors of chemical pesticides use among fruits vegetable farmers is the attitude. Generally, there are significant relationship between factor influencing chemical pesticides use among fruits vegetable farmers with attitude, subjective norm and perceived behavioral control. The future study should be more focus on all type of vegetables farmers to determine the factor influencing chemical pesticides use. Then, this study also can be improved by adding new variable such as knowledge in order to ensure either it has a relationship or not with the factor influencing chemical pesticides use among farmers.

Keywords: fruits vegetable, pesticides, attitude, subjective norm, perceived behavioral control, fruits vegetable farmers in ECER

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Tomato (*Solanum lycopersicum)* originated from Southern America, Chilli (*Capsicum annuum L.*) originated from Mexico, and Eggplant (*Solanum melongena*) was originated from India. These three types of *solanaceous* crops are from *Solanaceae* family that are now available to be planted in all climates. Tomato contains follic acid, Vitamin K and Vitamin C. Carotenoid, and lycopene determine the colour of tomato fruits. Chillies are known to have a strong spicy taste that from the content of active alkaloid compounds, which are *capsaicin, capsanthin,* and *capsorubin.* While eggplant contains the important phytonutrients which are have the antioxidant activity that include phenolic compounds; *caffeic* and *chlorogenic acid,* and flavonoids; *nasusin.*

Most of tomato plants are cultivated for the demand of domestic market and exported to Singapore. Malaysia also imported 4000 tons of tomato products per annum for local-population (Hengky, 2016). Eggplant phenotypic characters are found that to be strongly influenced by climatic factors and soil conditions that may lead to unreliable or the erroneous determination. Eggplant leaf and stem pigmentation, fruits size, shape and colour are very important that only can be discerned in an adult plant. Growing out

eggplant are very laborious and time-consuming (Hassan & Isa, 1998). Malaysia are currently producing 60% of its own red chillies in order to meet the local consumer demands which are from two varieties, Cili merah Minyak and Cili Merah Kulai. According to Abd Majid (2017), Datuk Seri Ahmad Sabri Cheek said that local consumers prefer on imported chillies due to its cheaper price than the local chillies even though the local chillies are higher quality that can cause the farmers will be soon out of business and increase the chance for foreigners to control chillies market.

These *solanaceous* crops (tomato, chilli and eggplant) usually damaged by nematodes attack. Nematodes are small microscopic roundworms that live in the soil and attacks the roots of these plant, causing small swellings which are known as root-knot or galls resulting in stunted plant growth due to blockage of nutrient and water movement. The root-knot nematodes are *Meloidogyne incognita, M. javanica and M. hapla*. The plants that affected by root-knot nematodes are easily infected by soil-borne diseases that caused by *Ralstonia solanacearum* (bacterial wilt) and *Sclerotium rolfsii* (southern blight).

Food demand is growing higher in Malaysia have caused many regions to opt for the fruit vegetable cultivation to meet the demand. The traditional systems of fruit vegetable production cannot fulfil the food demand (Mispan et al., 2015). Pests attack pose the big problem to the fruit vegetable, especially these so*lanaceous* crops production that need to be controlled by intensive pest management. In Cameron Highland, the use of chemical pesticides is very common practice in fruity vegetable cultivation. Pesticides refer to any substances or mixture of substances that are meant to prevent and kill pests.

However, the use of pesticides creates concern on the long term impacts towards the fruity vegetable production in Cameron Highland, especially on pesticides residues, the health concern and the impacts of the environment. The ways pesticides are stored, transported and disposed also creates concern that can cause short term and long term impacts to the farmers and their cultivation. Pesticides are used in different amounts on different crops due to its compatibility in order to maintain the yield and quality. Farmers tend to use many types of pesticides in response to prevent from crop losses due to pests' attacks. Farmers that using pesticides without better understanding regarding the pesticides impacts on human health and environment actually due to lack of information regarding the hazards associated with the chemical pesticides used (Ngowi, 2003).

This study focused on the factors influencing pesticides use among fruits vegetable farmers in East Coast Economic Region (ECER). It is important to know how the involvement of the individual, communities and government in influencing pesticides use among farmers. The high use of pesticides among farmers can be reduced by using biological control that costs less. The use of biological control can help farmers reduce their losses in production and high demand of the products due to little amount of pesticides content.

1.2 Problem Statement

Tomatoes, chillies and eggplants are the most demand fruits vegetable compared to the other fruits vegetable (Mispan et al., 2015). The higher demand of these *solanaceous* crops need higher production by the farmers by reducing the

products losses. In order to make sure the production can meet the demand, the farmers tend to use chemical pesticides by letting the quality of the products at the second thought. The pesticides residues in fruits vegetable and the environment issues are one of the major concerns by Malaysian government. Other than using safer control methods, pesticides still highly used by certain farmers as their pests control. The growing issues of pesticides problems have increased farmer interests to find the alternative pests control methods such as crop rotation and biological control (Mohd Roff, Zurina, Azizan & Idris, 2015). The misuse and overuse of the pesticides also can contribute to the bad health impact and environmental impacts that can cause increasing in death rate due to pesticides consumption. Some high levels of pesticides residues were detected in ground water even though certain highly toxic, persistent and bio-accumulative pesticides such as the chlorinated pesticides have been banned years ago.

Furthermore, the study regarding pesticides used are vital in reducing the pesticides risk and at the same time able to increase the public health policies related to pesticides (Ansam, Waleed, & Rahmat, 2010). There were several record stated that several farmers may use wrong pesticides for the wrong need or they use the right pesticides but in condition of either sub-optimal or excessive rates due to their lack of pesticides rules and regulations knowledge (Ramaswamy, 1992). The poisoning and suicide from pesticides used are frequently reported. This problem is the most major challenge faced among farmers (Jin, Wang, He & Gong, 2017). According to WHO (1990), there are still no segment of the population is completely protected against exposure to pesticides and potentially serious health effects, though a disproportionate burden, is shouldered by the people of developing countries and by high risks groups in each country. The widespread use of illegal (banned) pesticides rising rapidly in Cameron Highlands because they are cheaper and more powerful. This problem

occurred due to there are still no one has been prosecuted for selling or using banned pesticides for their crops. The Regional Environmental Awareness of Cameron Highlands president, Ramakrishnan Ramasamy said that farmers do not hesitate to use banned pesticides because they grow the vegetables for purpose of sale only and not for eat due to their awareness of the effects of this illegal pesticides (Fong, 2018).

Therefore, the aim of this current study is to determine the factors that influencing pesticides use among fruits vegetable farmers in East Coast Economic Region (ECER) using Theory of Planned Behavior of farmers' Specific Attitudes (SA), Subjective Norms (SN) and Perceived Behavioral Control (PBC).

1.3 Research Questions

1) What are the level of factors that influence the pesticides use among fruits vegetable farmers in ECER?

2) What are the level of attitudes, subjective norms, and perceived behavioural control towards the factors that can influence the fruits vegetable farmers to use pesticides in ECER?

3) There is any relationship between specific attitudes, subjective norms, and perceived behavioural control and the factors that influence pesticides use among fruits vegetable farmers in ECER?

1.4 Research Objectives

There are several of objectives that have been identified on this study by using theory of planned behaviour which are:

1) To determine the level of influencing factors of chemical pesticides use among fruits vegetable farmers in ECER.

2) To determine the level of attitudes, subjective norms, and perceived behavioural control towards factors influence chemical pesticides use among fruits vegetable farmers in ECER.

3) To analyse the relationship between specific attitudes, subjective norms and perceived behavioural control on factors influencing chemical pesticides use among fruits vegetable farmers in ECER.

1.5 Scope of Study

The study is focuses on factors influencing chemical pesticides uses on fruits vegetable among farmers in ECER. To fulfil the needed scope of this study, the respondents are picked using purposive sampling method among the fruits vegetable farmers in ECER. Before conducting the survey regarding the study, sets of questionnaire were prepared to ensure the process of survey went well. The main focuses of this study are exactly towards the attitude, subjective norms, and perceived behavioural control of factors influencing pesticides use among fruits vegetable farmers in ECER.

1.6 Significance of Study

The conducted research is focus on the factors that influencing pesticides use among fruits vegetable in ECER. The importance of this study are to know how the individuals, communities and government involved in the influenced factors of pesticides use on fruits vegetable among farmers and how to control the farmers from the pesticides overuse in fruits vegetable cultivation.

Besides, this study also important to help farmers increase their fruits vegetable production by less use of pesticides added by other biological control that can reduce the costs and increase profits. They able to increase their production when there were no pesticides overuse and the reducing of pesticides residues. So, it can help farmers reduce the losses of their production when there was only little amount of pesticides content in their products that can meet the demand throughout international market. The use of pesticides also able to help farmers in preventing pests and diseases to their crops. It possible to resist the pests and able to produce larger quantities of food supply.

Other than that, it can benefit the government in order to increase agriculture industry and boost the economic growth of the country if there are least use of pesticides in the cultivation. Since 1945, it was estimated that the use of pesticides had direct benefits toward human health which it has prevented about 7 million people deaths by applying the pesticides to kill the pests that carry and transmit diseases.

CHAPTER 2

LITERATURE REVIEW

2.1 Fruits Vegetable (*Solanaceous* crops)

Tomato, chilli and eggplant are fruit vegetable crops that known as *Solanaceous* crops that belong to *Solanaceae* family that known as the knight-shade family. These fruits vegetable crops are the most important of *solanaceous* vegetable worldwide. The world tomato production in 2001 was about 105 million of fresh fruits from approximately 3.9 ha of the tomatoes cultivation. Tomato is one of the fruity vegetable that a relatively short duration crop that manage to produce high yield. It is also economically attractive (Barbara, Shankara, Martin, & Hilmi, 2005). Yellow tomatoes are high in Vitamin A content than the red tomatoes varieties which are contain lycopene, the anti-oxidant that contribute to protection of carcinogenic substances. The *solanaceous* group of vegetables (tomato, eggplant, chilli) generally need some large amounts of nutrients. The amount of nutrients that needed are depend on the quantity of fruit and dry matter that they produce influenced by a number of genetic and environmental variables.

Even though tomato is an important vegetable in many countries, its production may not so highly profitable due to the growers and market gluts during the main

growing season. Usually, the tomato that produced in off-season got higher prices in the market. Growers can produce tomato during off-season by the help of protective structures such as net houses and poly houses. These structure need to be carefully constructed and maintained in order to increase the productivity and returns per unit area. However, if the structures are under improper management, it can result in high pest damage levels (Ramasamy & Ravishankar, 2017).

While chillies, one of the most popular fruit vegetable in Malaysia are able to grow very well in the areas that have temperature average about 24°C for 4 to 5 months in a year. Chilli are vegetable that planted for commercial value. Sandy loam soil is the most optimum soil type that suitable for chilli cultivation. Chilli is one of the crops that are rich in Vitamin A, B, C, Calcium, Phosphorus and Iron. Chilli is known as a multi-alkaloid plant species that are contain carotenoids and capsaicinoids that derive its pungency for flavouring and therapeutic effects. The red colour of chillies are determined by the presents of carotenoid pigments by capsanthin. Malaysian consumption of chillies about 1.82 kg of fresh chilli and 0.45 kg of dried chilli per capita per year.

Eggplant, *Solanum melongena* L., is one of vegetable crops that helped farmers in generating income and degraded the environment due to high use of pesticides. Eggplant is a versatile crop that able to adapted in different agro-climatic regions and grown up throughout the year. Eggplant fruit and shoot borer (EFSB) are the most noxious and damageable among the plethora of eggplant pests.

2.2 Fruits Vegetable (*Solanaceous* crops) Pests and Diseases

Basically, pests are known as the most important constrain in fruits vegetable production. According to McKinlay (1992), pests may have the indirect effects on plants such that, it transmits viruses and the other micro-organisms that can cause diseases to the plants. The indirect effects of pests on plants are by contaminating the plants with excretions. Farmers have reported that thrips population increasing rapidly even the initially more serious pests that encounter in their fields are the fruit worm (*Helicoverpa arinigera* Hubner) that attacked tomato crops, and shoot and fruit borer (*Leucinodes orbonalis* Guenee) that attacked the eggplant.

Farmers then apply insecticides to control these pests, but unfortunately the thrips population become increase significantly and become one of the most damaging pests that really difficult to control. Some farmers also claimed that the thrips attack become more serious as the plants grow older even though there were no pesticides application in the earlier stage (Talekar, 1991). The main insect pests of these *solanaceous* crops are aphids and thrips. Thrips always been the major pests towards eggplant (*Solanum melongena* L.) and chilli (*Capsicum annuum* L.). These vegetable damaged by thrips either by direct feeding on leaves, flowers or fruits or just act as vectors for viruses transfer (Tan, Peter, & Khoo, 2016). Thrips are known come from the order Thysanoptera. In Cameron Highland, the aphids' species are found immune towards several types of pesticides.

Tomatoes are the hosts to several species of root-knot nematodes (*Meloidogyne spp.)*. Chillies generally are affected by soil-borne diseases and root-knot nematode. *A*ccording to Brenna (2009), the most processing varieties of tomato with some notable

exceptions including AB2, while the other varieties of fresh market tomato possess the Mi gene that confers resistance to several of the species that attack tomato plants. Root-knot nematode comprises a group of endo-parasitic roundworms that cause most major economic damage to the crops around the world (Stephen, 1998). These *solanaceous* crops also susceptible to several diseases that can diminish and ruin the harvested products. The disease usually can negatively affect the plant health and vigour.

One of the pest insects that attack eggplant is the shoot and fruit borer. These pests also damaged the other solanaceous crops. These pests can be controlled by spraying carbaryl (0.1%) or Endosulfan (0.05%) or Cypermethion (0.01%). Then aphids are very active during December to March when there were various cruficerous and vegetable crops. Aphids attack can be controlled by spraying with Malathion (0.1%) or Endosulfan (0.05%) or Monocrotophos (0.05%) to avoid from worst crops damaged. While the root-knot nematode are the most common parasitic nematodes can cause the plant becomes stunted and leaves showing clorotic symptoms. This pest attacks can be avoiding by spraying with Carbofuran or phorate with the rate of 25 kg per hectare to ensure that the pesticides spraying show positive effects (Rajeshbhu, 2012).

Ryckewaert, Deguine, Brevault, and Vayssieres (2010) stated that fruit flies (Diptera: Tephritidae) are the main pests that attacked and damaged the *solanaceous* crops by stings the young fruits to lay eggs. The frequently observed statistics showed that about 80% of tomato losses occur due to fruit flies damaged. This species of fruit flies caused significant damaged to field-grown tomato, eggplant and chilli. Previous study by Ryckewaert *et al.* (2010), stated that farmers applied foliar insecticides directly onto the plots to control the fruit flies attacked, and the effectiveness of these spraying method have been reported by the farmers.

2.3 Pesticides

Pesticides are highly toxic chemical substances including herbicides that used for destroying weeds and the other unwanted vegetation, insecticides used for insects' control, and fungicides are used for molds and mildew growth prevention. While fungicides function as disinfectants to prevent the spreading of bacteria, and control mice and rats. In other word by (Alavanja & States, 2009), pesticides means the chemical substances that used to control, destroy and repel any pest that range from insects (insecticides), rodents (rodenticides), and weeds (herbicides) to microorganisms (*algicides, fungicides, or bactericides*). The functional class of the pesticides active ingredients are designed for references due to the type of organisms that specified to control. Generally, most of the commercial pesticides formulation are the complex mixture of active and other ingredients. According to Jeyanthi and Kombairaju (2005), pesticides are known as the main control tactics of pests and diseases management in vegetable cultivation and the pesticides effective control are determined the crop productivity. Pesticides used also helped Indian farmers to achieve a substantial increase in their agricultural productivity together with the use of high-yielding crop varieties and fertilizers (Birthal, et al., 2000).

In the whole world, the use of pesticides is 44% of the insecticides, 30% of herbicides, 21% of fungicides and 5% of others. Nowadays, the synthetic organic chemicals are the most used in agriculture which act as destroyer by interfering with a vital metabolic process in the targeted organisms (Mathur et al., 2005). In China about 20 years ago, the extensively wide use of pesticides was for the purpose in increasing the crop yield and to produce high products quality for consumption. It has been

recorded that the use of pesticides for the crops among Chinese farmers more than other country's producers (Huang, Hu, Pray, Qiao & Rozelle, 2003). The commercial mass production of chemical pesticides used has result in widespread and overuse that may cause the environmental degradation and bad effect to human health. Pesticide residues in vegetable can cause problems towards international trade and harm the consumers' health. Generally, the proper use of chemical pesticides in controlling the plant diseases and insect infestations would not result in bad ecological imbalance and the high pesticides residue levels in environment (Huo & Huo, 2005; Li, 2006). It is clearly stated by the previous study that the most important factors that lead farmers to use pesticides was the need to control the wide range of pest organisms which are insect pests, plant diseases, weeds and rodents. The farmers also use pesticides in order to control the crops losses and reducing the threats to human and livestock safety and health (Xu & Kuang, 2008).

According to Talekar (1991), the most used pesticides in controlling thrips attacked and damaged on different types of crops is profenofos + cypermethrin (Polytrin C). This type of pesticides is known to be the most effective for thrips control but not always available for interested users. To be more prepared, the farmers usually more ready with procured insecticides such as methamidophos, profenofos, methiocarb, monocrotophos, and cypermethrin. Endosulfan and azinphos-ethyl also the most common used pesticides against the other insect pests because it is readily available and easy to get. Malaysia was estimated facing crop losses due to stem borers about 33% that showed the highest among other country such as India, Bangladesh and Philippines (Teng et al., 1990).

Their toxicity may not be absolutely specific to the target organisms but can adversely affect different processes in the non-target host plants that can cause damages

to the plants and its production due to the concentration of applied pesticides (Shakir et al., 2016). The world pesticides use was reported about 20% in the developing countries that lead to human health and environment danger (Afari-Sefa et al., 2015). There were two types of pesticides which are naturally derived from arsenic or plant extract while some of pesticides that are mostly used are from man-made chemicals. The use of pesticides really gives the bad impacts towards surrounding including the degradation of biological capital of ecosystem because of pesticides use that can cause economic burdens to the country. There were also evidence proving that several pesticides that exposed to animal can generate immune dysfunction (Thomas & House, 1989). According to Wilson and Tisdell, (2001), they stated that the severity of ill-health due to pesticide use are higher in developing countries rather than in developed countries because mostly farmers from developed countries using pesticides from a closed environment while farmers in developing countries applying pesticides by using hand sprayers that can increase direct contact with pesticides.

The use of pesticides has several benefits that can help reduce the crop losses and get the better yield. But on the other side, it has been reported that pesticides also contribute the unfavourable effects on the environment quality and negative impacts to human health that indirectly consuming food that contain pesticides (Jamali, Solangi, Memon & Nizamani, 2014). However, the use of pesticide at first stage surely effective in reducing pest infestations and at the same time able to increase the agricultural production and productivity. But, the pest will grow such an extent stage where the pesticide no longer effective to control the pest and they may grow up until the level in excess of those predating the use of pesticides. This happened due to the use of pesticides that get rid of beneficial pest predators (Pimentel *et al.*, 1992).

Baral et al., (2006) mentioned that the farmers rely much on chemical insecticides application to control EFSB due to lack of alternative control measures. Their too much relying on chemical pesticides have caused the misused of pesticides that can lead to biodiversity losses and some other environmental impacts. The losses of pesticides effectiveness also occurred due to the excessive use and non-registered chemicals. There were several different ways of pesticides exposure that can occur in humans such as inhalation, ingestion and dermal contact. It can also affect birds, wildlife, domestic animals, fish and livestock due to the pesticides pollution towards the local environment. One of the factors that caused the bad effect towards environment is due to the used of un-prescribed pesticides without under control condition (Abhilash & Singh, 2009).

Food safety issues become serious threats towards public health due to the unprofessional used of pesticides by the farmers. According to (Wang, Deng, & Ma, 2017) stated that the over-used of pesticides among farmers caused worst series of human health issue and environmental problems. There were found that the pesticides residues have exceeded the highest limits in vegetables crops. Pesticides impacts have been reported contain high concentrations that interrupt the middle and downstream water that caused bad threats towards aquatic ecosystem. From previous study, (Liu, & Huang, 2013) there were several found stated that the farmers' factor on using pesticides are including their attitudes towards pesticides.

2.4 Concept of Factors Influencing Chemical Pesticides Use

Generally, pesticides actually not the recent inventions. There were many former farmers that have been used pesticides for protecting their crops from insects and pests. The past Medieval farmers have conducted an experiment with chemicals using arsenic that function for common crops. Pesticides can be grouped based on their biodegradable characteristics which are considered as biodegradable and persistent. Pesticides actually linked toward human health hazards, which from short-term impacts like headaches and nausea to the chronic cases such as cancer and reproductive harm. It was clearly stated from previous study by (Xu & Kuang, 2008), the most influencing factors that lead to pesticides use is the need of farmers to control wide range of pests organisms including insect pests, plant diseases, weeds and rodents for the sake of preventing crop losses and minimising the dangerous threats toward human and livestock health. Previous literature study showed that there were two method of factors that lead to pesticides use which are direct and indirect. These methods contribute to farmers' decisions on pesticides use and explaining the current pattern of pesticides overuse. Both method actually may lead to an increased frequency of pest infestation or the emergency of secondary pests that caused farmers to employ wider variety of pesticides and increasing the dosage use.

2.5 Theory of Planned Behaviour (TPB) Model

Written by La Morte (2016), the Theory of Planned Behaviour (TPB), the most popular social-psychological models were known as Theory of Reasoned Action

in1980 for the purpose of predicting an individual's intention to engage in behaviour for specific place and time. The functions of the theory were to explain all behaviours over which people have the ability to exert their self-control. This theory includes attitudes, subjective norms, and perceived behavioural control. These factors of this theory are shown to be related to the appropriate sets of salient behavioural, normative and control beliefs of behaviour due to the uncertain of exact nature of these relations (Ajzen, 1991). The theory of planned behaviour is found well supported by empirical evidence. Furthermore, Ajzen (1991) also states that for a good and predictive value of the model, it is necessary that the several model variables are defined on the same level of specificity. According to Petrea (2001), he has found that the TPB was a useful framework to understand farmers' behaviours for the development of targeted health and safety interventions in investigating the agricultural safety behaviour in regard to pesticides use. As cited in Ajzen, (2015), "in general, the more favourable the attitude and subjective norm the greater the perceived behavioural control which higher possibility a person will perform the question of behaviour".

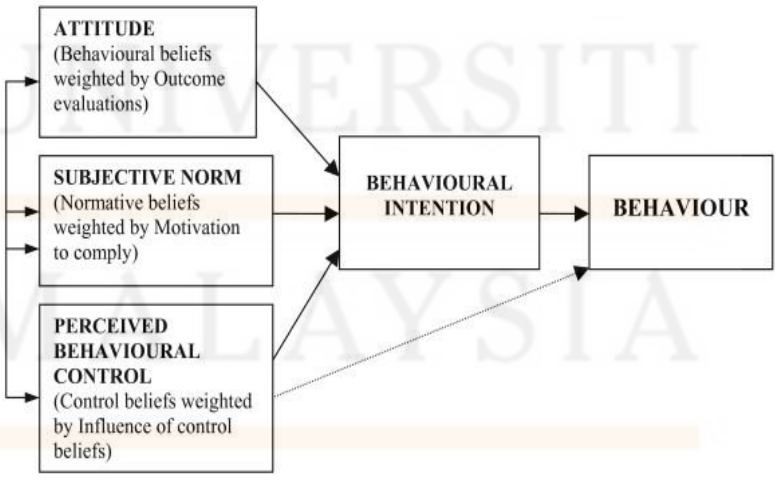

Figure 2.1: The diagram of TPB Model

Source: Ajzen, (1991)

2.5.1 Attitude

Attitude refers to a person's positive or negative evaluation of behaviour (Ajzen, 1991). The farmers all over the world use chemical pesticides in their cultivation to protect the commodities from pests and pathogens damaged in order to maximize the agricultural productivity in terms of quality and quantity of the produce (Damalas, 2006; Damalas, 2009). Damalas (2016) also state that there are certain farmers that cannot really read the pesticides labels correctly, tend to misinterpret the basics instruction regarding the personal safety, pre-harvest intervals, and environmental protection. The farmers prefer to follow the instructions from the pesticides retailer, other farmers and extension officers, cited from Van Hoi et al. (2009). The big impact of pest resistance in the fruits vegetable cultivation drives the farmers to use high quantities of pesticides that lead to environmental pollution, health risks and the resistance problems. Farmers' knowledge of the toxicological properties of pesticides is vital in order to reduce the risks in many aspects towards the end-users.

Some studies show that farmers tend to use excessive pesticides in order to produce high yield and cause them more exposed to the higher risks of pesticides hazards. Their lack of education and knowledge of pesticides and not active in training programmes on how to use the pesticides in the correct ways may lead to many health problems among farmers. These impacts are coming from the farmers' own attitudes towards pesticides use without referring to the correct techniques to be used (Kamsia *et al.* 2014).

2.5.2 Subjective Norms

Subjective norms are the second variable after attitudes in theory of planned behaviour study. Most farmers prefer to listen to people's opinion about the pesticides use particularly from the retailers without thinking the bad effects of the pesticides use. They trust the retailers' advice more than the truth facts of the pesticides use. Farmers usually tend to use the restricted pesticides for their cultivation (Wang, Wang, Huo, & Zhu, 2015). According to Bond, Kriesemer, Emborg and Chadha (2009), farmers had a strong behavioural intention and favourable attitudes, subjective norms and perceived behavioural control in applying pesticides in their cultivation. Subjective norms play a vital role in influencing farmers to use pesticides in their cultivation to control pests and diseases damaging. Farmers believe pesticides could destroy the pests and protect their cultivation from natural enemies but placed only moderate importance to conserve them. Health are believed to be very important to all the farmers but certain farmers had mixed beliefs that spraying the pesticides could bring about poor health (Heong & Escalada, 1999).

According to Ajzen (1991), subjective norms are related to the perceived social influences/pressure to indulge or not to indulge in a given behaviour situation. Subjective norms mean the individuals beliefs on how they viewed their references group in a certain performed behaviour. The previous study show that subjective norms are strongly related to attitude (Huque, Hafeez & Mohd Shariff, 2014).

2.5.3 Perceived Behavioural Control

Perceived behavioural Control (PBC) refers to peoples' perceptions of their ability perform a given behaviour. PBC is assumed as the reflected the past experience with the performance of the behaviour and anticipated obstacles that could inhibit the behaviour (Kiriakidis, 2016). Perceived behavioural control has a relation in factors that influence pesticides use among fruits vegetable among farmers in East Coast Economic Region. This variable plays an important role in influencing the farmers regarding the pesticides use based on the past experience. As stated by Jin, Wang, He and Gong, (2017), the farmers were found to overuse the pesticides even though most of them know that they were at some degree of risks when using pesticides. The probability of pesticides overuse significantly decreased with the farmers' risks perceptions, willingness to reduce the pesticides use, better social relationships not just listen to any peoples' advice regarding the pesticides use and based on government strict monitoring by giving specific terms and regulation regarding the pesticides use.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

This chapter briefly explained on how the research was conducted and the method that was used in collecting data to complete the research. There were three parts of research methodology that have been elaborated in this chapter, which the first part was the research design, second part was research framework and the last part was the instrumentation, population, sampling and data preparation procedures.

3.1 Research Design

A quantitative research design was used for this study in order to get and collect the data from selected respondents in East Coast Economic Region (ECER) regarding the factors influencing chemical pesticides use among fruits vegetable farmers. Quantitative research design has been chosen because of its nature of available data (interviews) or because of the availability of only limited number of cases. This study employed the technique of non-probability which was purposive sampling in order to

gather all the collected data. Purposive sampling was selected based on the characteristics of population and the objectives of the study. This sampling method was known selective method which only fruits vegetable farmers in ECER were selected to answer the questionnaires. The selected independent variables of the theory used are attitude, subjective norms, and perceived behavioural control, while the dependent variable of this study was the factors that influencing chemical pesticides use among farmers in ECER. Besides, the collected data was analysed by using SPSS, which are descriptive analysis and correlation analysis to perform data entry and analysis on the demographic profile, dependent and independent variables. The purpose of conducting a research design was to provide a plan of study that permitted accurate assessment of causes and effects between dependent and independent variables.

3.2 Research Framework

The research framework for this study has been prepared to identify the factors influencing chemical pesticides use among fruits vegetable farmers in ECER which was the dependent variable for this study. There were three independent variables for this study which attitude, subjective norms and perceived behavioural control. These independent variables were adapted based on the Theory of Planned Behaviour (Ajzen, 1991). According to Hasbullah, Mahajar and Salleh (2014), TPB are comprehensive and produce valid prediction on behavior, but still received many debates and criticism on its narrow sufficiency of three independent variables, which are attitude, subjective norms and perceived behavioral control.

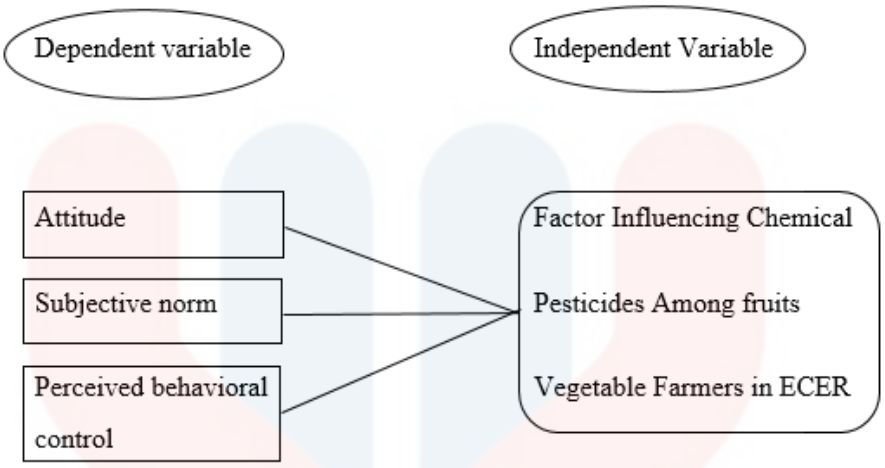

Figure 3.1: Conceptual Framework of factors influencing chemical pesticides used among fruits vegetable farmers in ECER

Source: Adapted from Ajzen, (1991)

3.3 Instrumentation

Instrumentation is one of the most important components of research design in social science research in gathering and collecting data or the information. The most common used instrument to get and collect the data was by using a questionnaire. Questionnaires were very important element in completing the research process. Previous research showed that questionnaires design directly affects the quality of the collected data. Questionnaires was one of the instruments that was systematic process in which researcher contemplates various types of question formats, number of factors characterized the survey that need to be considered, and ultimately words the various questions carefully.

3.3.1 Questionnaire Survey

For this study, the instrument used was self-administered survey questionnaires. Conducting a survey were the most suitable mechanisms in gathering and collecting data to ensure the relevancy and consistency of collected information based in the objective, standardized and comparable. The questionnaires were constructed based on the Theory of Planned Behaviour that consists of three variables which are attitude, subjective norms, and perceived behavioural control to determine the factors influencing chemical pesticides use among fruits vegetable farmers in ECER. The purpose of conducting a sample survey by using questionnaires distribution was to obtain data from a subset of a population, in order to estimate the population attributes.

3.3.2 Questionnaire Design

Questionnaire design means the process that the researcher need to go through a series of interrelated steps in conducting a survey to collect data. Questionnaires were distributed to the selected respondents among fruits vegetable farmers in ECER to fill in the information and answer all the required questions. To analyse the data, only the completed answers of questionnaire were taken in order to get the exact data and population. Basically, the instrumentation in conducting questionnaires for survey were taken from the standardized measures of the previous researchers in their past studies. Then, some changes have been made from it to suit with the new context of study. In a set of questionnaires, it should contain about six parts of the data that need to be collected.

For part A, it asked for respondents' demographic profile that involved in fruits vegetable farmers in ECER. Part A covered their demographic profile in order to get the desired data and information regarding the objectives of this study. Demographic profile included gender, race, religion, age, marital status, educational level and planted area. For part B, C, and D, the questions were asked regarding the three independent variables of theory of planned behaviour that has been used for this study. The required independent variables were behavioural attitude, subjective norms and perceived behavioural control. Then, for the last part, which part E, the questions were asked about the dependent variable of this study entitled factors influencing chemical pesticides use among fruits vegetable farmers in ECER. The responses of selected respondents were recorded based on a 5-point Likert-type scale that represent by (1) strongly disagree, (2) disagree, (3) neither agree or disagree, (4) agree and (5) strongly agree.

3.4 Population and Sampling Technique

Sampling technique means a process of choosing people from a specific group that called population as respondents that participated to the study where a sample was taken. It also defined as a researcher's population of interest based on the objectives of study. This study used purposive sampling method in conducting the survey. Only the selected respondents among farmers in selected area in ECER were distributed the questionnaires to get the data and information regarding the factors influencing pesticides use. The purpose of using purposive sampling technique was to get the exact data for the objectives of this study.

3.4.1 Population and Sample

For this study, population of fruits vegetable farmers in ECER were chosen to conduct a survey regarding the factors influencing pesticides use among them. ECER cover 51% of the land area of Peninsular Malaysia from more than 66,000 sq km of measured area. However, about 105 copies of questionnaires were distributed to several selected areas among fruits vegetable farmers' population as respondents in ECER due to time and money constrain. These number of questionnaires distributed were enough as the medium rate of sample size according to Kline (2005) as shown in table 3.1. This research used purposive sampling method to achieve targeted sample quickly and correctly as this sampling study only focus on a particular characteristics of population, which was the fruits vegetable farmers' population that on interest of the study. Purposive sampling is most used often during undergo such a difficult-to-reach population that needs to be measured. Usually, quantitative sample size should be large enough to get for most or all answers from the respondents during conducting a survey.

Table 3.1: Rate of Sample Size

Sample Size (N)	Description
<100	Minimum rate of sample size
100-200	Medium rate of sample size
>200	Maximum rate of sample size

Source: Kline (2005)

3.4.2 Sample Size

As stated by Dessel (2013), "a sample size is a selection of respondents that will be chosen in such a way that they represent the total population as good as possible". For this research, about 105 respondents among fruits vegetable farmers in ECER were chosen as sample size for survey. In conducting survey, it was very difficult to gather all the data that involved hundreds or thousands of respondents in a sample size. The number of respondents selected also considered due to the resources, money, and time constraint to cover all the selected places in ECER. In fact, by enlarging the number of respondents have produced more accurate and precise result of survey. The category of sample size shown in Table 3.1 by Kline (2005).

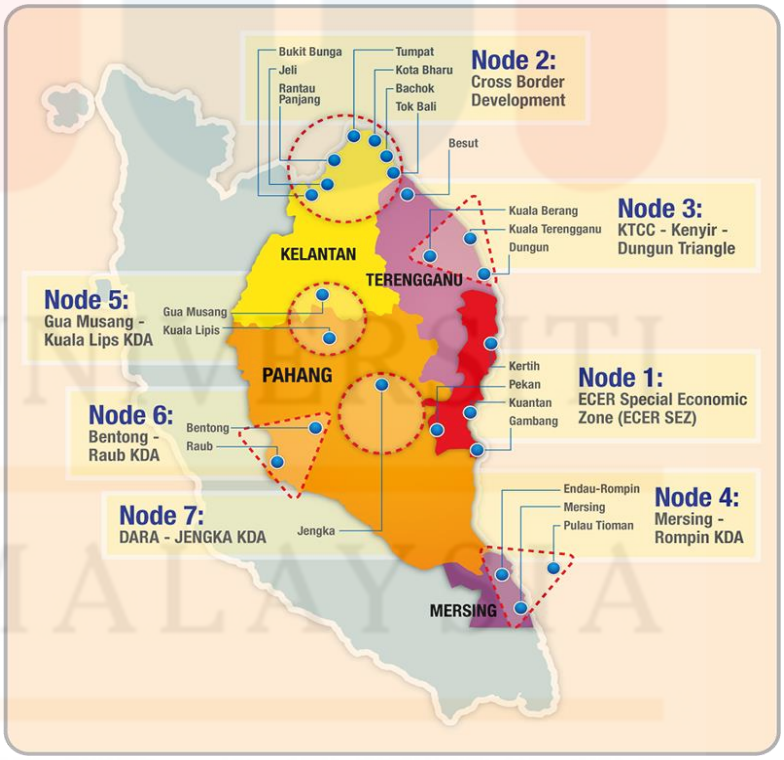

Figure 3.2: The location maps of ECER

Source: MIDF Research (2017)

3.4.3 Sampling Procedure

This research used purposive sampling method to conduct the survey from selected fruits vegetable farmers in ECER. Purposive sampling was known as judgement, selective or subjective sampling technique which researcher will rely on their own judgement when choosing sample from population to participate and involve in the study (Crossman, 2018). Purposive sampling was very suitable to use when in need of reaching target respondents quickly.

For this study, this purposive sampling method used when conducting a study in a particular group where a small group of population have been selected from a large group for the study. The aim of using this sampling method was to focus on respondents' specific characteristics who could be able to assist with relevant helps and information for the study. Fruits vegetable farmers in ECER were the most suitable respondents that have been selected as subject to conduct this study on factors that influencing chemical pesticides use among fruits vegetable farmers. This purposive sampling method was actually one of the most cost-effective and time-effective sampling methods that can be used by a researcher that facing money and time constrain.

3.5 Data Preparation

Before start conducting a survey regarding factors influencing chemical pesticides use among fruits vegetable farmers in ECER, data have been prepared to

ensure the validity of the survey. Pilot test have been conducted to check the validity of survey before started distributing full set of questionnaire for complete survey. The completed data was saved by using SPSS system to undergo pilot study. Then, the result obtained from pilot test was analysed by using reliability test to get the validity of questionnaires.

3.5.1 Pilot Study

30 respondents among fruits vegetable farmers in Kelantan were used as pilot test to determine the reliability of the study instrument. The purpose of conducting a pilot test was to ensure that the completed questionnaires that distributed to 30 respondents were accepted and it could ease the respondents to answer it to obtain the information from respondents. The Statistical Package for Social Science Software 21 (SPSS 21) were used in this study to analyse the collected data from 30 selected respondents that answer the questionnaires that been used to test the reliability of questionnaires.

According to Cronbach's alpha, the reliability coefficient was ranging between 0 to 1. Actually there were still not exist the lower limit for the coefficient. It was proven that the closer the Cronbach's alpha value to 1.0, the greater the internal consistency of the items in the scale. The Cronbach's alpha was developed by Lee Cronbach (1951) in providing measurement of the internal consistency of test or scale which was demonstrated in range number between 0 and 1. Reliability test by Cronbach's alpha estimated the amount of error occurred in the test measurement (Tavakol & Dennick, 2011). There were also some different records regarding the acceptable values of alpha

which ranging between 0.70 to 0.95 (Devellis R. 2003). George and Mallery (2003) contributed the rules of thumb, which were excellent, if value >0.9, good if value >0.8, acceptable if value >0.7, questionable if value >0.6, poor if value >0.5 and unacceptable if the value <0.5. However, the unreliable items found were deleted or restructured to ensure that the value of Cronbach's alpha for each measurement tool exceeding 0.7 which at the acceptable level.

A pilot test had been conducted to test the reliability and the internal consistency of the instruments. The reliability statistics were recorded from SPSS and the result was shown in table 3.2:

Table 3.2: Reliability Statistics of all variables

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.955	.955	26

Table 3.2 showed that the result of the reliability test analysis from SPSS. Cronbach's alpha value need to be higher than 0.7 in order to produce reliable instrument. From the result gained, the Cronbach's alpha that have been constructed in the table above showed that the value was reliable, 0.955 and able to be used for the actual data collection of survey.

3.6 Data Analysis

The collected data was analysed by using SPSS 21 in order to achieve the objectives of the pilot study from the research objectives. Descriptive analysis was used to analyse the demographic profile of selected respondents while the relationship between dependent and independent (variables) were analysed using Correlation analysis.

3.6.1 Descriptive Analysis

Descriptive analysis was employed in expressing the data features in the study. Descriptive analysis is vital in order to determine the normality of the distribution. It is necessary as the applied techniques for inferential data analysis were depend on the data characteristics. Therefore, the used of mean, variance, percentage and standard deviation were needed in elaborating respondent basic information and knowledge. These items were also been used in measuring the level of each independent and dependent variables (Shodganga, 2013).

3.6.2 Correlation Analysis

Correlation analysis means the association or relationship between the variables of the study. A positive correlation coefficient specify that two variables were strongly

related in a positive manner while if the correlation coefficient is negative, it shows that the variables were related in negative manner and the 0 correlation coefficient indicates that there was no relationship between the variables in the study. There were two methods can be used in calculating the correlation coefficient which are Karl's Pearson correlation, *r* that determine the relationship between the two variables while Spearman's rho (ρ) determine the value based on the given observations and not on the actual values (Gogtay & Thatte, 2017).

3.7 Summary

To summarize this chapter, it was discussed regarding the research design and methodology of the study. It related the study participants, instrument measurement, variables, the method and theory adopted in collecting data as well as the data preparation and statistical procedures. Research design has been employed to demonstrate the quantitative method. Moreover, research framework specified the dependent variable, factor influencing chemical pesticides use while independent variables are attitude, subjective norm and perceived behavioural control. Besides, there were about 105 respondents have been chosen among fruits vegetable farmers in ECER as sample size for this study. The pilot test has been conducted among 30 fruits vegetable farmers in Kelantan to observe and record the possibility of response, outcomes and achieve the understanding level that needed from respondents.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

There were total of 105 questionnaires have been distributed to the respondents (fruits vegetable farmers) in ECER. For this chapter, it has been covered the results of data analysis including descriptive analysis and correlation analysis from recorded data of questionnaires.

4.1 Descriptive Analysis

The collected data from survey contained respondents demographic background such as gender, race, religion, age, marital status, education level, types of crops, planting area and also include the dependent and independent variables. The recorded data through SPSS were clearly explained in this section of study.

4.1.1 Demographic Background of Respondents

From overall results, most of the respondents were male 69.5% and only 30.5% from female respondents. For race composition, Malay respondents were the highest among all which are 90.0%, followed by Chinese 5%, and Indian 4% in ECER while there is also 1% of other races. For religion category, Muslim respondents is the highest 88.6%, then Buddhism 6.7%, Hinduism 3.8% and lastly followed by others religion 1%. Among farmers' respondents in ECER, the highest age range percentage is between 29-39 years (32.4%), then >50 years (29.5%) and followed by age range between 40-50 years (22.9%) and followed by the lowest age range which is 18-28 years (15.2%). Most of selected respondents are married (62.9%) and followed by single (37.1%). Move forward to the educational level, the respondents that have SPM certificate are the highest (37.1%), then Degree (17.1%), followed by Diploma (13.3%), PMR (13.3%), Certificate (11.4%), others (4.8%) and lastly farmers that are Master holder (2.9%). Last but not least for demographic profile, planting area also have been recorded among the respondents. The highest planting area of farmers in ECER was in the range of 0-2 acre (62.9%), then followed by 3-4 acre (24.8%) and lastly about 12.4% of farmers that owned more than 4 acres of their crops.

Table 4.1: Demographic Profile of Fruits Vegetable Farmers in ECER

Characteristics	Frequency (n=105)	Respondents (%)
Gender		
Male	73	69.5
Female	32	30.5
Race		
Malay	95	90.5
Chinese	5	4.8
Indian	4	3.8
Others	1	1.0
Religion		
Islam	95	90.5
Buddhism	5	4.8
Hinduism	4	3.8
Others	1	1.0
Age		
18-28 years	16	15.2
29-39 years	34	32.4
40-50 years	24	22.9
>50 years	31	29.5
Marital Status		
Single	39	37.1
Married	66	62.9
Education Level		
PMR	14	13.3
SPM	39	37.1
Certificate	12	11.4
Diploma	14	13.3
Degree	18	17.1
Master	3	2.9
Others	5	4.8
Planting Area		
0-2 acre	66	62.9
3-4 acre	26	24.8
>4 acre	13	12.4

4.1.2 Level of Attitude on Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

Descriptive analysis was used for this study to identify the attitude of fruits vegetable farmers. It is really vital to determine their attitude in identifying the factors that influencing chemical pesticides use among them in order to achieve the objectives of this study. The results of farmer's attitudes regarding factors that influencing chemical pesticides use was analysed and shown in Table 4.2. The statement of "I'm really interested to involve in fruits vegetable cultivation" has 40.0% of farmers that strongly agree, 54.3% agree, 4.8% average, 1.0% disagree and there were no farmers that strongly disagree with the statement. This statement has shown that the farmers have high interest to involve in fruits vegetable cultivation.

Then, the statement of "I know that the use of chemical pesticides can prevent crop damaged from pest" showed 23.8% of strongly agree, 63.8% of agree, 7.6% of average answers by respondents, 1.9% of disagree and followed by 2.9% of strongly disagree. This shows that the majority of farmers know well regarding the function of using chemical pesticides to their crops. They are sure that chemical pesticides able to prevent their crops from damaged by pests.

After that, "I am aware regarding the impacts of chemical pesticides use towards vegetables production" statement has 28.6% of farmers that strong agree, 60.0% of farmers agree, then about 9.5% farmers that have average answer between agree or disagree, 1.9% farmers disagree and no farmers are found strongly disagree. From this, we can say that most of farmers are aware regarding the impacts of chemical pesticides that they used for their crops. There are only some of farmers do not care much of the

bad impacts that can affect their life and surrounding safety due to their education and knowledge factors.

Then, for “I studied thoroughly regarding pesticides functions before applying it to the vegetables” statement showed that 24.8% of farmers strongly agree, 50.5% of farmers agree, 19.0% of them are answered either agree or disagree. But there were about 4.8% of farmers disagree and 1.0% of them are strongly disagree with the statement. This answer from farmers can be conclude that most of them do study thoroughly about the pesticides that need to be used before applied to the crops. Only some of them do not aware and concern for the pesticides compatibility to certain crops.

Next, the statement is “I believe that chemical pesticides can give the best impacts if use under controlled condition”. The result for this statement showed that 24.8% of farmers strongly agree, 56.2% of farmers agree and about 16.2% of farmers confuse either they agree or not with the statement. This statement also has showed that about 1.9% of farmers do disagree and 1.0% of farmers strongly disagree. From this, it can be proved that most of the farmers do sure they could get the best impacts if they used pesticides for their crops protection. They preferred to use chemical pesticides to get the best impacts for their crops.

Based on the result showed from answered questionnaires, 22.9% of farmers strongly agree with “I choose to use chemical pesticides to control pest problems to the crops” statement. Then it followed by 55.2% of farmers that agree. But there were also some farmers, about 14.3% of them do response either agree or disagree with the statement. Then, the farmers that disagree with this statement also there with 3.8% of response and about 3.8% of farmers strongly disagree. This indicate that majority of

farmers choose and use chemical pesticides for their crops to eliminate pests and resists the diseases carried by pests.

The last statement for this section is “I know regarding the advantages and disadvantages of chemical pesticides use towards crops and users”. Not all farmers aware and know regarding the good and bad of using chemical pesticides but mostly farmers in ECER know the benefits of using chemical pesticides for their crops. The result from the survey showed that 21.9% of farmers strongly agree with statement, 57.1% of farmers do agree while there also 18.1% of farmers that do not know whether they agree or not, still about 2.9% of farmers disagree and there were none of farmers that strongly disagree with the statement. Not all farmers were well-educated to get to know details about the pesticides advantages and disadvantages. Also there were not all the farmers do have desire to know more about pesticides advantages and disadvantages as stated in this simple statement. There were also quite high percentage of farmers confused either they know or not regarding the pesticides advantages and disadvantages.

Hence, the mean score for farmer attitude are M = 4.05. Since this mean value is categorized as high mean value, it can be said that most of farmers do use chemical pesticides to control their crops from pests based on the attitude factor as shown in table 4.3.

Table 4.2: Descriptive Analysis of Attitude of Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER

	Statement	Percentage				
		1*	2*	3*	4*	5*
1	I'm really interested to involve in fruits vegetable cultivation	0.0	1.0	4.8	54.3	40.0
2	I know that the use of chemical pesticides can prevent crop damaged from pest	2.9	1.9	7.6	63.8	23.8
3	I am aware regarding the impacts of chemical pesticides use towards vegetables production	0.0	1.9	9.5	60.0	28.6
4	I studied thoroughly regarding pesticides function before applying it to the vegetables	1.0	4.8	19.0	50.5	24.8
5	I believe that chemical pesticides can give the best impacts if use under controlled condition	1.0	1.9	16.2	56.2	24.8
6	I choose to use chemical pesticides to control pest problems to the crops	3.8	3.8	14.3	55.2	22.9
7	I know regarding the advantages and disadvantages of chemical pesticides use towards crops and users	0.0	2.9	18.1	57.1	21.9

*Indicator: 1. Strongly Disagree 2. Disagree 3. Either Agree or Disagree 5. Strongly Agree

Table 4.3: Mean Score of Attitude

Factors	Frequency	Percentage (%)	Mean	SD
Attitude			4.05	0.47
Low (1.00-2.33)	0	0		
Moderate (2.34-3.67)	17	16.2		
High (3.68-5.00)	88	83.8		

4.1.3 Level of Subjective Norm on Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

Subjective norm has significant impact in influencing fruits vegetable farmers to use pesticides. The result of descriptive statistics of the society that influence framers in using pesticides were shown in table 4.3. As the data shown in the table 4.3, it can be said that the result was socially relevant to the influencing factors. The statement of "experienced farmers suggested to use chemical pesticides to reduce the crop losses" has 13.3% of strongly agree response from farmers. While about 59.0% of farmers agree with the statement, 21.9% either agree or disagree, 4.8% of farmers disagree and also it has about 1.0% of farmer response of strongly disagree with the statement. The result of this statement shows that experienced farmers support and encouragement were very important in influencing farmers to use chemical pesticides in controlling pests that damaging their crops.

While, “pesticides retailer encourages me to use the highest quality of chemical pesticides for faster effects and has lower cost compared to organic pesticides” statement was showing positive results which 18.1% of farmers strongly agree, and 49.5% farmers agree. But there were still some of farmer response toward this statement with 25.7% of either agree or disagree answer, 5.7% disagree and 1.0% of farmers strongly disagree. This statement can be accepted by more than half of the farmers while others do not accept due to some reasons. Pesticides retailers play an important role in influencing farmers to buy and use pesticides for their crops.

Then, the statement of “agriculture department prepared the suitable chemical pesticides lists with the correct and safe ways to control the pests” shows about 28.6% of farmers strongly agree, 49.5% of farmers agree,15.2 % of farmers either agree or disagree, 4.8% of farmers disagree and 1.9% of farmers strongly disagree. The farmers’ responses toward this statement can be classified as only selected farmers that shortlists under agriculture department society will be provided with the facilities as stated in the statement while other farmers that doing the cultivation on themselves need to study and buy the pesticides at the pesticides store. It can be said that agriculture department also need to be more fair in providing such important things in pesticides application.

The statement of “farmers’ friends suggest their most used chemical pesticides for effective pest control” resulted about 18.1% of farmers strongly agree, 56.2% of farmers agree, 19.0% of farmers not sure how to answer, 5.7% of farmers disagree and 1.0% of farmers strongly disagree. This statement actually intended to verify the important society role in influencing fruits vegetable farmers to use chemical pesticide for their crops. From the answers given by the farmers, it shows that most of them were influenced by their friends on how to use pesticides to control pests in their crops.

Farmer's friends are one of the important influencing factors that include in subjective norm category.

About 33.3% of farmers strongly agree, 52.4% agree, 13.3% either agree or disagree, 0% of farmers disagree and 1.0% of them strongly disagree with the statement of "I am confidence that the use of personal protective equipment (PPE) able to protect me during applying the chemical pesticides". It shows that most of the farmers do concern of their safety when applying pesticides. Most of them take serious in wearing the PPE when spraying the chemical pesticides toward their crops. The surrounding people also need to play an important role in convincing all the farmers to take serious in wearing the PPE for the sake of human health and environment.

The next statement from the questionnaires is "Pesticides advertisement on the market influenced me to use chemical pesticides" shows that about 14.3% of farmers strongly agree, 46.7% of them do agree, while 29.5% of them either agree or disagree, 7.6% disagree and there is some of them about 1.9% strongly agree. This statement stated that most of farmers do easily influenced by the advertisement of pesticides for the sake of their crops safety from pests damaged. They also prefer to choose pesticides that have been commonly used to avoid from any losses if the pesticides do not function well in controlling the pests.

Other statement that related on how subjective norm able works in influencing farmers to use pesticides is "my current used of chemical pesticides actually influenced by my previous experience". This statement has very interesting answers because mostly fruits vegetable farmers have more experiences. About 21.0% of farmers strongly agree, 60.0% of them agree while some of them, 18.1% either agree or disagree, 0% disagree and 1.0% of farmers strongly agree with this statement.

Last statement for subjective norm is “my involvement in agriculture courses influenced me to use chemical pesticides” has resulted about 21.0% of farmers strongly disagree, 53.3% agree, 21.9% of them either agree or disagree, 3.8% of farmers disagree and none of them strongly disagree. This statement shows positive responses from farmers which their involvement in any agricultural courses do really influenced them to use pesticides.

In addition, the mean score of subjective norm is M = 3.90. The mean value of this section is categorized as high value that shows farmers are highly influenced by society in using pesticides for their crops as shown in table 4.3.

Table 4.4: Descriptive Analysis of Subjective Norm of Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER

	Statement	Percentage				
		1*	2*	3*	4*	5*
1	Experienced farmers suggested to use chemical pesticides to reduce the crop losses	1.0	4.8	21.9	59.0	13.3
2	Pesticides retailer encourage me to use the highest quality of chemical pesticides for faster effects and has lower cost compared to organic pesticides	1.0	5.7	25.7	49.5	18.1
3	Agriculture department prepared the suitable chemical pesticides list with the correct and safe ways to control the pests	1.9	4.8	15.2	49.5	28.6
4	Farmers friends suggest their most used chemical pesticides for effective pest control	1.0	5.7	19.0	56.2	18.1
5	I am confidence that the use of personal protective equipment (PPE) able to protect me during applying the chemical pesticides	1.0	0.0	13.3	52.4	33.3
6	Pesticides advertisement on the market influenced me to use the chemical pesticides	1.9	7.6	29.5	46.7	14.3
7	My current used of chemical pesticides actually influenced by my previous experience	1.0	0.0	18.1	60.0	21.0
8	My involvement in agriculture courses influenced me to use chemical pesticides	0.0	3.8	21.9	53.3	21.0

*Indicator: 1. Strongly Disagree 2. Disagree 3. Either Agree or Disagree 5. Strongly Agree

Table 4.5: Mean Score of Subjective Norm

Factors	Frequency	Percentage (%)	Mean	SD
Subjective Norm			3.90	0.49
Low (1.00-2.33)	1	1.0		
Moderate (2.34-3.67)	33	31.4		
High (3.68-5.00)	71	67.6		

4.1.4 Level of Perceived Behavioural Control on Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

The result from descriptive analysis of perceived behavioural control regarding factors influencing pesticides use among fruits vegetable farmers in ECER is shown is table 4.4. For the first statement for this section is “It is easy to eliminate the pests in a short time period by using chemical pesticides” shows that 16.2% of farmers strongly agree, 67.6% of farmers agree while there were also some 11.4% of them confused either agree or disagree, 2.9% of farmers disagree and about 1.9% of them strongly disagree. These responses can be considered that farmers can easily using chemical pesticides for their crops.

The next statement is “I am sure that chemical pesticides used are needed to protect the crops from pest attack” shows that most of the farmers do really need the chemical pesticides for their crops. The result shown is about 17.1% of them strongly agree, 63.8% of farmers agree with the statement. While 14.3% of them do response

either agree or disagree, 3.8% of them disagree and 1.0% of farmers are strongly disagree.

For the statement of "I am able to control the pest attack effectively by using chemical pesticides" shows that about 15.2% of farmers are strongly agree. Then, followed by 68.6% of them do agree while 11.4% of farmers either agree or disagree, 3.8% of them disagree and about 1.0% of farmers' responses are strongly disagree with this statement. This statement shows that most of the farmers do agree with the use of chemical pesticides in controlling pests because chemical pesticides able to eliminate the pests just in a short time period.

Then, "If I continue the fruits vegetable business by maintaining the use of chemical pesticides, I am able to gain high profitability" statement resulted about 17.1% of farmers strongly agree, 47.6% of them agree. There were also some farmers do not confident with their answers by respond to either agree or disagree about 30.5%. This statement followed by 3.8% of farmers disagree and 1.0% of them strongly disagree.

After that, the statement of "I am able to use the chemical pesticides without agricultural department observation" shows that 20.0% of farmers strongly agree, and 35.2% of them do agree. Then, some of farmers also response of either agree or disagree are 25.7%. Followed by 12.4% of farmers disagree and 6.7% of farmers strongly disagree. This statement has shown that farmers nowadays are able to conduct on pesticides spraying and calibration on their own without any instructions or observation from agricultural department. They know how to apply the pesticides according to the need for their crops.

The last statement of this section is "It is easy for me to understand how to use the chemical pesticides in the right ways". According to the table 4.4 shows that this

statement has positive responses from the farmers. It has 24.8% of strongly agree and 53.3% of agree responses from farmers. While some farmers also responses about 19.0% of either agree or disagree,1.9 % disagree and 1.0% of farmers strongly disagree with this statement. This statement shows that majority of the farmers do agree that it is not so difficult to apply pesticides according to the right rules and regulations.

According to the recorded data, the mean score of this section is M = 3.84. This mean value is categorized as high mean value for this section, perceived behavioural control.

Table 4.6: Descriptive Analysis of Perceived Behavioral Control of Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER

	Statement	Percentage				
		1*	2*	3*	4*	5*
1	It is easy to eliminate the pests in a short time period by using chemical pesticides	1.9	2.9	11.4	67.6	16.2
2	I am sure that chemical pesticides used are needed to protect the crops from pest attack	1.0	3.8	14.3	63.8	17.1
3	I am able to control the pest attack effectively by using chemical pesticides	1.0	3.8	11.4	68.6	15.2
4	If I continue the fruits vegetable business by maintaining the use of chemical pesticides, I am able to gain high profitability	1.0	3.8	30.5	47.6	17.1
5	I am able to use the chemical pesticides without agricultural department observation	6.7	12.4	25.7	35.2	20.0
6	It easy for me to understand how to use the chemical pesticides in the right ways	1.0	1.9	19.0	53.3	24.8

*Indicator: 1. Strongly Disagree 2. Disagree 3. Either Agree or Disagree 5. Strongly Agree

Table 4.7: Mean Score or Perceived Behavioural Control

Factors	Frequency	Percentage (%)	Mean	SD
Perceived Behavioural Control			3.84	0.62
Low (1.00-2.33)	3	2.9		
Moderate (2.34-3.67)	43	41.0		
High (3.68-5.00)	59	56.2		

4.1.5 Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

For this section, the descriptive analysis was done to identify the factor that influencing chemical pesticides use among fruits vegetable farmers in ECER. The result of responses was shown in table 4.5. For the first statement of this section is “the use of chemical pesticides can speed up the effect of pest control” shows that 15.2% of farmers strongly agree, 67.6% of farmers agree and 15.2% of them confused either agree or disagree. This also followed with 1.0% of farmers disagree and 1.0% of farmers strongly disagree with this statement.

The next statement is “the use of chemical pesticides is able to improve the crops productivity and quality” shows positive feedback from the farmers. They strongly agree and agree with this statement with 19.0% and 61.0% respectively. While, some of them also responses to either agree or disagree about 16.2%, 2.9% of farmers

disagree and 1.0% of them strongly disagree with this statement. This statement has proven that most of the farmers agree that the use of chemical pesticides able to improve their crops quality and productivity.

Then, the statement of this section is “the use of chemical pesticides is able to avoid the worst pest attack towards the crops”. The result in the table shows that 20.0% of farmers strongly agree, 64.8% of farmers agree and 12.4% of them either agree or disagree. But there were also some farmers do disagree and strongly disagree with percentage of 1.0% and 1.9% respectively. This statement has showed that majority of the farmers very sure that chemical pesticides able to protect their crops from hard attack of pests.

After that, the descriptive analysis that shown in the table 4.5 stated that the statement of “the use of chemical pesticides can give positive impacts towards the crops growth” shows that 18.1% of farmers strongly agree, 46.7% of farmers agree followed by 30.5% of farmers either agree or disagree, then about 2.9% of farmers disagree and 1.9% of them strongly disagree. This statement has been agreed by just a few farmers because the misuse and overuse of pesticides also can cause bad effects towards their crops. Positive impacts only occurred when the chemical pesticides were applied correctly.

Last but not least, the statement is “the use of chemical pesticides able to increase my awareness regarding the importance of pests control towards the crops”. This statement shows that 21.0% of farmers strongly agree, 57.1% of them agree. While 18.1% of farmers either agree or disagree with this statement, 3.8% of them disagree and none of farmers strongly disagree. This statement showed that most of the farmers

aware about the impacts of pests attacks if they do not find any other ways of control besides of using biological control that have faster effects towards the pests.

In addition, the mean score of factor influencing pesticides use among fruits vegetable farmers in ECER is M = 392.

Table 4.8: Descriptive Analysis of Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER

	Statement	Percentage				
		1*	2*	3*	4*	5*
1	The use of chemical pesticides can speed up the effect of pest control	1.0	1.0	15.2	67.6	15.2
2	The use of chemical pesticides is able to improve the crops productivity and quality	1.0	2.9	16.2	61.0	19.0
3	The use of chemical pesticides is able to avoid the worst pests attack towards the crops	1.9	1.0	12.4	64.8	20.0
4	The use of chemical pesticides can give positive impacts towards the crops growth	1.9	2.9	30.5	46.7	18.1
5	The use of chemical pesticides able to increase my awareness regarding the importance of pests control towards the crops	0.0	3.8	18.1	57.1	21.0

*Indicator: 1. Strongly Disagree 2. Disagree 3. Either Agree or Disagree 5. Strongly Agree

Table 4.9: Mean Score of Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER

Factors	Frequency	Percentage (%)	Mean	SD
Factor Influencing Chemical Pesticides Use Among Fruits Vegetable Farmers in ECER			3.92	0.59
Low (1.00-2.33)	2	1.9		
Moderate (2.34-3.67)	23	21.9		
High (3.68-5.00)	80	76.2		

4.2 Normality Test

Normality test is used in determining whether the group data is fit as normal distribution or not by undergo the Kolmogorov-Smirnov Test. In order to get the normality of distribution, the significant value must be >0.05 and the Pearson correlation will be used. But if the significant the value is <0.05, the Spearman correlation will be used to justify the normality of the study. From the recorded data, the significant value is 0.000 which is <0.05, so this study was using Spearman correlation.

Table 4.10: Normality Test of Factor Influencing Chemical Pesticides Among Fruits Vegetable Farmers

	Statement	Asymp. Significant (2-tailed)
1	The use of chemical pesticides can speed up the effect of pest control	0.000
2	The use of chemical pesticides is able to improve the crops productivity and quality	0.000
3	The use of chemical pesticides is able to avoid the worst pest attack towards the crops	0.000
4	The use of chemical pesticides can give positive impacts towards the crops growth	0.000
5	The use of chemical pesticides able to increase my awareness regarding the importance of pest control towards the crops	0.000

4.3 Spearman Correlation

Spearman correlation, a non-parametric test was used in this study in order to identify the relationship between attitude, subjective norm and perceived behavioural control towards factor influencing chemical pesticides use among fruit vegetable farmers in ECER. According to Pallant (2005), the purpose of conducting the correlation test was to examine the strength and direction of the relationship that found between the researched variables. This correlation analysis was used in order to complete the third objectives of this study.

Table 4.11: Rules of Thumb for Interpreting the Size of Correlation Coefficient

Size of correlation	Interpretation
0.90 to 1.00 (-0.90 to -1.00)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to -0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0.0 to 0.30 (0.00 to -0.30)	Negligible correlation

Source: Hinkle *et al.,* (2003)

4.3.1 Relationship Between Attitude and Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

The Spearman correlation analysis was applied towards this study in order to determine the relationship between all the independent variables with the dependent variable. The correlation between attitude with factor influencing chemical pesticides use among fruits vegetable farmers in ECER was found significant at the level of 0.510. This correlation values were categorized as moderate positive correlation according to Rules of Thumb. This result showed that there has a relationship between attitude and factor influencing chemical pesticides use among fruits vegetable farmers in ECER. From this, it can be said that farmers showed positive attitude towards factors influencing chemical pesticides used for their crops. This finding can be supported by Mohamed et al. (2018) study stated that education level and knowledge really affected farmers' attitude. This study shows that farmers that have high level of knowledge do have positive attitudes towards factor influencing chemical pesticides use compared to farmers that have low education level.

4.3.2 Relationship Between Subjective Norm and Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

For subjective norm, the result of Spearman correlation analysis was also found significant at the level of 0.658 which can be categorized as moderate positive correlation towards factor influencing chemical pesticides use among fruits vegetable farmers in ECER. This result showed that subjective norm has relationship with the factors that influenced chemical pesticides use among fruits vegetable farmers. The subjective norm, which also known as society influencing factors were very important in influencing farmers in pesticides use. They have high possibilities to influence farmers to use chemical pesticides for their crops. The result of this study also can be supported by Monfared et al. (2015) stated that the subjective norms has significant relationship toward factor influencing chemical pesticides use. This is because the social norm by surrounding really play important role in influencing farmers to use chemical pesticides for many reasons.

4.3.3 Relationship Between Perceived Behavioural Control and Factor Influencing Chemical Pesticide Use Among Fruits Vegetable Farmers in ECER

The Spearman correlation between perceived behavioural control and factor influencing chemical pesticides use among fruits vegetable farmers was significant at the level of 0.577 which was categorized as moderate positive correlation. From this result, it showed that perceived behavioural control has relationship between the factor

influencing chemical pesticides use among fruit vegetable farmers. According to Bond et al. (2012), the perceived behavioural control has strong relationship toward factors influencing chemical pesticides use based on farmers' knowledge on pesticides application in relation of effectiveness. The pesticides knowledge among farmers were vital in order to determine whether it is suitable or not to apply the pesticides according to the types of crops.

Table 4.12: Results of Spearman Correlation

		Attitude	Subjective Norm	Perceived Behavioural Control
Factor influencing chemical pesticides use among fruits vegetable farmers in ECER	Spearman Correlation	0.510**	0.658**	0.577**
	Sig. (2-tailed)	0.000	0.000	0.000

**Correlation is significant at the level 0.01 level (2-tailed)

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarized and reviewed the factors that have been found from this study that influenced the chemical pesticides use among fruits vegetable farmers in ECER. This study put extra focuses on the relationship among three factors which are attitude, subjective norm and perceived behavioural control between factors influencing chemical pesticides use among fruits vegetable farmers in ECER. This chapter summarized the results obtained from the research questionnaires distributed by surveying. Besides that, this chapter also included brief discussion regarding the theoretical and methodological implications of the study.

5.1 Conclusion

In this study, there were three objectives that need to be done in order to get the valid data recorded. First objective was to determine the level of influencing factors chemical pesticides use among fruits vegetable farmers in ECER. While the second

objective of this study was to identify the level of attitude, subjective norm and perceived behavioural control towards factor influencing chemical pesticides use among fruits vegetable farmers in ECER. Then, the third objective was to analyse the relationship between specific attitude, subjective norm and perceived behavioural control on factors influencing pesticides use among fruits vegetable farmers in ECER. Generally, this study achieved all these objectives and answered all the research questions.

In this study, the descriptive analysis and Spearman correlation was applied to discuss the three objectives stated. The descriptive analysis was used in order to discussed the first and second objectives which are to determine the level of influencing factors chemical pesticides use among fruits vegetable farmers in ECER and to identify the level of attitude, subjective norm and perceived behavioural control towards factor influencing chemical pesticides use among fruits vegetable farmers in ECER. Then, this study was used Spearman correlation is to determine whether there was relationship or not between attitudes, subjective norm and perceived behavioural control towards factor influencing chemical pesticides use among fruits vegetable farmers in ECER. The correlation used in this study was decided after run a normality test based on One-Sample Kolmogorov-Smirnov Test. The result showed that the significant value is 0.000 which is not accepted by the normality of distribution theory. So, this study applied Spearman correlation to describe the relationship occurred between independent variables and dependent variables.

From the conducted survey, there were found that not all the farmers were influenced in using chemical pesticides for their crops. Some of them prefer organic pesticides even though the it has quite slow and long period of time to show any effect towards the pests. All the variable used in this study; attitude, subjective norms and

perceived behavioural control has relationship with factor influencing chemical pesticides use among fruits vegetable farmers in ECER.

5.2 Recommendation

So, agricultural department need to pay more attention towards this issues among farmers by suggesting them to use organic pesticides that can give faster effects towards pests or make sure they used the chemical pesticides under control by following the correct rules and regulations so that they confident to use the chemical pesticides for their crops. Besides, for the farmers that have been used chemical pesticides, they need to be guided to ensure that they more aware with the good and bad of the pesticides by providing them a bit professional knowledge through any agricultural courses or training. So that they able to apply the chemical pesticides in such a good way.

Other than that, this study can be improved and the result would be more efficient by adding a new variable such as knowledge in order to identify either it has relationship or not towards factor influencing chemical pesticides use among fruits vegetable farmers in ECER.

REFERENCES

Abd Majid, N. (2017). Agriculture Minister calls on Consumer to Support Local Chillies. Retrieved April 5, 2017 from News Straight Times website: https://www.nst.com.my/news/nation/2017/05/235908/agriculture-minister-calls- consumers-support-local-chillies

Abhilash, P. C., & Singh, N. (2009). Pesticide use and application : An Indian scenario, *165*, 1–12. https://doi.org/10.1016/j.jhazmat.2008.10.061

Afari-Sefa, V., Asare-Bediako, E., Kenyon, L., A. Micah, J. (2015). Pesticides Use Practices and Perceptions of Vegetable Farmers in the Cocoa Belts of the Ashanti and Western Regions of Ghana. *Advances in Crop Science and Technology, 3(3), 1-10.*

Ajzen, I. (1991). The Theory of Planned Behaviour. *Organizational Behaviour and Human Decision Processes, 50(2), 179-211.*

Ajzen, I. (2015). Consumer attitudes and behavior: the theory of planned behavior applied to food consumption decisions. *REA Italian Review of Agricultural Economics Rivista Di Economia Agraria*, *70*(2), 121–138. https://doi.org/10.13128/REA-18003

Alavanja, M. C. R., & States, U. (2009). Introduction : Pesticides Use and Exposure Extensive Worldwide, *24*(4), 303–310.

Ansam, H. Z., Waleed, F. S., & Rahmat, M. S. (2010). Knowledge and practices of pesticide use among farm workers in the West Bank , Palestine : safety implications, 252–261. https://doi.org/10.1007/s12199-010-0136-3

Baral, K., Roy, B. C., Chatterjee, H., Mondal, P., Mondal, D., Ghosh, D., & Talekar, N. S. (2006). *Socio-economic Parameters of Pesticide Use and Assessment of Impact of an IPM Strategy for the Control of Eggplant Fruit and Shoot Borer in West Bengal, India*. *Department for International Development*. https://doi.org/10.1017/CBO9781107415324.004

Birthal, P.S, O.P. Sharma, Sant Kumar and A. Dhandapani, (2000) Pesticide use in rain-fed cotton: frequency, intensity and determinants. *Agricultural Economic Research Review, 13(2), 107-122.*

Bond, J.L., Kriesemer, S.K., Emborg, J.E., and Chadha, M.L. (2009). Understanding Farmers' Pesticides Use in Jharkhand India. *Extension Farming System Journal, 5(1),53-61.*

Cerkauskas, R. (2004). Root-Knot nematodes. Retrieved on March 19, 2018 from The AVRC-The World Vegetable Center website:

Crossman, A. (2018). Understanding Purposive Sampling. Retrieved on April 10, 2018 from ThoughtCo. Website:https://www.thoughtco.com/purposive-sampling-3026727

Damalas,C.A., and Khan, M. (2016). Farmers' Attitudes towards Pesticides Labels: Implications for Personal and Environmental Safety. *International Journal of Pest Management, 62(4), 319-325.*

Dessel, G.V. (2013). Market Research: How to Determine Population and Survey Sam Size? Retrieved from Check Market website: https://www.checkmarket.com/blog/how-to-estimate-your-population-and-survesample-size/

DeVellis R. Scale development (2003): theory and applications: theory and application. Thousand Okas, CA: Sage.

Fong, F. (2018). Illegal Pesticides use Rampant in Cameron Highlands; Toxins Entering Water Supply. Retrieved from New Straits Times website: https://www.nst.com.my/news/nation/2018/04/351767/illegal-pesticide-use-rampant-cameron-highlands-toxins-entering-water

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.

Gogtay, N. J., & Thatte, U. M. (2017). Statistics for researchers principles of correlation analysis. *Journal of The Association of Physicians of India*, *65*(March), 78–81.

Hasbullah, N., Jumaat, A., Mad, M., and Salleh, I. (2014). A Conceptual of Extending the Theory of Planned Behaviour. The Role of Service Quality and Trust in the Consumer Cooperatives. *International Journal of Business and Social science, 5(2), 142-148.*

Hassan, S.M.Z., and Isa, M.L. (1998). Variability in Eggplant (*Solanum melongena* L.) And its Nearest Wild Species as Revealed by Polyacrylamide Gel Electrophoresis of Seed Protein. *Pertanika Journal Tropical Agriculture Science, 21(2), 113-122.*

Hengky, S.H. (2016). Competition Gaps of Tomatoes' Industries in Cameron Highland, Malaysia. *Business and Economic Research, 6, 368-378.*

Heong, K.L., and Escalada, M.M. (1999). Quantifying Rice Farmers' Pest Management Decisions: Beliefs and Subjective Norms in Stem Borer Control. *Crop Protection, 18(5), 315-322.*

Hinkle, Wiersma, & Jurs (2003). Applied Statistics for the Behavioral Sciences (5 th ed.)

Huang, J., Hu, R., Pray, C., Qiao, F., & Rozelle, S. (2003). Biotechnology as an alternative to chemical pesticides: A case study of Bt cotton in China, *Agricultural Economics, 29, 55-57.*

Huo, Y. Q., & Huo, X. J. (2005). Pesticides use on "No-public-harm" vegetables. *Agriculture Knowledge, 12, 12.*

Huque, S.M.R., Hafeez, M.H., and Mohd Shariff, M.N. (2014). The Role of Subjective Norms in Theory of Planned Behaviour in the Context of Organic Food Consumption. B*ritish Food Journal, 116(10), 1561-1580.*

Jamali, A.A., Solangi, A.R., Memon, N., and Nizamani, S.M. (2014). Current Scenario of Pesticides Practices among Farmers for Vegetable Production: A Case study in Lower Sindh, Pakistan. *International Journal of Development and Sustainability, 3(3), 493- 504.*

Jeyanthi, H., Kombairaju, S., (2005). Pesticide Use in Vegetable Crops: Frequency, Intensity, and Determinant Factors. *Agricultural Economics Research Review, 18, 209-221.*

Jin, J., Wanf, W., He, R., and Gong, H. (2017). Pesticides Use and Risks Perception among Small-Scale Farmers in Anqiu County, China. *International Journal of Environmental Research and Public Health, 14(1), 29.*

Kamsia, B., Shahida, M.S., Celestina, A., Suriani, H., Norlita, I., and Khadizah, G. (2014). Knowledge, Attitude, and Practice of Pesticides Use among Oil Palm Smallholders in Sandakan, Sabah. *IOSR Journal of Agriculture and Veterinary Science, 7(11), 18-20.*

Kiriakidis, S. (2016). Perceived Behavioural Control in the Theory of Planned Behaviour: Variability of Conceptualization and Operationalization and Implications for Measurement. *Strategic Innovative Marketing, 197-202.*

Kline, R.B. (2005). Methodology in the social sciences. *Principles and Practices of Structural Equation Modelling (2nd Ed.).* New York, NY, US: Guilford Press.

La Morte, W.W. (2016). The Theory of Planned Behaviour. Retrieved April 2, 2018 from Behavioural Change Models website: http://sphweb.bumc.bu.edu/otlt/MPHModules/SB/BehavioralChangeTheories/BehavioralChangeTheories3.

Li, B.J. (2006). Vegetable diseases control review in China. *China vegetable, 1, 1-5.*

Liu, E.M.; Huang, J.K. Risk preferences and pesticide use by cotton farmers in China. J.Dev. Econ. 2013, 103, 202–215.

Mathur H.B., Agarwal H.C., Johnson S, Saikia N (2005). Analysis of Pesticide residue in blood samples from village of Punjab. CSE Report, India. Pp.1-15.

Mispan, M.R., Haron, S.H., Ismail B.S., Abd Rahman, N.F., Khalid, K., Abdul Rashid M.Z. (2015). The use of Pesticides in Agriculture Area, Cameron Highlands. *International Journal of Scientific Progress and Research (ijspr), 15(1), 19-22.*

Mohd Roff, M.N., Zurina, M., Azizan, A., and Idris, A.B. (2015). Factors Influencing Farmers in Cameron Highlands to Use Insecticides in Cabbage Cultivation. *American -Eurasian J. Agriculture and Environmental Science, 15, 1095-1101.*

Monfared, N., Masoud Y., and Tavakoli, K. (2018). Why Do They Continue to Use Pesticides? The Case of Tomato Growers in Boushehr province in Southern Iran. *Journak of Agricultural Science and Technology 17(3), 557-588.*

Ngowi, A. V. F. (2003). A study of farmers' knowledge, attitude and experiences in the use of pesticides in coffee farming. *Afr. Newslett on occup. Healt Saf., 13, 62.*

Petrea, R.E. (2001). The Theory of Planned Behaviour: Use and Application in Targeting Agricultural Safety and Interventions. *Journal of Agricultural Safety and Health, 81, 787-795.*

Pimentel, D., Acquay, H., Biltonen, M., Rice, P., Silva, M., Nelson, J., Lipner, V., Giordano, S., Horowitz, A., D'Amore, M., 1992. Environmental and human costs of pesticide use. *Bioscience 42, 750–760.*

Rajeshbhu (2012). Cultivation of Brinjal. Retrieved from Agropedia website : http://agropedia.iitk.ac.in/content/cultivation-brinjal

Ramasamy, S. and Ravishankar, M. (2017). Integrated Pest Management Strategies for Tomato Under Protected Structures. *Sustainable Management of Arthropod Pests of Tomato, 313-322.*

Ramaswamy, S. (1992). Pest Control and Environment. Paper presented at the Bangladesh Research Council Seminar on Environment & Agriculture in Bangladesh, September 1992.

Ryckewaert, P., Deguine, J.P., Brevault, T. and Vayssiere, J.F. (2010). Fruit Flies (Diptera: Tephritidae) on Vegetable Crops in Reunion Island (Indian Ocean): State of Knowledge, Control Methods and Prospects for Management. *Fruits, 65(2), 113-130.*

Shakir, S.K., Kanwal, M., Murad, W., Rehman, Z. and S., and Daud, M.K. (2016). Effect of some commonly used of pesticides on seed germination, biomass production, and photosynthetic pigments in tomato (*Lycopersicon esculentum*). *Ecotoxicology, 25(2), 329-341.*

Shodganga. (2013). CHAPTER 7 DESCRIPTIVE ANALYSIS 7.0 Chapter Overview, 39. https://doi.org/10.1016/B978-1-4377-0651-2.10007-4

Stephen, B.M., John, B., Jaafar, Y., Isgouhi, K., and Velerie, M.W. (1998). The Root Knot Nematode Resistance Gene *Mi* from Tomato Is a Member of the Leucine Zipper, Nucleotide Binding, and Leucine-Rich Repeat Family of Plant Genes.

The Plant Cell, 10, 1307-1319.

Talekar, N.S. (Ed.). (1991). Thrips in Southest Asia: proceedings of a regional consultation workshop, Bangkok, Thailand, 3 March 1991. Asian Vegetable Research and development Center, AVRDC Publication No. 91-342, p.74.

Tan, J.L., Peter, A.C.O., and Khoo, G. (2016). Thrips on Eggplant, Chilli and Bell Pepper in Cameron Highlands, Malaysia. *Serangga, 21(1), 71-85.*

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Teng, P. S. et al. (1990). "Crop Loss Assessment: A review of representative approaches and current technology." In *Crop Loss Assessment in Rice.* Los Baňos: International Rice Research Institute.

Wang, Y., Wang, Y., Huo, X., and Zhu, Y. (2015). Why Some Restricted Pesticides Are Still Chosen by Some Farmers in China? Empirical Evidence from a Survey of Vegetable and Apple Growers. *Food Control, 51, 417-424.*

Wang, J., Deng, Y., & Ma, Y. (2017). Relationships between safe pesticide practice and perceived benefits and subjective norm, and the moderation role of information acquisition: Evidence from 971 farmers in China. *International Journal of Environmental Research and Public Health*, *14*(9). https://doi.org/10.3390/ijerph14090962

Wilson, C., & Tisdell, C. (2001). Why farmers continue to use pesticides despite environmental, health and sustainability costs. *Ecological Economics*, *39*(3), 449–462. https://doi.org/10.1016/S0921-8009(01)00238-5

Xu, R., & Kuang, R. (2008). Factors contributing to overuse of pesticides in western China, (December 2014), 37–41. https://doi.org/10.1080/15693430802346543

APPENDIX A

FACTORS INFLUENCING CHEMICAL PESTICIDES USE AMONG FRUITS VEGETABLE FARMERS IN EAST COAST ECONOMIC REGION (ECER)

FINAL YEAR PROJECT

Dear respondents:

1) This research is to:

i. To identify level of influencing factors of chemical pesticides use on fruits vegetable among farmers in East Coast Economic Region (ECER).
ii. To identify the level of attitudes, subjective norms, and perceived behavioural control towards factors that influence chemical pesticides use on fruits vegetable among farmers in East Coast Economic Region (ECER).
iii. To analyse the relationship between specific attitudes, subjective norms and perceived behavioural control on factors that influence chemical pesticides use among farmers on fruits vegetable in East Coast Economic Region (ECER)

Kepada responden:

1) Kajian ini adalah untuk:

i. mengenal pasti tahap faktor yang mempengaruhi penggunaan racun perosak kimia terhadap tanaman sayur buah dalam kalangan petani di ECER.
ii. menilai tahap pengaruh sikap, norma subjektif dan tanggapan kawalan tingkah laku terhadap faktor yang mempengaruhi penggunaan racun perosak kimia kepada tanaman sayur buah dalam kalangan petani di ECER.
iii. Menganalis hubungan antara spesifik sikap, norma subjektif dan kawalan tingkah laku dengan faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani di ECER.

SECTION A/ SEKSYEN A: RESPONDENTS PROFILE/ PROFIL RESPONDENT

Please answer all questions and (√) the appropriate answer.

Sila jawab semua soalan dan (√) pada jawapan yang sesuai.

1.	Gender / *Jantina*:	( ) i. Male / Lelaki ( ) ii. Female / Perempuan
2.	Race / *Bangsa*:	( ) i. Malay / Melayu ( ) ii. Chinese / Cina ( ) iii. Indian / India ( ) iv. Others/Lain-lain, nyatakan : _____
3.	Religion / *Agama*:	( ) i. Islam / Islam ( ) ii. Buddhism/ Buddha ( ) iii. Hinduism / Hindu ( ) iv. Others / Lain-lain nyatakan: _____
4.	Age / *Umur* Please state/ *Nyatakan*:	_____year / tahun
5.	Marital Status/ *Taraf Perkahwinan*:	( ) i. Single / *Bujang* ( ) ii. Married / *Berkahwin* ( ) iii. Others / *Lain-lain* please state/ *nyatakan* _____
7.	Education Level/ *Tahap Pendidikan*:	( ) i. PMR ( ) ii. SPM ( ) iii. Certificate/ *Sijil* ( ) iv. Diploma / *Diploma* ( ) v. Degree/ *Ijazah* ( ) vi. Master/ *Sarjana* /ii. Others / *Lain-lain, nyatakan* _____
9.	Planting Area / *Keluasan Tanaman* Please State / *Nyatakan :*	---------- Acre / *Ekar*

For the questions on **PART B, C, D and E** please read each item and **give your answer by circling the answer option that is appropriate** to the scale of 1 (strongly disagree) to 5 scale (strongly agree).

*Untuk soalan-soalan **BAHAGIAN B, C, D, DAN E**, sila baca setiap item dan **beri jawapan anda dengan membulatkan pada pilihan jawapan yang bersesuaian** dengan mengikut skala 1 (sangat tidak bersetuju) hungga skala 5 (sangat setuju).*

Strongly disagree / Sangat tidak setuju	Disagree / Tidak setuju	Average / Sederhana	Agree / Setuju	Strongly agree / Sangat setuju
1	2	3	4	5

SECTION B/ *SEKSYEN B*: ATTITUDE TOWARD THE BEHAVIOR/ *SIKAP TERHADAP TINGKAH LAKU*

Each statement below represents the attitudes of factors that influenced pesticides use among fruits vegetable farmers in ECER.
Setiap pernyataan di bawah mewakili sikap terhadap faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani sayuran buah di ECER.

In my opinion/ *Saya berpendapat* :						
1.	**I'm really interested to involve in fruits vegetable cultivation.** *Saya sangat berminat untuk melibatkan diri dalam bidang tanaman sayuran buah.*	1	2	3	4	5
2.	**I know that the use of chemical pesticides can prevent crop damaged from pest.** *Saya tahu bahawa penggunaan racun perosak kimia boleh mengelakkan serangan perosak.*	1	2	3	4	5
3.	**I am aware regarding the impacts of chemical pesticides use towards vegetables production.** *Saya sedar mengenai kesan penggunaan racun perosak kimia terhadap pengeluaran tanaman.*	1	2	3	4	5
4.	**I studied thoroughly regarding pesticides functions before applying it to the vegetables.** *Saya mengkaji dengan teliti mengenai fungsi racun perosak kimia sebelum mengaplikasikan kepada tanaman.*	1	2	3	4	5
5.	**I believe that chemical pesticides can give the best impacts if use under controlled condition.**	1	2	3	4	5

	Saya percaya bahawa ia akan memberi impak yang terbaik jika petani menggunakan racun perosak kimia dalam keadaan yang terkawal.					
6.	**I choose to use chemical pesticides to control pest problems to the crops.** *Saya memilih untuk menggunakan racun perosak kimia untuk mengawal perosak terhadap tanaman saya.*	1	2	3	4	5
7.	**I know regarding the advantages and disadvantages of chemical pesticides use towards crops and users.** *Saya tahu tentang kebaikan dan keburukan penggunaan racun perosak kimia terhadap tanaman dan pengguna.*	1	2	3	4	5

SECTION C/ SEKSYEN C: SUBJECTIVE NORM/ NORMA SUBJEKTIF

Each statement below represents the subjective norm of factors influencing pesticides use among fruits vegetable farmers in ECER.
Setiap pernyataan di bawah mewakili norma subjektif terhadap faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani sayur buah di ECER.

In my opinion/ *Saya berpendapat* :						
1.	**Experienced farmers suggested to use chemical pesticides to reduce the crop losses.** *Petani yang berpengalaman menyarankan penggunaan racun perosak kimia bagi mengurangkan kerugian tanaman.*	1	2	3	4	5
2.	**Pesticides retailer encourage me to use the highest quality of chemical pesticides for faster effects and has lower cost compared to organic pesticides.** *Peruncit racun perosak menggalakkan saya menggunakan racun perosak kimia yang berkualiti tinggi untuk kesan yang lebih pantas dan mempunyai harga yang lebih rendah berbanding racun perosak organik.*	1	2	3	4	5
3.	**Agriculture department prepared the suitable chemical pesticides list with the correct and safe ways to control the pests.** *Jabatan pertanian menyediakan senarai racun perosak kimia yang sesuai dengan kaedah yang*	1	2	3	4	5

	betul dan selamat bagi mengawal serangan perosak.					
4.	**Farmers friends suggest their most used chemical pesticides for effective pest control.** *Rakan petani menyarankan racun perosak kimia yang sering digunakan oleh mereka untuk kawalan perosak yang lebih berkesan.*	1	2	3	4	5
5.	**I am confidence that the use of personal protective equipment (PPE) able to protect me during applying the chemical pesticides.** *Penggunaan alat pelindung diri yang betul mampu meyakinkan saya semasa menggunakan racun perosak kimia.*	1	2	3	4	5
6.	**Pesticides advertisement on the market influenced me to use the chemical pesticides.** *Pengiklanan racun di pasaran mempengaruhi saya menggunakan racun perosak kimia.*	1	2	3	4	5
7.	**My current used of chemical pesticides actually influenced by my previous experience.** *Penggunaan racun perosak kimia saya kini sebenarnya dipengaruhi oleh pengalaman saya yang lepas.*	1	2	3	4	5
8.	**My involvement in agriculture courses influenced me to use chemical pesticides.** *Penglibatan dalam kursus pertanian mempengaruhi saya untuk menggunakan racun perosak kimia.*	1	2	3	4	5

SECTION D/ SEKSYEN D: PERCEIVED BEHAVIORAL CONTROL/ TANGGAPAN KAWALAN TINGKAH LAKU

Each statement below represents perceived behavioral control of factors influenced pesticides use among fruits vegetable farmers in ECER.
Setiap pernyataan di bawah mewakili tanggapan kawalan tingkah laku terhadap faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petani tanaman sayur buah di ECER.

In my opinion/ *Saya berpendapat* :						
1.	**It is easy to eliminate the pests in a short time period by using chemical pesticides.** *Adalah mudah bagi saya untuk menghapuskan perosak dalam masa yang singkat dengan menggunakan racun perosak kimia.*	1	2	3	4	5
2.	**I am sure that chemical pesticides used are needed to protect the crops from pest attack.** *Saya yakin penggunaan racun perosak kimia sangat diperlukan untuk melindungi tanaman daripada serangan perosak.*	1	2	3	4	5
3.	**I am able to control the pest attack effectively by using chemical pesticides.** *Saya mampu untuk mengawal serangan perosak dengan lebih berkesan dengan penggunaan racun perosak kimia.*	1	2	3	4	5
4.	**If I continue the fruits vegetable business by maintaining the use of chemical pesticides, I am able to gain high profitability.** *Jika saya mulakan perniagaan sayuran buah dengan mengekalkan penggunaan racun perosak kimia, saya berupaya memperolehi keuntungan yang tinggi.*	1	2	3	4	5
5.	**I am able to use the chemical pesticides without agricultural department observation.** *Saya mampu menggunakan racun perosak kimia tanpa memerlukan pantauan daripada pihak jabatan pertanian.*	1	2	3	4	5
6.	**It is easy for me to understand how to use the chemical pesticides in the right ways.** *Adalah mudah bagi saya untuk memahami cara panggunaan racun perosak kimia mengikut kaedah yang betul.*	1	2	3	4	5

SECTION E/ BAHAGIAN E: FACTORS INFLUENCING CHEMICAL PESTICIDES USE AMONG FRUITS VEGETABLE FARMERS/ FAKTOR YANG MEMPENGARUHI PENGGUNAAN RACUN PEROSAK KIMIA DALAM KALANGAN PETANI SAYURAN BUAH.

Each statement below represents factors that influenced chemical pesticides use among fruits vegetable farmers.
Setiap pernyataan di bawah mewakili faktor yang mempengaruhi penggunaan racun perosak kimia dalam kalangan petai sayuran buah.

Saya berpendapat :						
1.	**The use of chemical pesticides can speed up the effect of pest control.** *Penggunaan racun perosak kimia boleh mempercepatkan kesan kawalan serangga perosak.*	1	2	3	4	5
2.	**The use of chemical pesticides is able to improve the crops productivity and quality.** *Penggunaan racun perosak kimia mampu meningkatkan pengeluaran dan kualiti tanaman.*	1	2	3	4	5
3.	**The use of chemical pesticides is able to avoid the worst pest attacks towards the crops.** *Penggunaan racun perosak kimia berupaya untuk mengelakkan serangan perosak yang teruk terhadap tanaman saya.*	1	2	3	4	5
4.	**The use of chemical pesticides can give positive impacts towards the crops growth.** *Penggunaan racun perosak kimia boleh memberi impak yang positif terhadap pertumbuhan tanaman.*	1	2	3	4	5
5.	**The use of chemical pesticides able to increase my awareness regarding the importance of pests control towards the crops.** *Penggunaan racun perosak kimia mampu meningkatkan kesedaran saya tentang pentingnya kawalan perosak terhadap tanaman.*	1	2	3	4	5