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Farmers' Perception, Knowledge and Pesticide Usage Practices: A Case Study of Tomato Production in Inlay Lake, Myanmar

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The research was designed to study farmers' knowledge and perception on pest management and pesticide, their practices on pesticide usage. The research also attempted to find out the factors affecting pesticide applied by farmers. The results showed that they could not recognize the kinds of pest enemies very well while about 80% of them have never heard about IPM. In addition, although almost all farmers have known the negative effect of pesticide hazards on their health, only 86.9% of them always use protective things during pesticide spraying. The study also showed that farmers' farm experience and extension service have negative relationship with the amount of pesticide used by farmers. In the other words, these factors partly make farmers reduce their pesticide usage.

Key words: Attitudes, hazards, pesticide use, tomato farmer

INTRODUCTION

Pest and disease infestations are common occurrences in agricultural production. Productivity of crops grown for human consumption is at risk due to the incidence of pests, especially weeds, pathogens and animal pests. Crop losses due to these harmful organisms can be substantial and may be prevented, or reduced, by crop protection measures (Oerket, 2005). The use of synthetic pesticides in agriculture is the most familiar way to minimize potential crop yield loss due to pest. Although uses of chemical inputs like pesticides make an increase in agricultural production and productivity, they produce a lot of externalities like the negative effects of human health and the ecosystem. These problems can arise from misuse of the pesticides or over–reliance on them, particularly if the users are not aware of these potential problems. (William and Ntow, 2006). Adequate knowledge on how farmers perceive pests, their attitude, and practices to crop protection problems are required to implement successful pest control programs (Ajayia, 2000).

Inlay is famous for producing tomato in floating gardens in Myanmar. The primary income of the native Intha people is mainly derived from tomato production, one of the most important cash vegetable crops, comprising two third of the regions' agriculture. Unlike the past time, almost all farmers used to apply natural fertilizers or no pesticides, now chemical fertilizers and a lot of pesticides are used in the agricultural farming to increase yield and prevent from pests and diseases. In addition, since prolonged monoculture system and weather condition favoring pest and disease in Inlay Lake, tomato floating islands have been severely attacked by fungal diseases resulting in high yield losses during 1994 and 1995. It becomes an unavoidable for the farmers in Inlay Lake to use chemical pesticides for crop protection (Lwin, 2006).

The amount of farm pesticide utility has increased rapidly in recent years. Excessive use of pesticides aiming to control tomato plant insect, pests and diseases, as well as fertilizer and other chemical have become one of the major factors that pollutes and degrades the water quality. It has also detrimental effects on aquatic biota of the lake (Asian–Maff–Japan Project, 2006). Steve and Myint (2001) also concluded that current pesticide usage for tomato cultivation must be changed to protect the health of the residents in Inlay Lake. A clear understanding of farmer's knowledge, attitudes and practices of pesticide use is the first step for understanding the reasons why farmers overuse pesticides for their crop production. Therefore, the research was designed to study farmers' knowledge and perception on pesticide, pest and pest management and their practices on pesticide use. It also attempted to find out the factors affecting the amount of pesticides used by tomato farmers in Inlay Lake.

MATERIALS AND METHODS

Data

Primary data was used in this study. The target population of this study was tomato farmers who had tomato floating gardens and lived in Inlay Lake, Nyaung Shwe Township, Myanmar. Based on the sampling frame of tomato growing farmers in the selected villages as

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the first stage sample, some tomato–growing farmers was randomly selected as the second stage sample; from the population of tomato–growing farmers in the selected villages with simple random sampling without replacement. In the first stage sample, there were 12 tomato group villages while there were 130 tomato farmers randomly selected as the second stage sample selected from these 12 villages. These 12 sample villages in the first stage sample were found to belong to five village tracts in Nyaung Shwe Township. And then, from the selected tomato–growing farmers, the required data for this study on knowledge, perception and practice of the tomato farmers in production of tomato crop were collected with the aid of survey questionnaires well prepared in advance through face–to–face interview with the selected tomato farmer in the second stage sample.

Methodology

For data analyzing, descriptive statistics as percentage was used to describe the findings for perception on pest and disease trend change, information source on pesticide and pest management, attitude on pesticide requirements, knowledge on pest, pest management and pesticide hazards and so on.

Moreover, to find out the factors influencing current pesticide use levels by Inlay tomato farmers, the multiple linear regression approach was used. In this analysis, total value of pesticides applied by farmers was used as the dependent variable. It was perceived that the pesticide use level can be influenced by farmers' characteristics, perceptions on pesticide utilities and so on. The detail function is specified as:

$$Pes_i = \beta_0 + \beta_1 Exp_i + \beta_2 Edu_i + \beta_3 Area_i + \beta_4 Ext_i + \beta_5 Training_i + \beta_6 Trend_i + \beta_7 Know_i + \beta_8 Pesuse_i + \varepsilon_i$$

where, Pes_i is the value of pesticides used by farmer i in 000'kyat, Exp_i is experience (the number of tomato growing years), Edu_i is the education level of interviewee (the number of schooling years), $Area_i$ is the tomato area in acre, Ext_i is the variable of extension service (dummy variable is 1 if farmer gets extension advice, 0 otherwise), the variable of $Training_i$ (dummy variable is 1 if farmer has attended any agricultural trainings, 0 otherwise), $Trend_i$ is perception of pest and disease trend (dummy variable is 1 if farmers think pests and diseases increasing, 0 otherwise), $Know_i$ is the variable of knowledge on pesticide hazard (dummy variable is 1 if famers know about pesticide hazard, 0 otherwise), $Pesuse_i$ is the way of pesticide use (dummy variable is 1 if farmers use the same amount of pesticide as suggested in label, 0 otherwise).

RESULTS AND DISCUSSION

Use of Pesticides and Pesticide Usage Practices in Tomato Production

Farmers in the survey reported that there were pests such as red spider mite, white fly, leaf miner, pod borer and diseases such as early blight, late blight, Fusarium in their fields. All respondents have approximately experienced in yield losses due to pest and disease outbreak in their farming plot. Over 40 different kinds of pesticides are applied in tomato farming by the farmers in the sample. The results reveal that almost all respondents have utilized pesticides in the category Ⅲ created by WHO.

Table 1 shows that almost all the respondents (94.61%) always read well the instruction before they apply the pesticide in tomato production while only seven farmers (5.39%) have never read the pesticide labels before using.

The practice of using indiscriminate combinations of pesticides, particularly insecticides, may have contributed to an increase in incidences of insect pest infestation of tomato. In the recommendation of strategies for pesticide management, the use of mixtures of insecticides must be avoided, since mixtures of insecticides generally result in the simultaneous development of resistance (Ntow *et al.*, 2006). In the present survey, nearly 25% of the respondents always mix together the pesticide more than one kind of pesticides while about 53% sometime in the belief that the effect will be greater. Only 22% of them have never mixed the pesticides together.

With regard to protective clothing, majority of the respondents (86.92%) always wear protective accessories during applying the pesticide while only 12 respondents sometimes use protective clothing during spray-

Table 1. The situation of pesticide use practices

Questions	Respondent	
	Number	Percentage
Insecticide handling practices		
Reading pesticide labels before using		
– Always	123	94.61
– Sometime	7	5.39
– Never	–	–
Mixing pesticide more than one		
– Always	32	24.61
– Sometime	69	53.08
– Never	29	22.31
Use of protective clothing and re– entry period		
Use of protective things while spraying		
– Always	113	86.92
– Sometime	12	9.23
– Never	5	3.85
Waiting period at least 12 hours after spraying		
– Always	59	45.39
– Sometime	26	19.99
– Never	45	34.62

Source: own survey data, 2009

ing. However, five farmers (3.85%) have never used protective clothing when spraying.

The basic standard for safety is required not to enter the field about 48 to 72 hours after spraying pesticides (Warburton *et al*., 1995). Only 45% of farmers adhere to this safety standard while about 55% of them could not wait to return to their farm after 12–hour pesticide spraying.

Farmers' Perception on Disease Trend Change and Pesticide Requirement

As regard perception on pest and disease trend change, 66.2% of farmers perceives that the kind and frequency of insects and diseases have been increasing over the past ten years. Among 130 farmers interviewed, 19.2% of the respondents perceives the decreasing trend of insect and disease problems and only one respondent do not know the trend change. Only 13.8% perceived the pest and disease trend do not change (Table 2).

Table 2. Farmers' perception on disease trend change and pesticide requirement

Farmers' Perception	Respondent	
	Number	Percentage
Perception on Pest and disease trend change		
– Increase	86	66.2
– Decrease	25	19.2
– No change	18	13.8
– Don't know	1	0.8
Perception on pesticide requirement		
– Important	117	90.0
– Not so important	12	9.2
– Not require	1	0.8
Perception on recommended pesticide dosage		
– Too much	5	3.85
– Adequate	90	69.23
– Too less	34	26.15

Source: own survey data, 2009

Table 2 performs the perception of farmers on disease trend change and pesticide requirement. Almost all respondents (90%) perceive that the utility of pesticide in their tomato production is really important to avoid pest and disease infestations, revealing that tomato floating gardens' farmers heavily rely on pesticides for pest and diseases problems.

In concerning with recommended pesticide dosage, more than 69% of the respondents consider the recommendation as adequate while about 26% considers as under dosage. The study also show that over 36% of farmers apply more than the recommended dosage of pesticides.

Pest Management Information Source

Information is a powerful resource that provides the useful information about the market prices of inputs and outputs to help farmers improve their agricultural practices and general living standards (Ajayi, 2000). The study reveals that almost all farmers (for one respondent) obtain the general news and information of crop protection and agricultural practices from two or more sources, including extension agents, pesticide sale persons, fellow farmers and their own experience.

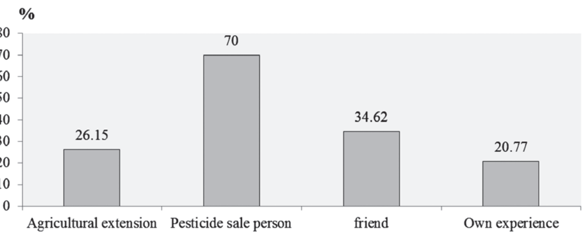

Fig. 1. Information source on pest and pest management.

Figure 1 performs where the sample respondents get information on pest management and pesticides. Only 26% respondents obtain information from agricultural extension staffs while most of them receive information from local pesticide sale persons, accounted for 70%.

Figure 2 shows farmers who used to attend trainings about pest management and utility. Only 37% of farmers are trained on pest management and pesticide related issues. Since extension access is also weak in the studied villages, informal farmer–to–farmer exchange of knowledge on crop protection could be took place to a considerable degree. Training experience on pest management and pesticide related issues are also needed to afford.

Farmers' Knowledge on Pest Enemies, Pest Management and Pesticide Hazards

Farmers' knowledge was examined based on their awareness of pest enemies, alternative pest manage-

Table 3. Farmers' knowledge on pest enemies, pest management and pesticide hazards

Farmers' knowledge	Respondent	
	Number	Percentage
Knowledge on pest enemies		
– Know	53	40.7
– Don't know	77	59.3
Knowledge on integrated pest management		
– Know	26	20.0
– Don't know	104	80.0
Knowledge on pesticide hazards		
– Know	108	83.1
– Don't know	22	16.92

Source: own survey data, 2009

Table 4. Description of variables related to the pesticide utilities

Variables	Notation	Mean	St.dev.
Pes	(Total pesticide value in 000'kyat)	181.3	110.9
Exp	(Farming experience in years)	17.5	11.4
Edu	(Education in years)	4.9	2.5
Area	(Tomato farm area in acres)	0.6	0.3
Ext	(1 = receiving extension advice, 0 = Otherwise)	0.3	0.4
Training	(1 = attending trainings, 0 = Otherwise)	0.4	0.5
Trend	(1 = Increase in pest and diseases, 0 = Otherwise)	0.7	0.5
Know	(1 = Knowing about pesticide hazard, 0 = Otherwise)	0.8	0.4
Pesuse	(1 = Using the same as suggested pesticide amount , 0 = Otherwise)	0.3	0.4

Source: own estimation results

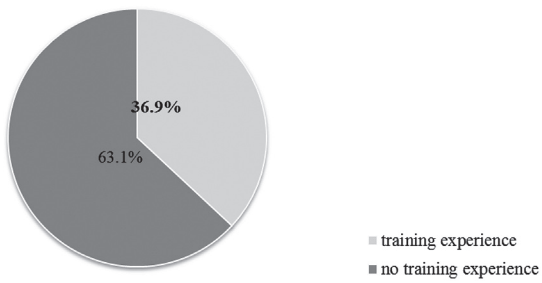

Fig. 2. The percentage of farmers trained on pest management and pesticide utility.

ment. Among 130 farmers, nearly 41% of the respondents in the survey have knowledge about pest enemies in their tomato production while over 59% have no knowledge about pest enemies (Table 3).

Regarding on knowledge of integrated pest management (IPM), the results reveal that around 80% of the respondents have never heard about IPM, while only 20% of them has knowledge on IPM.

In connection with knowledge on environmental and health effect due to pesticides, almost all the respondents (83.1%) have the knowledge of pesticide hazard while 16.9% of the respondents do not have the knowledge of hazard due to pesticides.

In summary, Inlay farmers have little knowledge on pest enemies and integrated pest management with limited education. Even though some farmers have knowledge on pest enemies, they could not tell very well the kinds of pest enemies. Although there are many projects such as Asean–Maff– Japan Project and other non–government organizations projects, guiding farmers the knowledge about pest enemies and how to prevent from them, in Inlay Lake area, farmers gradually forget acquired knowledge studied from the training sessions.

Factors affecting Pesticide Usage

Table 4 performs descriptive statistics of variables related to pesticide utilities of tomato farmers. Almost of farmers in the sample obtain the level of primary education, minimum education level with 1 year and maximum with 13 years, respectively. On farm size, Average farm size is 0.57 acre. Maximum farm experience is 47 years and the respondents in the research have 17.54 years of average farm experience. As regards the cost of pesticide per season, some 42.31% of the respondents stated that seasonal cost of pesticide was less than or equal 150,000 kyat. Some 39.23% of them reported between 150,000 kyat and 250,000 kyat while 18.46% spent greater than 250,000 kyat for pesticide in one season.

Table 5 shows the results of factors influencing pesticide use. The result estimates the R square value of 0.59 for cross–sectional household data. The positive and statistically coefficient of *Anca* indicates that as one acre the farm size increase, it is expected the value of pesticide applied by farmers to increase 248,160 kyat. The regression coefficients of *Exp*, *Training* and *Ext* variables are significantly negative, revealing that the farmers who have more experience, education years or are used to attend the trainings given by extension service have tendency to decrease applying pesticides

Table 5. The OLS results of factors affecting pesticides utility

Variable	Coefficient	t–value
Constant	77.241***	2.687
Exp	– 1.525**	– 2.359
Edu	0.213	0.073
Area	248.160***	10.643
Training	–29.348**	– 2.123
Ext	–45.318***	– 2.766
Trend	6.206	0.442
Know	5.348	0.298
Pesuse	7.602	0.513
R square	0.593	
Adjusted R square	0.566	

***, ** and * indicate statistical significance at the 0.001, 0.005, and 0.01 levels respectively
Source: own estimation results

for their crop.

CONCLUSION

The overall results could be concluded that farmers' knowledge on pest enemies and IPM was minimal in the study site and farmers were mainly dependent on pesticides with the lack of non–chemical alternatives. Although almost all farmers have become aware of pesticide hazards, inappropriate practices might cause possible poisoning symptoms. Concerning pesticide and pest management information, most of respondents obtained information from pesticide sale persons; some farmers followed their neighbors' advice. According to the regression results, the main factors negatively affecting on the value of pesticide applied by farmers were farm experience, extension service and training experience.

Based on the estimated results, some recommendations could be proposed such as educating the farmers on knowledge of pest and pest management, proper pesticide handling and safety measures is needed by encouraging the village pesticide retailers and farmer leaders to participate the training sessions in order to disseminate and share the right information. Although the effects of training experience and advices from extension services on pest management and pesticide issues were minimal, this study showed that training experience and extension had a discouraging impact on the value of pesticide use. This indicated if farmers were educated and provided enough the relevant information on pest problems and pesticide issues via training sessions and extension services, the pesticide negative externalities could be reduced without the adverse effect of crop productivity. Therefore, the local governments should pay attention to promote the development of training sessions and extension services more effectively among tomato farmers in Inlay Lake.

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