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Farmers' Awareness and Behavior of Chemical Pesticide Uses in Suan Luang Sub-District Municipality, Ampawa, Samut Songkram,Thailand

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Abstract**—**This paper is aimed to investigate farmers' level of awareness and behavior of chemical pesticide uses, by using a case study of Suan Luang Sub- District Municipality, Ampawa, Samut Songkram Province. Questionnaire was employed in this study with the farmers from 46 households to explore their level of awareness in chemical pesticide uses, while interview and observation were adopted in exploring their behavior of chemical pesticide uses. The findings reflected the farmers' high level of awareness in chemical pesticide uses in the hazardous effects of the chemical to human and environmental health, while their behavior of chemical pesticide uses explained their awareness paid to the right way of using pesticides, for instance reading the direction on the label, keeping children and animals away from the area of pesticide mixing, covering body with clothes and wearing hat and mask, no smoking, eating or drinking during pesticide spray or standing in windward direction.

Keywords**—**Awareness, Behavior, Pesticide.

I. Introduction

AGRICULTURE is truly a significant sector that produces food for humanity. However, due to an expansion of industrial sector and urban growth and the expansion of communities, lands for agricultural activities have a tendency to reduce by time. An increase of uses of high technology and pesticides to accelerate productivity of crops to meet population demands is also another factor that worsens the cause of soil damage. Besides, use of chemical pesticides is not safety for workers in agricultural farm lands. With the limitation of their literacy level, these farmers have less awareness of danger from using chemical pesticides, while the behaviour of use is not friendly to users, consumers and the environment. Toxic substances caused from the over use or misuse of pesticides have become pollutant to the air, soil and water. Soil and water are the vital source of foods and food production for human, thus pesticide residues in these natural resources have a significant negative impact to human lives. In this regards, this study aimed to investigate farmers' level of awareness and behavior of chemical pesticide uses, by using a case study of Suan Luang Sub - District Municipality, Ampawa District, Samut Songkram Province. Literature of awareness, human behaviour and pesticides and impacts were reviewed.

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II. Literature Review

A. Awareness

Awareness is psychological approach integrated with behavioural science. Awareness was defined by different authors. Praphol Milinthajinda [1] defined awareness as an expression of feeling or perception, opinion, mindfulness of individuals; a state in which an individual has ability to understand and evaluate particular conditions or events, where the individual's experiences of those particular conditions or events and length of time engaged are the factors of having awareness. Sommai Wanson [2] described that awareness was similar to feeling or perception. A difference is that awareness is based cognitive approach and ability to be conscious of events, objects or sensory patterns. Defined by Weerachon Khaophong [3], awareness is made to occur by events. Events stimulate individuals to feel, perceive and develop a self, represented by attitude, idea, belief and interest, and finally a state of awareness and consciousness occur. This definition is similar to Good [3] (demonstrated in Fig. 1). From the review, it was therefore to summarize that awareness was individuals' perception and recognition happened in a sudden towards particular conditions or events. Individuals develop awareness under the factors of circumstances, past experiences and impacts, which help them to be aware of impacts that may follow.

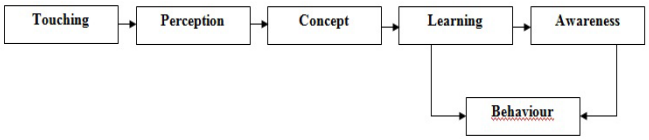


Fig. 1 Awareness was individuals' perception and recognition happened in a sudden towards

B. Human Behaviour

Human Behaviour is the range of actions or reactions and mannerisms of a person in response to external or internal stimuli. It is an action that alters the relationship between a human and its environment. This means that behavior provides outputs from human to the environment. Human behaviour may occur as a result of external stimuli or internal stimuli (such as hunger and thirst) or a mixture of two. Behaviour can be explained as innate and learned or learning behaviour. Innate behaviour refers to the behaviour that is instinctive to the organism usually for survival. It is determined by the nervous system. Such behaviour cannot be learned from the

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environment. Thus this type of behaviour is stereotyped and species- specific. Contrarily, learned or learning behaviour is altered as a result of the experience of the individual organism and not from ageing or maturation. Learned behaviour can be influenced by both gene and environment. Learned or learning behaviour can be classified into habituation, imprinting, classical conditioning, operant conditioning pr trial and error, observational learning, and insight learning or reasoning. Habituation is behaviour that an organism stops responding to repeated stimuli due to receiving none of appropriate response. Imprinting refers to behaviour influenced and designed by gene, which happens at a particular period of lifetime, called critical period; it is an irreversible learning and those stimuli of this type of learning behaviour is called imprinting stimulus. Classical conditioning is a kind of learning that occurs when a conditioned stimulus is paired with an unconditioned stimulus. It is that 2 stimuli are linked together in order to produce a new learned response in an organism. Operant conditioning or trial and error is a type of learning behaviour where an organism tries to link behaviour with reward or punishment. Being rewarded results in repeated behaviour while being punished results in avoidance of behaviour. Observational learning is a type of learning that occurs after an organism observes, retains and replicates particular behavior performed by others. Insight learning is learning or solving problem that occurs suddenly, through understanding the relationships of the different parts of a problem rather than through test and error. It is described as an epiphany. The last type of learning is cognition. Cognition is still in question whether animals have this type of learning. The question is whether cognition learning can only be described with human, or also with animals but in different level based on different types of species evolution. Cognition can be defined with human as the process by which an individual acquires knowledge or skill in cognitive processes. Cognitive processes include reasoning, abstract thinking, decision making, problem solving etc.

Human behaviour was mainly classified by the psychologists as overt and covert behaviour. Overt behaviour can be seen and felt by use of all senses, without any use of medical equipments such as speaking, laughing, crying, movement of body, or even heart beat. Overt behaviour can also be described for changes of substances, observable by facilitation of equipments or scientific analysis such as change of chemical substance, blood glucose level, functioning of stomach and intestine. Covert behaviour, contrarily, is a mental activity that is not directly observable. It is personal mentality such as memorizing, perceiving, understanding, smelling, hearing, dreaming, being hungry, being angry, thinking, decision making, having attitude and imagining. Covert behaviour is not observable, yet may be incidental from overt behaviour that is apparent. Human by nature has both overt and covert behaviour, where overt behaviour is influenced by covert behaviour. An understanding of individuals or social groups' overt behaviour requires an understanding of their covert behaviour.

C. Pesticides

Pesticides can be chemical or biological agent, used for attracting, seducing, destroying or mitigating any pest or insects. These include pesticides which have a qualification of accelerating or delaying growth of plants and crop products, and protecting plants from damaging influences such as weeds, plant diseases or insects. Pesticides also mean chemicals used before and after harvest of crops with a purpose of preserving and transporting. Pesticides are grouped into the following groups: Insecticide used to kill insects; Herbicide known as weed killer used to kill unwanted plants; Fungicide which is biocidal chemical compound used to kill fungi or fungal spores; Bactericide which is a substance used to kill or prevent bacteria; Rodenticide, a rat poison categorized as a pest control chemical and classified by fast and slow- reacting substance; Molluscicide used to control snails or mullusks; Acaricide used to kill members of Acari, a arachnid subclass which includes ticks and mites; Nematicide, a type of chemical pesticide used to kill plant- parasitic roundworms. Pesticides in other groups include, for instance, Avicide or a chemical substance used to kill birds.

1. Durability of Pesticides

Durability of pesticides refers a length of time used to measure durability and persistency of pesticide in normal use level and environment. Normally a pesticide considered persistent is durable up to 2 years; a pesticide considered moderately persistent is durable between 1- 18 months; and a pesticide considered non-persistent is obsolete within 1- 12 weeks and can no longer be used. Factors that facilitate durability of pesticides were defined by Chatphol Songsuntharawong [4]. The first factor is organic soil matter, which is the most important influence of pesticide durability. Soil with higher organic matter absorbs higher level of pesticide. The second factor is amount of clay in the soil, where the soil with higher amount of clay influences a longer residue of pesticide than the soil with lesser amount of clay. Soil content is another factor, in that pesticide remains longer in the finer soil content that the rougher one. A study of Priwan Busarakam [5] found that Dieldrin and Lindane were less absorbed in sand. The next factor is soil pH. Soil with lower pH can absorb more pesticide content, while soil with too high pH results in a replacement of Hydrogen ion in clay particles, reducing a level of pesticide absorbed. Malee Phothiratch [6] studied about an influence of the amount of metal cation in the soil on pesticide durability and residue in the soil. The finding revealed that metal cation had an effect on decomposition of toxic substances in the soil, Lindane left longer particularly in the soil with high Magnesium, and soil with high iron matter absorbs higher amount of DDT chemical substance. Chemical qualification of chemical substance was also found to be a factor that facilitates longer duration of chemical substance left in the soil. Suphamas Phanichsakphattana [7] found that evaporation of chemical substance increases by higher amount of soil matters, humidity above the soil surface, temperature of the soil, soil aeration and level of soil humidity. The last three factors include

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temperature where higher temperature causes faster evaporation of chemical substance; soil humidity; and ploughing.

2. Impacts of Pesticides Use

Over use and misuses of pesticides cause soil contamination due to chemical residues, causative to severe effects [8]. The effects cause negative consequences from sickness to death directly to users who handle pesticides, which are farmers and agriculturalists. This behaviour relates to lack of knowledge and understanding of pesticide uses and consequences of wrong uses. Toxicity caused by over use and misuses of pesticides is known into 2 types: acute toxicity which can cause immediate death unless patients brought to hospital or treated in time; and chronic toxicity in which a body gradually receives pesticide in small amount in a long enough period of time until some illnesses present such as headache and cancer. Moreover, health effects of pesticides can cause a wider impact to other people who live within the environment found overuses of pesticides. Uses of pesticides also disrupt the ecological balance, in way that it develops insecticide resistance in insect population, which in consequence, originates spreads and growth of insect pest and plant disease. Additionally, it was found that there was a reduction of bee population due to intense uses of chemical substances in agriculture. A long term effect from pesticide is chemical contamination in the environment and food sources, which finally affect malfunction of human health from generation to generation. At a larger outlook, economic losses can be rooted from misuses of pesticide with shortage of knowledge and awareness of safety.

III. Methodology

This paper aimed to investigate farmers' level of awareness and behaviour of chemical pesticide uses, by using a case study of Suan Luang Sub- District Municipality, Ampawa District, Samut Songkram Province. Questionnaire was employed in this study with the farmers from a total of 46 households to explore their level of awareness in chemical pesticide uses, while interview and observation were adopted in exploring their behaviour of chemical pesticide uses.

IV. Findings

The demographic finding (Table I) revealed female respondents as the majority with an average age of 62.87 years old (78.3 percent). The highest level of education was primary school. An average number of household members presented 4.28. An average length of years working in agricultural sector was 36.9 years. A level of awareness in chemical pesticide uses was investigated by the respondents' level of knowledge and understanding of danger and impacts from chemical pesticide uses. It was found that the respondents' level of awareness was high, which could be ranked in 2 groups: high level of awareness and low level of awareness as follows:

TABLE I
THE CLASSIFICATIONS OF FARMERS

	Classifications	Number	Percentage
Gender			
	Male	13	28.27
	Female	33	71.73
	Total	46	100.0
Ages			
	40 – 50	4	8.7
	51 – 60	15	32.6
	61 – 70	18	39.1
	More than 70	9	19.6
	Total	46	100.0
	$\bar{x}$ = 62.87 SD = 10.72		
Educational background			
	Elementary	36	78.3
	Secondary	7	15.2
	Bachelor's	1	2.2
	Uneducated	2	4.3
	Total	46	100.0
Number of members in the household			
	1 – 5	36	78.3
	6 – 9	8	17.4
	10 – 12	2	4.3
	Total	46	100.0
	$\bar{x}$ = 4.28 SD = 2.39		
Length of career performance			
	5 – 20 years (less than 20)	7	15.2
	21 – 35 years	13	28.3
	36 – 50 years	21	45.6
	More than 50 years	5	10.9
	Total	46	100.0
	$\bar{x}$ = 36.91 SD = 14.51		

A. High Level of Awareness

1) Chemical pesticide uses with lack of knowledge and understanding of right use can cause illness and fatal effect to health.
2) Chemical pesticide, when over used, can become pollutant to the environment which disrupts the surrounding ecology.
3) Inappropriate use of chemical pesticide with crops can cause toxic contamination in food (i.e. vegetable) which is dangerous to consumers' health.
4) Illness among population is increasingly intense.

B. Low Level of Awareness

1) Continuous use of chemical pesticides at a certain length of time can cause spreads of insect pest and plant disease.
2) Chemical substance contaminated or polluted in the environment affects living system of human and other organism.

From the interview conducted with observation to find out behaviour of the respondents in chemical pesticide uses, the findings unveiled some significant behaviour before, during and after use of chemical pesticides. Before using chemical pesticides, most of the respondents performed the following:

1) Studying/ reading pesticide user's guide or information on the label for direction of use (i.e. amount of use)
2) Mixing pesticides in accordance with the indication on the label.
3) Keeping children away from the area of mixing the chemical

4) Using stick to stir the mixed substances
5) Wearing long sleeve shirt and pants to protect the body from the chemical hazard
6) No smoking, eating during the mixing process
7) Checking pesticide application such sprayer before use to ensure the readiness of the application.

The observation revealed that some respondents did not wear glove and mask, while some were less careful in mixing pesticides, making spills off. During use of chemical pesticides, the majority of the respondents wore long sleeve shirt, hat and mask, did not smoke, eat or drink. Children were also kept away from the area of pesticide use. They avoid use of pesticides in the days with high rain and wind, and always spray in windward direction. It was found from the observation that some respondents took a break for smoking during pesticide spray. After pesticide spray was done, most respondents took the following actions:

1) Taking a bath/ shower and cleaning up
2) Separating the clothes wore during pesticide spray before washing
3) Cleaning up all equipments used in pesticide spray
4) Avoiding disposal of unwanted pesticides and wash water into river
5) Disposing empty pesticide container by burying or burning.

The observation found that after the pesticide use, some respondents continued doing some other works in the farm area until dusk, without immediate bath- taking or change of clothes.

V. Conclusion

The findings reflected the farmers' high level of awareness in chemical pesticide uses in the hazardous effects of the chemical to human and environmental health, while their behaviour of chemical pesticide uses explained their awareness paid to the right way of using pesticides, for instance reading the direction on the label, keeping children and animals away from the area of pesticide mixing, covering body with clothes and wearing hat and mask, no smoking, eating or drinking during pesticide spray or standing in windward direction. The farmers' behaviour after pesticide spray included clean- up of clothes and spray equipments, disposing empty pesticide container by burying or burning and avoiding disposal of unwanted pesticides and ash water into river. However, a level of awareness of hazardous effects from consecutive pesticide uses for several years was low, particularly the effect that could cause spreads of insect pest and plant disease, and chemical contamination resulting in environmental pollution and malfunctioning of human and other organism living system.

Acknowledgment

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