

Risk Identification of Paraquat Usage for Paddy Production among the Smallholders in Bagan Serai, Perak

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Abstract

Pesticides and herbicides have been used by paddy farmers in their agricultural activities to increase rice crop yield for the past few decades. Paraquat is mostly used because of its efficiency in killing the weed faster compared to other chemicals. However, the usage of this chemical with limited knowledge and proper management could affect smallholders' health, handling, weed condition, cost of operation and may cause problems for the farmer and the production of paddy. The study aimed to identify the health risks and critical impact of paraquat usage on smallholders and paddy production in Bagan Serai, Perak. The data have been collected through face-to-face interviews and analyzed using descriptive and multiple regression analysis in SPSS version 21. The result revealed that smallholders mostly experienced headaches, skin itchiness, and eye itchiness after exposure to the use of paraquat. Besides, in terms of costing shows that high cost of production in the paraquat usage on paddy production among the smallholders. Thus, multiple regression analysis shows that health conditions were the most highly influenced by the impact of paraquat usage with a coefficient of 0.382, followed by the handling of paraquat in paddy fields. The government and non-governmental organizations must continually raise awareness and knowledge of effective pest and disease control measures to assist farmers in increasing national rice production by producing high-quality rice rather than utilizing paraquat in their paddy fields.

Keyword: Paddy Production, Paraquat, Health Risk, Weed Condition, Paraquat Handling, Cost Production

Introduction

Paddy also known as *Oryza sativa*, is an important crop in Malaysia and it has played a role in the nation's food security. Besides, Malaysia largely depends on key granary areas for paddy production as it contributes 70% of the domestic supply and imports 30% from other countries. One of the risks in rice production is the growth of weed populations, which often

threaten paddy plantations as they could lead to a deterioration in paddy yield quality and quantity. In addition, weed infestation is classified as one of Malaysia's main constraints because it will grow like paddy and cause competition in paddy fields. Herbicides, particularly paraquat, are commonly used by farmers, according to Adekunle et al (2017), with 89.3% of farmers using it. It is widely used for its effectiveness in killing the weed in a short time. In a rural area, paddy had become an important economic activity and a major source of employment and income for the people. Paddy farmers often use paraquat to control the weed population in their agricultural activities (Marambe and Herath, 2020).

However, paraquat is currently banned in Malaysia and other countries because of its high toxicity and hazardous chemicals, which are not only meant to kill a number of weed populations but may also impact the health of farmers and paddy production (Ko et al., 2017). Thus, ignorance of the ban on paraquat usage in paddy fields will lead to a decline in paddy production as the health risk to farmers is rising. The continuation of paraquat usage through farmers' ignorance of its ban can also lead to inadequate use and handling of paraquat. Based on a study by Jean et al (2019) it stated that 47% of farmers are aware of mouth poisoning, but 31% are still unaware of other transmission paths, such as skin, eyes, or nose. In addition, 27% reported having knowledge of precautions for storage, and the remaining 73% just store their pesticides anywhere after buying and using them one way. Thus, without proper use and handling of paraquat, there could be a health risk to the farmers and even their families without their recognition, as the farmers did not go to the hospital for a check-up, and some of the symptoms of paraquat poisoning are difficult for local health officials to diagnose until they worsen. Because of that situation, the aims of this study are to identify the type of risk faced by farmers and determine the major risk faced by smallholders.

Risk Involved in Paraquat Usage

Health Condition

According to Jalaludin et al (2019), pesticides such as paraquat were believed to cause harm to people, especially the sprayer and the farmer, who may be exposed to these hazardous residuals through inhalation, skin contact, and indigestion of the pesticide during farming. Paraquat is known as a highly toxic chemical to humans and animals; one small accidental sip can be fatal, and no antidotes are available yet. Then, a study conducted by Lima et al (2018) also mentions that acute paraquat toxicity, paraquat toxic effects on the lungs, and paraquat toxicity mechanisms are the most frequent concerns that can cause lethal human and animal toxicity. It is believed that exposure to paraquat was linked with breathing symptoms that can cause a dry cough, chest pain, and difficulty breathing.

Handling of Paraquat

When a farmer or worker is using paraquat, they need to be aware of the proper way to handle that chemical. This is because, due to the high toxicity of paraquat, mishandling can have an impact on farmers and workers. There are many researchers who have discussed the lack and mishandling of appropriate training and education for farmers and workers while using pesticides. In handling chemicals, especially paraquat, it is necessary to use PPE, but somehow, there are still farmers who say they did not use PPE when they stored the pesticides or formulated pesticide sprays (Konthonbut et al., 2019). The PPE had been used only for spraying periods because farmers usually think that there is no need or importance to wear PPE after the spraying periods. Moreover, it believes farmers who have put less

protection and less PPE into practice during the application of pesticides have encountered more exposure to paraquat poisoning.

Weed Condition in Paddy Field

Research reveals that nutrients are absorbed by weeds due to their fine and long roots Shekhawat et al (2020) but since paraquat is a contact chemical, it will just destroy the upper part of the weed. Moreover, the research found that paraquat is not fully killed since the damage does not reach the root (Tzvetkova et al., 2019). Since the paraquat is not fully killed, that could be the reason why the paraquat could show a faster result on its impact on the weed population compared to other chemicals.

Cost of Production

Cost production in paddy management is an important aspect that should be managed well by the farmers. With good management of the cost of production for the paddy field, it helps the farmers get the maximum profit from the crop production. A study conducted by Dhananjayan and Ravichandran (2018) mentioned that paddy was the most intensive user of pesticide application in paddy production.

Materials and Methods

Location of Study

The study was conducted under the Farmers' Organization Authority, Bagan Serai also known as Pertubuhan Perladang Kawasan (PPK), Bagan Serai as part of Kerian District, Perak. Besides, Alor Pongsu has been chosen because Alor Pongsu is one of the areas for paddy field in Bagan Serai and the smallholders are also covered under PPK Bagan Serai. 50 respondents who represent smallholders of paddy in the area of Alor Pongsu, Perak have been involved in this study by answering the questionnaire forms. Besides, this sample size had to be calculated using the Raosoft sample size calculator.

Data Collection Method

Primary data were collected through a structured questionnaire, which was distributed to the 50 respondents that had been chosen among the smallholders at Alor Pongsu. Generally, the questionnaires are divided into seven sections, which are Section A: general information for smallholders; Section B: knowledge about Paraquat 15; Section C: health condition; Section D: handling of Paraquat; Section E: weed condition in paddy fields; Section F: cost production; and Section G: use of Paraquat in paddy production. The data that has been collected through the primary data will be analyzed using Statistical Package for Social Science (SPSS) version 21 software for data management in this case study. There are several analyses that have been used to test the factors and the results of the research as well. The analyses that have been used for this research are reliability tests, descriptive analyses, and multiple regression.

Conceptual Framework

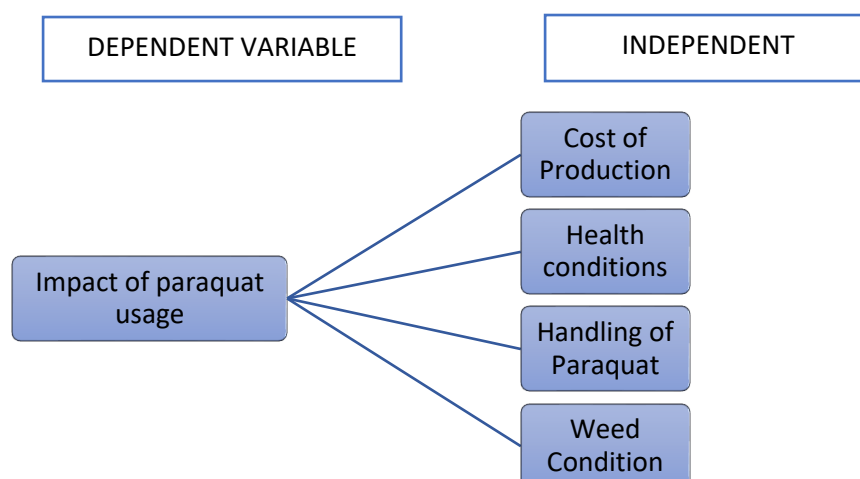


Figure 1. Dependent and independent variables

Result and Discussion

Demographic information of respondent

In Table 1, the minimum age in the study is 3 (41–50 years old) respondents, with a maximum age of 4 (above 50 years old). Therefore, the farmers’ maximum working experience is 6 (more than 25 years), with a minimum recorded as 2 (6–10 years). Next, the total area owned by farmers for paddy fields shall be a minimum of 1 (3-5 acres) and a maximum of 5 (more than 15 acres). Lastly, the minimum and maximum level of education for farmers are identical to 2 (secondary school), since all the respondents have only completed secondary school education.

Table 1

Minimum, maximum and mean for the demographic profile.

Demographic profile	Minimum	Maximum
1) Age	3	4
2) Working experience	2	6
3) Total field area	1	5
4) Level of education	2	2

Paddy Varieties

Based on Figure 2, 54% of the farmers are using MR219 in every season as the sole variety in their paddy fields. Furthermore, the results also show there are only 8% of farmers who choose CL220 as the sole variety in their paddy fields. Then, 18% are using a variety of MR291 or MR219, 10% for MR219, MR297, or CL220, 6% for MR219 or MR217, and they are also using MR219 or MR217 (6%) in different paddy fields, or the farmers will rotate different varieties for each season.

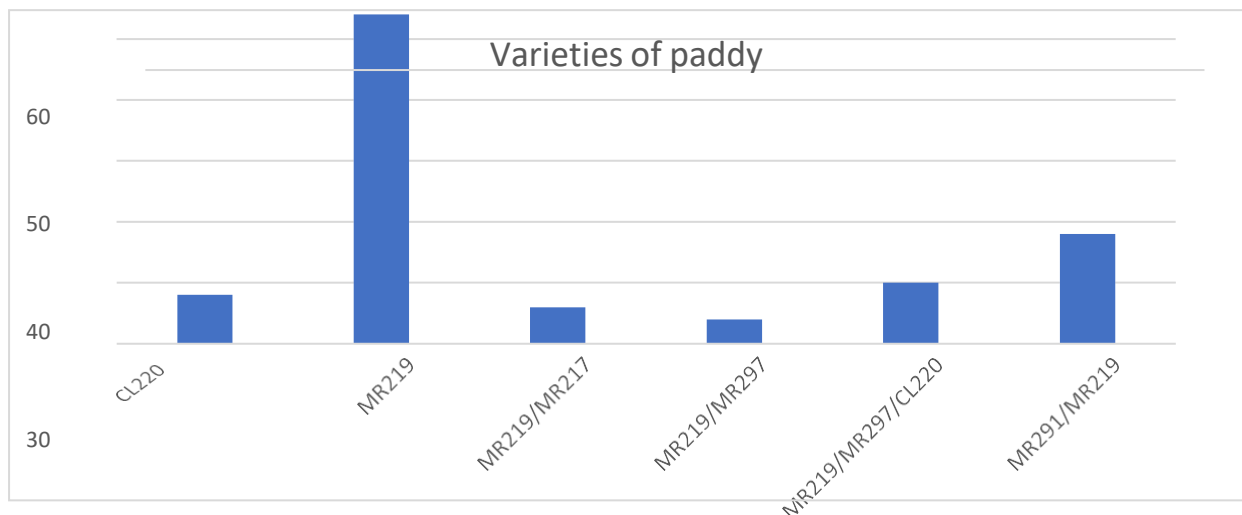


Figure 2. Varieties of paddy use by the farmer

Knowledge about Paraquat

According to the information in Figure 3, only 6% of farmers have a low understanding and knowledge of paraquat use, while 84% have medium knowledge and 10% have a high understanding and knowledge of paraquat use. As shown by the farmers’ knowledge of paraquat, they can mostly understand the major events associated with its use, particularly those impacting them.

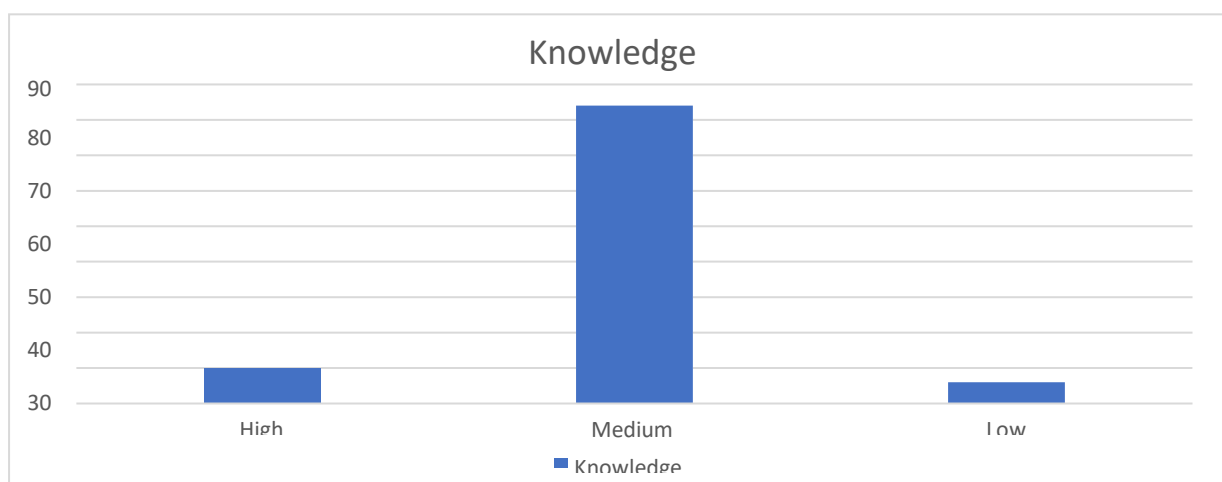


Figure 3. Farmer’s knowledge about Paraquat

Effect on the Health Condition

The impact of paraquat use on farmers health was assessed through the use of standardized and validated questionnaires. Figure 4 shows that most of the paddy farmers (20%) were reported to have headaches, skin itchiness, and eye itchiness (10 of them). Then, headache and skin itchiness were also another symptom that occurred among the exposed group, with 8 people having recorded cases by 16%, and this was also the case with the other 2 cases that had 8 recorded cases with symptoms for reddish face skin itchiness and nausea, vomiting, reddish face, and skin itchiness. Moreover, there are 4% that experience effects for headache

and eye itchiness, as well as nausea, headache, and skin itchiness. While others are experiencing difficulty concentrating, numbness, headaches, skin itchiness, and eye itchiness (3%), nausea, reddish face, skin itchiness, and eye itchiness (3%), and 2 percent for vomiting, numbness, and headache.

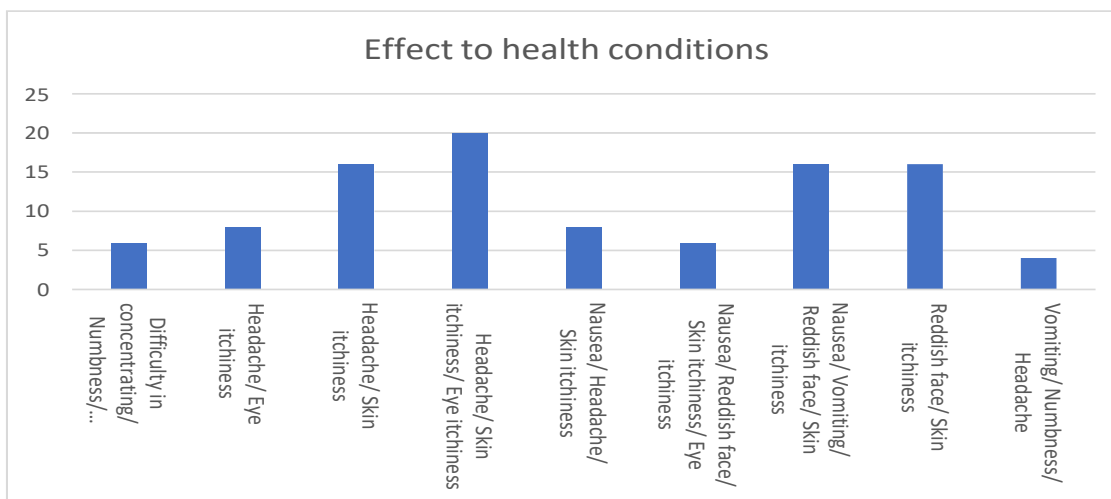


Figure 4. Effect to health conditions experienced by farmers

Multiple Linear Regression Analysis

The result in the Table 2 revealed that the health condition and handling of paraquat show significant relationships with the impact of paraquat usage since the result show the significant value is 0.011. According to Table 3, the health condition was the most highly influenced by the impact of paraquat usage, with a coefficient of 0.382, followed by the handling of paraquat, with a coefficient of -0.382. On the other hand, another two independent variables, which are weed condition in paddy fields and cost production, were not significant because their p-values, which are 0.117 and 0.656, were greater than the significance level of 0.05 as showed in Table 3. It revealed that there is no association between the changes in both independent variables and the shifts in the impact of paraquat usage.

Furthermore, based on the result, it is clear that the health risk was the main contributor to the impact of paraquat usage experienced by the farmers. Besides, there are also studies that support the fact that farmers who experienced lung function problems were exposed to high exposure levels of pesticide (Jalaludin et al., 2019). The study also concluded that working as a paddy framer with pesticide use can increase the risk of a reduction in lung function, and there is also potential for the prevalence of respiratory symptoms to increase. There are also studies showing the impact of paraquat usage through the handling of paraquat. Due to improper handling of paraquat, it is believed that this could lead to another risk in the paddy field. According to Ismail et al (2011), paraquat was detected in many provinces in fresh surface water samples, and this could cause water pollution that affects paddy growth.

Table 2

ANOVA table for Regression

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.575	4	0.394	3.671	.011 ^b
	Residual	4.825	45	0.107		
	Total	6.400	49			

ANOVA^a

a. Dependent Variable: Impact_Paraquat

b. Predictors:(Constant),

Cost_production,Handling_of_Paraquat,Weed_condition_in_paddy_field,Risk_on_health_condition

Table 3

*Coefficient table for impact of Paraquat***Coefficients^a**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.655	1.107		5.108	0.000
Health_condition	0.569	0.219	0.382	2.593	0.013
1 Handling_of_Paraquat	-0.554	0.195	-0.382	-2.842	0.007
Weed_condition_in_paddy_field	-0.499	0.313	-0.235	-1.598	0.117
Cost_production	0.101	0.226	0.071	0.449	0.656

a. Dependent Variable: Impact_Paraquat

Conclusion

As conclusion, the majority of the farmers in the survey were between the ages of 41 and 50, with 11 to 15 years of experience working on paddy fields. The majority of farmers understand and are aware of the impact and dangers of paraquat. Furthermore, farmers' ongoing use of paraquat can harm their health if it is misused, and the risk of this happening will have an impact on their paddy production. The use of paraquat in the paddy field may have an effect on paddy yield among smallholders. Furthermore, the biggest risk that smallholders confront while applying paraquat in the paddy field is harm to their health

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