THE EVALUATION OF COGNITIVE ACHIEVEMENT ON AGRICULTURE TRAINING, CASE STUDY: RISK DECREASING PROGRAM IN FARMERS' ILLNESS FROM PESTICIDE EXPOSURE AT SAI THONG TAM BON PA MOK DISTRICT ANG THONG PROVINCE

AMNAJ SEESUWAN

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
(APPROPRIATE TECHNOLOGY FOR RESOURCES AND
ENVIRONMENTAL DEVELOPMENT)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2004**

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was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Appropriate Technology for
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ACKNOWLEDGEMENTS

I am greatly indebted to Associate Professor Sukhum Phoothong, the chairman of the supervising committee, whose advice and correction are invaluable

I would like to thank Assistant Professor Sayam Aroonsrimorakot and Lect. Sukul Suwanatada who are kind and considerate in examing the thesis and give useful advice.

My thanks go to the health officials of Pa Mok District, Sai Thong Health Station, and Ban Pai Thong Health station. The work would not be successful without their helpful cooperation.

I also would like to thank friends and students of the Department of Environment and Resource Science at AT14 who provided support and encouragement.

Last but not least, my special thanks are due to my parents and my wife who regularly support and encourage me to do successful work.

Amnaj Seesuwan

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ABSTRACT

The increasing number of deaths caused by pesticide exposure, has alarmed farmers in particular. This study aimed to evaluate the cognitive achievement resulting from a training program to decrease risk from pesticide use organized by the Ministry of Public Health in 2001. The second objective was to observe some socio-economic factors associated with the technological transfer through such a training program in Sai Thong, Pa Mok distinct, Ang Thong. Eighty agriculturalists who joined the training and 160 who did not attend the training and live in the same area were comparatively observed. Data were collected through questionnaire. Percentage, distribution, average, standard deviation, t-test, chi-square test, one-way analysis, and stepwise multiple regression were adopted as statistical tools.

It was found that the trained agriculturalists had significantly higher knowledge, attitude and behavior on pesticide use than the non-trained group at 0.05 alpha level. Considering single factors, the factors associated with the technology transfer on the use of the pesticide were; age and the size of the family. Access to information was associated with knowledge. Career, income, area of land occupied and access to information were associated with attitude. Age, career, income, area of land occupied and experience in using the pesticide were associated with behavior.

With regard to multiple factors, it was shown that access to information, family size, career, age and training were associated with knowledge R^2=27.7. Also, area of land occupied, career, and age associated with attitude R^2=14.2. Experiences in training, age, career, family size, experience in using pesticides and training in the project were associated with the behavior of the agriculturalists R^2=26.4.

The result suggested that the government agencies should continuously hold and extend the training on pesticide use to improve knowledge attitude and behavior of the agriculturalist.

KEY WORDS: EVALUATION/ TRAINING/ AGRICULTURE/ TECHNOLOGY TRANSFER/

131 pp. ISBN 974-04-5112-8

การประเมินผลสัมฤทธิ์ทางการเรียนรู้จากการฝึกอบรมของเกษตรกรในโครงการลดอัตราเสี่ยงโรคพิษจากสารเคมีป้องกันกำจัดศัตรูพืช ตำบลสายทอง อำเภอป่าโมก จังหวัดอ่างทอง (THE EVALUATION OF COGNITIVE ACHIEVEMENT ON AGRICULTURE TRAINING, CASE STUDY: RISK DECREASING PROGRAM IN FARMERS' ILLNESS FROM PESTICIDE EXPOSURE AT SAI THONG TAM BON PA MOK DISTRICT ANG THONG PROVINCE)

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บทคัดย่อ

เนื่องจากเกษตรกรมีจำนวนการตายจากการได้รับสารเคมีป้องกันกำจัดศัตรูพืชเพิ่มขึ้น การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาประเมินผลสัมฤทธิ์ทางการเรียนรู้จากการฝึกอบรมของเกษตรกร โครงการลดอัตราเสี่ยงโรคพิษจากสารเคมีป้องกันกำจัดศัตรูพืช ซึ่งจัดโดยองค์กรในกระทรวงสาธารณสุข ปี 2544 และปัจจัยที่ผลต่อการถ่ายทอดเทคโนโลยีเกี่ยวกับการใช้สารเคมีกำจัดศัตรูพืชของเกษตรกร ตำบลสายทอง อำเภอป่าโมก จังหวัดอ่างทอง โดยใช้แบบสอบถาม แบ่งออกเป็น 2 กลุ่ม คือ กลุ่มเกษตรกรที่เคยเข้าฝึกอบรม จำนวน 80 คน และกลุ่มเกษตรกรที่ไม่เคยเข้าฝึกอบรม จำนวน 163 คน โดยใช้สถิติ ร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน การทดสอบค่าที ค่าไคแสควร์ การวิเคราะห์ความแปรปรวนทางเดียว และวิเคราะห์การถดถอยพหุแบบขั้นตอน

ผลการศึกษาพบว่าเกษตรกรที่เคยฝึกอบรมมีระดับความรู้ ทัศนคติ และพฤติกรรมเกี่ยวกับการใช้สารเคมีกำจัดศัตรูพืชดีกว่าเกษตรกรที่ไม่เคยฝึกอบรมอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 และปัจจัยที่มีผลการถ่ายทอดเทคโนโลยีเกี่ยวกับการใช้สารเคมีกำจัดศัตรูพืชจากการฝึกอบรมของเกษตรกร ที่แตกต่างกันอย่างมีนัยสำคัญที่ระดับ 0.05 คือ อายุ จำนวนสมาชิกในครัวเรือน และการรับรู้ข่าวสาร มีผลต่อความรู้ ส่วนอาชีพ รายได้ พื้นที่ถือครองทางการเกษตร และการรับรู้ข่าวสารมีผลต่อทัศนคติ และอายุ อาชีพ รายได้ พื้นที่ถือครองทางการเกษตร และประสบการณ์ใช้สารเคมีกำจัดศัตรูพืชมีผลต่อพฤติกรรม เมื่อหาความสัมพันธ์ตัวแปรร่วมพบว่า การรับรู้ข่าวสาร สมาชิกในครัวเรือน อาชีพ อายุ และการฝึกอบรมในโครงการนี้ มีผลต่อความรู้ อธิบายความสัมพันธ์ได้ร้อยละ 27.7 (R^2=27.7) ส่วนพื้นที่ถือครองทางการเกษตร อาชีพ และอายุมีผลต่อทัศนคติ อธิบายความสัมพันธ์ได้ร้อยละ 14.2 (R^2=14.2) และประสบการณ์การฝึกอบรม อายุ อาชีพ สมาชิกในครัวเรือน ประสบการณ์ใช้สารเคมีกำจัดศัตรูพืช และการฝึกอบรมในโครงการนี้มีผลต่อพฤติกรรมของเกษตรกรอธิบายความสัมพันธ์ได้ร้อยละ 26.4 (R^2=26.4)

จากการวิจัยครั้งนี้มีข้อเสนอแนะว่า หน่วยงานของรัฐที่เกี่ยวข้อง ควรส่งเสริมการฝึกอบรมเกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืชอย่างต่อเนื่อง เพราะเป็นกระบวนการที่มีต่อการเพิ่มพูนความรู้ ทัศนคติ และพฤติกรรม เพื่อให้เกษตรกรมีความเข้าใจ เกิดตระหนักและนำไปปฏิบัติได้อย่างถูกต้อง

131 หน้า ISBN 974-04-5112-8

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CHAPTER 1
INTRODUCTION

1.1 Background and statement of problem

Thailand lies in the equator or tropical zone, having a great biodiversity. Its climate is favorable for the spread of pests and insects. Agriculturists have to find out means to prevent and get rid of pests to reduce crop damages. They mainly use pesticide as it is more effective and faster than bio – method (Siriwat Wongsiri, 1993: 55). They use pesticide, as it is quick to kill and destroy pests and diseases. Besides, it can be used with other chemical substances (Khanchai Sombutsiri, 1983: 3). It is likely that chemical use in Thailand is on the rise because pests with long exposure to chemicals develop resistance. Consequently, it is inevitable to increase the chemicals to control pests.

Statistics of chemical import in Thailand from 1993 – 1998 were found to be on the rise. In 2536, about 25, 140 tones of herbicide were imported, in 1994, 29, 718 tones, in 1995, about 32, 248 tones, in 1996 about 42, 198 tones, in 1997 about 42, 240 tones and 1998 about 32, 190 tones respectively. (The Office of Policy and Public Health Plan, and Public Health Division, 1999: 27)

As farmers do not have proper knowledge, and enough care in using chemicals, so chemical residues are found in environment, food and agricultural products. (Wichian Nuttawattananon, 1983: 34)

Chemical use in large amount in inappropriate way from the past to the present results in chemicals being accumulated in food chain and environment. Some insects that are natural enemies of pests are inevitably destroyed as well. If chemicals remain in soil, water and agricultural products, environment will deteriorate. Living organisms are destroyed. Agricultural ecology is affected. Only 25% of chemicals used is beneficial while the remaining 75% remains in the air, water and soil. (Witool

Lianjumroon, 1992: 46) As a result, there are increasing environmental and ecological problems. Chemical residues will then be passed on to the food chain. Humans as the last consumers are inevitably affected.

Living organisms can accumulate the pesticide in bone tissues. Dieldin or heptachlor may be found in plants like carrot. In marine lives, for example, shells which take food present in water, DDT may be found accumulated in the tissues approximately about 70,000 times of DDT in the sea level. In fish, which eat marine plants growing in water which is contaminated with endrin for a couple of months, substances in the body are about 10,000. (Supanee Pimsaman, 1994: 83)

Analysis of chemical residues in soil and water found that the chemicals in soil and water were one of the causes responsible for fish being weak and substantially extinct.

The most apparent case was the epidemic in fish from 1979 onwards. (Witool Lianjumroon, 1992: 47) Wounds found on fish' body caused a great loss. No damage assessment could be made. A number of academics assumed that the major cause of fish's death was toxic accumulated in water (Nuansri Tayapatchara, n.d.: 48). In addition, DDT did not only affect fish life, but also the reproductive system of some bird species. The toxic made the bird eggs rotten and fragile. As a result, some species had been extinct. (Supanee Pimsaman, 1994: 83)

The report of statistics on illness and death relating to the pesticide by the Endemiology Department of the Public Health Ministry (The office of Policy and Environment Planning, 1995: 58) found that from January to December, 1995, the total number of patients who were exposed to the pesticide were 3,354, and a number of deaths were 20, as compared to 3,165 patients and 41 deaths in the corresponding period of the previous year.

The report of the environmental pollution found that in 1994, there were 3,165 patients who got sick due to exposure to the pesticide. Ratio was 5.36 per 100,000. In 1995, the patients were 3,398 or 5.71% per 100,000.

Statistics above cited show that illness and deaths relating pesticide were on the increase. Data of the Sanitation Department in finding out cholinesterace in agriculturists from 1987 – 1998 found that the number of peoples who get exposed to

the pesticide and had abnormal enzyme level between 16 – 21 had not reduced. (The Office of Policy and Public Health Plan, 1999: 126 – 127)

Table 1-1: Level of cholinesterace in agriculturists during 1992 – 1998

Years	Number of farmers	Abnormal	
		Number	Percentage
1992	42,471	8,669	20.41
1993	242,820	48,500	19.97
1994	411,998	72,590	17.62
1995	460,521	78,481	17.04
1996	156,315	40,520	25.92
1997	563,354	89,926	15.96
1998	369,573	77,789	21.05

Source: The Sanitation Department, The Public Health Ministry

Ang Thong has 502,163 rais for agricultural occupation or 81.90% of the province's total areas. Farming areas are 358,657 rais, plantation areas are 38,519 rais, regulation areas are 63,298 rais, vegetable areas are 10,938 rais and others are 29,949 rais. (The province's commerce office, 2001: 10)

A campaign was launched to reduce dangers from the chemical use. Agriculturists (10,627) had their blood checked for cholinesterace. 980 of them were found to have unusually high level, which was higher than the level set up in the 8th Public Health Development plan (1997 – 2001).

Toxic chemicals are to be urgently solved. Knowledge about the chemicals used is extremely important. One is to be aware that the chemicals kill not only insects but also the users directly or indirectly, if the users do not use them with care and proper understanding. (Banpot Na-Pompet, 1986: 59)

For people to have an awareness of environment, responsibility and involvement in maintaining and preserving the environment, education plays a very important part to bring about a right attitude and behavior in preserving the environment. To solve the problems caused by chemical use, it is necessary to apply the educational process to the situations and environment. (Tem–duang Rattanatussanee, et al., 1996: 183 – 184)

The said process can be carried out in and outside the school. Learners should be given chance to make a right decision.

Teaching the environmental issues to the target groups can be undertaken through media, handbooks, texts, educational tour and other means, (Tem–duang Rattanatussanee, et al., 1996: 192 – 194).

One method, which is suitable and widely accepted, is "training". Beach (1970: 613) said training was the process for the person to know and specialize for one objective or another to change a human behavior in the direction required. Thus training is s process of human resource development and crucial for the organizational development. (Nakrob Rawangkan, et al., 1996: 4)

Having been aware of the public health problems, the Ministry of Public Health made an attempt to strengthen a community. The community should have potentials to improve itself and administer well. It should put forward additional demands to the public sector for additional assistance.

The 8th public health development plan (1997 – 2001) featured three activities; human potential development, basic public health work development and community problem solution, and public health service.

The Public Health ministry increases more prevention and solution of pollution and toxic waste with the aims to get families and community to know the dangers of environmental destruction and get involved in activities good for health. People are encouraged to appreciate the environment for humans. They are to be careful in using pesticide and fertilizer. Pesticide and fertilizers should not be excessively used. Natural means should be more used if possible. All – families have to be aware of chemical hazards and residues.

The public health officials have undertaken the training. But no information is available as to how much efficient it is. The present researcher hence became interested in the achievement on the agriculturists, part as far as the training is concerned. The study was conducted on the project to reduce the risk rate posed by the pesticide in agriculturists at the sanitation station of Sai Thong, Pa Mok, Ang Thong. The study was expected to be beneficial to state officials and people involved in imparting knowledge to people to make them aware of the dangers and get involved in preventing and maintaining the environmental quality.

1.2 Concept in research

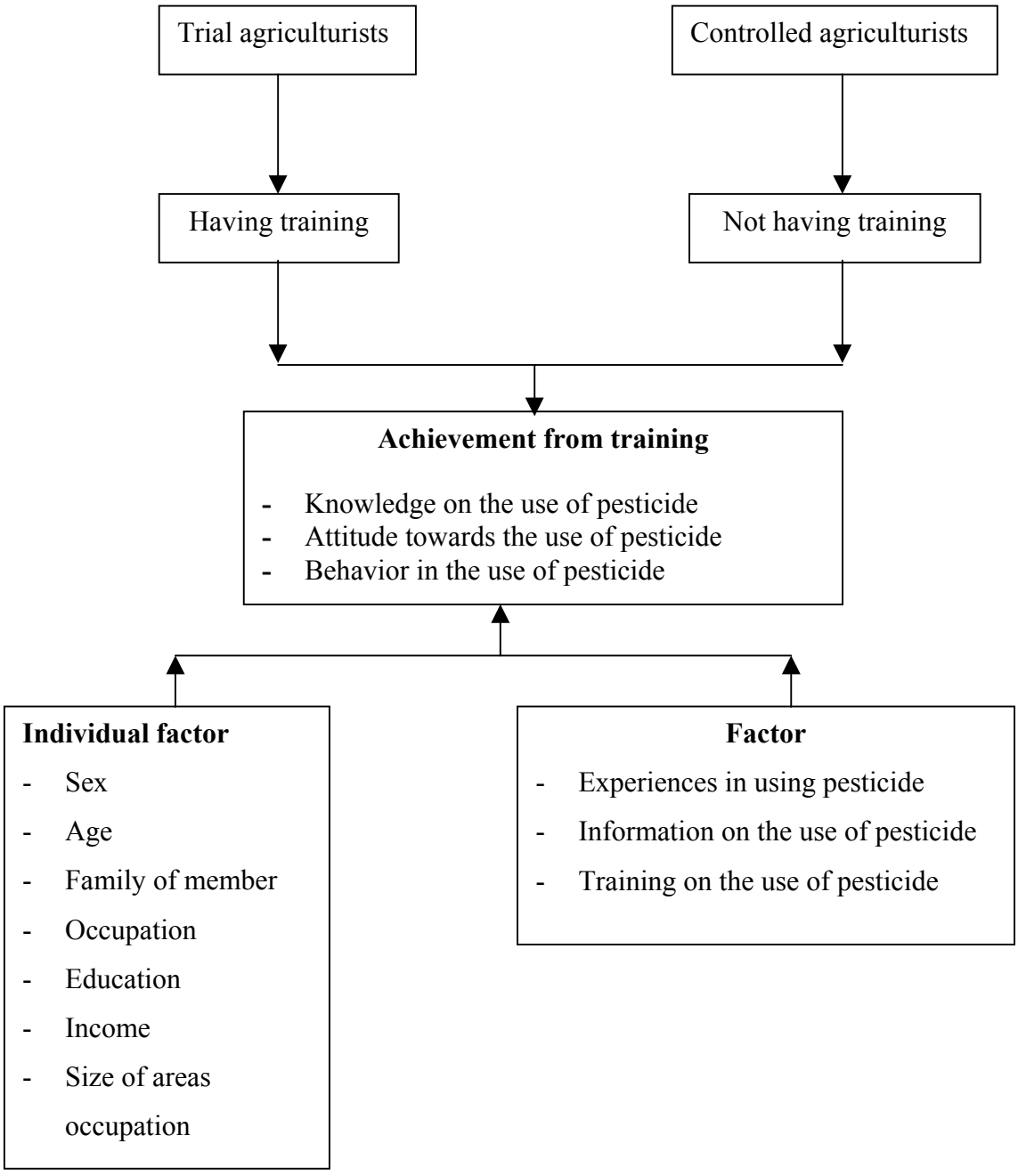

Figure 1-1: The concept framework of research

1.3 Objective of study

1. To carry out a comparative study of achievement in knowledge, attitude and practice of agriculturists between the trained groups and the untrained groups in the project.

2. To study factors affecting the technological transfer concerning the use of pesticide by the agriculturists in the project.

1.4 Scope of study

The research was concerned with the assessment of achievement of learning of agriculturists in the project to reduce illness and diseases from the sue of pesticide, conducted by the sanitation station Sai Thong, Pa Mok in Ang Thong province. Agriculturists were divided into two groups. The first were 163 agriculturists who did not have training and the second groups were 80. The study was carried out one day on August 8, 2001 in the project, which covered the following.

1. Situations and problems in using pesticide
2. Practices in using pesticide
3. Replacement with natural substances
4. Use of equipment
5. Hazards from pesticide
6. First aids after/ if there is exposure to pesticide

Limitations of research

The present study did not cover the training factors; the course structure, media used, academic persons, training duration, training methods.

1.5 Variables used in research

Independent variables

- Population, sex, age, family member, occupation, education, income, area possession.

- Contributing factors regarding the use of pesticide – experiences, information and training.

Dependent variables

- Knowledge
- Attitude
- Behavior

1.6 Hypothesis

1. The agriculturists who underwent the project training had better knowledge, attitude and behavior in using pesticide than their counterparts who did not take part in the project. The statistical significance was 0.05.

2. Different populations had different knowledge, attitude and behavior regarding the use of pesticide.

2.1 Different sex had different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.2 Different age had different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.3 Different family members had different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.4 Different occupations led to different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.5 Different education led to different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.6 Different income led to different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

2.7 Size of area occupation led to different knowledge, attitude and behavior regarding the use of pesticide at the statistical level of 0.05.

3. Contributing factors concerning the use of pesticide were different with respect to knowledge, attitude and behavior in using pesticide.

3.1 Experiences in using the pesticide were different with respect to knowledge, attitude and behavior at the statistical significance of 0.05.

3.2 Different information would lead to different knowledge, attitude and behavior at the statistical significance of 0.05.

3.3 Different training experiences would lead to different knowledge, attitude and behavior at the statistical significance of 0.05.

1.7 Definitions in research

Training is a process of educating, aiming to equip persons with knowledge, skills, attitude and experiences in a given issue. The result of the training was a change of behavior under suitable circumstances and duration.

Agriculturists are those who do general farming.

Occupation is the major career of the farmers.

Pesticide are the chemicals used to control pests and weeds, diseases and others.

Achievement in learning means an assessment of farmers who had received training on the use of pesticide. They were assessed in terms of knowledge, understanding, attitude and behavior.

Size of area occupation means areas used for farming in the previous year. They are measured by rais.

Experiences in training in using pesticide means the persons receiving training on the use of pesticide organized by the government agencies and the private sector.

Transferring technology regarding the pesticide means passing knowledge, experiences and techniques about the pesticide to farmers.

Knowledge on the pesticide means awareness of the fact by agriculturists about the use of pesticide.

Attitude towards the use of pesticide means feeling, opinions or views, agreement or disagreement concerning the use of pesticide.

Behavior in using the pesticide means actual practice or acts of persons in the use of pesticide.

1.8 Expected benefits

1. It is possible to know the success of training on the use of pesticide for further improvement and the result can be applied to other projects.

2. Agriculturists who received training have knowledge, right understanding and proper skills in using pesticide and in preserving the environmental quality, improving the life quality of farmers and consumers.

3. The research can be a means of further training for agencies, officials or people interested.

CHAPTER 2
LITERATURE REVIEWS

The present study reviewed concepts, theories and documents including relevant documents. The literary review was divided into 5 parts.

2.1 Concepts and theories about the pesticide

2.2 Concepts and theories about training

2.3 Concepts and theories about adults learning

2.4 Concepts and theories about knowledge, attitude and behavior

2.5 Relevant researches

2.1 Concepts and theories about the pesticide

Herbicide was not new for agriculturists. It has been used for thousands of years from the time of Greeks, Romans and Chinese. It became more popular in 1941 when Paul Muller (Khanchai Sombutsiri, 1983: 5) discovered the property of DDT in getting rid of insects. It was found that Chinese were the first to use some substance to destroy insects more than two thousands years ago (Knanchai Sombutsiri, 1983: 5, Palab Singhasenee, 1986: 2)

In 1990, tobacco leaves were used to kill beetle, which destroyed pears in Europe.

Persians used Pyrethrum in exterminating fleas in about 1800. Later in 1848, Malaysians used Lotin powder to eliminate insects. (Khanchai Sombutsiri, 1983: 5)

In 938, Gerhard Schrader (quoted in Khanchai Sombutsiri, 1983: 5 – 6) produced a new type of pesticide which consisted of organophosphate, TEPP and Parathion. In 1958, American company Union Carbide could produce a new pesticide,

carbonate, which was less hazardous to humans, but more effective in killing insects. The first drug produced was Carboryl. Another group of drugs in wide use was Pyretroids. In 1973, M. Elliot succeeded in synthesizing Phenothrin and Permithrin, which were endurable to sunlight and effective in destroying pests.

Following a wide use of harmful chemicals, the governments and people around the word were aware of dangers of the substances, thus, they sought other chemicals for example, hormone – like substances to replace the harmful ones. (Palab Singhasenee, 1986: 2)

Thailand first used the chemicals for agriculture in 1950. They were initially used in central Thailand and the lower part of the North. Since then, the chemicals were more used in wider areas. Consequently, Chemical amounts increased rapidly, because new agriculture required fertilizers to yield more products.

In addition, plants were usually grown in the same large land plots. That made it easy for the outbreak of diseases and the spread of pests. Agriculturists were left with no option but to use chemicals. With chemicals long used, pests and weeds developed resistance to the used chemicals. That forced the farmers to use chemicals in greater amounts. (Witool Lianjumroon and Witool panyakul, quoted in Surachai Whankeaw, 1993: 122 –127)

The Ministry of Public Health introduced DDT to exterminate mosquitoes in the project of malaria eradication of WHO. Later on, it used toxic substances to destroy weeds and to increase agricultural yields. At present, there are more than 100 types of toxic chemicals and there are more than 1,000 formulas. They can be divided into there according to their endurance in nature.

Quick – to – dissolve chemicals are those which dissolve within 1 –12 weeks after being used. They included parathion, methyl parathion, malathion and carbonate – meththomil, carboril and carbofuran etc.

Moderate – to – dissolve chemicals will dissolve in 1 – 18 months after being sprayed, for example, 2, 4 D Athrasine etc.

Very slow – to – dissolve chemicals will take at least 2 – 5 years to dissolve. They are chlorinate hydrocarbon. At present, they are no longer used. (Preecha Churepanit, 1986: 7).

Paitoon Pisutsin, et al., (1986: 8 – 9) collected data on toxic materials from the division of plant diseases and agricultural materials, the Agricultural Academy Department and showed the quantity of the chemicals imported since 1987 – 1995. The conclusion drawn was that the overall quantity of chemicals in 1995 was higher than the previous years as shown in the table.

Table 2-1: Shows the quantity (tones) and value (Millions Baht) of the chemicals during 1987 – 1995

Year	Pesticide		Fungicide		Herbicide		Others*		Total	
	quantity	value	quantity	value	quantity	value	quantity	value	quantity	value
1987	6,670	765	6,524	288	5,864	570	1,212	129	20,270	1,752
1988	8,034	1,137	6,382	350	8,273	822	1,562	110	24,251	2,419
1989	9,068	1,206	5,865	367	10,600	1,151	1,364	159	26,897	2,883
1990	9,356	1,472	4,243	311	14,518	1,512	1,346	165	29,463	3,460
1991	7,233	1,244	5,112	371	12,372	1,228	1,343	202	26,060	3,045
1992	7,903	1,386	5,192	441	15,227	1,707	1,535	247	29,857	3,781
1993	7,330	1,193	5,651	438	15,386	1,788	1,329	232	29,696	3,651
1994	7,708	1,151	7,065	534	16,108	1,705	1,393	204	32,274	3,594
1995	10,560	1,644	6,937	603	19,954	2,044	1,303	212	38,754	4,503

Source: The toxic material section, the plant disease and agricultural material division, the Agricultural Academic Department.

2.1.2 Types of pesticide

The Department of Agricultural Extension, (1988: 3 – 7) classified the types of pesticide into two;

1. According to destruction of weeds, chemicals could be divided in four.

1.1 Fatal chemicals were Dildrin, sulfur, and rat substances.

1.2 Chemicals, which destroy by touching, The chemical would spread by touching, for example, spaying or weeds getting contact with the chemicals on the leaves. These chemicals can affect the nerve and breathing

system. Some types like anabesin, nicoltin, pyrethrum, chemiton etc – can harm the plants.

1.3 Chemicals, which were absorbed, The chemicals were sprayed on leaves, trucks, fruits, and roots. They were absorbed to destroy weeds and plant diseases. They became effective by eating or contacting. They were chemiton, forate and newinfort etc.

1.4 Smoke – using chemicals, They were easily volatile, affecting the plant destroyers in form of toxic gas through the breathing system. Toxic gas could be liquid or solid, suitable to control the plant destroyers in a storehouse. They can be used with all types of insects. The said chemicals were nicotine, DDDT, carbonsulphide, ecilinecloride etc.

2. The chemicals, which were classified according to the chemical components, were two; organic and inorganic.

2.1 Organic

2.1.1 Organochlorine pesticides, Important components were carbon, chlorine, hydrogen, and oxygen – DDT, clorobensiret, ethyl, DDT etc. The chemicals can be accumulated and take long time to dissolve, for instance, DDT will take 3 – 10 years to dissolve by half.

2.1.2 Ogranophosphate pesticides were highly effective to destroy weeds. They were toxic to pests, vertebrate and humans. But they were not endurable, quick to dissolve. Besides, they were toxic to bees and fish, etc. They included malation, kriclophon, dimatethonate.

2.1.3 Carbanate was the substance, not highly toxic to mammals. They were left over in environment and plants for a short time. They were carbaril, methomile etc.

2.1.4 Formadens was the pesticide, which could affect eggs and destroy worms. It could be used to control pests, which were resistant to organohposphate and carbanate.

2.1.5 Synthetic pyrethroid had low toxicity to mammals and birds. But it was highly toxic to fish, easy to get dissolved in soil. There was no residue of it. Disadvantages were; it was hazardous to bees and other useful insects. Pests could quickly develop resistance.

2.2 Inorganic

It was a pesticide which was a by – product of super phosphate fertilizer, sulfur and borax. Many types of these chemicals were hazardous to humans, and so not appropriate to use.

2.1.3 Types of pesticide

Pesticide could be classified into six major types, (Siriwat Wongsiri, 1983: 61 – 62).

1. Insecticide and Acaricide were toxic materials used to destroy insects and pests. They might be organic or inorganic or might naturally be available.

2. Herbicide was used to destroy weeds.

3. Fungicide and bactericide were toxic wastes used to prevent and exterminate plant diseases and fungi.

4. Rodenticide was a toxic material used to exterminate rats and rodents. It proved fatally hazardous to warm – blooded animals as it could destroy the heart function and nerve center.

5. Nematicide was used to exterminate worms that destroyed plants.

6. Molluscicide

The chemicals above mentioned were used, not to treat, but to prevent plants from diseases. Diseases were prevented from coming into contact with plants directly. These chemicals were used to immunize the plants and stop the growth of weeds.

2.1.4 Toxicity and hazard of pesticide

If the chemicals are carelessly used, they can harm other living beings including humans. Siriwat Wongsiri, (1983: 63) said the trial of toxicity of the chemicals on the animals could be carried out in three ways.

1. It was the acute oral LD_{50}. It was the most widely used.

2. It was the acute deral $LD_{50.}$

3. It was on halation $LC_{50.}$

Adisak Baunkeeyapan, (quoted in Temdueng Rattanatussanee, et al., 1986: 143) said the standard of measuring toxicity was called LC_{50} or Lethal Dose. 50 meant the quantity of toxic substance which caused trial animals to die by half (50%). The measuring unit was milligram of the substance per a kilogram of the trial animal.

(LC_{50}) Lethal concentrate (mg/ l) was the pesticide spread in the ratio of milligram of water or air, which was responsible for the death by half of trial animals (Siriwat Wongsiri, 1983: 63).

But generally the level of toxicity was measured through oral or skin toxicity. Danger level of the chemicals was illustrated as follows.

Table2-2: The danger level of chemicals on trial animals

Types	Danger Scale	Oral*		Skin*	
		powder	Liquid	Powder	liquid
Ia	Most dangerous	<5	<20	<10	<40
Ib	Dangerous	5-50	20-200	10-100	40-400
II	Moderately dangerous	50-500	200-2,000	100-1,000	400-4,000
III	Low dangerous	>500	>2,000	>1,000	>4,000

*Value LD_{50} for mouse Mg/kg

It can be concluded that the chemicals used in agriculture show different scales of toxicity. They can be hazardous to both animals and humans if they are used without proper care.

2.1.5 Formulas of pesticide

The chemicals are in different forms, for instance, powder, liquid, tablet etc. They are composed of two parts; effective and ineffective. Siriwat Wongsiri, (1983: 67 – 69) said the effective part was the chemical which had direct effect, or it could mean adjuvant. Label and percentage of this type would be shown for the users.

The ineffective part was the substances not directly affecting weeds. It contributed in other aspects, for example, it can lessen the effective substance to be less toxic to the users.

Chemicals are primarily in the form of oil. So they are not soluble in water. Some are soluble, but excessively toxic. Thus, there is a mixture of chemicals in different forms. (The Department of Medical Science, 1988: 1 – 2)

1. Water dispersible powder or notable powder or WDP or WP for short. It has effective substance and carrier substance – white soil powder.

2. Emulsifiable Concentrate or EC for short. It has the effective substance and soluble agent that cannot be mixed with water. This type is the most widely used.

3. Solution concentrate, water soluble concentrate, liquids, liquid concentrate or known as SC, WSC, SCW LC. The chemical has the effective agent and the soluble agent that can be mixed in water without emulsifier.

4. Suspension concentrates, flowable formulation. The chemical is ground with carrier agent, then mixed with water. It turns out like the mixture of chemical with powder.

5. Water soluble powder or WSP or SP for short. It can be produced in tablets, can immediately dissolve in water. It can easily dissolve in water and does not form sediment.

6. Dust or D, It can be produced by grinding the effective agent and then mixing with the non- active agent.

7. Granule (G), It is similar to powder, but with larger size. Its compounds are active agent and carrier substances. This type of chemicals can be used only through soil. It is active by roots. Using it in water must be avoided because it is extremely dangerous and it takes time to dissolve.

8. Ultra – low – valume (ULV), It has an active compound and low volatility. It is to be sprayed by machine.

2.1.6 Problems and effects from pesticide

It is important to consider the ends and relations as far as the use of pesticide is concerned. Witool Lianjumroon, (1992: 46) said only 25% of chemicals used were beneficial while the remaining 75% would be present in the soil, water and air. It was apparent that agriculturists used the chemicals more than necessary. That could lead to more spending and could be harmful to the users as well.

According to (Siriwat Wongsiri, 1983: 70 – 79), with the chemicals wrongly used, the ecological system would inevitably be affected and destroyed. The problems that were identified were;

1. Pesticide resistance

If the pesticide had been continuously used for 2 – 3 years, pests could develop resistance. That forced the agriculturists to use more pesticide. The serious consequence was the insects became more abundant as they become resistant to the pesticide. At present there are more than 200 species of insects that could be resistant to the pesticide. (Siriwat Wongsiri, 1983: 20)

2. Resurgent outbreak

As the pests were resistant to the pesticide, and the chemicals killed the species which were useful in controlling the pests, it turned out that the pests spread more quickly and seriously.

3. Problems to environment and living things

All types of pesticide and herbicide were toxic. They took one week to ten years to dissolve or they would never dissolve at all. If they were accumulated in the environment, living beings in nature and environment were affected. The problems were;

3.1 Pesticide in food chain and body of living things

Chemicals in food chain came from dissolution of the pesticide. Some type did not well dissolve in water, for example, DDT could only dissolve by 0.02 in ppm. Therefore, residues of DDT were found in the marine species. The accumulation would multiply according to the food chain of living things. (Siriwat Wongsiri, 1983: 79) The marine species that had the chemicals in their bodies

were consumed by other beings like birds, snakes, or humans. As a result, chemicals like DDT would get transferred into food chain (Witool Lianjumroon, 1994: 46 – 47)

3.2 The pesticide in air and water;

The pesticide, which was sprayed especially when it was sprayed by the aeroplane, would spread through the air. Some chemicals like DDT could be in the air for years. Small marine species accumulate the chemicals in their body, and eventually were extinct.

3.3 The pesticide in soil

There were chemical residues because;

1. Pull by soil particles depended on the soil types and molecules of soil organic substance were attached to the pesticide.
2. Water flow
3. Volatility
4. Chemical dissolution by soil organisms
5. Chemical dissolution by reaction of soil chemicals
6. Chemical dissolution by sunlight
7. Absorption of particles of the pesticide into plants and soil living organisms (Siriwat Wongsiri, 1983: 77)

3.4 Chemical Residues in Species and Plants used as food.

Chemical use for agricultural purpose brought about accumulation of toxic in foods at an alarmingly high level. Vegetables for sales had a high level of chemicals and were unsafe to eat. Some vegetables had the chemical residues exceeding the standard set by FAO and WHO. It was the case with fruits and meats. It was found that 70.2% of the samples examined had organoclorine and organophostphate. (Witool Lianjumroon and Witool Panyakul in Surachai Whankeaw, 1993: 133 – 135)

4. Effects of pesticide

4.1 Ecological effects

Some toxic chemicals made fish ill and extinct as it occurred in Thailand since 1979. (Witool Lianjumroon, 1992: 47) Assumption for the fish death was the toxic chemicals were the key culprits.

DDT could have adverse effect on the reproductive system of some bird species. As a consequence, some species had disappeared. (Supanee Pimsaman, 1984: 83)

4.2 Effects on humans and other living beings

The pesticide could harm plants, animals and humans. With the chemicals accumulated in the body through the food chain, there were changes in the organ system and behaviors of living beings, for example, reproduction, migration and growth etc. According to Preeya Kullavanich, (2535: 228-229) the pesticide could adversely affect the body systems like skin, respiratory system, nerve system, food tract and urinary system. The Endemiology Department of the Public Health Ministry reported deaths and illnesses relating to the pesticide. In 1994, there were 3,165 patients or 5.36% per 100,000 and 41 deaths.

The majority of patients were in working age, 25 – 34 years, 15 –24 years and 35 – 44 years respectively. In 1995, the rate raise to 5.65% per hundred thousand. According to Somchai Pattananon, (quoted in Tassanee Nan-udon, 1996: 23), the chemicals that were the cause of illness and death mainly belonged to organophosphate by 55.37%, belonged to the herbicide by 25.34% and to carbanate by 13.34%.

2.1.7 Principles in selection and usage of the pesticide

Correct usage of the pesticide was very important in order to gain maximum effect and avoid the side effect. The principles in using could be said as follows; (Siriporn Janjiam, 1992: 45 – 51)

2.1.7.1 Selection

1. It is essential to know the types of insects or pests to be exterminated so that the effective pesticide could be selected accordingly.

2. The users have to choose the pesticide which dissolves quickly to reduce the toxic residues in environment.

3. The users should buy the pesticide as allowed by the Act of the Toxic Materials.

3.1 The pesticide has the mark of the skull with bone cross. The word “toxic material” is clearly written.

3.2 Chemicals and common names of active agents and trace are given.

3.3 Names of producers and sources are written.

3.4 Quantity of active substances and others is mentioned.

3.5 Expiry date is shown.

3.6 Explanations of how to use and keep and warnings are provided.

3.7 Toxicity, first aid treatment, and advice are given.

4. The users have to choose the herbicide less harmful to humans, warm – blooded animals and other useful species, but more toxic to those to be eliminated.

5. Choose the chemicals not toxic to plants to be grown.

6. For the pests with slow movement, use the chemicals that dissolve quickly, for example, organopjhosphate and carbonate.

7. For pests which destroy tissues and roots, use the pesticide whose residues last long.

8. For pests that eat trunk or destroy the interior parts, choose the pesticide that kills by touching or it’s to toxic residues last long, for example, organophostphate and carbonate.

9. For pests that lay eggs on the vegetables, use the pesticide whose residues do not last long because the vegetable age is relatively short.

2.1.7.2 Principles in using the pesticide

1. Carefully read the label before use.

2. Use the pesticide in a appropriate amount. A suitable concentration is explained on the label. Users are required to strictly observe the instructions.

3. Do not use hands to mix the chemicals.

4. Avoid breathing in the chemicals while mixing or spraying the pesticide.

5. While working, wear protective gears.

6. Spray the pesticide in an appropriate time – in the morning or evening. Some chemicals, when sprayed before rain, get diluted and are not effective.

7. Keep children or pets away from the site where the pesticide is used.

8. While spraying, be careful not to let dust fly to residences and water wells. Water jars or containers have to be properly closed.

9. Do not drink, eat or smoke while spraying the pesticide.

10. Be careful not to get in contact with the pesticide.

11. After spraying, clean the body.

12. If exposed to the chemicals, follow the instructions on the label, and see the doctor immediately.

2.1.7.3 Keeping the pesticide

1. If possible, have a separate place to keep the pesticide.

2. Keep the pesticide in the room and keep in the locked.

3. The room where the pesticide is kept should have good air ventilation.

4. Do not keep the pesticide close to foods of human or animals and close to plant seeds.

5. Keep the pesticide in the container well closed. Keep checking for leakage.

6. Do not keep different types of the pesticide together.

7. The container of liquid should be placed on the cushion stick so that the container will not get rusty.

8. Do not keep the pesticide in a great amount. That can be done by properly calculating the sufficient amount while using.

9. Destroy the pesticide when it begins to dissolve. It can be seen from the following.

Formulas	Sign of dissolving
Concentrated Liquid.	Not white when mixed with water.
Powder to dissolve in water.	Gets combined. Not float in water.
Powder	Gets combined.
Tablets	Gets combined and liquid.

10. Storehouse should have the fire extinguisher.

11. Water pipe, water and soaps should be available in case of accident.

12. If some amount of the pesticide is to be kept in a house, keep it in a dry cabinet and away from children and pests.

2.1.7.4 Ways of destroying the containers and the remaining chemicals.

1. Burning the box container, the paper and plastic bags. Burning is the most suitable if the incinerator is available. For a proper burning, temperature should not be less than 1,100 c. If there is no incinerators, care must be given to prevent smoke from reaching humans, pets. The ashes should be buried well and away from water sources.

2. Metal containers, buckets, bottles should be properly buried. Before being buried, they should thoroughly be cleaned. They have to be buried in non- cultivated areas, away from water sources. The hole has to be deep enough and is clearly marked.

3. Remains of the pesticide, Remains of the pesticide in any form must be buried. Selecting the site for burning is very crucial because the pesticide can penetrate, water sources or destroys the nearby environment. The burning site must be clearly marked. Warnings are to be given.

2.1.8 Mixed prevention

Toxic synthetic materials used to control and get rid of pests can prove hazardous to the environment and users. In addition, pests become resistant to the pesticide. And new species of pests are born. Thus it is necessary to find out a better way to cope with this. The new method called "Prevention and Elimination of pests" with combined means has the following details. (The Department of Agricultural Extension, 1996: 1 – 8)

2.1.8.1 Definitions of the new method

It is a combination of various methods found suitable. No any specific method is used.

2.1.8.2 Different ways of the new method

1. Natural way

In this way, nature, sunlight, rainwater and moisture control the pests and weeds.

2. Mechanical way

Equipment and tools – rat trap, net, wrapping – are used.

3. Physical way

Neon light is used to lure aphids before rice cultivation and harvest. The disadvantage is the insects useful may be destroyed as well.

4. Agricultural activity

This often over looked way is very crucial. Land conditions should be adjusted in such a way that they are unfavorable to the growth and spread of pests. Included in this method are soil preparation, good air ventilation, proper temperature, proper moisture, pruning and weed destruction etc.

5. Cultivation of circulatory plants and of plants of more than one type for example, growing peanuts and soybean in the rainy season.

6. Resistant gene

It is to be careful in selecting the gene types suitable and resistant when there is an outbreak of diseases.

7. Biological method

It is the method using living things to control pests, for example, NPV virus is used to contain worms etc.

8. Using the pesticide by spraying and mixing with seeds is very dangerous. Therefore, it is very important to consider the right type of the pesticide and strictly observe the instructions. If possible, choose the pesticide least harmful to the environment.

2.2 Concepts and theories about training

Concerning Personnel Development and Training

2.2.1 Definitions

Man plays a very important role for organization. Goals, no matter how good they are, may bot be successful it the persons lack knowledge, understanding, competence or expertise. Therefore, personnel development requires a good plan, especially, for the large organizations. Development and quality improvements vary, depending on responsibility and practice. This particular development is important for the organization function.

According Theera Prawalpruks (1995: 2), the personnel development is implementation to increase knowledge, skill and attitude in the tasks assigned.

Nadler (1980: 5) defined the personnel development as the cooperation for the staff to gain experiences and learning at a particular time to bring about capacity and progress.

Pace (1991: 6) said “the personnel development is an integrated combination of human roles concerning self – development, vocational development to generate a better quality that leads to a better production, satisfaction and more effectiveness”

Jira Hongladarom (1990: 5 – 6) said, "the personnel development is not only giving knowledge, skills and experiences acquired from training, but it is making full use of individual potentials"

The personnel development is divided into two. (Theera Prawalpruks, 1995: 2)

1. Qualification increase

This type of the personnel development is mainly carried outs in the bureaucratic system and state enterprise.

2. Potential reinforcement

That can be done by training short – term course etc. This type is more popular because it takes less time to develop the personnel. Besides, it is worth investing.

2.2.2 Activities in the personnel development

Nadler and Nadler (1989: 6) classified the personnel development into three types.

Training is the process affecting behavior or skills in works. Its aim is to equip the personnel with skills, knowledge and attitude that are relevant to the organization targets.

Education is a learning activity of a system of information processing. Its aims are to prepare the personnel for knowledge, skills and values necessary for life.

Development is a process of the growth or expansion of the organization. Its aims are to build confidence for organization considering the personnel, technology and equipment.

Pace (1991: 3 – 6) proposed the activities of the organization which are related to development as follows,

1. Individual training and development enable individuals do know strength and weakness of their own. That can increase the efficiency.

2. Vocational development focuses on the relationship between the personal targets and the organization's targets.

3. Organizational development is concerned with the structure and function of the organization, including the organizational change to bring about the effective relationship.

2.2.3 Definition of training

Training in general means giving knowledge to the ones being trained. It also includes simple practice. At present training has a broader sense, covering ways of importing to increase knowledge, skills and experiences. It can be used to develop a learning process of individuals, ranging from working skills, attitude and behavior.

According to Nattapang Khejoranan, (1998: 136 – 177), training is the process in making the trainee get knowledge, increase potentials including the behavioral change.

Chanchai Ajinsmajan, (1995: 18) said training is the process from which the persons will gain knowledge and skills.

2.2.4 Significance of training

The 8th National Economic and Social Development Plan emphasized on humans as major and valuable resources in the organizations. Hence it is necessary to improve the persons, quality, knowledge and capacity to be competitive. (Chongkolnee Chutimatewin, 1999: 4)

Training has many advantages. (Theera Prawalpruks, 1995: 7)

1. The working system becomes better and more effective thanks to training.

2. Training saves spending. Trained personnel require less time in operating, hence less spending.

3. Training shortens time in learning. The personnel can function immediately after training.

4. Training reduces the burden of executives.

5. Training encourages development.

6. Training boosts the morale of workers, as they are confident that they can perform better.

7. Training gives the personnel positive attitudes to organization.

2.2.5 Types of training

Training can be divided as follows; (Theera Prawalpruks, 1995: 61 – 62)

1. Training is divided according to before and after work.

1.1 Pre – Service training, for example, orientation and induction training.

1.2 In – Service training, for example, coaching, and demonstration.

2. Training is divided according to the number of trainees.

2.1 Individual Training

2.2 Group Training

3. Objectives of Training are divided into two types;

3.1 Training for Promotion

It is arranged for those getting more responsibility. The methods used are mock play, case study and modeling behavior.

3.2 Training to enhance the Potentials

It is arranged for both the executives and practitioners to perform more effectively.

Reinforcement straining can be carried out as follows;

- Training on human relation for the executives. The techniques used are lecture and mock play.

- Training on general education to better understand new administration and organization, the operation in the present or in the future.

- Skill training – for example, use of technology or tools in the plants. Techniques used are demonstration, situation simulation and practice in the actual situation.

- Self – development to encourage the persons to seek more knowledge. It can be implemented by studying texts, documents, interviews etc.

4. Training is divided according to the methods;

4.1 On – the – job – training is the actual practice to increase skill in carrying out the jobs.

4.2 Off – the job – training prepares the worker for the actual practice. Some types of jobs require specialization. Techniques may be lecture, demonstration, trials etc.

2.2.6 Benefits of training

Training gives numerous benefits. The following are the benefits from training.

1. Training increases the work efficiency. Besides, it encourages the persons to develop more interest in works, and be more capable to perform effectively.

2. Training saves spending,

Having been adequately trained, the workers are capable to work more effectively, thus being able to avoid unnecessary damages.

3. Training reduces time, which is taken by the personnel, as the persons have learned in advance the nature of works they are to do.

4. Training can ease and reduce the burden and responsibilities of a foreman. The supervisor does not need to give advice to new workers.

5. Training plays a crucial role in encouraging the employees to work for their promotion. Many organizations will consider the personnel who underwent training for higher promotion.

2.2.7 Processes in training

There are 8 steps of training.

1. Need analysis

The training organizers have to study and analyze the needs of the target groups. The needs may come from defects or work – related problems.

2. Need examination

The organizers have to take into account priority, and relevant factors – budget, man force and duration.

3. Training program design

The organizers have to consider types of training, topics, the member of trainees, venues and equipment.

4. Program proposal

Having surveyed and planned the training, the organizers have to prepare it to the senior executives for the success of the project.

5. Regulation on training

With the project approved by the executives, the organizers have to issue regulations on training.

6. Training

The organizers admit and choose the target groups, organize the venue for the purpose.

7. Evaluation

It is done to see whether the training achieves the targets or not, what are the obstacles and problems.

8. Follow – Up

It is a crucial step. It is important for the organizers to follow the outcome and study how much the project is successful and whether or not the trainees change.

2.2.8 Techniques of training

There are several techniques. Only some are to be explained (Jindaluk Watanasin, 1990: 15 – 27)

1. Lecture

It is widely used in the educational institutes. A lecturer speaks in front of audiences. The assumption is that the lecturer is a learned person who can give knowledge and ideas to the audiences. The lecturer may give chances to the audiences to ask questions.

2. Conference

It aims to collect and give attention to opinions from participants. It is complementary to the lecture.

3. Case study

This specific technique is appropriate for training on the person administration. Better understanding does not only arise from learning, but also from studying the examples of training and comparing.

4. Role playing

The technique is used along with lecture and conference. Participants are given mock roles. They should prepare and know how to react towards the situations that have arisen.

5. Demonstration

In this technique, the person must demonstrate how to use some equipment – for example, assembling, de – assembling, installing, controlling and using etc.

6. Programmed instruction or Teaching machine

The essence of this technique is that a learner can learn by himself. Tools, not teachers, are necessary. The learners can, under the programmed instruction, answer the questions and assemble the equipment. The process will be repeated if there are mistakes. If the questions are wrongly answered, they are repeated to bring about understanding and knowledge.

7. Sensitivity training or T – Group training

It aims at establishing the cooperation or human relations, which is different from other technique, which focus on skills or works.

8. Workshop

It aims to enhance skills and expertise. Participants jointly discuss problems, study, analyze and exchange opinions. It is important to prepare documents and information for further research.

9. Syndicate method

In this technique, participants are divided into small groups. Each group is then given tasks. Group division aims for different opinions or conclusions.

10. Management games

This particular technique is used for those in higher positions. The participants are given the roles and responsibility in the situations which are like real ones. The participants have to deal with and solve the problems.

11. Incident method

Events happening in works are told or presented to the participants so that they can understand and apply to the actual circumstances. The technique can be concluded in 2 ways.

1.The academic persons themselves tell the events.

2. Performance is used.

2.2.9 Indirect training

In developing the persons, besides training, there are other techniques in the process.

1. Under study

The persons are assigned to study works under their responsibility. There are no changes of positions. Those who are under study still retain their positions.

2. Acting

The person can act like the real position holder. He or she can issue orders. One of the aims of this method is the practitioner gets a chance of learning jobs in higher position.

3. Observation

The observation is not restricted only to a place. It can be anywhere. It is used when there are new changes – a new working system, new equipment.

4. Job rotation

The aim is to enable the practitioner to get more experiences. It is a technique popularly used in the development.

5. Coaching

It is an effective method in the personal development. The head or commander will teach subordinates one by one.

The training methods above described are widely used. The organizers may take resort to any sort of these, or combined methods to bring about the maximum benefits and the more efficiency.

2.3 Concepts and theories about adults learning

2.3.1 Concepts and theories of learning (The Department of Communal Development, The Training Division, 1993: 10)

Learning and social changes

As education is a life – long process, it is the activity to be carried out along with living. Education can suitably contribute to fulfillment of human needs, to creative adjustment.

Daily living as the experiences of learning.

Confucius, Chinese philosopher, spoke of an experience – based learning as follows;

I hear and I forget.

I see and I remember.

I do and I understand.

That means knowledge and understanding arise from direct experiences. In our daily life, a learning process is all the time going on. So learning is a continuation from life experience.

Learning process and problem pollution

Kert Lewin, (quoted in The Department of Communal Development , The Training Division, 1993: 12) an American psychologist, proposed a theory that re–education was a process to solve the problems caused by a group conflict. He said re–education is a learning process, which can lead to changes. According to Lewin, there are two conditions for the re – education to be successful. First, individuals have to take part with others to find out defects, and then improve them. Second, there must be a guarantee for freedom of members to accept or deny new values, new knowledge.

Malcolm S. Knowles, (quoted in Siriporn Jiamjan, 1992: 84) concluded the theory of learning for adults as follows;

1. Needs and interests in life situation; Adults can learn well if things are related to their needs and interests.

2. Analysis of experience; Experiences are the source of learning for adults. So it is important to analyze what experiences can be used in the process.

3. Self – directing; Adults want to be capable to direct themselves. Thus, teachers' role should be more concerned with manual inquiry than with passing knowledge.

4. Individual difference will increase, as individuals grow old. Ability to learn depends on the individual competence.

Achone F. George, (quoted in Ratana Sanimthong, 1984: 49) proposed the roles of learners – teachers in the process that the teachers in learning process for adults have to be changed from a teacher to a learning facilitator.

1. Teachers have to contribute to analysis of problems, and design of learning experiences.

2. Teachers have to understand the environment and create the atmosphere favorable to the adults' learning.

2.1 The adult learning can work well if the adults are actively involved. The popularly used techniques are discussion, team – work etc.

2.2 Experiences taught have to be relevant to their actual life.

2.3 Adults are willing to accept new concepts providing that they are compatible with the old ones.

2.4 Learners' needs are to be studied to be use as means in learning.

2.5 Teachers create a relaxed learning atmosphere that is new and inspiring.

Nawarat Suwanpong, (n.d.: Mimeographed) referred to the characteristics of adults learning

1. Although the adults had a lot of experiences, they should leave them out because the experiences may have the obstacles.

2. Adults had a lot of activities to do. They might get irritated if they found the training useless.

3. Training could prove futile if it did not help the adults solve the problems facing them.

4. Adults would respond to things, which happened according to their experience. It was not feasible to force them to learn as we wish.

5. They would feel proud if they did things by themselves.

6. Learning was to enhance and increase knowledge in commensurate with the position, duty and responsibility. What was gained from training must be applicable in practice.

Boonsri Kaewkamsri, et al., (1991: 41 – 44) referred to the adult learning in the following aspects.

1. Adults would learn when they wanted to learn. They did not want to be forced to do things. If that happened, they became resistant.

2. Adults would learn the only things they found necessary.

3. Adults learned by acting. They tended to quickly forget what they learned if teaching was by lecture or reading. But it was the opposite if it was by using skills and practice.

4. Experiences could have an effect upon the adults learning. As the adults already had a lot of things in their brain, teachers had to link the adults' experience with what was being taught.

5. Adults could learn better and perform better if an atmosphere and an environment were favorable.

6. Different methods should be used to teach the adults.

7. An adult wanted guidance, not marks. Therefore scores or marks may not be useful to the adults.

2.3.2 Six important components affecting learning

1. Environment

It includes light, temperature, relations between participants and academic personnel etc.

2. Motivation

It is to be cleverly used to stimulate needs and attempts to learn. There are four factors causing motivation.

- Arousal, The participants have to be alerted.
- Expectation

The participants are made to expect and feel fulfilled with what they expected.

- Incentive
- Punishment for example, those who did not have 80% attendance would not be given a certificate.

3. Trainee – centered training

The objectives are, participants, learning, teaching are to be related to the needs of the participants. Individual differences are to be accepted. The academic personnel are only the information source. Group activities and discussion are necessary.

4. The Participants' involvement in activities

5. Reinforcement the Participants should feel positive to the trainers.

6. Transfer of knowledge

Trainers had to link what was learned with actual practice. If training of focused too much on academic aspects, the participants would not appreciate it. So situation models, role-play, case study and other activities were necessary and helpful.

It was apparent that the theory of the adult learning was in accordance with a participatory training which was based on ideas of an educator of adult learning – Paulo Freir – who concluded that all humans no matter who they were should be given chance and allowed to design and decide for their own actions. Education would enable the individuals to think, decide and practice independently. Hence the cycle of adult learning would be similar to learning coupled with reflection. It began from experiences, actions and reflections in order to carry on learning.

2.4 Concepts and theories about knowledge, attitude and behavior

2.4.1 Definition of knowledge

Dictionary of Education by Carter V. Good, (1973: 531) defined knowledge as facts, laws, details received and collected by humans.

According to Prapapen Suwan, (1977: 20), knowledge was a basic behavior. The learners might remember by recollecting, seeing, hearing and acting. This knowledge was concerned with definitions, meanings, facts, theory, law and methods.

From the above concepts, knowledge was concerned with facts, laws, details that were form experiences both directly and indirectly.

2.4.2 Types of knowledge

Bloom and other (1972, quoted in Thawatchai chaijirachayakul, 1984: 45) classified knowledge into three types.

1. Knowledge of specifics

It can be sub-divided as

1.1 Knowledge of terminology was recognition of meanings and definitions of technical terms including symbols used in respective fields.

1.2 Knowledge of specific facts was knowledge and recognition of information, events, persons, places and sources etc.

2. Knowledge of way and means of dealing with specifics

It was a study, consideration, judgement and criticism etc. It was further divided into;

2.1 Knowledge of conventions

It was knowledge about methods of practice and presentation of ideas and incidents, for example, symbols in the map and the dictionary.

2.2 Knowledge of trends and consequences was concerned with process, direction of phenomenology, which depended on time.

2.3 Knowledge of classification and categories was concerned with sets, series, types etc.

2.4 Knowledge of methodology was knowledge of methods, techniques in each branch, including the problem survey and specific phenomena.

3. Knowledge of the universals and abstractions in fields was about concepts, means and forms used to cope with phenomena. Knowledge of various sources was combined as the principles, and then was sub – divided as fellows;

3.1 Knowledge of principles and generalizations was knowledge about the conclusion of particular things. That conclusion was worthwhile in explaining, describing and predicting actions, which were appropriate.

3.2 Knowledge of theories and structures was about the laws and principles plus mutual relations.

2.4.3 Levels of knowledge

Bloom and others, (1972, quoted in Thawatchai Chaijirachayakul, 1984: 24 – 34) categorized knowledge into 6 levels, ascending from the simple to the difficult.

1. Knowledge was the brain capacity to retain events perceived.

2. Comprehension was the ability to communicate clearly and effectively.

3. Application was the capability to apply knowledge and understanding to solve problems with satisfactory results.

4. Analysis was the capacity to consider things in great details.

5. Synthesis was the capacity to put together small pieces. It was the ability to consider things from different perspectives. Then things were re – structured to generate more efficiency.

6. Evaluation was the competence to judge, and value by using criteria and standard accepted.

2.4.4 Definitions of attitude

Milton Rokeach, (1970: 88) defined that attitude was a combination or belief in something or situations. The overall result of belief would give rise to response in a positive or negative way.

Carter V. Good, **(**1973: 48 –49) viewed that attitude was trend or view toward some thing or situation. It could not be observed, but it could be inferred from speech and expressions.

Prapapen Suwan, (1983: 3) defined that attitude was the opinion with the emotions playing a key role.

Thai Dictionary of the Royal Academy 1982 (1983:393) defined that attitude was the conception.

Boontum Kijpreedaborisut, (1992: 234) viewed that attitude was the overall expressions of individuals which arose from mental tendency. The expressions were shown to the inspiring things like matters, and social situations.

It can be concluded that attitude means belief, ideas and feelings the persons have towards things around them. It also includes the mental conditions to respond to the stimulus. The stimuli came from the experiences and learning the persons had received and accumulated for quite some time.

2.4.5 Components of attitude

Psychologists offered 3 components of attitude (Boontum Kijpreedaborisut, 1992: 235 – 236)

1. Attitude has three components

1.1 Cognitive Component; It means knowledge, belief, idea and opinion.

1.2 Affective Component; It is like, dislike, good or bad attitude, negative or positive feeling.

1.3 Behavioral Component; It is tendency or readiness of individuals to behave towards the attitude.

2. Attitude with two Components; It is cognitive and affective components.

3. Attitude with one component; It is affective component which may be expressed in negative or positive way.

Out of thee three, the attitude with the affective component is the most accepted.

2.4.6 Factors contributing to attitude

1. Specific experiences; It is learning from the experiences with particular things, for example, with good impression, one may like that particular person and vice versa.

2. Communication from other; Attitude may be caused by communication with others. Teaching and training can influence beliefs and attitude of children.

3. Models; Attitude is accepted by imitating others through actions, speech and expressions of others.

4. Institutional factors

2.4.7 Meanings of behavior

Sopa Chupikulchai (1978: 2) defined behavior as actions to living beings and others, which can be observed and tested.

Prapapen Suwan (1993: 15) viewed behavior as all activities made by humans, they can be observable or unobservable.

Chaiporn Vijjawut (1980: 1) viewed the behavior as all actions made by humans. The actions may be conscious or unconscious, observable or unobservable.

In sum, behavior is an action to response to a certain circumstance. This action could be associated with objective and having influenced by knowledge comprehension and attitude of that individual to stimulate such an expression.

2.4.8 Measurement of behavior

Behavior can be measured in three aspects. Cognitive, emotional and practical. (Wichian Ketsing 1981: 13 – 14)

1. Cognitive behavior means human intelligence, being concerned with perception and behavior.

2. Emotional behavior is concerned with mental conditions, feelings, attitude and values.

3. Practical behavior means the use of organs, and bodily movement etc.

2.5 Relevant researches

The relevant researches on the evaluation of cognitive achievement on agriculture training were as follows;

Thanin Sutheeprasert, (1997: abstract) conducted a study on the training course on environment for the health volunteers in Supanburi, by assessing the test form on knowledge, attitude before and after the training. He found that the average of the trial group increased with the statistical significance at 0.05. As for the controlled group, there was no difference in the attitude.

Siriporn Jiamjan, (1995: 114) undertook a research on the construction and assessment of the training course on the use of the pesticide, which had effect upon the environment. The research was for agriculturists in Nakorn Pathom. It was found that 95.1% found the training course very useful.

Sam-Ang Pluemjareon, (1993: 120 – 128) carried out the study on the development of training course "Prevention and Elimination of Pests for Agriculturists" in Puttamonthon Nakorn Pathom. The course had the content necessary for occupation, application, prevention and correct use of the pesticide. The training took 2 days. It was found that in the wake of training, the average of the agriculturists significantly increased at 0.05.

Somsuk Chipipat**,** et al., (1993: 64 - 65) studied the use of chemicals by agriculturists and health problems. The study revealed that the majority of the agriculturists did not correctly use chemicals. They used more amounts than specified on the label, mixed several types at a time and they did not have sufficient protective gears which they were spraying.

Jintana Sripakdee and others, (1989: abstract) studied factors which affected enzyme cholinesterase in the blood of agriculturists in Pa Teuw, Yasothon. Ninety-one agriculturists were asked and their blood was tested. It was found that they did not correctly practice while using the pesticide. 87% of the blood that was checked indicated it was at unsafe level.

Sethapong Puchakarn, (1998: abstract) undertook a research on knowledge, attitude and participation in waste disposal by community; a case study in Ban Bueng, Chonburi. The study found that knowledge changed according to educational level.

Attitude changed according to age, educational level and information. Participation in disposal changed according to the type of membership at 0.05.

Chamnan Wongvinitsorn, (2002: abstract) conducted a study on knowledge, attitude and participation of the local Administration in preservation of environment; a case study, Noen Maprang, Pitsanuloke. The study found that different individual factors did not give rise to difference in knowledge, attitude and participation. Information led to change in knowledge and attitude at 0.05.

Slukjit Sirimanan, (1996: abstract) studied factors affecting decision by housewife to choose toxic – free vegetables in Bangkok. The study found that contributing factors that affected knowledge, attitude and decisions to choose toxic – free vegetables were, age, income, frequency of eating out, concerns for dangers in vegetables and information. In addition, education, and occupation had impact on knowledge, but not on attitude and decision. The number of children had impact on attitude, but not on knowledge and decision.

CHAPTER 3
METHODOLOGY

The present study aimed to examine cognitive achievement of agriculturists from training in the project to reduce the pesticide-related risks. The tools which were used in the research were the questionnaires and the post-test controlled group design.

3.1 Target population

Populations in the study were agriculturists taking part in the project. They were 80 inhabitants from Moo 4, 5, 6 and 7 of Sai Thong, Pa Mok, Ang Thong. There were another 163 agriculturists from Moo 1 – 8 of the same district. These agriculturists did not take part in the project.

3.2 Size of the groups and random sampling

The first step

The researcher resorted to the purposive sampling on the 80 farmers who join the training in the project.

The second step

The researcher took random sampling on the 163 farmers from every household. The farmers in this group did not participate in the project.

3.3 Tools used

The researcher used the questionnaires and the tests in the evaluation of cognitive achievement from the training. They were divided into the following sections.

Section 1 was concerned with personal information – sex, age, number of family members, occupation, education, income and land occupation.

Section 2 was the tests on knowledge on the pesticide. One point was for a correct answer. 0 was for wrong answer.

Finding out the quality of tools

1. Consultation with the experts on the questionnaires and the test patterns.

2. Evaluation and correction of the questionnaires and the tests which were examined and rectified by the experts.

3. The tests on the achievement were tried out on 15 agriculturists (not trained) from Klong Khanak, Wiset Chaichan, Ang Thong and on the same number of agriculturists (who were trained) from Bang Plab, Po Thong, Ang Thong. Then reliability, difficulty and discrimination were analyzed, with the formulas as shown below.

3.1 Difficulty

0.2 indicated that the test was too difficult. If the test was higher than 0.8, it was too easy. If these happened, they had to be removed or changed. (Boontum Kijpreedaborisut, 1992: 87)

$$P = \frac{PH+PL}{2N}$$

P = Difficulty of each question

PH = High level of correct answers

PL = Low level of correct answers

N = Total answers in groups

3.2 The tests were analyzed to find out discrimination. This was to be carried out along with the first step to cut off irrelevant items. The items with 0.2 discrimination were selected. The items with less than 0.2 discrimination had less discrimination. Or if the items had 0, they did not have discrimination at all. (Boontum Kijpreedaborisut, 1992: 87)

$$R = \frac{PH - PL}{N}$$

R = Discrimination for each item

PH = More correct answers

PL = Low correct answers

N = total numbers in the groups

3.3 The test was used to gain reliability with Kuder – Richardson, K.R. 20. (Puangrat Taveerat, 1997: 124)

$$r_{tt} = \frac{n}{n+1}\left[\frac{1- \Sigma pq}{S^2_t}\right]$$

r_{tt} = reliability

n = number of items

S^2 = variability of the whole items

P = ratio of correct answers

Q = ratio of wrong answers

Knowledge levels of agriculturists were divided into three levels.

Low points = Lower than the overage – Standard deviation

Moderate = From the average – The standard deviation to the average + The standard deviation

High = The average + The standard deviation

Section 3 was the items used to assess the attitude on the pesticide based on contents and the Likert's scale. The section had 5 choices; very much agree, agree, not sure, disagree, and totally disagree. Points according to the rating scale were;

Positive	
Very much agree	5
Agree	4
Disagree	2
Totally disagree	1
Negative	
Very much agree	1
Agree	2
Not sure	3
Disagree	4
Totally disagree	5

Attitude of agriculturists was divided into three levels;

Low = Lower than the average – The standard deviation

Moderate = From the average – The standard deviation to the average + The standard deviation

High = The average + High standard deviation

1. Discrimination

For this, t – test was used. T – value from 1.25 upward was set, t. descending from the highest to the lowest. The value lower than the standard was left out, with the formula. (Puangrat Taveerat, 1997: 131)

$$t = \frac{\bar{X}_{High} - \bar{X}_{Low}}{\sqrt{\frac{S^2_{High}}{n_{High}} + \frac{S^2_{Low}}{n_{Low}}}}$$

t = value used

$\bar{X}_{High}$ = High average

$\bar{X}_{Low}$ = Low average

S^2_{High} = High variation

S^2_{Low} = Low variation

n = Equal number

2. The questionnaire was used to find out reliability. Cronbach recommended finding out a coefficient with the formula. (Puangrat Taveerat, 1997: 125)

$$\alpha = \frac{n}{n-1}\left[1 - \frac{\sum S_i^2}{S_t^2}\right]$$

α = confidence coefficient

n = numbers of items

S_i^2 = variation in each item

S_t^2 = overall variation

It was found that with 30 sets of questions tested, five out of the total questions were not up to the criterion. So only 15 questions remained. Reliability was equivalent to 0.82.

Section 4 was the tests of behavior of using the pesticide, consisting for positive and negative statements.

Positive	
Every time	3
Often	2
Once in a while	1
Never	0
Negative	
Every time	0
Often	1
Once in a while	2
Never	3

Points on behavior were divided into three levels.

Low = Lower than the average – The standard deviation

Moderate = From the average – The standard deviation to the average + The standard deviation

High = The average + the standard deviation

Section 5 was the questionnaires on problems, obstacles and recommendations on the pesticide.

3.4 Data collection

1. By approaching and coordinating with the officials from agencies concerned, and informing them of the objectives of a study.

2. By using the questionnaires on knowledge, attitude and behavior from the agriculturists both trained and not trained in the project to reduce the risks from pesticide. Data were collected from December 15, 2002 to January 31, 2003.

3. Total data were analyzed to find out statistical relationship.

3.5 Data analysis

Data were analyzed by SPSS (Statistical Package for Social Science). Data had the following statistics.

1. Basic data – percentage, frequency, mean, the highest and lowest value, the standard and deviation.

2. Analysis of independent and dependent variables by t – test and Chi – Square to compare and contrast data.

3. Use of statistic analysis, One – way Anova and LSD (Least Significant Difference) to relationship between independent and dependent variables.

4. As for the relationship between one variable and multiple independent variables, it was a stepwise multiple regression analysis.

CHAPTER 4
RESULTS

The research aimed to study a cognitive achievement of agriculturists who were trained in the project to reduce risks from the pesticide. The research was experimented on two groups; one group was 80 farmers, who took part in the training, the other was a controlled group of 163 agriculturists who were not trained in the project.

The researcher presented the results in 10 major parts.

4.1 General characteristics of person, economy and society

4.2 General agriculturists conditions and the pesticide usage

4.3 Information and technological transfer on use of the pesticide

4.4 Knowledge about the use of pesticide

4.5 Attitude towards the use of pesticide

4.6 Behavior concerning the use of the pesticide

4.7 Analysis of factors affecting knowledge on the use of the pesticide

4.8 Analysis of factors affecting attitude towards the use of the pesticide

4.9 Analysis of factors affecting behavior on the use of the pesticide

4.10 Analysis of relationship between multiple independent variables and knowledge, attitude and behavior towards the use of pesticide

4.1 General characteristics of persons, economy and society

From data on the subjects who were 80 trained agriculturists and 163 others who were not trained, the results could be explained as follows;

Sex

In the trained group, 51.2% were males and 48.8% were females. In the second group (not trained), 52.8% were males, 47.2% were females. Statistical analysis found that sexes of both groups were not different at 0.05.

Age

The majority of the trained group was 53.8 years on average. 47.4% were between 46 – 60. 28.8% were over 61 and 23.8% were below 45 years. The average age for the second group was 55.9. 39.3% of them were over 61 years. 36.2 were 46 – 60 and 23.9% were below 45 years.

Statistical analysis found that there was no significant difference at 0.05 between two groups.

Marital status

81.3% of the first group were married. 11.2% were in widowhood, separated and divorced. 7.5% were single. 79.1% of the second group (not trained) were married. 17.8% were in widowhood, separated and divorced. 3.1% were single.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Education

77.5% of the first group finished the primary school (P.4). 15.0% completed the first high school level. 7.5% finished the second primary school (P.6). 69.3% of the second group finished the first elementary school (P.4). 17.2% finished the second elementary school (P.6) and 13.5% finished the primary high school.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Family members

The average family member of the first group was 3.9% in one family. 47.5% had 3 – 4 family members. 33.8% had up to five members. 18.8% had 1 – 2

members. The average family member of the second group was 3.7. 46.6% of them had 3 – 4 persons in a family. 28.8% had 5 persons. 24.5% had 1 – 2 persons.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Number of laborers in the family

The average number of the family laborers was 2.0. 81.3%had 1 – 2 laborers. 18.8% had 3 laborers. In the second group (not trained) the average number was 1.99. 86.5% of them had 1 – 2 laborers. 13.5% had three laborers.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Position/ membership in a community

50.5% the first group did not hold position and were not members. 14.4% were the village committee. 11.3% were members of the housewife group. 8.2 were health volunteers. 6.2% were the communal leaders. 58.0% of the second group did not hold position and were not members. 12.8% were health volunteers. 9.6% were the village committee. 6.9% were the members of the housewife group. 4.3% were the communal leaders. 3.7% were members of the agricultural group.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Occupation

52.5% of the first group were agriculturists. 23.8% were general laborers. 10.0% were animal farmers. 6.3% were traders. 3.7% were the employee of the private sector. 55.2% of the second group were agriculturists. 20.9% were general laborers. 11.7 were traders. 7.4% were animal farmers. 3.7% were government officials/ in state enterprise.

Statistical analysis found that there was no significant difference of the status at 0.05 between the two groups.

Size of occupied agricultural land

The average areas occupied by the first group were 26.0 rais. 46.3% of the agriculturists had 11 – 30 rais. 31.3% occupied less than 10 rais. 22.5% occupied more than 31 rais. The average areas occupied by the second group were 17.4%. 53.4% of

the group occupied less than 10 rais. 33.1% occupied 11 – 30 rais, and 13.5% had more than 31 rais.

Statistical analysis found that there was a significant difference of land occupation at 0.05 between the two groups.

Income

The average income for the trained group was 40,723 Baht / year. 60.0% of the group had the income between 10,001 – 50, 000 Baht / year. 27.5% had an income of 50,001 onwards. 12.5% had an income lower than 10,000 Baht /year.

The average income of the second group was 28,526 bath / year. 50.9% of the group had an income between 10,001 – 50,000 Baht / year. 35.0% had an income lower than 10,000 baht / year. 14.1% had an income of 50,001 Baht / year.

Statistical analysis found that there was a significant income difference at 0.05 between the two groups.

Table 4-1: Percentage of Agriculturists according to general characteristics of economy and society.

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Sex					$\chi^2 = 0.490$	0.825
Male	41	51.2	86	52.8		
Female	39	48.8	77	47.2		
Total	80	100	163	100		

Table 4-1: Percentage of agriculturists according to general characteristics of economy and society. (Continued)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Age					t = -1.046	0.296
Below 45 years	19	23.8	39	23.9		
46-60 years	38	47.4	59	36.2		
Over 61 years	23	28.8	65	39.9		
Total	80	100.0	163	100.0		
	Mean =53.8 SD =10.6 Min =27 Max =78		Mean = 55.9 SD = 12.2 Min = 21 Max = 80			
Marital status					χ^2=3.827	0.148
Single	6	7.5	5	3.1		
Married	65	81.3	129	79.1		
Other[widowhood, separated, divorced]	9	11.2	29	17.8		
Total	80	100.0	163	100.0		
Education					χ^2=4.177	0.124
The first elementary school [P.4]	62	77.5	113	69.3		
The second elementary school [P.6]	6	7.5	28	17.2		
The primary high elementary school onwards	12	150	22	13.5		
Total	80	100.0	163	100.0		

Table 4-1: Percentage of agriculturists according to general characteristics of economy and society. (Continued)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Family member					t =1.081	0.281
1-2	15	18.8	40	24.5		
3-4	38	47.5	76	46.6		
5 onwards	27	33.8	47	28.8		
Total	80	100.0	163	100.0		
	Mean = 3.9 S.D. =1.4 Min = 1 Max= 7		Mean = 3.7 S.D.= 1.4 Min = 1 Max= 8			
Number of family laborers					t =1.069	0.286
1-2	65	81.3	141	86.5		
3 onwards	15	18.7	22	13.5		
Total	80	100.0	163	100.0		
	Mean = 2.0 S.D. = 0.8 Min = 1 Max= 6		Mean = 1.9 S.D. = 0.7 Min = 1 Max= 8			

Table 4-1: Percentage of agriculturists according to general characteristics of economy and society. (Continue)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Position/member*					χ^2=6.033	0.419
No position	49	50.5	109	58.0		
Tambon Admiministration Orgranization[TAO]	3	3.1	9	4.8		
Groups of Agriculturists	6	6.2	7	3.7		
Housewife Groups	11	11.3	13	6.9		
Communal leader	6	6.2	8	4.3		
Village Committee	13	14.4	18	9.6		
Health officials	8	8.2	24	12.8		
Total	80	100.0	163	100.0		
Occupation					χ^2=5.448	0.364
Agriculture	42	52.5	90	55.2		
trading	5	6.3	19	11.7		
Animal farming	8	10.0	12	7.4		
Casual laborers	19	23.8	34	20.8		
Government job / state enterprise	3	3.7	6	3.7		
Private company	3	3.7	2	1.2		
Total	80	100.0	163	100.0		

*One agriculturist could answer more than one question.

Table 4-1: Percentage of agriculturists according to general characteristics of economy and society. (Continued)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Size of occupied lands						
Less than 10 rais	25	31.3	87	53.4	t =3.160	0.002
11-30 rais	37	46.2	54	33.1		
31 rais onward	18	22.5	22	13.9		
Total	80	100.0	163	100.0		
	Mean = 26.0 S.D. =29.1 Min = 0.3 Max = 200		Mean = 17.4 S.D. =21.2 Min = 0.2 Max = 130			
Income					t = 4.016	0.000
Less than 10,000 Baht	10	12.5	57	35.0		
10,001-50,000 Baht	48	60.0	83	50.9		
50,001 Baht onwards	22	27.5	23	14.1		
Total	80	100.0	163	100.0		
	Mean = 40723.0 S.D. =36752.0 Min = 2000 Max = 189400		Mean = 28562.0 S.D. = 22098.0 Min = 2000 Max = 284900			

4.2 General agricultural conditions and the pesticide usage

The study of the general conditions and the use of the pesticide by two groups; 80 trained subjects and 163 untrained subjects. The results could be illustrate as in the table 4-2.

Years of agricultural farming

The average year of farming of the trained group was 21. 32.5% of the group had years of farming less than 10. 27.5% had 11 – 20 years. 21.3% had 21 – 30 years of farming. 18.8% had more than 31 years of farming. The average year of farming of the second group was 18.39. 43.6% had years of farming less than 10. 28.2% had 11 – 20 years of farming. 13.5% had 21 – 30 years of farming.

Statistical analysis found that there was no significant difference of agricultural occupation at 0.05 between the two groups.

Types of cultivating areas

73.5 of the trained group grew rice. 13.7% grew vegetable and 12.7% grew fruit trees. 55.3% of the second group planted rice. 27.4% grew fruit trees and 17.4% planted the vegetables.

Statistical analysis found that there was significant difference of the types of cultivating areas at 0.05.

Experiences in using the pesticide

87.5% of the agriculturists who were trained used to spray the pesticide while 12.5% never used to. 74.8% of the group that was not trained used to spray the pesticide while 25.2% never used to.

Statistical analysis found that there was a significant difference of experiences in using the pesticide at 0.05 between the two groups.

Types of chemicals used

22.8% of the trained group used the herbicide, 22.0% used the pesticide, 13.8% used production enhancing chemicals, 1.5% used other substances. 25.2% of the second group used the herbicide. 22.2% used the pesticide. 18.6% used the production accelerating chemicals. 17.1% used chemicals for plant diseases, and 3.4% used other substances.

Statistical analysis found that there was a significant difference of types of chemicals used at 0.05.

Reasons in using the pesticide

77.5% of the trained group wanted a higher yield.10.0% found it convenient to use. 5.0% had a good protective method. 3.8% had no choice and no better method. 59.5% of the second group wanted a high product. 25.8% had no better method. 2.5% found it convenient in using. 1.3% wanted to stop, but were left with no choice.

Statistical analysis found that there was a significant difference of the reasons in using the pesticide at 0.05 between the two groups.

Table 4-2: Shows the percentage of agriculturists classified according to agriculture and the use of the pesticide.

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Years of farming					t =1.805	0.072
Less than 10 years	26	32.5	71	43.6		
11-20 years	22	27.5	46	28.2		
21-30 years	17	21.3	22	13.5		
31 years upwards	15	18.8	24	14.7		
Total	80	100.0	163	100.0		
	Mean = 21.5 S.D. =13.5 Min = 2 Max = 52		Mean = 18.3 S.D. = 14.0 Min = 1 Max = 60			
Types of plants*					χ^2=10.515	0.005
Rice	75	73.5	105	55.3		
Vegetables	14	13.7	33	17.4		
Fruits	13	12.7	52	27.4		
Total	80	100.0	163	100.0		

Table 4-2: Shows the percentage of agriculturists classified according to agriculture and the use of the pesticide. (Continued)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Experiences in using pesticide					χ^2=5.615	0.018
Never	10	12.5	41	25.2		
Ever	70	87.5	122	74.8		
Total	80	100.0	163	100.0		
Types of pesticide used*					χ^2=14.357	0.026
Herbicide	77	22.6	138	25.7		
Insecticide	75	22.0	119	22.2		
Plant disease chemicals	71	20.8	92	17.1		
Rodenticide	66	19.4	70	13.0		
Production accelerating substances	47	13.8	100	18.6		
Other substances (Herb)	5	1.5	18	3.4		
Total	80	100.0	163	100.0		
Experiences with pesticide exposure					χ^2=7.900	0.005
Never	56	70.0	139	85.3		
Ever	24	30.0	24	14.7		
Total	80	100.0	163	100.0		

*One agriculturist could answer more than one question.

Table 4-2: Shows the percentage of agriculturists classified according to agriculture and the use of the pesticide. (Continued)

General Conditions	Trained Group		Untrained Group		Statistics	P value
	Number	%	Number	%		
Experiences with pesticide exposure					χ^2=7.900	0.005
Never	56	70.0	139	85.3		
Ever	24	30.0	24	14.7		
Total	80	100.0	163	100.0		
Causes of using pesticide					χ^2=23.607	0.000
High product	62	77.5	97	59.5		
Convenience	8	10.0	4	2.5		
No other better ways	3	3.8	42	25.8		
No choice	3	3.8	7	4.3		
Availability of good protective methods	4	5.0	13	8.0		
Total	80	100.0	163	100.0		

4.3 Information and technological transfer on the use of pesticide

Experiences on training on the use of the pesticide

It was found that 93.8% the group that was trained used to attend the training on the use of the pesticide, while 6.3% never attended. As for the second group, 74.2% were never trained on the use of pesticide, while 25.8% used to have the training on the use of the pesticide.

Statistical analysis found that there was a significant difference of the use of the pesticide at 0.05.

Difficulty and simplicity of the training

83.3% of the trained group found it moderate in difficulty and simplicity. 10.7% found it difficult. 4.0% found it simple. 73.8% of the second group found it moderate. 19.0% found it simple and 7.1% found it difficult.

Statistical analysis between the groups found that there was a significant difference of the training contents at 0.05.

Improvement of the training process

96.0% of the trained group found that the training should be improved, while 4.0% found it should not be improved. 90.5% of the second group found that it should be improved, 9.5% found that it should not be improved.

Statistical analysis between the two groups found that there was no significant difference of the training process at 0.05.

The process to be improved

84.7% of those who were trained viewed that contents should be made easy. 15.3% viewed that ways of imparting knowledge should be improved. 73.7% of those who were not trained viewed that contents should be improved. 26.3% viewed that ways of imparting should be improved.

Statistical analysis showed that there was no significant difference of the process to be improved at 0.05.

Training duration

66.7% of the first group found that the training duration was suitable. 33.3% found that it was not. 59.5% of the second group (not trained) viewed that the training duration was appropriate while 40.5% found that it was no suitable.

Statistical analysis found that there was no significant difference of the training duration at 0.05 between the two groups.

Information from media

The most of the agriculturists in trained group, 72.5% get information and technological transfer on use of the pesticide from the product labels, 66.3% of them get it from training, 58.8% of them get it from agricultural officials, 43.8% of them get it from shop keepers, 41.3% of them get it from community development officials, 38.8% of them get it from radio/TV, 36.3% of them get it from neighbors, 27.5% of them get it from experiences and academic document, 18.8% of them get it from

newspaper and 16.3% of them get it from health officials and teachers. For the group which has not been trained, most of them, 66.7% of them get it from product labels, 52.5% of them get it from radio/TV, 46.3% of them get it from agricultural officials, 45.1% of them get it from shop keepers, 32.1% of them get it from academic documents, 25.3% of them get it from experiences, 19.8% of them get it from neighbors, training and newspaper, 3.7% of them get it from community development officials and 3.1% of them get it from health officials and teachers.

Statistical analysis found that there was a significant difference of the training duration at 0.05 between the two groups.

Media used in imparting knowledge

It was found that 41.3% of the trained group were given knowledge through 3 – 4 types of media. 32.4% were given knowledge through 5 types of media, 26.3% through 1 – 2 types of media respectively. 43.6% of the agriculturists who did not join the training got knowledge through 3 – 4 types of media. 36.8% got it via 1 – 2 types and 19.6% got it via 5 types of media respectively.

Statistical analysis showed that there was a significant difference of media used in imparting knowledge at 0.05.

Table 4-3: Shows number and percentage, information and technological transfer on the use of the pesticide.

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Training experiences					χ^2=99.341	0.000
Ever had	5	6.3	121	74.2		
Never had	75	93.8	42	25.8		
Total	80	100.0	163	100.0		

** The agriculturist had the experiences of training.

Table 4-3: Shows number and percentage, information and technological transfer on the use of the pesticide. (Continued)

General conditions	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Levels of content**					χ^2=7.156	0.028
Difficult	8	10.7	3	7.1		
Moderate	64	83.3	31	73.8		
Simple	3	4.0	8	19.0		
Total	75	100.0	42	100.0		
Parts not understood in training**					χ^2=14.789	0.227
Practice	31	41.3	8	19.0		
Nature usage	25	33.3	15	35.7		
Chemical hazard	14	18.7	9	21.4		
First aid	3	4.0	10	23.8		
Other	2	2.7	0	0		
Total	75	100.0	42	100.0		
Improvement of the training process**					χ^2=1.460	0.227
Not to be made	3	4.0	4	9.5		
To be made	72	96.0	38	90.5		
Total	75	100.0	42	100.0		
The process parts to be adjusted**					χ^2=1.962	0.161
Content to be made easy	61	84.7	28	73.7		
Transferring to be made easy	11	15.3	10	26.3		
Total	72	100.0	38	100.0		

*One agriculturist could answer more than one question

** The agriculturist had the experiences of training

Table 4-3: Shows number and percentage, information and technological transfer on the use of the pesticide. (Continued)

General conditions	Trained Group		Untrained group		Statistics	P value
	Number	%	Number	%		
Training duration**					χ^2=0.597	0.440
Suitable	50	66.7	25	56.5		
Not suitable	25	33.3	17	40.5		
Total	75	100.0	42	100.0		
Information from media*					χ^2=77.583	0.000
Product labels	58	72.5	108	66.7		
Radio/TV	31	38.8	85	52.5		
Newspaper	15	18.8	32	19.8		
Training	53	66.3	32	19.8		
Shop keepers	35	43.8	73	45.1		
Community development officials	33	41.3	6	3.7		
Agricultural officials	47	58.8	75	46.3		
Academic documents	22	27.5	52	32.1		
Information from media*(Continue)						
Neighbors	29	36.3	32	19.8		
Experiences	22	27.5	41	25.3		
Other (Health officials, Teachers)	12	16.2	5	3.1		
Total	80	100.0	163	100.0		

*One agriculturist could answer more than one question

** The agriculturist had the experiences of training

Table 4-3: Showed number and percentage, information and technological transfer on the use of the pesticide. (Continued)

General conditions	Trained Group		Untrained group		Statistics	P value
	Number	%	Number	%		
Media					t = 2.303	0.022
1-2 types	21	26.3	60	36.8		
3-4 types	33	41.2	71	43.6		
5 onwards	26	32.5	32	19.6		
Total	80	100.0	163	100.0		
	Mean = 4.4 S.D. =2.6 Min = 1 Max = 11		Mean = 3.3 S.D. = 1.5 Min = 1 Max = 11			

4.4 Knowledge about the use of pesticide

The results of a study of knowledge on the use of pesticide could be illustrated as in the table 4-4.

14 points and lower were the group with little knowledge

15 – 22 points meant the group had moderate knowledge

23 – 25 points meant the group had more knowledge

Knowledge about the use of pesticide

The average level of knowledge of the first group was 20.1. 62.5% of the first group had a moderate knowledge on the pesticide. 35.0% had a high level and 2.5% had a low level of knowledge on the pesticide.

The average level of knowledge of the second group was 18.5. 69.4% of the group know how to use the pesticide at a moderate level. 15.3% had both high and low level of knowledge.

The results of statistical analysis showed that there was a significant difference of knowledge on the pesticide at 0.05 between the two groups.

Table 4-4: Shows number and percentage given according to knowledge on the pesticide.

Knowledge levels	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Low awareness (14 points and lower)	2	2.5	25	15.3	t = 4.369	0.000
Moderate awareness (15-22 points)	50	62.5	113	69.4		
High awareness (23 points and higher)	28	35.0	25	15.3		
Total	80	100.0	163	100.0		
	Mean= 20.1 S.D.=3.7 Min.=12 Max.=25		Mean= 18.5 S.D.=3.8 Min.=5 Max.=25			

4.5 Attitudes towards the use of the pesticide

The results of a study of agriculturist's attitude towards the use of the pesticide could be illustrated as shown in the table 4-5.

49 and lower meant the group had a negative attitude

50 – 61 meant the group was moderate

62 – 75 meant the group had a positive attitude

Attitudes towards the Use of the Pesticide

The average points on the attitude of the agriculturists who joined the training were 57.5. 73.8% were moderate in their attitude towards the use of pesticide. 21.2% were positive and 5.0 were negative.

The average points of the agriculturists who did not join the training were 55.5%. 82.2% of them were moderate in their attitude towards the use of pesticide. 9.2% were negative and 8.6% were positive in their attitudes.

The results of statistical analysis showed that there was no significant difference in attitudes towards the pesticide at 0.05.

Table 4-5: Shows number, percentage according to agriculturists' attitude towards the pesticide.

Attitude levels	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Low awareness (49 points and lower)	4	5.0	15	9.2	t= 2.771	0.006
Moderate awareness (50-61 points)	59	73.8	134	82.2		
High awareness (62 points and higher)	17	21.2	14	8.6		
Total	80	100.0	163	100.0		
	Mean= 57.5 S.D.=6.8 Min.=35 Max.=72		Mean= 55.5 S.D.=5.4 Min.=33 Max.=72			

4.6 Behavior concerning the use of the pesticide

The results of a study of the behavior on the use of the pesticide from 25 items experimented on 80 agriculturists who joined the training and 163 agriculturists who did not join the training could be illustrated as shown in the table 4-6.

52 points and lower meant the negative (low) behavior

53 – 70 meant the moderate behavior

71 – 75 meant the positive (high) behavior

Behavior towards the Use of the pesticide

The average points of the practical behavior of the first a group were 65.3. 68.8% of the agriculturists had a moderate practical behavior concerning the use of the pesticide. 26.2% had a high (positive) behavior and 5.0 had a low practical behavior.

The average points of the second group were 59.9%. 72.4 had a moderate practical behavior concerning the use of the pesticide. 16.6% had a low level and 11.0 had a high behavioral level.

The results of statistical analysis showed that there was a significant difference of behaviors in using the pesticide at 0.05.

Table 4-6: Shows number, percentage divided according to behaviors towards the use of the pesticide.

Behaviors levels	Trained group		Untrained group		Statistics	P value
	Number	%	Number	%		
Low awareness (52 points and lower)	4	5.0	33	20.2	t = 3.751	0.000
Moderate awareness (53-70 points)	55	68.8	92	56.4		
High awareness (71 points and higher)	21	26.2	38	23.3		
Total	80	100.0	163	100.0		
	Mean= 65.3 S.D.=7.5 Min.=36 Max.=75		Mean= 59.9 S.D.=8.7 Min.=34 Max.=75			

4.7 Analysis of factors affecting knowledge the use of the pesticide.

The results of the factor analysis could be described as follows. The factors affect knowledge on the use of agriculturists.

Sex

Males and female agriculturists had the average points of 19.8 and 20.4 as far as knowledge on pesticide was concerned. It was found that females had higher scores than their male counterparts.

Statistical test found that different sexes did not bring about different results concerning the use of the pesticide at the level of 0.05.

Age

The average points of knowledge on the use of pesticide for those below 40 years, 46 –60 years old and 61 years old were 21.6, 20.3 and 18.6 respectively.

It was found that younger agriculturists had the average points higher than their older counterpart. Statistical test found that different age led to difference in knowledge of the use of pesticide at 0.05.

Number of family members

The average points of knowledge on the pesticide of the agriculturists with 1 –2, 3 – 4 and 5 family members were 18.4, 19.5 and 22.0 respectively.

It was found that the agriculturists with fewer family members had the lower mean points than with more family members.

The family members brought about difference in knowledge of the pesticide at 0.05.

Occupation

The major occupation was farming. The average points of agriculturists were 20.4. The agriculturists who did farming as the major occupation had the higher scores than those who did engaged in many types of farming, 19.8.

Statistical test found that there was no significant difference of knowledge on the pesticide at 0.05.

Income

The agriculturists whose incomes were 10,000, 10,002 – 50,000 and 50,001 Baht had the average points at 18.5, 20.3 and 20.5 respectively. The statistical tests found that there was no significant difference of knowledge on the use of the pesticide at 0.05.

Experiences in using the pesticide

The agriculturists who had the experiences in using the pesticide had the average points at 20.3. The agriculturists who never had the experiences in spraying the pesticide had the mean points at 18.9. The statistical tests showed that there was no significant distinction of knowledge on the use of the pesticide at 0.05.

Experiences on training

The agriculturists who had the experiences in training had the average points at 20.2. The agriculturists who never had the experiences in training had the mean points at 19.6. The statistical tests showed that there was no significant distinction of knowledge on the use of the pesticide at 0.05.

Information about the use of the pesticide

The agriculturists who had information on the pesticide from 1 – 2, 3 – 5 and 5 types of knowledge on the pesticide at 17.8, 20.8 and 21.1 respectively. The agriculturists who had more information had higher scores than those who had little information.

The statistical tests found that there was a significant difference of knowledge on the use of the pesticide at 0.05.

Table 4-7: Analyzes the factors that affect knowledge on the use of agriculturists.

Variables	Number	Mean	S.D.	Statistical test
Sex				
Male	41	19.8	3.5	t = -0.756
Female	39	20.4	3.9	P= 0.452
Age				
Below 45 years	19	21.6	3.4	F= 3.783
46 – 60 years	38	20.3	3.4	P= 0.027*
Over 61 years	23	18.6	3.9	

* The mean difference is significant at the 0.05 level.

Table 4-7: Analyzes the factors which affect knowledge on the use of agriculturists. (Continued)

Variables	Number	Mean	S.D.	Statistical test
Member of family				
1 – 2	15	18.4	4.2	F = 6.321
3 – 4	38	19.5	3.6	P = 0.003*
5 onwards	27	22.0	2.8	
Occupation				
Agriculturists	42	20.4	3.6	t = 0.788
Not agriculturists	38	19.8	3.8	P= 0433
Education				
The primary elementary school	62	19.6	3.8	F= 2.321
The second elementary school	6	21.3	4.0	P= 0.105
The primary high school onwards	12	22.0	1.8	
Income				
Lower than 10,000 Baht	10	18.5	3.2	F= 1.154
10,001 – 50,000 Baht	48	20.3	3.7	P= 0.321
Over 50,001 Baht	22	20.5	3.9	
Occupied land				
Less than 10 rais	25	19.7	4.1	F= 0.217
11 – 30 rais	37	20.3	3.4	P= 0.805
Over 31 rais	18	20.4	3.7	
Experiences in using pesticide				
Used	70	20.3	3.7	t = 1.224
Never used	10	18.9	3.4	P= 0.244

* The mean difference is significant at the 0.05 level.

Table 4-7: Analyzes the factors which affect knowledge on the use of agriculturists. (Continued)

Variables	Number	Mean	S.D.	Statistical test
Experiences in training				
Had	75	20.2	3.6	t = 0.270
Never had	5	19.6	4.8	P= 0.800
Getting information				
1-2 Types	21	17.7	3.9	F= 6.815
3-4 Types	33	20.9	3.3	P= 0.002*
5 Types onwards	26	21.1	3.2	

* The mean difference is significant at the 0.05 level

4.8 Analysis factors affecting attitude towards the use of the pesticide

Sex

The mean point of male and female farmers concerning the use of the pesticide were 58.3 and 56.6 respectively. The statistical tests showed that different sexes did not bring about difference of attitude towards the pesticide at 0.05.

Age

The mean points of the agriculturists who were below 45, 45 – 60 and over 60 regarding the pesticide were 59.1, 57.8 and 55.7.

The statistical tests found that different age did not lead to difference in attitude towards the pesticide at the level of 0.05.

Number of the family member

The average points of the agriculturists whose family members were 1-2, 3-4 and 5 with regard to the attitude towards the pesticide were 54.3, 58.1 and 58.4.

The static tests found that there was no significant difference of attitude towards the pesticide at 0.05.

Education

For the agriculturists who finished the primary elementary school, the second elementary school, the mean points of the attitude towards the use of the pesticide were 56.2, 59.3 and 60.9. The statistical tests showed that these was no significant difference of the attitude towards the pesticide at 0.05

Income

The mean points of the agriculturist who had less than 10,000 Baht income, 10,001-50,000 Baht and 50,001 onwards were 54.8, 56.1 and 61.8. The statistical tests found that there was a significant difference of the attitude towards the pesticide at 0.05. With the pair distinction tested, it was found that the income could lead to different attitude concerning the pesticide at 0.05.

Occupied Lands

The mean points of the agriculturists whose land occupation was 10 rais, 11-30 rais, and 31 rais were 55.2, 55.8 and 64.2. The statistical tests found that there was a signification difference of attitude towards the pesticide at the level of 0.05.

Experiences in using the pesticide

The agriculturists who had the experiences in using the pesticide had the average points at 57.9 The agriculturists who never had the experiences in spraying the pesticide had the mean points at 54.4. The statistical tests showed that there was no significant distinction of attitude on the use of the pesticide at 0.05.

Experiences on Training on the use of pesticide

As for the agriculturists who had the experiences of training on the use of the pesticide, their average points were 57.7. and the average points o f these who did not have experiences in training were 54.6. The statistical tests found that there was no significant difference of knowledge on the use of pesticide at the level of 0.05.

Getting information on the pesticide

The agriculturist got the information on the pesticide through 1-2, 3-4, and 5 types of media. And their mean points on the attitude towards the use of he pesticide were 55.2, 58.3 and 59.1 respectively. The statistical tests found that there was no significant difference of attitudes towards the use of pesticide at 0.05.

Table 4-8: Analyses the factors affecting attitude towards the use of the pesticide.

Variables	Number	Mean	S.D.	Statistical test
Sex				
Male	41	58.3	7.5	t = 1.075
Female	39	56.6	6.0	P= 0.283
Age				
Below 45 years	19	59.1	6.9	F= 1.287
46 – 60 years	38	57.8	6.1	P= 0.282
Over 61 years	23	55.7	7.8	
Member of family				
1 – 2	15	54.3	7.3	F= 2.080
3 – 4	38	58.1	6.8	P= 0.132
5 onwards	27	58.4	6.2	
Occupation				
Agriculturists	42	59.5	6.7	t = 2.915
Not agriculturists	38	55.2	6.3	P= 0.005*
Education				
The primary elementary school	62	56.7	6.8	F= 2.172
The second elementary school	6	59.3	6.4	P= 0.121
The primary high school onwards	12	60.9	6.2	
Income				
Lower than 10,000 Baht	10	54.8	9.3	F= 6.973
10,001 – 50,000 Baht	48	56.1	4.1	P= 0.002*
Over 50,001 Baht	22	61.8	8.5	

* The mean difference is significant at the 0.05 level.

Table 4-8: Analyses the factors affecting attitude towards the use of the pesticide. (Continued)

Variables	Number	Mean	S.D.	Statistical test
Occupied land				
Less than 10 rais	25	54.8	6.6	F= 14.982
11 – 30 rais	37	55.8	4.3	P= 0.000*
Over 31 rais	18	64.2	7.4	
Experiences in using pesticide				
Used	70	57.9	6.3	t = 1.154
Never used	10	54.4	9.5	P= 0.275
Experiences in training				
Had	75	57.7	6.4	t = 0.555
Never had	5	54.6	12.5	P= 0.608
Getting information				
1-2 Types	21	54.2	5.0	F= 3.589
3-4 Types	33	58.3	6.7	P= 0.032*
5 Types onwards	26	59.1	7.6	

* The mean difference is significant at the 0.05 level.

4.9 Analysis of factors affecting behavior on the use of the pesticide

Sex

The average points of both male and female agriculturists concerning the use of the pesticide were 65.7 and 64.8. Statistical tests found that different behavior towards the use of the pesticide at 0.05.

Age

The average scores for the farmers below 45, 46-60 and over 40 regarding the behavior towards the use of the pesticide were 68.2, 65.9 and 61.8 respectively.

The statistical tests found that different age brought about difference of behavior towards the use of the pesticide at 0.05.

Family member

The mean points of behavior towards the use of pesticide of farmers with family members of 1-2, 3-4 and 5 were 62.4, 65.1 and 62.1 respectively.

Education

The mean points of the agriculturists who completed the first elementary school, the second elementary school and the primary high school were 64.4, 68.0 and 68.2 respectively. There was no difference of behavior in using the pesticide at 0.05.

Income

The mean points of behavior concerning the use of pesticide of the farmers with less than 10,000 Baht income, 10,001-50,000 Baht and 50,001 Baht onwards were 57.8, 65.5 and 68.1 respectively. The statistical tests found that there was difference of behavior at 0.05.

Land occupation

For the agriculturists who occupied less than 10 rais, 11-30 rais and 31 rais, their mean points of behavior towards the use of pesticide were 63.6, 64.3 and 69.6. It was found that there was behavioral difference in using the pesticide at 0.05.

Experiences on using the pesticide

The average points of the farmers who had experiences in spraying the pesticide were 65.9. The average points for the farmers who had no experiences in spraying the pesticide were 60.6. It was found that there was behavioral difference concerning that use of pesticide at 0.05.

Experiences on Training

As for the agriculturists who had the experiences of training on the use of the pesticide, their average points were 65.5. and the average points of these who did not have experiences in training were 62.0. The statistical tests found that there was no significant difference of behavioral on the use of pesticide at the level of 0.05.

Getting information on the use of the pesticide.

The mean points of the agriculturists who got information on the pesticide through 1-2, 3-4, and 5 media types were 64.2, 65.1 and 66.2. It was found that there was no behavioral difference on the use of the pesticide at 0.05.

Table 4-9: Analyses the factors affecting the farmers, behavior in using the pesticide.

Variables	Number	Mean	S.D.	Statistical test
Sex				
Male	41	65.7	6.5	t = 0.495
Female	39	64.8	8.4	P = 0.624
Age				
Below 45 years	19	68.2	6.1	F= 4.380
46 – 60 years	38	65.9	8.9	P= 0.016*
Over 61 years	23	51.8	9.2	
Member of family				
1 – 2	15	62.4	8.8	F= 1.960
3 – 4	38	65.1	7.2	P= 0.148
5 onwards	27	67.1	6.7	
Occupation				
Agriculturists	42	67.7	5.3	t = 3.160
Not agriculturists	38	62.6	8.6	P= 0.002*
Education				
The primary elementary school	62	64.4	7.9	F= 1.728
The second elementary school	6	68.0	4.9	P= 0.184
The primary high school onwards	12	68.2	5.3	
Income				
Lower than 10,000 Baht	10	57.8	13.6	F= 7.782
10,001 – 50,000 Baht	48	65.5	5.7	P= 0.001*
Over 50,001 Baht	22	68.1	4.8	

* The mean difference is significant at the 0.05 level.

Table 4-9: Analyses the factors affecting the farmers, behavior in using the pesticide. (Continued)

Variables	Number	Mean	S.D.	Statistical test
Occupied land				
Less than 10 rais	25	63.6	7.3	F= 4.211
11 – 30 rais	37	64.3	8.1	P= 0.018*
Over 31 rais	18	69.6	4.4	
Experiences in using pesticide		.		
Used	70	65.9	6.7	t = 2.166
Never used	10	60.6	10.7	P= 0.033*
Experiences in training				
Had	75	65.5	7.1	t = 0.619
Never had	5	62.0	12.5	P= 0.568
Getting information				
1-2 Types	21	64.2	8.4	F= 0.407
3-4 Types	33	65.1	6.8	P= 0.667
5 Types onwards	26	66.2	7.5	

* The mean difference is significant at the 0.05 level.

4.10 Analysis of the relationships between multiple variables and the achievement from the training in the project to reduce risks of the pesticide – related diseases.

The study of factors affecting knowledge, attitude and behavior towards the use of the pesticide was analyzed by the stepwise multiple regression technique to establish the models of the relationship between independent variables and dependent variables. Each variable was studied.

All variables were used to enter the equation of the stepwise multiple regression analysis. The important technique of this analysis was results of

independent variables were systematically analyzed. There were two types of variables; independent variables – personal factors, economy and society, experiences in using the pesticide and in training.

Dependent variables were knowledge, attitude, and behavior towards the use of pesticide.

4.10.1 Analysis of relationships between multiple independent variables and knowledge on the pesticide

The analysis found that the value of co – relative coefficient (r) at 0.093 – 0.360 as shown (in the table 4-10). The stepwise multiple regression analysis found that the independent variables were significant in explaining or predicting knowledge on the pesticide. There were 5 variables, which were put in the equation (Table 4-11).

Step 1

Information on the pesticide was positively related to knowledge on the pesticide (Beta = 0.3.04). Information the past of agriculturists could explain the variability of knowledge by 12.9% (R^2= 0.129).

Step 2

Family members were positively related to knowledge on the use of the pesticide (Beta = 0.249). Farmers' Age could explain the variability of knowledge by 5.9% (R^2 Change = .059). Family member and the first selected variable could explain the change of knowledge about18.8% (R^2= 0.188).

Step 3

The occupation of the agriculturists was the variable positively related to knowledge on the pesticide (Beta = 0.223). That meant the farmers had good knowledge. The occupation could explain variability of knowledge by 3.9% (R^2 Change =0.039). The occupation, the first and the second selected variable could explain the change of knowledge about 22.7% (R^2= 0.227).

Step 4

The age of farmers was a variable negatively related to knowledge on the pesticide (Beta = 0.183). It meant the older farmers did not have

good knowledge. The age of farmers could explain variability of knowledge by 3.4% (R^2 Change = 0.034). The age and the first three variables could explain the change of knowledge about 26.1% (R^2= 0.261).

Step 5

Training in the project to reduce the risks of the pesticide was a variable positively related to knowledge on the pesticide (Beta = 0.130). In other words, the farmers who joined the training had better knowledge than those who did not join the project. The training could explain the variability of knowledge by 1.6% (R^2 Change = 0.016). Combined with the first four variables, it could explain the change of points of knowledge by 27.7% (R^2 = 0.277).

Knowledge = 13.955+ 1.575 (getting information) + 1.339 (family members)+ 1.745 (occupation) – 0.92 (age) + 1.074 (training)

Table 4-10: Shows the value of co – relation (r) between the independent variables and knowledge on using the pesticide.

Variables	r
Sex	-0.105
Age	-0.237
Family members	0.268
Occupation (Career)	0.144
Education	0.143
Income	0.139
Occupied cultural land	0.185
Experiences in using pesticide	0.039
Experiences in training	0.169
Getting information	0.360
Training in the project	0.198

Table 4-11: The stepwise multiple regression analysis to show the relationship between the independent variables and knowledge on using the pesticide.

Order of variable	B	Beta	R	R^2	R^2chang	SE B	F	Sig.F
1. Getting information	1.575	0.304	0.360	0.129	0.129	0.291	35.851	0.000
2. Family members	1.339	0.249	0.434	0.188	0.059	0.307	27.816	0.000
3. Occupation (Career)	1.745	0.223	0.477	0.227	0.039	0.443	23.436	0.000
4. Age	-0.932	-0.183	0.511	0.261	0.034	0.288	21.024	0.000
5. Training in the project	1.074	0.130	0.527	0.277	0.016	0.464	18.201	0.000
SEE = 3.350	Constant = 13.955							

4.10.2 Analysis of relationship between the multiple independent variables and attitude towards the use of the pesticide.

The results showed that there was a value of co – relative coefficient (r) between 0.020 – 0.260 (Table 4-12).

The stepwise multiple regression analysis found that independent variables were very significant in explaining the attitude towards the use of the pesticide. There were three variables (Table 4-13).

Step 1

Occupied land was positively related to the attitude towards the use of the pesticide (Beta = 0.182). The occupied land could explain variability of scores of attitude by 6.8 % ($R^2 = 0.068$).

Step 2

Occupation (career) was positively related to the use of the pesticide (Beta = 0.248). The farmers had a positive attitude. The career could explain variability of attitude by 4.5% (R^2 Change = 0.045). Combined with the first variable, it could explain the change of attitude by 11.3% ($R^2 = 0.113$).

Step 3

The age of agriculturists was negatively related to the attitude towards the use of the pesticide (Beta = 0.176). That meant, the older farmers had a negative attitude. The age could explain variability of attitude by 2.9%

(R^2Change= 0.029). Combined with the first two variables, it could explain the change of attitude by 14.2 % (R^2 =0.142) as in the equation.

Attitude = 52.973 + 1.497(occupation land) + 2.994 (career) – 1.386 (age)

Table 4-12: Shows the value of co – relation (r) between the independent variables and the attitude towards the use of the pesticide.

Variables	r
Sex	-0.011
Age	-0.175
Family members	0.093
Occupation (Career)	0.258
Education	0.098
Income	0.151
Occupied cultural land	0.260
Experiences in using pesticide	0.020
Experiences in training	0.075
Getting information	0.121
Training in the project	0.154

Table 4-13: The stepwise multiple regression analysis to show the relationship between the independent variables and the attitude concerning the use of the pesticide.

Order of variable	B	Beta	R	R^2	R^2chang	SE B	F	Sig.F
1. Occupation land	1.497	0.182	0.260	0.068	0.068	0.512	17.469	0.000
2. Occupation (Career)	2.994	0.048	0.336	0.116	0.045	0.748	15.283	0.000
3. Age	-1.386	-0.176	0.377	0.142	0.029	0.486	13.199	0.000
SEE = 5.617	Constant = 52.973							

4.10.3 Analysis of relationship between multiple variables and behavior towards the use of the pesticide

The analysis found that there was the value of co – relative coefficient (r) at 0.007 – 0.290 (table 4-14) The stepwise multiple regression analysis found that the independent variables were significant, in explaining the behavior in using the pesticide. There were 6 variables (table 4-15)

Step 1

Experiences in training were positively related to the behavior in using the pesticide (Beta = 0.152). The experiences in training could explain variability of behavior by 10.3% ($R^2 = 0.103$)

Step 2

The age of the farmers was negatively related to knowledge on using he pesticide (Beta = 0.212). The farmers' age could explain variability of behavior by 4.7% (R^2 Change = 0.047). Combined with the first variable, it could explain the points of behavior by 15.0% ($R^2 =0.150$)

Step 3

Career of agriculturists was positively related to knowledge on using to pesticide (Beta = 0.230). The career could explain variability of behavior by 3.7% (R^2 change = 0.037). Combined with the first two variables, it could explain the change of points of behavior by 18.2% ($R^2 = 0.187$).

Step 4

The number of the family members was positively related to behavior in using the pesticide (Beta = 0.190). The number of the family members could explain variability of behavior by 3.9% (R^2 change = 0.039). Combined with the first three variables, it could explain the change of the behavior points by 22.6% ($R^2 = 0.226$).

Step 5

Experiences in using the pesticide were positively related to the behavior in using the pesticide (Beta = 0.168). The experiences could explain variability of behavior by 2.5% (R^2 change = 0.025). Combined with the first four variables, it could explain the change of the points of behavior by 25.1% ($R^2 = 0.251$).

Step 6

Training in the project was a variable positively related to knowledge on using the pesticide (Beta = 0.145). The training could explain variability of points by 1.2% (R^2 change = 0.012). Combined with the first five variables, it could explain the change of points of behavior by 26.4% (R^2 = 0.264) as in the equation.

Behavior = 54.958 + 2.639 (experiences in training) – 2.413 (age) + 4.02 (career) + 2.280 (the number of family member) + 3.557 (experiences in using the pesticide) + 2.690 (training in the project)

Table 4-14: Shows the value of co – relation (r) between the independent variables and behavior in using the pesticide

Variables	r
Sex	-0.007
Age	-0.251
Family members	0.217
Occupation (Career)	0.154
Education	0.071
Income	0.195
Occupied cultural land	0.166
Experiences in using pesticide	0.255
Experiences in training	0.321
Getting information	0.118
Training in the project	0.290

Table 4-15: The stepwise multiple regression analysis to show relationship between the independent variables and behavior towards using the pesticide.

Order of variable	B	Beta	R	R^2	R^2chang	SE B	F	Sig.F
1. Experiences in training	2.639	0.152	0.321	0.103	0.103	1.299	27.759	0.000
2. Age	-2.413	-0.212	0.387	0.150	0.047	0.651	21.163	0.000
3. Occupation (Career)	4.021	0.230	0.433	0.187	0.037	1.000	18.337	0.000
4. Family members	2.280	0.190	0.475	0.226	0.039	0.694	17.351	0.000
5. Experiences in using pesticide	3.557	0.168	0.501	0.251	0.025	0.694	15.895	0.000
5. Training in the project	2.690	0.145	0.513	0.264	0.012	1.230	14.078	0.000
SEE= 7.617	Constant = 54.958							

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

The study aimed to examine the achievement of agriculturists who joined the training. The subjects were divided into two groups. One was the trial group who joined in the project, totaling 80. The other was the controlled group that did not join the training, totaling of 163.

The questionnaires were used to collect data. Data were analyzed to get ratio, percentage, the mean, the test of hypothesis, one way variation and the stepwise multiple regression analysis.

5.1 CONCLUSION

5.1.1 General characteristics of person, economy and society

51.2 % of the farmers who joined the training were males. 47.4% were 45-60 years old. The average age was 53.88. 81.3% were married. 77.5% finished the elementary school. 47.5% had 1-2 laborers. 46.3% occupied 11-30 rais. 60.0% earned between 10,001-50,000 Baht. The average income was 40,723 Baht/year.

As for the agriculturists who did not join the training, 52.8% were males, 39.9% were over 61 years. The average age was 55.9. 79.1% were married. 63.9% finished the elementary school. 46.6% had 3-6 family members. 55.2% were farmers. 53.4% had the land less than 10 rais. 50.9% earned between 10,001-50,000 Baht/year. The average income was 28,526 Baht/year.

5.1.2 General Characteristics of agriculture and use of the pesticide

32.5% of the agriculturists who joined the training were engaged in the career less than 10 years. 73.5% grew rice. 87.5% used the pesticide. 22.6% used the herbicide. 70% were never exposed to the hazard of the pesticide. 77.5% used the pesticide because they wanted high products. 43.6 % of them did farming less than 10 years. 55.3% planted rice. 74.8% ever used the pesticide. 25.7% used the herbicide. 59.5% used the pesticide because they wanted a high product.

5.1.3 Information and technological transfer

93.8% of the first group used to have the experiences in training on using the pesticide. 72.25% get informations in using from the product labels. 74.2% of the second group never had experiences in training on using the pesticide. 66.7% get informations in using from the product labels.

5.1.4 Knowledge, attitude and behavior were concerning the use of the pesticide.

The average points of the total group were 20.16. 62.5% of them had a moderate knowledge on the pesticide. 73.8% has a moderate attitude in using the chemicals. The mean points of behavior were 65.3. 68.8% had a moderate behavior towards the use of the pesticide. The average points of the controlled group were 18.52 (25 items). 69.4% had a moderate knowledge on using the pesticide. The average points of attitude were 55.5 (15 items). 82.2% had a moderate attitude on using the pesticide. The average points of behavior were 59.9 (25 items). 56.4% had a moderate behavior in using the pesticide.

5.1.5 Comparison of variables between the farmers who were trained and not trained.

The study found that occupied land, income, types of plants, experiences in using types of chemicals, the reason in choosing the pesticide, types of information, knowledge, attitude and behavior were significantly different at 0.05. Sex, age, marital status, education, number of members commercial position, career, duration of career were not significantly different at 0.05. The study found that both groups of the agriculturists had knowledge, attitude and behavior at a moderate level.

5.1.6 Analysis of Factors affecting knowledge, attitude and behavior concerns the use of the pesticide.

A study of the factors affecting knowledge on the pesticide found that age, the number of family members and information brought about difference of knowledge at 0.05.

Sex, career, education, income, occupied land, experiences in training were not significantly different at 0.05.

A study of factors affecting the attitude towards the use of the pesticide found that career, income, occupied land and information led to difference of knowledge at 0.05.

But sex, age, education, the number of family members, experiences in using the pesticide and in training were not significantly different at 0.05.

A study of factors affecting behavior in using the pesticide found that age, career, income, occupied land, and experiences in using the pesticide led to difference of knowledge at 0.05.

Sex, the number of family members, education, experiences in using the pesticide and information was not significantly different at 0.05.

5.1.7 The Stepwise multiple regression analysis between independent variables and knowledge, attitude and behavior regarding the use of the pesticide

A study of relationship found that the independent variables that could explain relationship with the dependent variables were getting information from media, the number family members, career, age and participation. The variable of information could best explain variability (12.9%), followed by the number of family members (5.9%), career (3.9%) age (3.4%) participation (1.6%). All 5 factors could explain knowledge on the chemical by 27.7%. 72.3% could be explained by other causes, as in the equation.

Knowledge = 13.955 + 1.527 (information) + 1.339 (family member) + 1.745 (career) – 0.932 (age) + 1.074 (training in the project).

$R^2 = 0.277$

A study of relationship of independent variables and attitude found that land occupation, career, and age could explain the relationship with dependent variables. Land occupation could best explain the relationship (6.8%), followed by career (4.5%) and age (2.9%). All there could explain the attitude by 14.2% other 85.8% could be explained by other causes as in the equation.

Attitude = 52.973 + 1.497 (land occupation) + 2.994 (career) – 1.386 (age)
R = 0.142.

$R^2 = 0.142$

A study of relationship between independent variables affecting the behavior of using the pesticide found that the independent variables that could explain the relationship with dependent ones were experiences, age, career, family member and participation in the project.

The variable of experiences in training could best explain variability (10.3%), followed by (4.7%), family member (3.9%), career (3.7%), and

joining the training (1.2%). These factors could explain the behavior towards using the pesticide by 26.4%. 73.6% were explained by other causes as in the equation.

Behavior = 54.958 + 2.639 (experiences in training) – 2.413 (age) + 4.021 (career) + 2.280 (family member) + 3.557 (experience in using the pesticide) + 2.690 (joining in the project)

$R^2 = 0.264$

5.2 Results discussion

In studying the cognitive achievement, the researcher had the hypotheses to examine the factors affecting knowledge, attitude and behavior concerning the use of the pesticide.

Hypothesis 1

Agriculturists who had the training in the project had a better knowledge, attitude and behavior in using the pesticide than their counterparts who did not joining the training. Statistical tests found the difference at 0.05. That was because the training could help, in the development process. The agriculturists came out with better knowledge skills and expertise.

Hypothesis 2

Different population led to difference in knowledge, attitude and behavior.

2.1 Different sexes brought about difference in using the pesticide at 0.05.

2.2 Different age contributed to difference in knowledge, attitude and behavior in using the pesticide at 0.05. Regarding knowledge and behavior statistical tests showed that different age of agriculturists contributed to difference in knowledge, attitude and behavior at 0.05. The young farmers the better level of the said factors than the older farmers. That was in line with the study by Udom Ampornpan, (1995: 100).

As regards the attitude, it was found that different age did not lead to difference in using the pesticide at 0.05 as it was hypothesized. The assumption was that the farmers were in the similar conditions, so had the similar attitude. That was congruent with the study by Pijitra Ngoenpat, (2000: 66)

2.3 The different number of the family members contributed to difference in knowledge, attitude and behavior at 0.05.

The study of knowledge of agriculturists showed that the diffident number of family members were responsible for difference of knowledge at 0.05. The farmers with more family members had better knowledge on the pesticide. That was in line with the hypothesis.

2.4 Different career contributed to difference of knowledge, attitude and behavior at 0.05.

It was found that different careers did not bring about difference of knowledge in using the pesticide at 0.05. That was not consistent with the hypothesis. The assumption was the agriculturists get equal chance to access information and new sciences. That resulted in not being different in using the pesticide. Their knowledge on using the chemical was not different. That was in accordance with the study by Chamnan Wongvinitsorn, (2002: 96)

2.5 Different education led to difference of knowledge, attitude and behavior at 0.05.

The study from statistical tests found that different educational level did not result in difference regarding the use of the pesticide at 0.05. The assumption was the farmers get equal chance to get access to learning and information on equal terms. They, in addition, could improve understanding, skills and expertise to appropriately and successfully generate the change in their career.

2.6 Different income resulted in difference in knowledge, attitude and behavior at 0.05.

The study found that different income did not lead to different knowledge in using the pesticide at 0.05. That was not consistent with the hypothesis. The assumption was that though having different income, the farmers could learn and exchange their experience. As a result knowledge was not much different. As for attitude and behavior, it was found that different income could bring

about difference in using the pesticide at 0.05. That was congruent with the assumption. The income was positively related to attitude and behavior. The agriculturists with better income had better attitude and behavior than those with lower income.

2.7 Different occupied land was responsible for difference in using the pesticide at 0.05.

The study found that different occupied lands did not bring about difference at 0.05. That was not in line with the hypothesis, because the farmers got new knowledge traded experiences with one another.

As for attitude and behavior, it was that different occupied land led to difference at 0.05. That was corresponding with the hypothesis. The farmers who had more occupied land were better equipped with knowledge, attitude and behavior that their counterparts with less lands.

Hypothesis 3

Different factors resulted in difference knowledge, attitude and behavior in using the pesticide.

3.1 The study of knowledge and attitude found that different experiences in using the pesticide did not contribute to difference in using the pesticide at 0.05. That was not congruent with the hypothesis, maybe because the farmers always sought knowledge and new sciences.

The study of behavior found difference in using the chemicals at 0.05. That was consistent with the hypothesis. The agriculturists with experiences had a higher behavioral in using the pesticide that those without experiences.

3.2 The study found that access to different knowledge led to difference in knowledge and attitude in using the pesticide at 0.05. That was in line with the hypothesis. The farmers with better access to information had better knowledge that those with less information. That was in line with the study by Sethapong Puchakan, (1998: 98).

The study of behavior found that access to different information did not bring about difference in using the pesticide at 0.05. That was not consistent with the hypothesis.

3.3 It was found that experiences in using the pesticide did not cause difference in the attitude towards the use of the pesticide at 0.05. That was not congruent with hypothesis. The assumption was that the farmers could access knowledge and experiences from various sources. Thus attitude and belief of the agriculturists were not affected. That was in line with the study by Chamnan Wongpinit, (2002: 109) which said that training on environmental protection did not have an impact on knowledge and attitude.

5.3 Recommendations from the present research

1. There should be training on using the pesticide for agriculturists as it was the process, which could have an impact on knowledge, attitude and behavior. The training had to be continuous, extensive and accessible.

2. The study found that the agriculturists below 45 would be more aware and more responsible as they were more willing to accept new innovation. Those with more occupied land and more income had a better behavior in using the pesticide. With more lands they were to face more agriculture – related problems. So they had to be careful and more interested in using the chemical in order to get more products but least loss.

3. The government agencies concerned should play more roles to disseminate information on the pesticide through all types of media. That could be person like the personnel of academic promotion and mass media – radio, TV and newspaper. The agriculturists should be urged to be more aware of the problems and effects caused by the pesticide.

4. The study found that the majority of the agriculturists preferred the pesticide. They did not give attention to natural substances to replace the pesticide. The government and agencies concerned should address the issue by creating the demonstration land plot and holding the training.

5.4 Recommendations for further research

1. There should be suitable form, process and course used in the training on the use of the pesticide by agriculturists.

2. There should be a study of the effects of the chemicals on environment.

3. There should be a comparative study of the products from the use of the pesticide and the natural substances.

4. There should be an in-depth study of the agriculturists' behavior in using the pesticide in their areas.

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APPENDIX

แบบสัมภาษณ์เลขที่……..

แบบสอบถาม

เรื่อง

การประเมินผลสัมฤทธิ์ทางการเรียนรู้ของเกษตร จากการฝึกอบรมในโครงการลดอัตราเสี่ยง
การเกิดโรคพิษจากสารเคมีกำจัดศัตรูพืช ตำบลสายทอง อำเภอป่าโมก จังหวัดอ่างทอง

ชื่อ เกษตรกรผู้ให้ข้อมูล(นาย,นาง,นางสาว)……
อยู่บ้านเลขที่……หมู่ที่…… ตำบล……อำเภอ ……. จังหวัด อ่างทอง
ชื่อผู้สัมภาษณ์ ……
วันที่สัมภาษณ์ ……./ ……../……..

<u>คำชี้แจง</u> แบบสัมภาษณ์นี้ เป็นส่วนหนึ่งของการทำวิทยานิพนธ์ เรื่อง “การประเมินผลสัมฤทธิ์ทางการเรียนรู้ของเกษตร จากการฝึกอบรมในโครงการลดอัตราเสี่ยงการเกิดโรคพิษจากสารเคมีกำจัดศัตรูพืช ตำบลสายทอง อำเภอป่าโมก จังหวัดอ่างทอง” ของ นายอำนาจ สีสุวรรณ์ นักศึกษาหลักสูตรวิทยาศาสตรมหาบัณฑิต สาขาเทคโนโลยีที่เหมาะสมเพื่อการพัฒนาทรัพยากรและสิ่งแวดล้อม มหาวิทยาลัยมหิดล ขอให้ผู้ตอบแบบสัมภาษณ์ กรุณาตอบตรงตามความเป็นจริง โดยคำตอบที่ได้รับจะใช้เฉพาะการทำวิจัยและถือเป็นความลับ คำตอบของท่านจะเป็นประโยชน์อย่างยิ่งในการศึกษาวิจัยครั้งนี้ โดยแบบสัมภาษณ์มีทั้งหมด 5 ตอน คือ

ตอนที่ 1 ข้อมูลทั่วไปของเกษตรกร

ตอนที่ 2 แบบทดสอบความรู้ เรื่อง การใช้สารเคมีป้องกันกำจัดศัตรูพืช

ตอนที่ 3 แบบวัดทัศนคติต่อเรื่อง การใช้สารเคมีป้องกันกำจัดศัตรูพืช

ตอนที่ 4 แบบวัดพฤติกรรมการใช้สารเคมีป้องกันกำจัดศัตรูพืช

ตอนที่ 5 ปัญหาอุปสรรคและข้อเสนอแนะเกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช

ตอนที่ 1 ข้อมูลทั่วไป

โปรดตอบคำถามที่เกี่ยวกับตัวท่านต่อไปนี้ให้ถูกต้องตรงกับความเป็นจริง โดยทำเครื่องหมาย √ ใน ( ) ที่กำหนดให้ และเติมคำในช่องว่างให้สมบูรณ์

1.1 ข้อมูลส่วนบุคคล สภาพพื้นฐานทางเศรษฐกิจและสังคม

1. สถานภาพของผู้ให้สัมภาษณ์

( ) หัวหน้าครัวเรือน ( ) เป็นภรรยาหัวหน้าครัวเรือน

( ) เป็นสมาชิกในครัวเรือน ( ) อื่นๆ ระบุ.....

2. เพศ ( ) ชาย ( ) หญิง

3. อายุ..... ปี

4. สถานภาพสมรส

( ) โสด ( ) คู่ ( ) หม้าย

( ) แยกกันอยู่ ( ) อื่นๆ ระบุ .....

5. ระดับการศึกษา

( ) ไม่ได้เรียน ( ) ม.6 ( ) ปริญญาเอก

( ) ต่ำกว่า ป.4 ( ) ปวช.

( ) ป. 4 ( ) อนุปริญญา หรือ ปวส.

( ) ป. 6 ( ) ปริญญาตรี

( ) ม. 3 ( ) ปริญญาโท

( ) อื่นๆ ระบุ.....

6. จำนวนสมาชิกในครอบครัว (รวมผู้ให้สัมภาษณ์ด้วย) จำนวน ..... คน

ลำดับ	เพศ	อายุ(ปี)	เกี่ยวข้องกับครอบครัว	อาชีพ	หมายเหตุ
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

7. จำนวนสมาชิกที่เป็นแรงงานที่ทำการเกษตร ในครัวเรือน ..... คน

8. ท่านดำรงตำแหน่งใดบ้างในชุมชน(ตอบได้มากกว่า 1 ข้อ)

( ) ไม่ได้ดำรงตำแหน่งใด ( ) กำนัน ผู้ใหญ่บ้าน

( ) อบต. ( ) กรรมการหมู่บ้าน

( ) ผู้นำกลุ่มเกษตรกร ( ) อาสาสมัครสาธารณสุข

( ) ผู้นำกลุ่มแม่บ้าน ( ) อื่นๆ

ระบุ……

9. อาชีพหลักที่ทำควบคู่กับอาชีพการเกษตร

( ) ไม่มี ( ) ค้าขาย ( ) เลี้ยงสัตว์

( ) รับจ้าง ( ) รับราชการ ( ) บริษัทเอกชน

( ) อื่น ระบุ ……..

10. ขนาดของพื้นที่ถือครอง

เป็นของตนเอง …….. ไร่……งาน……ตารางวา

เช่า …….. ไร่……งาน……ตารางวา

อื่นๆ ระบุ ……..

11. รายได้ของครอบครัว ในรอบปีที่ผ่านมา

1. รายได้จากการปลูกพืช

ข้อมูลที่ทำการศึกษา	ชนิดของพืชที่ปลูก				หมายเหตุ
	ข้าว	พืชผัก	ไม้ผล	อื่นๆระบุ……	
รายจ่ายในรอบปีที่ผ่านมา					
ขนาดพื้นที่เพาะปลูก	……	……	……	……	……
(….ไร่…..งาน…….ตารางวา)	……	……	……	……	……
1. ค่าเช่าที่ดิน	……	……	……	……	……
2. ค่าสารเคมีปราบศัตรูพืช	……	……	……	……	……
3. ค่าปุ๋ย	……	……	……	……	……
4. ค่าเตรียมพื้นที่	……	……	……	……	……
5. ค่าเมล็ดพันธุ์	……	……	……	……	……
6. ค่าแรงงานปลูก	……	……	……	……	……
7. ค่าแรงงานเก็บเกี่ยว	……	……	……	……	……
8. ค่าเครื่องมืออุปกรณ์	……	……	……	……	……

ข้อมูลที่ทำการศึกษา	ชนิดของพืชที่ปลูก				หมายเหตุ
	ข้าว	พืชผัก	ไม้ผล	อื่นๆระบุ.....	
9. ค่าขนส่ง	.....	.....	.....	.....	.....
10. ค่าน้ำมันเชื้อเพลิง	.....	.....	.....	.....	.....
11. อื่น.....	.....	.....	.....	.....	.....
รวมรายจ่าย	.....	.....	.....	.....	.....
รายได้ในรอบปีที่ผ่านมา					
1. ปริมาณผลผลิต กก./ปี	.....	.....	.....	.....	.....
2. ใช้บริโภค กก./ปี	.....	.....	.....	.....	.....
3. เก็บไว้ทำพันธุ์ กก./ปี	.....	.....	.....	.....	.....
4. ผลผลิตที่ขาย กก./ปี	.....	.....	.....	.....	.....
5. อื่นๆ ระบุ.....	.....	.....	.....	.....	.....
6. ราคาที่ขายปีที่แล้ว	.....	.....	.....	.....	.....
(กก.ละ)	.....	.....	.....	.....	.....
รวมรายได้ ข้อ 4 คูณ ข้อ 6	.....	.....	.....	.....	.....
รายได้สุทธิ (รายได้ - รายจ่าย)					

รวมรายได้สุทธิจากทำอาชีพเกษตรกรรมในครัวเรือนต่อปี.....บาท

1.2 ข้อมูลเกี่ยวกับสภาพการเกษตรกรรม การป้องกันและกำจัดศัตรูพืช

12. ท่านทำอาชีพเกษตรกรรมมาแล้ว…….. ปี (รวมปีนี้ด้วย)

13. ประเภทของพืชที่กำลังปลูกอยู่ในขณะนี้

( ) ข้าว

( ) ผักต่างๆ และพืชสวนครัว (ระบุ)……

( ) ผลไม้/ไม้ยืนต้น (ระบุ) ……

( ) ดอกไม้ (ระบุ) ……

( ) อื่นๆ ……...……

14. ท่านเคยฉีดพ่นยาปราบศัตรูพืชด้วยตนเองหรือไม่

( ) เคย ……ครั้ง/เดือน

( ) ไม่เคย ระบุผู้ฉีด ……

15. ในรอบปีที่ผ่านมา ท่านใช้สารเคมีป้องกันกำจัดศัตรูพืชประเภทใดบ้าง

( ) สารกำจัดวัชพืช	( ) ใช้	( ) ไม่ใช้	( ) ไม่ทราบ
( ) สารเคมีกำจัดแมลงศัตรูพืช	( ) ใช้	( ) ไม่ใช้	( ) ไม่ทราบ
( ) สารเคมีกำจัดโรคพืช	( ) ใช้	( ) ไม่ใช้	( ) ไม่ทราบ
( ) สารเคมีกำจัดสัตว์ ศัตรูพืช	( ) ใช้	( ) ไม่ใช้	( ) ไม่ทราบ
( ) สารเคมีเร่งผลผลิต	( ) ใช้	( ) ไม่ใช้	( ) ไม่ทราบ

16. ท่านหรือคนในครอบครัวเคยได้รับอันตรายจากสารเคมีป้องกันกำจัดศัตรูพืชหรือไม่

( ) เคย จนถึงชีวิต

( ) เคย รุนแรง (มีอาการ อาเจียน มือเท้าชา ชักกระตุก หายใจติดขัด หมดสติ)

( ) เคย ไม่รุนแรง (มีอาการผื่นคัน มึนงง วิงเวียน ปวดศรีษะ หน้ามืด)

( ) ไม่เคย

17. ท่านมีปัญหาในการใช้สารเคมีป้องกันและกำจัดศัตรูพืช หรือไม่

( ) มี ( ) ไม่มี (ข้ามไป ข้อ 19)

18. ท่านมีปัญหาในเรื่องการใช้สารเคมีป้องกันกำจัดศัตรูพืช ส่วนมากท่านปรึกษาใคร(ตอบเพียงข้อเดียว)

( ) ครู – อาจารย์

( ) เกษตรตำบล/อำเภอ

( ) พัฒนากร

( ) เจ้าหน้าที่สาธารณสุข

( ) ร้านขายยากำจัดศัตรูพืช

( ) เพื่อนบ้าน ญาติ

( ) อื่นๆ ระบุ ……..

19. เมื่อท่านทราบว่า สารเคมีป้องกันกำจัดศัตรูพืช มีอันตรายเหตุใดท่านยังใช้อยู่

( ) ต้องการให้ได้ผลผลิตสูง

( ) มีความสะดวกในการใช้

( ) ร่างกายมีความต้านทานได้ยังไม่เกิดอันตราย

( ) ยังไม่มีวิธีที่ดีกว่านี้

( ) อยากเลิกแต่ไม่มีทางเลือก

( ) คิดว่าตนเองมีวิธีป้องกันที่ดีอยู่แล้ว

( ) เราไม่ใช้ คนอื่นใช้เราอยู่ไม่รอด

1.3 ข้อมูลการสื่อสารและการถ่ายทอดเทคโนโลยีเกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช

20. ในรอบปีที่ผ่านมา ท่านเคยเข้ารับการฝึกอบรมเกี่ยวกับเรื่อง การใช้สารเคมีป้องกันกำจัดศัตรูพืชหรือไม่

( ) เคย …….. ครั้ง

( ) ไม่เคย

คำถาม ข้อ 21 – 24 เฉพาะผู้ที่ได้รับการอบรมตอบเท่านั้น

21. จากเนื้อหาที่ท่านได้รับการอบรมความรู้เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช เนื้อหาโดยรวมท่านคิดว่ามีความยากง่าย มีมากน้อยเพียงใด

( ) ยาก ( ) ปานกลาง ( ) ง่าย

22. จากการที่ท่านเข้าร่วมอบรมความรู้เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช เนื้อหาส่วนใดที่ท่านคิดว่าไม่เข้าใจ

( ) การปฏิบัติตนในการใช้สารเคมีป้องกันกำจัดศัตรูพืช

( ) การใช้สารธรรมชาติทดแทน

( ) อันตรายจากสารเคมีป้องกันกำจัดศัตรูพืช

( ) การปฐมพยาบาล

( ) อื่นๆ ระบุ .....

23. ท่านคิดว่าในการบรรยาย เรื่อง เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช ควรจะปรับปรุงหรือไม่

( ) ไม่ควร ( ) ควรปรับปรุง คือ

( ) เนื้อหาให้ง่ายขึ้น

( ) การถ่ายทอดให้ง่ายขึ้น

( ) อื่นๆ ระบุ.....

24. ระเวลาที่ใช้ในการอบรม 1 วัน ท่านคิดว่าเหมาะสมหรือไม่

( ) เหมาะสม ( ) มากเกินไป ( ) น้อยเกินไป

25. ในการถ่ายทอดความรู้เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช ท่านคิดว่าสื่ออย่างไรในการส่งเสริม ทำให้ท่านเกิดความรู้ความเข้าใจมากที่สุด (ตอบได้มากกว่า 1 ข้อ)

( ) สาธิต ( ) ฉายวิดีโอ ( ) ฉายสไลด์ประกอบเสียง

( ) แจกเอกสารวิชาการ ( ) อื่นๆ ระบุ .....

26. การนำความรู้เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช ในการถ่ายทอดความรู้ ท่านคิดว่าใช้สื่ออย่างไรในการส่งเสริม ทำให้ท่านเข้าใจมากที่สุด

( ) ใช้สื่ออย่างเดียว ( ) ใช้สื่อสองอย่างประกอบกัน

( ) ใช้สื่อหลายอย่างประกอบกัน ( ) อื่นๆ ระบุ.....

27. เคยมีเจ้าหน้าที่ หรือผู้เชี่ยวชาญด้าน ด้านวัตถุมีพิษ มาสาธิตเกี่ยวกับเรื่อง การใช้สารเคมีป้องกันกำจัดศัตรูพืช ให้แก่ท่านหรือไม่

( ) เคย ..... ครั้ง

( ) ไม่เคย

28. ในรอบปีที่ผ่านมา ท่านได้รับความรู้ในเรื่องการใช้สารเคมีป้องกันกำจัดศัตรูพืช จากที่ใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

( ) ฉลาก/เอกสารที่บรรจุภัณฑ์ ( ) เจ้าหน้าที่เกษตรตำบล
( ) วิทยุ โทรทัศน์ ( ) เอกสารสิ่งพิมพ์
( ) หนังสือพิมพ์ ( ) จากคำแนะนำของเพื่อนบ้าน
( ) การฝึกอบรม ( ) จากประสบการณ์ที่ปฏิบัติด้วยตนเอง
( ) จากร้านขายยากำจัดศัตรูพืช ( ) เจ้าหน้าที่สาธารณสุข
( ) พัฒนากรชุมชน ( ) ครู-อาจารย์
( ) อื่นๆ ระบุ.....

ตอนที่ 2 แบบทดสอบความรู้ เรื่อง การใช้สารเคมีป้องกันกำจัดศัตรูพืช

โปรดทำเครื่องหมาย / ลงในช่องที่เป็นคำตอบของคำถามแต่ละข้อ เพียงช่องเดียว

คำถาม ทดสอบความรู้	ใช่	ไม่ใช่	ไม่ทราบ
1. สารเคมีป้องกันกำจัดศัตรูพืช ที่สลายตัวได้ช้ามาก ก่อให้เกิดการตกค้างของสารพิษในอาหารและสิ่งแวดล้อมมากที่สุด			
2. ยาฆ่าแมลงมีอันตรายต่อแมลงและคนเท่านั้น			
3. สารเคมีป้องกันกำจัดศัตรูพืช ที่สะสมอยู่ในดินสลายตัวช้าหรือเร็วขึ้นอยู่กับความคงทนของสารเคมีป้องกันกำจัดศัตรูพืชที่เกษตรกรใช้			
4. ยาฆ่าแมลงที่สะสมอยู่ในดินจะแพร่กระจายไปสู่แหล่งน้ำได้โดยฝนหรือน้ำใต้ดินเป็นตัวชะล้าง			
5. มนุษย์เป็นสิ่งมีชีวิตที่สะสมสารเคมีป้องกันกำจัดศัตรูพืชในร่างกายได้มากกว่าสิ่งมีชีวิตอื่นๆ			
6. สารเคมีป้องกันกำจัดศัตรูพืช สามารเข้าสู่ร่ายกายคนเราได้โดยทางปากและจมูกเท่านั้น			
7.ถ้าแมลงดื้อยา ควรเพิ่มความเข้มข้นของยาฆ่าแมลงให้มากขึ้น			
8. ในการผสมสารเคมีป้องกันกำจัดศัตรูพืช ควรใช้มือเปล่าคน เพื่อความสะดวก			
9. ถ้าสารเคมีป้องกันกำจัดศัตรูพืชหกใส่ร่างกายควรรีบหาผ้าเช็ดออกทันที			
10. ในการฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืชผู้ใช้ควรฉีดพ่นเมื่อมีลมพัดแรง			
11. การใช้สารเคมีป้องกันกำจัดศัตรูพืชชนิดเดียวติดต่อกันเป็นเวลานานๆ จะทำให้ศัตรูพืชเกิดการดื้อยา			
12. หลังจากฉีดสารเคมีป้องกันกำจัดศัตรูพืช แล้ว ไม่จำเป็นต้องเว้นระยะเก็บผัก เพราะกว่าจะถึงคนซื้อยาก็หมดฤทธิ์			
13. ในการฉีดพ่นสารเคมีแต่ละครั้งไม่ควรกระทำเพียงคนเดียวควรมีผู้ช่วยไปด้วย			
14. ในขณะทำการฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืช ถ้ารู้สึกไม่สบายอ่อนเพลีย ควรทำการปฐมพยาบาล เมื่อรู้สึกดีขึ้นแล้วทำการฉีดพ่นต่อ			

คำถาม ทดสอบความรู้	ใช่	ไม่ใช่	ไม่ทราบ
15. การได้รับพิษแบบเรื้อรัง ค่อยเป็นค่อยไป เป็นภัยอันตรายที่มองไม่เห็น			
16. เมื่อร่างกายได้รับสารพิษเข้าไป เบื้องต้นจะมีอาการ น้ำลายและเหงื่อออกมาก			
17. ในการเก็บรักษาสารเคมีป้องกันกำจัดศัตรูพืชควรเก็บในที่ที่มีอากาศร้อน			
18. ไม่ควรเก็บสารเคมีป้องกันกำจัดศัตรูพืชไว้ข้ามปี			
19. การกำจัดทำลายภาชนะที่บรรจุสารเคมีที่เป็นพลาสติกหรือขวดแก้ว โดยนำไปทิ้งลงแหล่งน้ำ หรือนำกลับบรรจุสิ่งอื่นต่อไป			
20. ห้ามเผาภาชนะที่บรรจุสารเคมีป้องกันกำจัดศัตรูพืช และกระป๋องสเปรย์ที่อัดความดัน			
21. การใช้สารสะเดา หรือปลูกพืชหมุนเวียน สามารถป้องกันกำจัดศัตรูพืชได้			
22. ตัวห้ำ ตัวเบียน มีหน้าที่ทำลายแมลงศัตรูทางธรรมชาติด้วยกัน			
23. แมลงทุกชนิดเป็นศัตรูพืช			
24. การป้องกันกำจัดศัตรูพืชด้วยวิธีผสมผสาน คือการนำวิธีการต่างๆของการป้องกันกำจัดศัตรูพืชมาผสมผสานกันตามความเหมาะสม ไม่ใช้เพียงวิธีใดวิธีหนึ่งเท่านั้น			
25. การตรวจนับศัตรูพืช ถือว่าเป็นหัวใจ ในการป้องกันกำจัดศัตรูพืช			

ตอนที่ 3 แบบวัดทัศนคติ เกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืช

จงทำเครื่องหมาย / ในช่องที่ท่านเลือกคำตอบ

คำถาม แบบวัดทัศนคติ	เห็นด้วยอย่างยิ่ง	เห็นด้วย	ไม่แน่ใจ	ไม่เห็นด้วย	ไม่เห็นด้วยอย่างยิ่ง
1. การใช้สารเคมีป้องกันกำจัดศัตรูพืชทุกครั้ง ควรปฏิบัติตามฉลากไม่ควรใช้เกินกว่าที่ระบุไว้ในฉลาก					
2. สาเหตุที่ปลาตายในแม่น้ำลำคลอง มีแผลบริเวณลำตัวและตายเป็นจำนวนมาก ไม่น่าจะเกี่ยวกับสารเคมีป้องกันกำจัดศัตรูพืช					
3. การป้องกันกำจัดศัตรูพืช ด้วยวิธีผสมผสานสามารถป้องกันกำจัดศัตรูพืชและลดผลกระทบต่อสิ่งแวดล้อมได้					
4. เกษตรกรจำเป็นต้องมีความรู้ เรื่องการใช้สารเคมีป้องกันกำจัดศัตรูพืช อย่างถูกวิธี					
5. การเผยแพร่ความรู้ เรื่องการใช้สารเคมีป้องกันกำจัดศัตรูพืช ในชุมชนไม่มีความจำเป็นเพราะเกษตรกรส่วนใหญ่รู้ดีอยู่แล้ว					
6. เกษตรกรไม่จำเป็นต้องใช้อุปกรณ์ป้องกันอันตรายจากสารเคมีป้องกันกำจัดศัตรูพืชขณะฉีดพ่น เพราะสิ้นเปลื้อง					
7. แมลงทุกชนิดเป็นศัตรูพืช					
8. การใช้สารเคมีป้องกันกำจัดศัตรูพืชจะได้ผลดีต้องผสมให้มีความเข้มข้นมากๆ					
9. ควรเก็บสารเคมีป้องกันกำจัดศัตรูพืชไว้ในบ้านหรือใต้ถุนบ้าน เพื่อความสะดวกในการใช้					

คำถาม แบบวัดทัศนคติ	เห็นด้วยอย่างยิ่ง	เห็นด้วย	ไม่แน่ใจ	ไม่เห็นด้วย	ไม่เห็นด้วยอย่างยิ่ง
10. ยาฆ่าแมลงที่ตกค้างอยู่ในดินสามารถถ่ายทอดไปยังสิ่งมีชีวิตที่อยู่อาศัยบนดินและในน้ำได้					
11. ในขณะฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืช ไม่ควรรับประทานอาหารหรือเครื่องดื่มขณะฉีดพ่น แต่สามารถสูบบุหรี่ได้					
12. ขณะฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืช ถ้าสารเคมีหกถูกผิวหนัง และเสื้อผ้า ใช้ผ้าเช็ดให้แห้งก็เพียงพอแล้ว					
13. การใช้สารเคมีป้องกันกำจัดศัตรูพืชไม่ถูกต้องจะเป็นอันตรายเฉพาะผู้ใช้ เท่านั้น					
14. เพื่อลดค่าใช้จ่ายในการซื้อสารเคมีป้องกันกำจัดศัตรูพืช ควรเลือกใช้ ชนิดที่มีฤทธิ์ตกค้างนาน					
15. การฉีดพ่นยาฆ่าแมลง จะฉีดพ่นมากหรือน้อย ก็ไม่เห็นจะมีความสำคัญกับผู้ฉีดหรือผู้บริโภค					

ตอนที่ 4 พฤติกรรมการใช้สารเคมีป้องกันกำจัดศัตรูพืช

จงทำเครื่องหมาย / ในช่องที่ท่านเลือกคำตอบ

คำถาม แบบวัดพฤติกรรม	ปฏิบัติทุกครั้ง	ปฏิบัติบ่อยครั้ง	ปฏิบัติเป็นบางครั้ง	ไม่เคยปฏิบัติเลย
1. การซื้อสารเคมีฯท่านได้เลือกซื้อที่ฉลากถูกต้อง ตามพระราชบัญญัติวัตถุมีพิษหรือไม่				
2. ทุกครั้งก่อนใช้ท่านเลือกชนิดยาที่เหมาะสมกับแมลง หรือ เจ้าหน้าที่แนะนำ หรือฉลากระบุ				
3. ก่อนใช้สารเคมีฯท่านได้อ่านฉลากให้เข้าใจถึงวิธีการใช้โดยละเอียด				
4. ก่อนผสมสารเคมีฯ ท่านได้ปฏิบัติตามคำแนะนำโดยเคร่งครัด				
5. เมื่อท่านจะผสมอัตราส่วนจะต้องตรวจเช็คและปรับอัตราส่วนให้เหมาะสมตามที่ฉลากระบุ				
6. ก่อนใช้สารเคมีท่านตรวจชนิดสารที่จะใช้ และวันหมดอายุ				
7. ก่อนการผสม และฉีดพ่นสารเคมี ท่านสวมเสื้อผ้า หมวก แว่นตา ถุงมือ และหน้ากากมิดชิดทุกครั้ง				
8. ก่อนทำงานเกี่ยวกับสารเคมี เมื่อท่านรู้สึกไม่สบายหรืออ่อนเพลีย แต่ยังทำอยู่				
9. การฉีดพ่นสารเคมี ฯท่านได้ทำการฉีดพ่นทันทีโดยไม่ทิ้งไว้นานๆ				
10. การฉีดพ่นสารเคมี ท่านฉีดพ่นตามความต้องการของท่าน โดยไม่มีการคำนวณปริมาณการฉีดต่อไรต่อถังให้ถูกต้อง				
11. ก่อนลงมือฉีดพ่นสารเคมี ท่านสังเกตและดูทิศทางลมหรือไม่				

คำถาม แบบวัดพฤติกรรม	ปฏิบัติทุกครั้ง	ปฏิบัติบ่อยครั้ง	ปฏิบัติเป็นบางครั้ง	ไม่เคยปฏิบัติเลย
12. การใช้เครื่องมือฉีดพ่นสารเคมี ท่านได้ใช้เครื่องที่ชำรุดและมีการรั่วไหลของสารเคมีหรือไม่				
13. ในขณะปฏิบัติงาน หากร่างกายเปียกเปื้อนสารเคมี ท่านรีบล้างน้ำ ฟอกสบู่ให้สะอาด และเปลี่ยนเสื้อผ้าทันที				
14. ระหว่างฉีดพ่นท่านสูบบุหรี่หรือรับประทานอาหารหรือดื่มน้ำโดยไม่ล้างมือให้สะอาดก่อน				
15. เมื่อฉีดพ่นสารเคมีฯเสร็จแล้ว ยาที่เหลือท่านเทลงในร่องสวน หรือเทลงดิน				
16. ท่านรีบอาบน้ำทันที หลังจากการฉีดพ่นสารเคมีฯ				
17.การล้างเครื่องมือฉีดพ่นสารเคมีฯ ท่านได้ระวังมิให้ไหลลงบ่อน้ำ หรือลำคลอง				
18. เสื้อผ้าที่ท่านใส่ฉีดพ่นยา ท่านแยกซักล้าง				
19. ท่านทิ้งระยะเวลาไม่พ่นสารเคมีก่อนเก็บผลผลิตไปขายตามระยะเวลาที่ระบุไว้ในฉลาก				
20. เมื่อสารเคมีหกเปรอะเปื้อน ท่านได้ใช้ขี้เลื่อยแล้วนำไปฝังดิน ในที่ห่างไกลจากที่อยู่อาศัย หรือน้ำเข้าถึง				
21. ท่านใช้ปูนขาว หรือขี้เถ้าในการขจัดพิษสารเคมีที่รั่วไหลก่อนนำไปฝังดิน				
22. การเก็บรักษาสารเคมี ท่านได้เก็บรักษาสารเคมีในที่เหมาะสม และมีความปลอดภัยจากคน สัตว์เลี้ยง				
23. ท่านเผาพลาสติคหรือภาชนะบรรจุสารเคมีที่มีความดันทุกชนิดที่มีความดันภายใน				
24. ภาชนะบรรจุสารเคมีที่ใช้หมดแล้ว ท่านได้ทุบทำลายแล้วนำไปฝังกลบดิน				
25. ภาชนะที่บรรจุสารเคมีที่ใช้แล้ว ท่านได้นำไปล้าง และนำไปบรรจุสิ่งของอย่างอื่น				

ตอนที่ 5 ปัญหาอุปสรรคและข้อเสนอแนะเกี่ยวกับการใช้สารเคมีป้องกันกำจัดศัตรูพืชของเกษตรกร

1. ปัญหาเกี่ยวกับการเตรียมสารเคมีป้องกันกำจัดศัตรูพืช

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2. ปัญหาเกี่ยวกับการฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืช

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3. ปัญหาหลังการฉีดพ่นสารเคมีป้องกันกำจัดศัตรูพืช

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4. ปัญหาเกี่ยวกับอุปกรณ์ป้องกันอันตรายจากสารเคมีป้องกันกำจัดศัตรูพืช

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5. ปัญหาที่เกี่ยวกับการฝึกอบรมเกษตรกร เรื่องการใช้สารเคมีป้องกันกำจัดศัตรูพืช เพื่อลดอัตราเสี่ยงการเจ็บป่วย จากการใช้สารเคมีป้องกันกำจัดศัตรูพืช

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6. ข้อเสนอแนะอื่น ๆ

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การหาประสิทธิภาพของเครื่องมือวิจัย

การวิเคราะห์หาความยากง่ายและค่าอำนาจจำแนกของแบบวัดความรู้

ข้อที่	จำนวนผู้ตอบถูกกลุ่มสูง	จำนวนผู้ตอบถูกกลุ่มต่ำ	ค่าความยากง่าย (p)	ค่าอำนาจจำแนก (r)	ข้อที่ใช้จริง
1.	2	1	0.19	0.12	ไม่ใช้
2.	8	8	1.00	0.00	ไม่ใช้
3.	8	4	0.75	0.50	ใช้
4.	8	5	0.81	0.37	ใช้
5.	8	6	0.87	0.25	ใช้
6.	8	3	0.69	0.62	ใช้
7.	8	6	0.87	0.25	ใช้
8.	8	4	0.75	0.50	ใช้
9.	8	6	0.87	0.25	ใช้
10.	8	6	0.87	0.25	ใช้
11.	8	6	0.87	0.25	ใช้
12.	8	5	0.81	0.37	ใช้
13	7	4	0.75	0.50	ใช้
14.	8	6	0.87	0.25	ใช้
15.	8	7	0.94	0.12	ใช้
16.	8	6	0.87	0.25	ใช้
17.	6	6	0.87	0.25	ไม่ใช้
18.	8	5	0.81	0.37	ไม่ใช้
19.	8	6	0.87	0.25	ใช้
20.	8	3	0.69	0.62	ใช้
21.	8	6	0.87	0.25	ใช้
22.	8	6	0.87	0.25	ใช้
23.	5	3	0.50	0.25	ใช้
24.	2	1	0.19	0.12	ไม่ใช้

การวิเคราะห์หาความยากง่ายและค่าอำนาจจำแนกของแบบวัดความรู้ (ต่อ)

ข้อที่	จำนวนผู้ตอบถูกกลุ่มสูง	จำนวนผู้ตอบถูกกลุ่มต่ำ	ค่าความยากง่าย (p)	ค่าอำนาจจำแนก (r)	ข้อที่ใช้จริง
25.	8	6	0.87	0.25	ใช้
26.	8	6	0.87	0.25	ใช้
27.	8	4	0.75	0.50	ใช้
28.	8	4	0.75	0.50	ใช้
29	7	5	0.75	0.25	ใช้
30.	8	6	0.87	0.25	ใช้

ค่าความเชื่อมั่นของแบบวัดความรู้ เท่ากับ 0.76

แสดงค่า t-test ของแบบวัดทัศนคติ จำนวน15 ข้อ

ข้อที่	t-test
1	0.780
2	0.000
3	0.571
4	1.871
5	2.614
6	2.898
7	2.393
8	2.826
9	4.638
10	2.016
11	1.886
12	1.888
13	1.821
14	2.183
15	1.941
16	3.789
17	5.017
18	0.798
19	3.000
20	-0.509

ค่า t- test ของแบบวัดทัศนคติใช้ข้อที่มีค่าตั้งแต่ 1.75 ขึ้นไป

ค่าความเชื่อมั่นของแบบวัดทัศนคติ เท่ากับ 0.82

BIOGRAPHY

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