Factors Influencing Group Farmers' Behaviour Towards Safe Pesticide Use in Malaysia

Nyak Nur Hamida Nyak Hashim[1], Roslina Mat Salleh[1], Syuhaily Osman[1], Zuroni Md. Jusoh[1]

[1]Department of Resource Management and Consumer Studies, Faculty of Human Ecology, Universiti Putra Malaysia, Malaysia

Abstract

Pesticide is widely used by farmers to control agricultural pest. The purpose of this study was to measure factors influencing farmer's safety behaviour in pesticide use. A total of 431 respondents from four states which are Perak, Pulau Pinang, Johor, and Kelantan were chosen through stratified random sampling. Multiple regression analysis found that attitude was the most influential factor for farmers' behaviour with R square of 0.671. Farmers should have positive attitudes and obtain support from several parties to educate them to handle the pesticide wisely. This study provides several insights for policy makers to overcome the obstacle by providing farmers with technical guidance and designing long-term collaborative programmes that support, develop, and foster sense of control among farmers.

Keywords: pesticide, attitude, subjective norms, perceived behavioural control, intention

1.0 Introduction

Agriculture is the source of food supply for all countries in the world whether they are an underdeveloped, developing, or developed country. Pesticide use can help increase crop yield (Widawskye et al., 2015) and is widely used in the agricultural sector (Bagheri et al., 2019). Aktar et al. (2009) mentions that pesticide can be found in the air, the food we eat, and water. Although pesticides are developed through very strict regulation processes to function with reasonable certainty and have minimal impact on human health and the environment, serious concerns have been raised about health risks resulting from occupational exposure and from residues in food and drinking water.

People all around the world depend immensely on agriculture as one of the main sources to fulfill their basic needs and doubtlessly agriculture is pertinent for the survival of mankind. In Malaysia, the

population in 2019 is estimated to be 32.6 million people, an increase of 2 million people as compared to 2018 with 32.4 million people. The increased population could double the demand for agriculture. In an effort to increase agricultural production, the use of pesticides has become relatively prevalent. According to the Department of Agriculture (DOA, 2013), about 3000 pesticide products have been registered from April 2008 to March 2013.

Pesticides ranging from insecticide, fungicide, herbicide, and rodenticide are widely used in farms in Malaysia (DOA, 2013). While pesticides are widely used to control agricultural pest, previous study conducted by Greene and Pohanish (2005) has shown that less than 0.1% of applied pesticide actually reach the target pest, with the remaining spreading into the environment, and consequently effecting the farmers, consumers, air, soil, and water. Pesticide act as a crucial tool to increase land productivity, minimize crop damage, and to ensure that the quantity and quality of agricultural products can be protected (Aktar et al., 2009). One study by Bakand et al. (2012) examined the market trend where the demand for supply of pest-free and nice-looking products has led to misuse and overuse of these chemicals beyond the recommended levels.

Despite the numerous benefit that could come from the use of pesticide, the risk of effect to human health and environmental contamination remains a major concern. These chemicals can enter the environment via various ways such as water contamination through spraying activities and soil seepage (Aktar et al., 2009). According to Kim et al. (2017), the high toxicity of these pesticides can be detrimental to public health when exposed either through consumption, dermal contact, or inhalation. Farming is one of the most hazardous job in a developing country where agricultural production is concerned (Hashmi & Khan, 2011). The risk of health hazards due to pesticide exposure depends not only on how toxic the ingredients are but also on the level of exposure (Kim et al., 2017).

Unsafe farming practices such as eating and smoking while applying pesticide and inadequate use of protective equipment were mostly due to farmers' low level of knowledge about pesticide toxicity (Ngowi et al., 2001). However, lack of knowledge and training among farmers on proper handling and usage of pesticide can effect neurological health, for example, reduced visual ability, reduced speed of response, and loss of coordination (Lah, 2011). Xu et al. (2008)

suggest that farmers can improve their awareness by attending training programs to minimize pesticide exposure.

2.0 Literature Review

According to World Health Organization (2017), pesticides are chemical compounds that are used to kill pests including insect, fungi, weeds. and rodents. Pesticide is the substance used to destroy insect and other harmful organism including herbicides, insecticides, fungicides, rodenticides, molluscicide, and nematocide. Bakar (2009), mentioned that pesticide use among farmers has increased from RM289 million in 1995 to RM403 million in 2008.

Group farming is a farming approach that has been used to increase productivity and manage cost of production systematically and efficiently. Group farming mainly refer to the farming of fruits and vegetable involving multiple individuals of farmers who are not related by kin or employment who then share resources for the purpose of farming (Srinath et al., 2000). According to Srinath et al., (2000) group farms are a farming approach which rely on harmonised farming operations and collective management by a number of individuals within a locality. The purpose of group farming is different based on their nature and origin and purpose of creation (Galeski, 1987). The main objective of farmers' group in this research is to improve agricultural development and share resources.

Arya (2004) stated that pesticide has been detected to cause of neurological, gastrointestinal, respiratory, and dermatological problems which can lead to heart attack, coma, or even death (Kim et al., 2017). The link between pesticides and cancer has been reported by many studies (Kim et al., 2017). This in addition to causing many negative impacts not only to humans but also to the environment.

Farmer's attitude refers to a person's positive or negative evaluation of their behaviour. Ali et al. (2018) stated that one-third of farmers in their research have negative attitude and was willing to break the rules if an attack by insect or pests occurred. Farmers tend to overuse or misused pesticide due to lack of information on pesticide use. There is a lack of general knowledge on management strategies like use of trapping devices, crop rotation, sanitation, biopesticides, and biological control agents used in an Integrated Pest Management (IPM) approach (DOA, 2009).

Farmers were also influenced by subjective norms to perform the behaviour; the social pressure to perform the behaviour or not. Ali

et al. (2018) highlighted that farmers were willing to use illegal pesticides if other farmers use illegal pesticides in their farming activity. In most previous literature by Gesesew et al. (2016); Abadi (2018); and Rezaei et al. (2018), inappropriate use of pesticides in most cases has been linked to farmers' weak knowledge and inappropriate attitudes towards using pesticide.

Regarding to perceived behavioural control (PBC), the study found that farmers can practice good farming if they have enough knowledge and skill to perform good agriculture practices. Marcoux and Urpelainen (2011) stated that there is a lack of crucial tool to minimize crop damage, increase land productivity, and ensure that the quantity and quality of agricultural products can be protected (Aktar et al., 2009).

3.0 Conceptual Framework

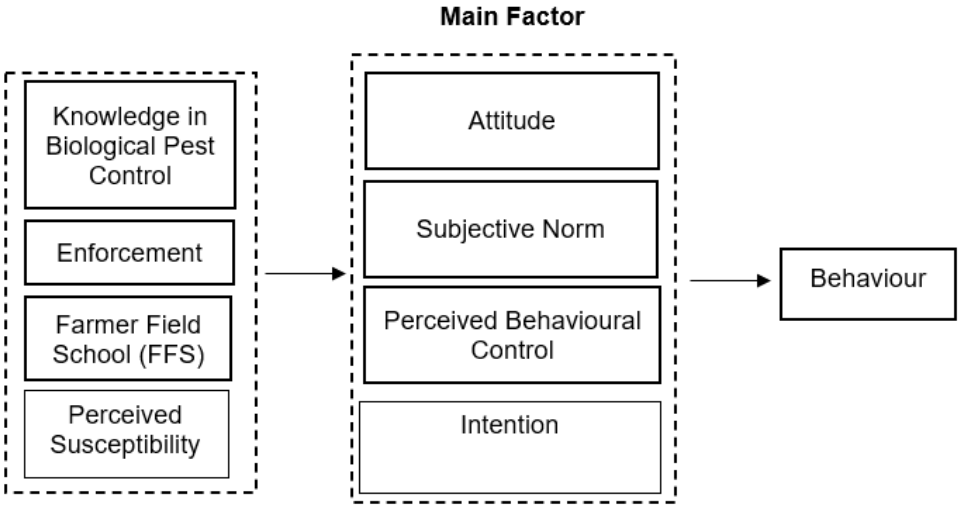

Figure 1 : The Study Model

This framework is developed from the Theory of Planned Behaviour (TPB) and Health Belief Model (HBM). The Theory of Planned Behaviour is designed to predict and explain behaviour in a specific context (Ajzen, 1991). Meanwhile, perceived susceptibility from HBM is designed to study the farmers' belief about their chances of getting a condition or disease (Becker, 1974). Roslina (2019) suggests that farmers' intention was used as the determinant of a farmers' behaviour in practicing safe pesticide use. This study shows that behavioural intention is not able to be a mediator to predict farmers'

behaviour in practicing safe pesticide use. Meanwhile, knowledge in biological pest control, enforcement, farmers field school (FFS), and perceived susceptibility were taken as additional construct to the TPB.

In most previous literature by Gesesew et al. (2016); Abadi (2018); and Rezaei et al. (2018), inappropriate use of pesticides in most cases has been linked to farmers' weak knowledge and inappropriate attitudes towards pesticide use. Gesesew et al. (2016) found that knowledge was significantly associated with farmers' attitudes towards safe pesticides use. Farmers who participated in FFS have more positive attitude towards biological control in comparison to those who did not participate (Osko et al., 2007). Besides, Wang et al. (2017) stated that subjective norms has a positive influence towards safe pesticide used among farmers.

Perceived susceptibility may lead to the changes in farmers' intention and gives an impact on farmers' behaviour. Perceived susceptibility is termed as a person's perception of the risk of developing a disease. Chin and Mansori (2019) mentioned that if farmers perceive that they have a high risk of getting a particular disease, most probably the farmers will execute the intended behaviour to reduce the risk.

4.0 Methodology

A cross-sectional study was carried out and the main research instrument used was a questionnaire. The study was conducted among 431 farmers who practiced group farming who were involved in pesticide spraying activity. It was carried out in four locations in four states which were Teluk Intan (Perak), Batu Pahat (Johor), Pasir Mas (Kelantan), and Kepala Batas (Pulau Pinang). These four states are known as the largest area of group farming practiced in Peninsular Malaysia (DOA, 2009). The group of farmers in this area are involved in vegetable, rice, and fruits farming and are exposed to pesticides.

The 431 farmers were selected through stratified random sampling from the lists obtained from the Department of Agriculture. Stratified random sampling involved categorising the members of the population into mutually exclusive and collectively exhaustive groups. Stratified sampling techniques can provide more precise estimates, can enable the researcher to determine desired levels of sampling precision for each group, and can provide administrative efficiency (Chua, 2016). A sample of 431 farmers was selected using the minimum sample size in the table from Krejcie and Morgan (1970).

The farmers in this study were given questionnaires to answer. The questionnaire was modified according to research by Roslina (2019). The questionnaire comprises of four sections: section A: background of respondents, section B: farmers behaviours in pesticide use, section C: knowledge in IPM, and section D: health belief, training (FFS), and law enforcement. The questionnaire was written in Malay which is the local language used in Malaysia. The average time for the farmers to complete the questionnaire was 30 minutes. After collecting data in the field, the data were analysed using the Statistical Package for Social Sciences (SPSS) (ver. 23).

Pre-test was conducted to ensure the reliability and validity of the questionnaire used in this study. According to Mujis (2004) the validity concern is about measuring what we want to measure and reliability refers to the consistency and stability of the measuring instrument. The pre-test was carried out on 30 farmers in Batu Pahat, Johor which have the same inclusion criteria as the respondent in the study area. Cronbach's alpha of the pre-test showed the questionnaire was of an acceptable reliability; attitude is 0.802, behaviour is 0.663, farmer field school is 0.904, perceived behavioural control is 0.823, knowledge is 0.674, perceived susceptibility is 0.842, enforcement is 0.891, subjective norms is 0.804, and intention is 0.879.

5.0 Findings

5.1 Socioeconomic Background

Based on Table 1, the majority of the group farmers that participated in this study were male (91.6%), Malay (91.4%), and are above 51 years old (43.9%). This study shows that Malaysia has an inadequate number of young farmers as only 10.4 percent of the respondent were between 21 to 30 years old. Most of respondents (52%) obtained an education until SPM only while 30.2 percent had not completed primary education. 44.3 percent of the farmers earned a yearly income between RM 10,001 to RM 20,000.

Table 1 : Farmers' socioeconomic background

Variable	Respondent Information	Frequency n = 431	Percentage (%)
Gender	Male	395	91.6
	Female	36	8.4
Age	< 20 years	4	0.9
	21– 30 years	45	10.4
	31– 40 years	63	14.7
	41– 50 years	125	28.9
	> 51 years	189	43.9
Race	Malay	392	91.4
	Indian	0	0
	Chinese	33	7.4
	Others	6	1.2
Education	SPM	224	52.0
	STPM/ASASI/Diploma	56	13.0
	Degree	16	3.7
	Postgraduate	5	1.1
	Do Not Complete Primary Education	130	30.2
Income	≤ RM 10,000	191	44.3
	RM 10,001 – 20,000	171	33.4
	RM 20,001 – 30,000	38	8.8
	RM 30,001 – 40,000	13	3.0
	> RM 40,000	18	4.2

5.2 Farmers' Agriculture Background

Most of the farmers own their farm (47.1%) while 40.1 percent of them rent the farm and 12.1 percent have both. For experience in agriculture, 49.2 percent of them have more than 10 years' experience in agriculture. In terms of farm size, the average size of the farming area was 1 to 2 hectares (35.3%). Almost 37.4 percent of farmers in this study are involved in paddy cultivation. Farmers' agriculture background information is summarised in Table 2.

Table 2 : Farmers agriculture background

Variable	Respondent Information	Frequency n = 431	Percentage (%)
Types of farm	Rent	173	40.1
	Own	203	47.1
	Both	52	12.1
Experience in agriculture	Less than one year	2	0.5
	1-5 years	114	26.5
	6-10 year	103	23.9
	More than 10 years	212	49.2
Farm size (hectares)	<1.0	135	31.3
	1.01 – 2.00	152	35.3
	2.01 – 3.00	42	9.7
	3.01 – 4.00	27	6.3
	4.01 – 5.00	21	4.9
	>5.01	47	10.9
Types of crop	Paddy	161	37.4
	Fruits	50	11.6
	Vagetable	77	17.9
	Industrial	98	22.7
	Cash	26	6.0
	Spices	5	1.2
	Herbs	1	0.2
	Fruits and vagetable	9	2.1
	Paddy and palm oil	4	0.9

5.3 Multiple regression

Table 3 : Multiple regression

Variable	B	Beta	t	Sig.
Constant	-22.777		-6.627	.000
Attitude	.521	.391	9.188*	.000
Subjective Norm	.341	.331	9.882*	.000
Perceived Behavioural Control	.221	.239	7.285*	.000
Intention	.039	.029	0.719	0.472
Farmers Field School	.187	.156	4.968*	.000
Knowledge	.550	.154	3.566*	.000
Perceived Susceptibility	.106	.073	2.396*	.017
Enforcement	.110	.101	3.369*	.001

R=0.819; R^2=0.671; Adjusted R^2= 0.664; F=106.207; Sig. F=.000; *$p \leq 0.05$

Results from multiple linear regression analysis in Table 3 were used to identify the most influential factor affecting farmers' behaviour. As shown in the table, the F value is 106.207 while p-value is 0.000. This shows that the result of the regression model fit was significant where p-value is less than alpha (0.05). In terms of the strongest factor affecting farmers' behaviour, attitude was found to be the strongest factor as the beta value was highest (β = 0.391) compared to the other factors. The result of the regression indicates that the model explained 66.4 percent of the variance. From the findings, the farmers showed positive attitude as they were aware of the perceived benefit from such behaviour. Bond et al., (2009) also stated that attitude contributed the greatest weight to behaviour. An individual's action or attitude can be influenced by the perceived benefit related to the activity (Baker, 2003).

From the eight factors, there are seven factors which significantly and positively contributed to the variance of behaviour. Subjective norm was found to contribute to some of the variance in behavior (β = 0.331) as this factor encourages farmers to apply better farming practices due to social pressure from relatives, friends, neighbour, and government agencies. This is followed by perceived behavioural control with (β = 0.239). This factor refers to a farmer's ability to comply with standard pesticide application, while Farmers Field School (β = 0.156) was an approach to give farmers training and group-based learning. Knowledge with (β = 0.154) is also a powerful influence on farmers' attitude. Enforcement is also one of the factors that may influence farmers' attitude to comply with standards of pesticide usage with (β = 0.101). Finally, perceived susceptibility with (β = 0.073) means that farmers who perceive that they are susceptible to a particular health problem will engage in behaviors to reduce their risk of developing said health problem when applying pesticide to their crops. Meanwhile, intention was the lowest contributor and is not significant to the variance of behavior.

6.0 Conclusion and Recommendation

Generally, it can be said that attitude had the greatest impact on farmers' safety behaviour in pesticide use. These findings were supported by previous studies in this field. Farmers' attitude will reflect into farming practices and lead to farmers developing a good attitude towards safe food production. To build positive attitude, farmers need adequate knowledge in pesticide handling. Damalas and Koutroubas (2017) stated that farmers with more technical knowledge of pesticide

use appear more likely to act safely while using pesticide. Thus, achieving safe pesticide use behaviour requires farmers' knowledge of the dangers of pesticide. The study also noted that other factors such as subjective norm also influence farmers' safety behaviour in pesticide use. Social pressure from their relatives, friends, neighbours, and government agencies will determine their decision making. While farmers may be unwilling to comply with standards of pesticide usage in the beginning, they may change their behaviour as a response to social pressure from the people surrounding them.

Therefore, it is essential to provide a well-structured, systematic, and focused training to farmers to ensure that they are always committed towards good pesticide handling. Farmers should get some training on how to handle, prepare, and apply pesticide safely. Training such as Farmers Field School can educate farmers on the proper handling and usage of pesticide thus reducing the risk of exposure. Authorities and retailers play important roles in providing information and guidance to facilitate farmers' pesticide selection and increase their awareness of pesticide risk. This can be done by promoting proper use of pesticide not only to farmers, but also to their families and communities. Greater public awareness on proper pesticide usage is expected to impose greater social pressure for farmers to comply.

According to Du et al. (2014), regulations and information services provided by the government and pesticide retailers will enhance farmers' ability to comply with the standard pesticide application. These finding suggested that the Ministry of Agriculture and Agro-based Industry should provide more information to farmers and the public about the procedure to use and the impact of pesticide on humans and the environment. The Malaysian government also should review the mechanisms to enforce existing legislation in the import, distribution, and usage of pesticide. The government also can introduce new alternative techniques which are safer and more environmentally friendly.

Acknowledgements

This research was supported by a grant from the Putra Grant (9562000). Special thanks for the assistance provided by Ministry of Agriculture in collecting data and to all respondents for participating in this research.

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