CHAPTER II

LITERATURE REVIEW

The following areas of theories and researches had been studied for this research.

a. Knowledge, Attitude and Practice Theory
b. Insecticides
c. Organophosphate Insecticides
d. Carbamate Insecticides
e. Related Researches

2.1 Knowledge, Attitude and Practice Theory

Definitions of Knowledge

Knowledge has many different definitions such as:

Parattakul (cited in Pujoy, 1999) said, "Knowledge is facts and details of stories and of actions that one has been told and thought from generation to generation." Longuthai (cited in Pujoy, 1999) has given the definition of knowledge as abilities to gain insight, analyze and synthesize different facts and ideas.

The Lession Webster Dictionary 1997 states that knowledge is an understanding of facts, truth and structure divided from researching. Also knowledge is information about a place or a person derived from observation, experience, and report. To have a clear understanding of such facts would take time.

Suwan (1983) said that knowledge is a basic understanding of message of which learners recall from what they have seen and heard. This stage of understanding is knowledge of definition, meaning, fact, theory, structure and problem solving.

Jan-Aim (cited in Pujoy, 1999) referred to knowledge as message decoding process which occurs in between stimulating and responding:

Stimulus ⟶ Perception ⟶ Response

Pinyoananpong (cited in Pujoy, 1999) said that knowledge is an ability to recall general and/or specific events accurately. This knowledge depends on how a person decodes a particular event. An ability to understand is the very basic cognitive skill to decode, to memorize and to make use of a message.

The Webster Dictionary(cited in Pujoy, 1999) states that knowledge is:

(i) The state of knowing and understanding about a subject clearly and accurately

(ii) Awareness gain through observation and self-study

(iii) Skill gained through experience

(iv) Familiarity

(v) Information collection

(vi) Realization of facts

Bloom (cited in Pithakthape Pujoy, 1999) has divided knowledge into 6 stages, as follows:

Stage1 – Recall: Abilities to recognize and to remember a concept, an object or a phenomenon.

Stage2 – Comprehension: Abilities to express a message as well as to interpret, to summarize and to describe such message.

Stage3 – Application: Ability to make use of knowledge one has in problem solving.

Stage4 – Analysis: Ability to classify information into parts to which all are related.

Stage5 – Synthesis: Ability to combine different ideas, facts or experiences to form a single idea. The process requires creative thinking.

Stage6 – Evaluation: Ability to make a judgment about an idea, an achievement or methodology

In conclusion, knowledge is information, standard and structure learned from others' experience and stored for recall, comprehension, application, analysis, synthesis and evaluation. It is abilities to interpret and to summarize a message as well as to foresee its response.

Definitions of Attitude

Larsuwan (cited in Pujoy, 1999) summarized that an attitude is one's willingness physically and mentally in response to a stimulus by confronting or avoiding it. There are 2 types of attitude:

Positive attitude or good attitude is one's willingness to confront or to turn to a stimulus or a situation because of his satisfaction.

Negative attitude or bad attitude is one's willingness to avoid a stimulus or a situation because of his dissatisfaction.

Maungman et al. (cited in Pujoy, 1999) said that an attitude is a mental state of readiness exciting an influence upon an individual's response to all. It is a determining factor whether the person likes or dislikes someone or something.

Suwan (1983) said that attitudes involve the categorization of a stimulus along an evaluative dimension, based on affective, cognitive, and psycho-motor components.

Sometimes behavior is controlled by attitudes and sometimes not. Attitude may encourage self-improvement as well as help the person to understand the world around him. All can be explained by the diagram below:

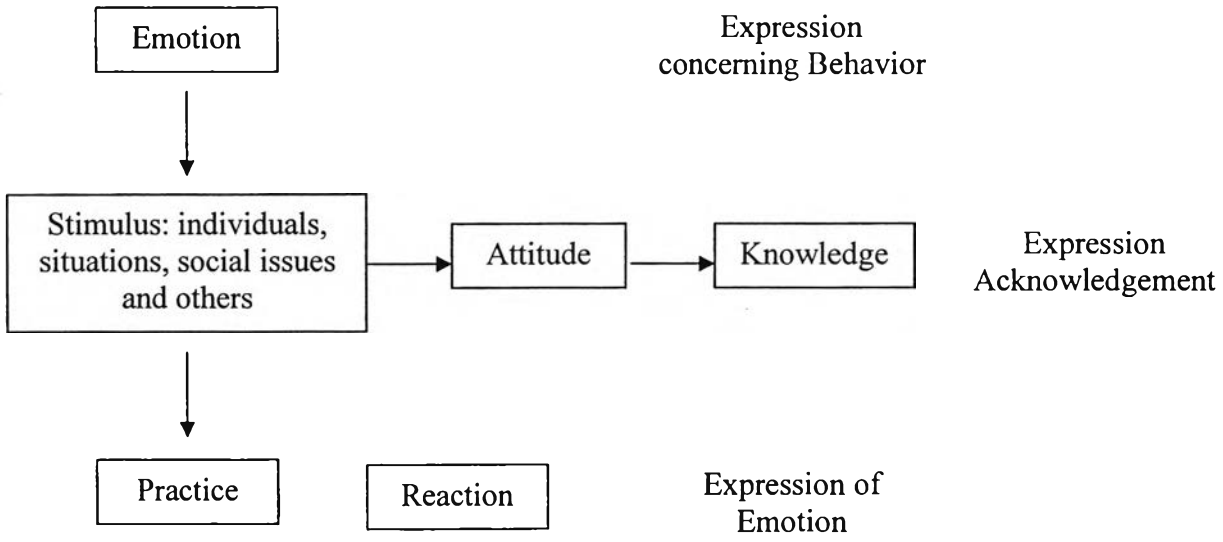

Figure 2: Elements of practice.

Where Are Attitudes form

Specific experiences: People are exposed to stimuli; they learn through reinforcement; and this personal experience determines the person's attitude.

Communication: An individual may unintentionally acquire information and feelings by the process of communication. This generally occurs among family members where the atmosphere is informal.

Model: Attitude can also be learned through imitation.

Institutional factors: They are, for example, family school, temple and organization. These institutions have a major impact on an individual's attitudes.

Benefits of Attitudes

(i) Help to understand the world around by categorization.

(ii) Encourage self-esteem by avoiding thinking about negative self-perceptions or avoiding situations that would bring them to the fore.

(iii) Help to conform to group behaviors in order to gain social acceptance.

Malinee (cited in Pujoy, 1999) pointed out the benefits of attitudes as follows:

To expect others' behavior

Attitudes consist of all the person's emotions toward the object, especially positive and negative evaluations, as well as the thoughts the person has about that particular object, including facts, knowledge and beliefs. Accordingly, attitudes are likely to predict how the person tends to act regarding the object.

To create social harmony

In some social situations people perceive one person or group as having the legitimate authority to influence our attitudes and behavior. Obedience to legitimate authority is often the price people pay for social harmony.

To seek for problem-solving measure

There should be social rules upon which the social members agree. When someone deviates from the rules, the person may be reminded of his obligations via punishment.

To be reasonable

Relations between attitudes and behavior can go either way. Attitudes may control behavior, and behavior sometimes controls attitudes.

Onkoksoong (cited in Pujoy, 1999) suggested the implementation of L.L. Thurstone Principle or Likert Model to measure people's attitudes toward other individuals, objects or situations. These principles may apply to 'yes/no' questions, observation and interview.

Suwan (1983) has proposed Likert Model, named after RensisLikert. This model is to build attitude statements covering areas of the study. Grading ranges in degree from negative score to positive score. The answer to each statement is to be chosen from 5 choices as follows:

(i) Absolutely agree

(ii) Agree

(iii) Not sure

(iv) Disagree

(v) Absolutely disagree

Grading

Choices	Positive Score	Negative Score
Absolutely agree	4 or 5	0 or1
Agree	3 or 4	1 or 2
Not sure	2 or 3	2 or 3
Disagree	1 or 2	3 or 4
Absolutely disagree	0 or 1	4 or 5

Definitions of Practice

Suwan (1983) has defined practice as all human's activities – both visible and invisible. They can be, for example, cardiovascular system, muscular system, walking, speaking, eating, sensation, enjoyment, satisfaction etc. Psychologists hold the same belief that there is always an objective, a reason, a stimulus or a motivation behind any activity done.

Practice is a part of behavior which could be observed. In this case, practice refers to chemical utilization. Practice is an action or a reaction to stimulus. Sometimes it could be clearly observed, other times measuring tools are needed (Srisang cited in Boonnark, 1999). Likewise, Prapapen Suwan and Sawing Suwan (cited in Pujoy, 1999) pointed out that effective practice is related to 5 steps of body's working system:

(i) Imitation: To choose an interesting model

(ii) Manipulation: To follow an interesting style

(iii) Precision: To decide what is the appropriate style to follow

(iv) Articulation: To continuously carry out the appropriate style

(v) Naturalization: To automatically behave as the style has become a part of the self

Reasons for Practice

Singhasut (cited in Pujoy, 1999) has mentioned the reasons for practice as below:

(i) Physical needs

(ii) Appropriate Stimuli

(iii) Emotions or feelings

(iv) Knowledge, an understanding and expectation of the outcome

(v) Motivations i.e. need for success

Practice Change

Practice may alter with respect to an individual's self-development; it is settled during some periods of life and undergone transformation during the others.

Singhasut (cited in Pujoy, 1999) has classified practice change into 3 patterns.

(i) Obedience of authority i.e. social rules, laws and regulations

(ii) Imitation others i.e. a teacher, a parent or a superstar

(iii) Acceptance: People alter their behavior because a change supports their private beliefs.

Factors Influencing Health Practice

Sukhothaitammatirat Open University (cited in Pujoy, 1999) defined factors influencing health practice' as follows:

(i) Psychological factors i.e. maturity, needs, interests, motivations, skills etc. These may well influence knowledge and attitudes, and for that reason, there is no need for medical treatment. For example, a person who does not want to study or receive any information would be unlikely to alter his knowledge, attitudes and practice. Similarly, individuals differ in the levels in maturity would have different knowledge, attitudes and health practice.

(ii) Social and cultural factors i.e. family, social group, social status, culture etc. Differences in cultures would lead to differences in health practice. Some communities in the Northeast prefer animistic treatment to modern medicine. In some communities, a mother is not allowed to have meat for a while after giving birth. Some villagers prefer well water to boiled water because the former is tastier.

(iii) Economic factors: The poor tend to possess knowledge and hold beliefs inappropriate for health practice. Most Thais live in upcountry and have low income. In view of that, many Thais have a very high chance of acquiring improper health practice, and therefore tend to become ill easily.

(iv) Educational factors: The higher level of education people pursue, the more likely they are to obtain knowledge and beliefs appropriate for health practice.

(v) Political factors: Laws and regulations passed by the legislature may possibly have an effect on citizens' knowledge, attitudes and health practice.

Suwan (1983) has summarized the relationship between knowledge, attitudes and practice as follows:

Knowledge and personal experience shape and influence attitudes. Besides cognitive, attitudes are founded on affective and behavioral components. Attitudes exemplify overall evaluations toward attitude objects. Also, an attitude contains some tendency to behave in connection with the attitude object. Relations between attitudes

and behavior can go either way. Attitudes may control behavior, and behavior sometimes controls attitudes. In addition, behavior is sometimes controlled by attitudes and other times by norm, habit or expectation of a particular outcome.

Individuals' health practice is complicated because each decision making involves motivations, beliefs as well as the current balance of incentives. Attitudes may not predict practice therefore observation is employed as an effective measuring tool.

Concept of Health Belief Model and Implementation of Proceed Model for Health Practice Development

A Belief is an opinion which can be either rational or irrational. A particular belief will lead to a particular practice on purpose and/or unintentionally. It may be right or wrong. A belief could be derived from direct personal experience and/or others'. Additionally, it is essential for self-improvement and, for that reason, health belief should have a great impact on personal health concern and disease prevention.

Health Belief Model is founded on a social-psychological theory. The theory assumes that in adopting a practice, people would try to think of its various possible outcomes, the value of those outcomes and the expectancy of those outcomes. The theory is rooted in Kert Levin's concept taking for granted that individuals will turn to someone or something they like and maximizes their gains, and keep away from those they dislike. Later on, Rosenstock IM has developed the health belief model consisting of the following components:

(i) Willingness for health practice with respect to awareness of disease likelihood and of its seriousness

(ii) Possible outcomes and effectiveness of health practice

(iii) Conditions leading to health practice

Rosenstock IM pointed out that individuals will adopt a disease preventive method only if they believe they are at risk of a deadly disease.

Later on, Becker MH et al. have developed the health belief model as the diagram below:

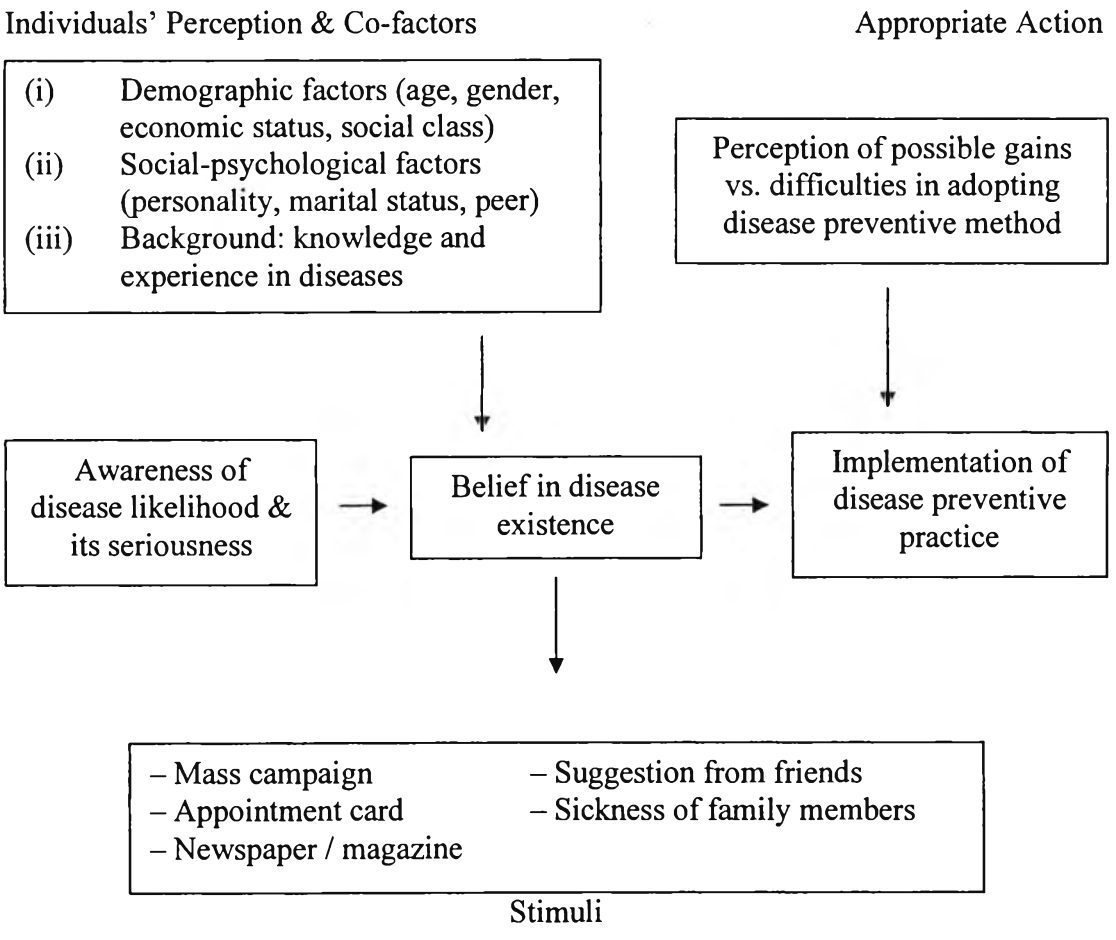

Figure 3: 'Health Belief Model' to Predict Disease Preventive Practice

Source: Becker HM, Drachman RH and Kirscht JP 1974: 206(cited in Pujoy, 1999)

Health Belief Model consists of 5 factors:

(i) Awareness of disease likelihood: This refers to an individual's belief in a physician's diagnosis.

(ii) Awareness of diseases' seriousness: This refers to the individual's belief in the disease's seriousness.

(iii) Perception of possible gains in adopting disease preventive method: This is important in getting the patient's co-operation for medical treatment.

(iv) Motivation: This applies to the person's emotion caused by stimuli. This emotion would encourage him to follow the physician's advice.

(v) Co-factors: These could influence the medical prevention appropriate for each particular person.

2.1 Insecticides

According to the Food and drugs Administration, Ministry of Public Health (1995),

2.1.1 Insecticide is a chemical substance used for pest control and prevention.

2.1.2 Pests could be animals, plants and micro-organisms that annoy and/or harm vegetation, human and/or animal.

Advantages of Pesticide Practice

(i) High productive and on time

(ii) Ready to use

(iii) Easy to use

(iv) Worthy

Disadvantages of Pesticide Practice

(i) A residue builds up in individuals' body and contaminates the environment.

⇒ Agriculturists who come into contact with pesticide could be poisoned.

⇒ Consumers could become ill from taking contaminated food.

⇒ The resistance of pests is developed.

⇒ Ecosystem is out of balance.

⇒ Microbes residing in the soil are damaged.

⇒ Food chain is contaminated by toxic chemicals.

(ii) Excessive amounts or rates of application could cause damage to plants such as leaf burning.

(iii) Other biological problems may arise:

⇒ Beneficial insects and animals are harmed.

⇒ A pest epidemic may sweep through an area.

⇒ Smell and taste of vegetation are altered.

Insecticides could be powder or liquid. When choosing pesticides, their bio-characteristics, active ingredients' effectiveness, and side-effects should be taken into consideration.

Main Types of Insecticides Are:

(i) Organochlorine compounds such as DDT, Dieldrin, Chlordane, Heptachlor, Methoxychlor etc. These are traditional chemicals. Their effects are strong

and long-lasting, composed with total disregard for the environment, therefore they are mostly banned. At present, DDT is only allowed for malaria control.

(ii) Organophosphate compounds such as Malathion, Diazinon, Fenitrothion, Trichlorfon, Temephos (Abate) etc. Formerly, they were employed to control mosquitoes. Temephos, for instance, is still used for larva control. Because of their strong odor, these compounds have to be kept in sizeable space away from residential area. They are even more toxic than the first group but relatively easy to decay. After employing, agriculturists have to leave their plantation after used at least 1 week.

(iii) Carbamate compounds such as Furadan, Carbarylbendiocarb, Propoxur etc. They are widely used for insect control and applicable for a wide range of insects. The compounds are easy to decay and their remains are short-lived. The group is familiarly known for mosquito spray.

(iv) Pyrethroid compounds such as Permethrin, Deltamethrin, Lamda, Cyhalothrin etc. They are synthesized chemicals which have a structure similar to that of Pyrethrin extracted from plants. The formers' residue however lasts longer and is less affected by the sun than the latters'. The compounds are available both in powder and oil.They are very much safe for humans.

Danger of Insecticides

Insecticides could be harmful to lives and property in 5 ways:

(i) Flammable

(ii) Toxic to human and animals

(iii) Dermal irritation

(iv) Evaporation to a toxic gas in humidity

(v) Contamination of the environment around the area of application

Toxicity of Chemical Product

1. Contact with Posion

Most practical insecticides are poisonous. Therefore a user or a person coming into contact with insecticides has an exellent probability of having a build-up of poison in the body. Individuals may get toxins via oral, inhalation as well as dermal.

a. Oral: This usually happens when an individual attempts to commit suicide because insecticides are known for their toxicity. Besides a crime, some cases are accident because an individual keeps toxic insecticides in a bottle of drinking water or a drug bottle. Some users carelessly dissolve pesicides by hand and do not wash the dirty hand before drinking water, taking food or even smoking. After oral contact, poison would pass through one's gastro-intestinal tract and osmosis to gastric wall, to intestine and eventally to blood circulation.

b. Inhalation: Some insecticides like Organophosphate compounds are easy to evaporate. Oftentimes agriculturists breathe in a toxic gas while spraying; the poison would then enter their lungs. Spraying without wearing a canister mask will inevitably lead to inhalation of insecticides. In addition, type of insecticides and demographic character of individuals are factors influencing the quantity of insecticide intake. Likewise, working environment is important. People working in an insecticide storehouse would surely have a higher chance of inhaling a toxic gas than people working in an open-air area would. If their package is not sealed well,

insecticides may spread all around the store. Good ventilation could reduce the chance of inhalation. Quantity of insecticides absorbed into one's lungs are influenced by these factors:

(i) Solubility: Insecticide having less ability to dissolve in water will absorb to pulmonary sac easier than the one which has much more dissolve.

(ii) Particle Size: Insecticide which is small particle can absorb to lung without leftover at nose, mouth and bronchus.

(iii) Respiratory Rate: Higher respiratory rate, higher absorbent rate to lung, e.g. the respiratory rate while working is higher than sleeping, this cause more absorbtion in the lung. Exceptional case, child has respiratory volume only 5 cubic meters a day while adult has 20, but compare insecticides per 1 kg. weight in child is higher than adult.

(iv) Volume of each breath: the more volume per breath, the more insecticides absorbent to lung.

c. Dermal Some insecticide can absorb into a human body via Dermal while dissolving it, spraying it or contact with out flow insecticide. These cause insecticide absorb into a human body, may be a lot or a little depends on many factors:

(i) State of Dermal: if it is tear or cut, injured, it will be absorbed easily Solubility and Absorb via Dermal: if a substance can be dissolved in oil, it can be absorbed very well e.g. Chlorinated hydrocarbons

(ii) Particle Size: so small so easy to absorb

(iii) Temperature: Organophosphate can absorbed easily when the weather it is hot, so agriculturists should not take off clothes while doing spray under sunshine

this can be absorbed via soft tissues such as testicles, armpit, ear tube, forehead, head's dermal

2. Toxin's symptoms (Boonyaho-tra, cited in Pujoy, 1999)

Organophosphate and Carbamates Chemical are the most important to be toxic. They can evaporate easily and works by stop Cholinesterase enzyme's working. This enzyme control nervous system. Toxin's symptoms from Organophosphate and Carbamates are

a. Less severe symptoms: headache, ill, retching, feel dizzy, fatigue, dermal, eye, nose and throat irritation, diarrhea, sweat, have no appetite.

b. Moderate symptoms: vomit, abdominal spasticity, exhaust, diarrhea, facial, abdominal, arms and legs muscular twitching, fatigue, blurred vision, constricted iris, tachycardia.

c. Serious symptoms: have a spasm, respiratory system failure, be unconscious, cardiac arrest, some can die immediately.

Individual Protection Equipment

(i) Helmet

(ii) Rubber gloves

(iii) Canister mask

(iv) Rubber boots

(v) Protective clothing

Correct Pesticide Practice *(Hynter,* cited in Pujoy, 1999*)*

Liquid Pesticide This is chemical which is dissolved in solvent or oil, high concentrated, have to dissolve with water before using, some are premixed. There are 3 different types of usage.

1. **Much Water**: dissolving water and pesticide more than 60 liters per rai. This is the most esteem method by cylinder sprayer e.g. shoulder slinging, back slinging or sprayer with water pressure engine. These will get big particles and become water - drop on leaf, then flow to soil. This method cause getting loss pesticide on leaf, not enough to protect pests, so we should no spray too much soak.

2. **Less Water**: use only 5 – 20 liters of water dissolve with pesticide by back slinging sprayer with air engine. This will get small regular particles. So we can reduce cost and work more quickly. But have to concern it's danger to the sprayer and others who live in that area.

3. **Pure Usage**: use special sprayer which has spin plate nozzle or electric charge nozzle or motor sprayer which ULV nozzle. This method use only 300 – 1,500 ml. per rai, get very small particles and spread easily. So it should be sprayed under wind current not faster than 5 kilometers per hour.

Because of wrong usage of pesticide, the pests, insects have chemical resistance and cause agriculturists have to pay a lot for pests control whenever used only little in the past. So we should study how to use pesticide correctly and safe.

Use pesticide conform to pests, we should know what kind of pests in farm before use pesticide. How to know is to catch it. If we are not sure, ask from agricultural officer e.g. provincial agricultural officer or district agricultural officer. Then choose pesticide to conform to pests otherwise we have to pay with useless. Each type of pests are conformable with different type of pesticides e.g.

- Piercing Sucking Insects e.g. bug, coccus, mealy bug, aphid etc. has slow movement. The suitable pesticides are systemic and contact pesticides, has short residue toxin such as Organophosphate and Carbamates.
- Rodent Insects, destroy timber and bark, root (radical) and live in soil. Choose contact or taking pesticides, has long residue toxin, use by soil dressing. This is Chlorinated hydrocarbons.
- Stem or Cork Borer flowers,cotton or long term reaping fruits should use contact or systemic pesticides which has long residue such as Carbamates and some Organophosphate pesticides.
- For insects that lay eggs within the flesh of plants, should use contact pesticides and long residue , but have to left it for a long while before harvesting.

1. Use in appropriate dosage and method. There are many types of pesticides which has different benefit and usage. The best way to get most benefit is to read it's instructional first, this will tell how to use it correctly. Most powder has to dissolve in water or oil then spray in field. Most systemic types are grains which have to spread on field (soil), some has to fertilizer dressing before spreading. Some pesticides become more effective after dressing with another. But some can not dressing because it will cancel and less benefit to pest control. Dressing ratio is also important, if it is too dilute, too less effective and becomes chemical resistance. Also agriculturists have to pay more for pesticides. You have to ask or consult agricultural officer or seller in case you doubt.

2. Appropriate timing. You should spray in the morning because there are dews on leafs which powder can fix easily. At noon or under strong sunshine, systemic pesticides are easy to absorb via derma. In serious case may be toxic especially the sprayer who takes off his clothes while spraying. The other reason is some plant can not bear some chemical in high temperature and becomes depressed, droop and perish. Do not spray while it rains because pesticides will be wash out. It would be great to know pests' behaviors because some insects' cycle are not only in field, some have epidemical season. If we spray before its epidemical season, will get more effective in chemical usage and can reduce some pesticides.

3 steps of pesticides usage

1. Before usage Read it's instructional or asks for explanation from officer to understand usage, its danger and follow seriously. Choose pesticides which has correctly label under poisonous materials act and shows the following items,
    - Skull with cross sign and clear red or black "poisonous materials"
    - Its chemical and common name of activate substance and ingredients(compounds)
    - Producer's name and address
    - Quantity of poisonous compounds and others
    - Manufacturing and expiry date
    - Description/instruction, benefit, usage, keeping and warning
    - Toxin's sign, how to counteract a poison and doctor's instruction
2. While using
    - Do not dissolve pesticides by hand

- Spray windward to protect pesticides absorb via dermal and inhalation
- Wash, take a shower with soap and clean water in case you are dirty from pesticides
- Do not smoke or take any food
- Wash your hands, rinse your mouth before smoking or taking food every time

3. After using
   - Clean up pesticides package with soap
   - Do not wash/clean in or near a well
   - Keep pesticides in safe place with danger label, away from children and food
   - The sprayer must take off clothes and wash with soap then take a shower
   - Put sign in sprayed area for 6 – 7 days
   - Leave the sprayed plants for a while, this is up to each type of pesticide, normally not less than 7 – 15 days

3. First Aids

In case you see the one who gets toxin, help him before take to the hospital. The important knowledge in first aids is as follow:-

- Patient gets toxin from spread pesticides, take him away from that area
- Pesticides spill over his body (dermal), wash off with water. Do not use warm water or alcohol.

- If get pesticides via eyes, wash off with clean water 10 – 15 min. continuously
- If swallow pesticides, make him to vomit by reaching into his throat or drink salty water (ratio 1 glass of water: 1 tablespoon of sodium chloride). If he is unconscious, do not help him to vomit, take him to hospital.
- Take him to hospital with package and label. Before doing first aids, protect yourself by observation chemical on his body, if yes, clean up him and do not contact pesticides. Before make him to vomit please read instruction on label, if it is not necessary, take him to see the doctor immediately.

Hazard Classification, we classify by toxicity measurement of pesticides. We call this toxicity hazard level "LD_{50}" which is toxicity level of poison that killed 50% of total experiment animals. LD_{50} is mg. of poison per kg. of experimental animal (mg/kg) (**Bailey and Swift**) e.g. taking 1 mg. of pesticide could kill 50% of experimental rats which average 1 kg. Each experiment is about 10, 20, 30 rats and half are killed. This international measurement from the oral rat is LD_{50} which is I mg./kg. Compare to human who has average 50 kg. and take 50 mg. of pesticides, its result is as same as rat such as group of 10, 5 may be died.

Toxicity measurement of pesticides, the popular method both in agricultural and medical is acute toxicity measurement. This is to measure toxicity of poison after experimental animals take poison which has 3 methods such as:

1) Acute oral LD_{50}

2) Acute dermal LD_{50}

3) Inhalation LD_{50}

The popular method of pesticides' quantity test is to check blood cholinesterase because Organophosphate and Carbamates are cholinesterase enzyme's resistance. So level of cholinesterase in red blood cell and lymph is to indicate toxicity's serious as following:-

1) Lower cholinesterase in lymph, normal in red blood cell means patient get a little poison from pesticide. Let him stop working for a while then he will get better.

2) Normal cholinesterase in lymph, lower in red blood cell means patient get much poison from pesticide. Let him stop working and see the doctor.

3) Lower cholinesterase in lymph and red blood cell means patient get serious poison from pesticide.

Human blood cholinesterase

- Male	Normal cholinesterase in lymph	88-137	unit/ml.
	Normal cholinesterase in red blood cell	137-303	unit/ml.
- Female	Normal cholinesterase in lymph	81-125	unit/ml.
	Normal cholinesterase in red blood cell	167-302	unit/ml.

(Pakorn Sumethanurakkhagul, et al. 1983)

2.3 Organophosphorous insecticides

Organophosphorous insecticide are Parathion or Folidol, Fenitrothion, Gusathion, Malathion, Mevinphos, Diazinon, Pirimophos methyl and Disyston. There are more different names of these insecticides, some has highly hazardous which has skull with cross sign e.g. Parathion or Folidol, some has lightly hazardous for warm – blooded animal e.g. Malathion. Their advantage is high efficiency in pest control and

less residue because of fast detoxicate, so it is good for vegetables, fruits, by doing spray before harvesting in short time. This depends on compounds and its residue which declare on label. Beside this, some compounds are systemic insecticide. This means it will be absorbed into stem after sprayed and will be toxin to piercing sucking or rodent insects only. These are Disyston, Fosdrin, Azodrin etc. This kind of systemic insecticide is good for rodent insects.

Phosphorous compounds or organic compound is an important compound in Protoplasm and very important to support human and animals life because they are Nucleic acid, Nucleotide, Coenzymes, Phosphatides and Metobolite intermediate. In additional, it may be lubricant, Plasticizers and pesticides. (Fungicide, Insecticide, Herbicide and others)

Study of Phosphorous compound has started since B.E. 2363 by Lassaigne experimented many kinds of phosphate which have Phosphorous compound, grouping P-N or P-C and has succeed synthetic Phosphate esters from natural. During the Second World War, 2 scientists, Saunders and Schrader found Phosphorous compound poison. Saunders synthesis poison that can destroy nervous system includes Diisopropylphos- phorofluoridate (DPF) and Schrader found pesticide compound in B.E. 2480.

From this discovery, they can synthesis other pesticides e.g. in B.E. 2482 Schrader and team synthesis systemic insecticide called Octamethylpyrophosphoramide (OMPA) and named Schradan later. In B.E. 2487, synthesis new insecticide named Bladan which has Tetraethyl Pyrophosphate (TEPP) compound.

Schrader has developed insecticide to be Parathion in B.E. 2487 which is widely used later. Malathion, Fenthion and Fenitrothion has produced since B.E.2493, 2501 and 2502 in sequence.

Reaction of Organophospate pesticide which kill insects are assembly between poison and enzyme Cholinesterase that cause this enzyme can not decay Acetylcholine which send impulse from nerve ending to muscle. This caused to cumulate Acetylcholine, so it is still nerve impulse, muscular stimulatic, paralysis and die. In mammal, Organophospate cause dementia, affect periphery system, movement, behavior and respiratory system, die because of respiratory obstruction. This becomes usual by have new enzyme instead the declined enzyme.

Acute toxin has started from getting poison or within 12 hours (normally within 4 hours). Some are neurasthenia, its symptom is slowly, may take a few days. Most symptoms found are hands, forearms and legs pain, weakness. Some get well in 2 – 3 weeks, some are emaciated muscles and partial paralysis. (Department of Agriculture, 1989)

Brain Symptoms. There is something wrong with central nervous system, found symptoms are giddy, headache, perplexed (confused), impatient, be alarmed (frightened), disorder. In serious case, can be spasm and unconscious. Some die because heart attach (breathe fail). This is because of trachea becomes contracted, respiratory muscular system are paralysis and respiratory center stop working. Some are not serious, will get well within 2 – 3 days, but still be tired, weakness for a while.

(Singhasenee, 1986)

Medical Treatment

Caution, the one who help patient should avoid direct contact with clothes which dirty from poison or his vomit, wear rubber gloves while clean up poison out from his dermal and hair

1. Let him has smoothly inhalation by sucking waste, oxygenation, get lung loosen and have more oxygen before be taken Atropine for heart's risk decrease.
2. Let him get Atropine Sulphate via vein or muscles. Atropine will prevent form muscarinic which results from much more Acetyl Chlorine accumulation, his toxin becomes worse when Atropine lose working while there is still much Organophosphate poison. Atropine is good for counteracting muscarinic poisoning, but not for nicotinic poisoning (whose symptoms include weakness, spasm and respiratory obstruction.

Common names and trade of Organophosphate Pesticides

Common names	Trade names
Highly Hazardous	
Monocrotophos	Azodrin, Monocron, Nuvacron
Methyl parathion	Penncab-M, Dalf, Folidol N
Ethyl parathion	Folidol E-605, Thiophos, Ethion
Methamidophos	Monitor, Tamaron
Dicrotophos	Bidrin, Egtafot, Carebicron

Moderate Hazardous

Dichlorvos	DDVP, Vapona, Fotwit, Marvech
Triazophos	Ostathion
Chlorpyrifos	Lersbandersban
Dimethoate	Cygon, D-fen, Rogor, Rocvion
Diazinon	Spectracide,Bazudin, Diacide
Fenitrothion	Agrothion, Cumethion, Citel
Malathion	Cithion, Emmatos, Malaspray

2.4 Carbamate Pesticide

Carbamates are new compounds and are lightly hazardous to warm – blooded animals. The most used are Carbaryl or Sevin which is broad spectrum. The advantage of Sevin is lightly hazardous to human and warm – blooded animals. Beside, it has short residue time to vegetables, environment. Its disadvantage is highly hazardous to bees and fishes. Carbamate is good for house insects especially cockroaches.

Organophosphate and Carbamate are classified to be contact poisons. They have same toxicity to nervous system; when organophosphate and carbamate molecule get through insects, they will react by binding with cholinesterase enzyme at sensory nerve or neurologic synapse. This cause acetylcoline could not decay by enzyme as normal. So, there will accumulate acetylcoline at the end of nerve until it reaches toxic levels. Symptom of organophosphate and carbamate's toxin is presented on involuntary nervous system e.g.slow breathing, constricted iris, and sweating.

Metabolism of Carbamate in human and animals, if they can be detoxicated by enzyme before to nervous, system, it becomes lightly hazardous. Beside outside body protection, producers have produced some pesticides which can be metabolized by human, animals' enzyme, but can not be metabolized by insects. These are selective herbicides. (has toxicity to insects but very little in human and animals)

Carbamate is other pesticide that is Ester in Carbamic acid. Scientist synthesis them by Physostigmine Structure in Calabar, Physostigma Venenosum (Balfour) which has toxin in destroy nervous system by stop Cholinaesterase enzyme. In West Africa, They use this poison to punish the prisoner by let them take grind Calabar with a little water. Some get poison until die, but some can vomit and not to die and get free from guilt later.

Compound from Calabar is only Carbamate Ester from natural. It was named Eserine in B.E. 2406 and changed to be Physostigmine one year later, and can calculate structure compound in 2468. This is not good for insects control because it's active is Antifeedant. It means insects do not like to take it. We use for plant disease. And synthesis Repellent later, but it has highly hazardous to some kinds of insects e.g. fly, aphid and small insects. This synthesis is Dimetan which inspire to synthesize others such as Isolan and Dimetilan but not run through until Carbaryl (Sevin) in B.E. 2500. This is very run through and develop to be many kinds later.

Carbamate pesticides are used for many kinds of pests e.g. piercing sucking insects, pests in soil and garden snail. Carbamate pesticides are very popular especially Cabaryl because of broad spectrum both plants and animals. Carbamate pesticides can absorb via dermal easily, so user should be careful from direct contact.

Unless use of Carbamate pesticide for insects, it can be used for fungi, earthworm and weed flora. The beginning toxin is a little slower than Organophosphate, not store up toxin and fast detoxicate in human and animals. This caused less toxicity to human and animals.

Carbamate react affect between Carbamate and Acetyl cholinesterase enzyme that will accumulate Acetylcholine at nerve ending, and cause effect to nervous system such as twitching muscles, (this reaction can be back and forth). It will be normal quicker than toxin from Organophosphate which also has reaction to Acetyl Cholinesterase enzyme too.

Carbamate's toxin are absorb via inhalation, oral and dermal then has chemical reaction in liver and excrete by liver and kidney later. Some Carbamates are formulated with methyl alcohol, so should think of methanol's poison too e.g gastric irritation, get danger to central nervous system and neurotic disease.

Common names and trade names of Carbamate Pesticides

Common Names	**Commercial names**
Highly Hazardous	
Aldicarb	Temik, Aldicarb, Ambush
Oxamyl	Vidate L, Oxamyl
Carbofuran	Furadan, Curatare, Camedan
Methomyl	Lannate, Nudrin, Newdrin
Formetanate hydrochloride	Dicarzol, Carzol

Moderate Hazardous

Promecarb	Carbamult
Methiocarb	Mezurol, Draza
Propoxur	Baygon, Anden, Sunside
Pirimicarb	Pirimer, Rapid, Fernos
Carbaryl	Sevin, Carbaryl, S.L.
BPMC	Ofzin, Bicarb, Bussa
Thiodicarb	Larvin

Medical Treatment

Caution: A caretaker should avoid direct contacts with clothes contaminated by poisonous chemicals and/or a patient's vomit. Besides, he should wear rubber gloves while washing the chemicals off the patient's skin and hair

1. Let the patient take easy breaths by taking all waste from his bronchus. Provide him oxygen before giving atropine in order to reduce risk from heart muscular stimulatic.

2. Atropine sulphate is to be given via vein or muscle. Atropine will prevent the patient from muscarinic developed out of Acetyl accumulation at nerve ending. Atropine is an effective drug to counteract muscular reaction, but ineffective to nicotinic action such as fatigue, muscular stimulatic, and respiratory obstruction.

2.5 Related Researches

Sukhothai Provincial Health Office (1994): studied satisfaction of natural agriculture in Amphur Sawankalok by using questionnaire about general data and

their satisfaction of natural agriculture. These were microorganisms agriculture in soil without fertilizer and pesticides which damage ecology and environment. The natural agriculture is to return effectiveness microorganisms to the earth for natural balance which is called Biotechnology Agricultural Style. This is the modern natural agriculture or new style agriculture technology that could solve current agriculturists and consumers problem in their health which are from leftover toxin. The result showed that it is good for doing in plant field, agriculturists can make insecticide from Effective Microorganisms (EM), 24 hrs compost, EM Bokashi, Bioextract, and the market demand is very high. Also can reduce their blood chemical, they aware in chemical toxin to environment both earth, water supply and air. This is related to Prof. Dr. Teruo Higa, who studied the effectiveness of EM by doing in plant field, he found that the plant which had sprinkled EM was 1 time growth more than others. And EM was related with ABB or Ancitic acid, when left it for a while it would be digest and synthesis hormone for plant. Plant pathology and pest are gone and get high quality product. The research found that agriculturists were happy with natural agriculture.

Phitsanulok Provincial Health Office (1994): studied the appropriate method of leftover pesticides' toxin in agriculturists reduction and protection by community's volunteer at Amphur Phrom Phiram. The village's volunteers studied all target population by suggestion questionnaire for the one who is risky to toxin allergy with created by research team. District health officers did blood cholinesterase examination by using reactive paper to find out toxin allergy both before and after. Also studied their knowledge, attitude and practice in chemical usage, this was not successful because it was not permanent method, just did in short

period, late delivery of supported tools, materials and exam set. Beside, the volunteers had always visit with unpaid and limited time.

Nakhonratchasima Provincial Health Office (1994): studied the appropriate basic health processing style about pesticides pollution reduction at Amphur Non Sung. The objectives of questionnaire is to find out general data and their occupation, fertilizer and pesticides usage and blood cholinesterase examination of the one who had involve pesticides. These had done by the researchers who had been trained. Primary Health Care Center was the center in communication to target group, develop appropriated technology in community and brain storming in problems perception and solving by basic health fundamental. These had done by meeting, training for the community's leaders and volunteer handbook which they created themselves, continuously meeting and training at Primary Health Care Center. This center is also use to distribute, deliver all information about pesticides protection, set up the appropriated technology, pesticides protection set which including protective clothing, mask, gloves, basic health volunteer and community leader handbook about pesticides' danger, VDO 1 set for every health center to educate their target group and villagers to acknowledge in new mechanic of health education, monthly follow up in education by health officer, coordinated with other related offices such as Agricultural official, temple, Department of Provincial Administration, District Chiefs, Village Headmans, Provincial Health Office supported Primary Health Care Center all 13 tools as standard condition and expand Primary Health Care Center in every villages. From this model, although target group had more knowledge, Primary Health Care Center . is quite good for all activities and distribute all information, target group used more protection tools and belief that handbook is the best way to

study in pesticides also tools, materials are good. But these are provided by officer whenever they are moved from that community or lack of supporting; these activities had to stop or can not run continuously. So this should be successful by take time to improve that villagers can run all activities by themselves.

Nu-sorn and Songwut (1997) studied the appropriate style in agriculturists' blood pesticides reduction. From blood chemical examination found that agriculturists who had been taught in pesticides usage safely from exhibition had more normal level of cholinesterase than the one who did not. Also gender, education and their incomes were related to their knowledge in pesticides usage. From deep interviewing and group conversation found that lack of knowledge and practice lead them had much more blood pesticides.

Boonnark (1999) studied type, volume and frequency in pesticides usage of agriculturists who did lemon farm in Tambon Yanghag Amphur Pak Tho Ratchaburi Province 117 people. He found that the top 3 of insecticides and pesticides are Super corn (Trade name) or prophenotol(Common Name), 3 zodrin (Trade name) or monocrotophos (Common Name) and mevinphos (Common and Trade Name) orderly. The volume of insecticides and pesticides usage 500-900 cc./rai is 42.74%, 1,000 cc./ rai is 40.17% and spray 3 times a month is 48.70%. Their knowledge and behavior in insecticides and pesticides usage is medium. By observation, they had wrong behavior in dressing such as did not wear rubber gloves, canister mask while spray windward and downwind. Duration and volume in insecticides and pesticides usage were related (P-value < 0.05)

Sripak et al. (1990) studied Agriculturists Cholinesterase Enzyme Level's Affective Factors by doing case study at Amphur Pa Tio Yasothon Province, found

that behavior in pesticides usage and its danger protection are still be problem such as had wrong practice, used many kinds of pesticides also high frequency, did not study or read the correctly usage e.g. mix chemical by his hand.

Natapin et al. (1996) studied about behavior in pesticides usage of vegetables agriculturists in Amphur Mueang Khon Kaen Province, they found 90% of agriculturists did not have the correct and suitable method in pesticides' danger protection. Besides this, some did not have any protection, choosing and its concentrate. Some perceive that to use many kinds of high active pesticides together will get more effective. These caused be pests resistance in next generation, so they had to used more concentrate or change to other kinds and these are impact to their health, environment and consumer.

Thepsiri (1997) studied about knowledge, attitude and practice in pesticides usage of agriculturists in Tambon Ban Khuan Amphur Lang Suan Chum Phon Province, this found most agriculturists are between 27-51 years old, average is 39 years, they were men more than women, finished primary school, average incomes is 1,001-5,000 Baht. They used pesticides twice a year, duration of using was more than 5 years, studied pesticides usage from neighbors and suggestion on label. About related factors, showed that age had related to knowledge and attitude but not related to practice, gender had related to knowledge and attitude but not related to practice, education had related to knowledge and attitude but not related to practice, duration in usage had related to knowledge and attitude but not related to practice.

Sruamsiri (1991) studied about related factors to leftover blood pesticides of agriculturists in Saladang District Bang Nam Priao Chachoengsao Province, this found that most agriculturists who used pesticides are between 26 – 35 years old

which is 31.43%, average age is 36 years, finished primary school (grade 1 – 4) is 68.57%, has incomes from agricultural product selling between 40,001 – 60,000 Baht per year which is 23.57%. About related factors, pointed out incomes, respiratory tract's protection, working hour in pesticides using and duration in pesticides using (years) did not relate to agriculturists' blood pesticides.

Yassin et al. (2002) studied knowledge,attitude,practice and toxicity symptoms associated with pesticide use and exposure among 189 farm workers in Gaza Strip,Egypt,found that farm workers reported high level of knowledge on the health impact of pesticides(97.9%).Moderate to high levels of knowledge were recorded on toxicity symptoms related to pesticides.Most farm workers were aware of the protective measures to be used during applying pesticides.However,no one took precautions unless they knew about the measures.Burning sensation in eyes/face was the commonest symptom(64.3%).The prevalence of self reported toxicity symptoms was dependent on mixing and use of high concentrations of pesticides.The highest percentage of self reported toxicity symptoms was found among the farm workers who returned to sprayed fields within one hour of applying pesticides.

Ohayo-Mitoko et al. (1999) this study was to assess health hazards posed by handing, storage and use of pesticides on agricultural estates and small farms in Kenya(n = 408),found that symptom prevalence in exposed subjects was higher during the high exposure period than the low exposure period,although these differences were not significant.Interestingly, a clear and significant change in symptoms prevalence was found in the controls with a higher prevalence in the low exposure period.Analysis of the relation between cholinesterase inhibition and symptoms showed that prevalence ratios were significantly>1 for respiratory, eye, and

central nervous system symptoms for workers with >30 % inhibition.Similar results were found for analyses with the actual level of acetylcholinesterasa activity.

Farahat et al. (2002) studied 102 cotton crops in the fields in Menoufiya Governorate,Egypt,found that after correcting for confounders of age and education, the exposed participants exhibited significantly lower performance than controls on six neurobehavioural tests (Similarities, Digit Symbol, Trailmaking part A and B, letter Cancellation, digit Span, and Benton Visual Retention).A longer duration of work with pesticides was associated with lower performance on most neurobehavioural tests after adjusting for multiple comparisons.Although serum acetylcholinesterase was significantly lower in the exposed than the control participants, it was not significantly correlated with either neurobehavioural performance or neurological abnormalities.