Science on Natural Resources and Environment
Journal homepage: tapchikhtnmt.hunre.edu.vn

SURVEYING CURRENT STATUS UTILIZATION AND MANAGEMENT OF PESTICIDES IN CHAU THANH A AND LONG MY DISTRICTS, HAU GIANG PROVINCE

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Received 09 March 2020; Accepted 14 December 2021

Abstract

This research was implemented to assess the current status of pesticide utilization and management in Chau Thanh A and Long My districts, Hau Giang province The study was conducted by interviewing 60 households, which have two-rice crop and three - rice crop per year in agricultural cultivation. The results showed that farmers in the two - rice crop model used the right pesticides at the right dose, only 3.33 % used the lower doses. In contrast, 36.67 % of farmers in the three - rice crop model used pesticides at higher doses than the prescribed and 63.33 % of the farmers used the right doses. The toxicity of the pesticides in the three - rice crop model was found to be lower than that of the two - rice crop model. More diverse types of pesticides were applied in the three-rice crops model. The percentages of the farmers concerned of the harmful effects of pesticides in the two and three - rice crops were 100 % and 73.33 %, respectively. The main methods to handle the used bottles of pesticides were burial, burning, store and selling to the vendors. In this study indicated that awareness of the interviewed farmers in the area of two - rice crop regarding use, management and understanding of harmful effects of pesticides was better than those in the three - rice crop cultivating area. The local environmental managers should continually propagate to farmers of knowledge of selection, use and management of pesticides, especially, the farmers in the three - rice growing area to protect health and prevent environmental pollution.

Keywords: Dose; Environmental protection; Pesticides; Rice production, Three rice crops.

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1. Introduction

Hau Giang is a province located in the center of the Mekong Delta, with low - lying terrain and intermittent river systems that are favorable for agricultural development, so agriculture is identified as the dominant and strength economy and it is priority to invest in the early period of the province's industrialization - modernization process. According to the Hau Giang Province Statistical Yearbook (2019) [1], rice production reached 1,258,924 tons, which has increased by about 12,801 tons compared to 2018 (Winter - spring rice output reached

575,354 tons, an increase of 5,310 tons; summer - autumn rice output reached 468,802 tons, an increase of 5,350 tons; rice output autumn and winter reached 214,768 tons, an increase of 2,141 tons). However, due to population pressure and social development, there is a continuous increase in agricultural productivity and output. However, there are still many shortcomings in the agricultural production quality that are caused by inappropriate exploitation and use, especially the conversion of two - rice cultivation to three-rice crop model. Three - rice crop intensification is a way to increase people's income, ensure food security and export requirements. Three - rice crop are now applied which are winter - spring, summer - autumn, autumn - winter or wet season. Together with the increase in agricultural cultivation activity, an increase of the use of agrochemicals also has been recorded [2]. In addition to specializing in rice cultivation, irrational use of pesticides is also a local situation. For instance, farmer's pest management decisions are influenced more by perceptions rather than the economics of the situation specializing in rice cultivation, irrational use of pesticides is also a local situation. Although the amount of pesticides used has increased, the collection and treatment still have many shortcomings [3]. Meanwhile, the collection and treatment of this waste only accounts for a very small proportion. In addition, the amount of pesticide remaining after using remains in the packages and bottles accounts for about 2 % of the volume. This type of hazardous waste is difficult to decompose and the potential risk of environmental pollution is very high [4 - 5]. As reported by Nhan et al. (2016) [6] propiconazole residues in paddy fields in the area where the rice crop is cultivated with 3 crops/ year was higher than that in the area 2 crops/year. In the three - rice crop system, the frequent of pesticides could lead to an increase in the accumulation of phenolic compounds, lignin and other persistent substances into the humus composition of the soil. In the Mekong Delta, Dasgupta et al. (2007) [7] found that over 35 % of 190 rice farmers, experienced acute pesticide poisoning and that 21 % were chronically poisoned. The study was conducted to evaluate the use and management of pesticides in two and three - rice cropping systems in Chau Thanh A and Long My districts, Hau Giang province. The results of the study provide useful information for the strategy for dealing with hazardous waste in agricultural production.

2. Methodologies

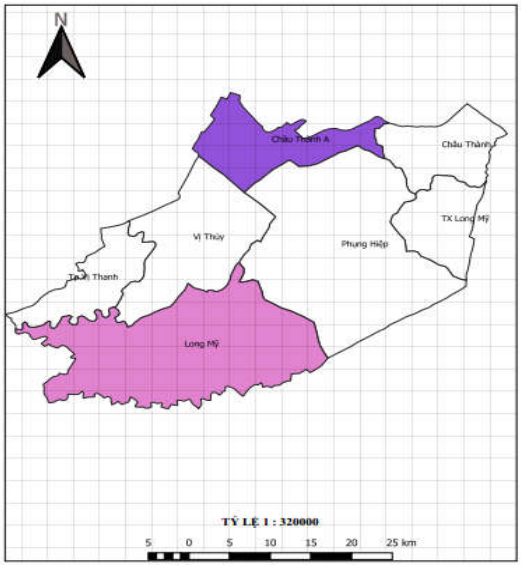

Figure 1: Research locations at Chau Thanh A and Long My districts, Hau Giang province

The study was conducted in two districts of Long My and Chau Thanh A, Hau Giang province; These can be considered as the two districts with the majority of the population living on

agriculture, with about 22,676 ha, 13,814 ha of agricultural land, respectively (ranked 2nd and 4th in Hau Giang province) [1]. Moreover, rice productivity was recorded the highest in all districts of the province, which were 67.36 quintal/ha and 65.18 quintal/ha, in turn. The method of interviewing directly farmers has been applied with two models of rice cultivation, including two crops and three crops of rice. There are about 60 questionnaires for two land use models in the district in order to investigate the management and use of pesticides by farmers, of which about 30 questionnaires/model. Households selected in the study, who have been cultivating two or three crops of rice in Long My and Chau Thanh A districts. The questionnaire was designed to collect general information about the current farming status of farmer (area, frequency of pesticides use,…). In addition, the information related to methods of managing pesticides in households and management of bottles and packaging after use was also collected to assess the current status of waste management in agriculture.

3. Results and discussion

3.1. Education, land area and cultivating experience of the farmers

The interviewing results showed that the education level of the farmers at primary, secondary and high school accounted for 73.33 %; 23.33 %; 3.33 % in the area two - rice crops/year; 10 %; 70 %; 20 % in the three - rice crops/year. There were no illiterate farmers in the surveyed areas (Fig. 2). Educational level will also affect the ability of the farmers to apply scientific and technological advances in agricultural production to achieve high efficiency.

Farmers with farming experience (number of years of rice cultivation) ranged from 10 to 20 years, accounting for the highest of 53.33 % in the two - rice cropping/year and 76.67 % in the three - rice cropping/year; experienced farmers from 21 - 30 years accounted for 30 % and 10 % respectively; followed by 31 - 40 years (13.33 % and 10 %, respectively). Farmers in the study area with rice cultivation experience <10 years and > 40 years account for the lowest proportion (Tab. 1).

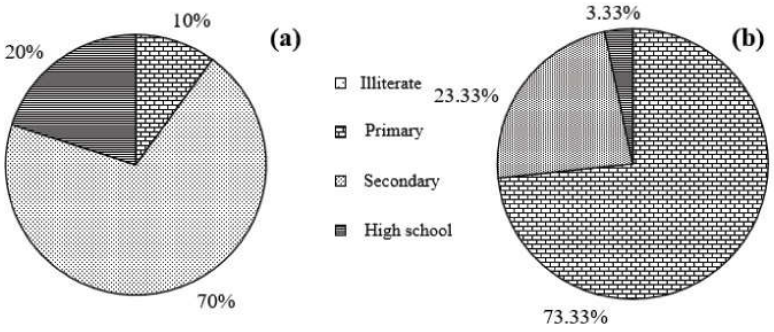

Figure 2: Educational levels of the farmers in Chau Thanh A (a) and Long My (b)

Table 1. Land areas and rice cultivating experiences

	Two - rice crops (%)	Three - rice crops (%)
Land area (ha)		
≤ 1	60	77.67
1,1 - 2	33.33	20

> 2	6.67	3.33
Experiences in rice growing (years)		
< 10	3.33	0
10 - 20	53.33	76.67
21- 30	30	10
31 - 40	13.33	10
> 40	0	3.33

The cultivated area ≤ 1 ha accounted for the highest percentage of 60 % and 77.67 % in the area of two - ice crops/year and three - ice crops/year respectively; the cultivated area of 1.1 - 2 ha accounted for 33.33 % and 20 %, respectively. The areas of more than 2 hectares accounted for the lowest percentage (Tab. 1); of which, the farmers with an area of > 2 ha in the area of two - rice crops/year (6.67 %) were higher than those in the area of three - rice crops/year (3.33 %) (Tab. 1). However, compared with the study of Giao et al., (2020) [3] in Thoi Lai district showed that the cultivated land area in the study area is small and odd. This could make it difficult to manage the use of pesticides.

3.2. Current use of pesticides in the study areas

The results from Table 2 showed that the number of pesticides used in the three - rice cropping area was always higher than those at the two - rice area, accounting for 39 and 13 types, respectively. In particular, insecticides accounted for the highest number of 46.15 % in both two and three crops; followed by fungicides with 30.77 % and 38.46 %, respectively. Herbicides and other pesticides showed lower numbers, accounting for 7.69 % for three - rice area, 12.82 % in two - rice growing area.

Table 2. Type of pesticides used in the study areas

Pesticides	Number of active ingredients	
	Two - rice system	Three - rice system
Insecticides	6	18
Fungicides	5	12
Herbicides	1	4
Other	1	5

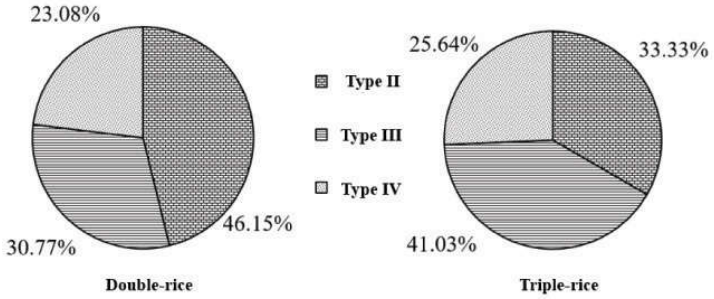

Figure 3: Porportion of types of pesticides used in the study areas

Survey results show that pesticides used in the study area belonging to the toxic group (II) in two - rice cultivation area were higher than those at the three - rice system, accounting for 46.15 % and 33.33 %, respectively; the toxicity group (III) in the two - rice - growing area (30.77 %) was lower than that in the three -

rice growing area (41.03 %); In the area of three - rice crops, the farmers tended to use the toxicity group (IV) higher than that of two - rice crop system, occupying 25.64 % and 23.08 %, respectively (Fig. 3).

The interview results presented that in the three - rice - growing area, the farmers used diverse types of pesticides than those at the two - rice cropping area. The widespread use of pesticides can lead to increased pest resistance, negative impacts on aquatic ecosystems and users' health. The number of households using toxic pesticides (Type II and III) did not differ significantly between the two areas, accounting for 28 and 29 farmers in two - rice growing area, respectively; 26 and 30 farmers in the three - rice area, respectively. There were 28 farmers using the group of toxic type IV in the two - rice area higher than that at the three - rice area (21 farmers) (Fig. 3). In both areas, farmers did not use toxic groups (Ia and Ib), which could show that farmers in the study areas tended to avoid using toxic pesticides.

The findings in this study revealed that the farmers in the study areas tended to use the correct doses labeled on the pesticide bottles. The correct doses used by farmers in the two-rice and three - rice systems were 96.67 % and 63.33 %, respectively. The proportion of farmers who used a lower dose than the recommended dose was only discovered in the two - rice - growing area accounting for 3.33 %. there were 36.67 % of the farmers in the three - rice crop per year used pesticides at higher doses than recommended. However, farmers in the two areas acknowledged that application of higher doses of pesticides could increase the effectiveness of the pesticide use accounting for 23.33 % and 36.67 % of the farmers' opinions in the two-rice and three - rice areas, respectively (Fig. 5). For farmers who use lower concentrations recommend that they have empirically mixed with other pesticides and are willing to increase concentrations if ineffective. Therefore, as can be seen that the choice of pesticide concentration mainly depended on experience or decided to spray according to other farmers and relied less on support from plant protection staff, which could increase disease resistance and the frequency and concentration of pesticides used more and more. This information has also been recorded in the previous study by Nhan et al. (2015) [8]; Berg and Tam (2018) [9]; Giao et al., (2020) [3]. In general, farmers in areas cultivating 3 crops/year tended to overuse pesticides higher than those in areas where 2 crops/year were cultivated. In addition, the annual disease situation can also affect the frequency and dosage of pesticides used in each crop.

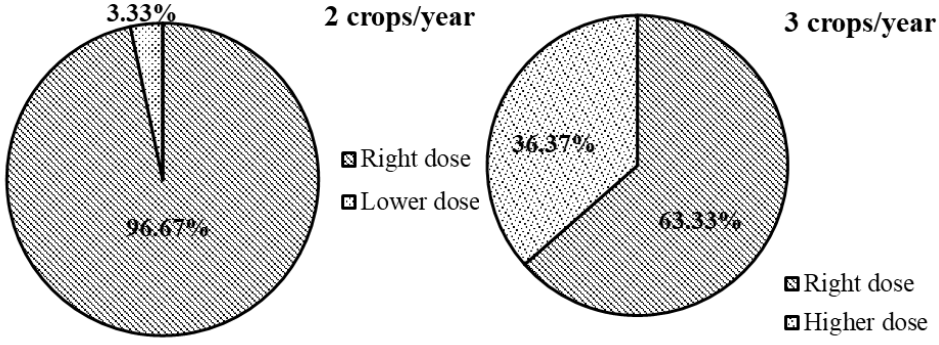

Figure 4: Dose of pesticide applied in the study areas

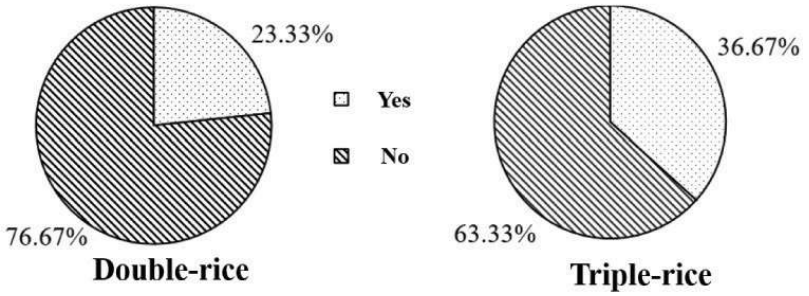

Figure 5: Opinions of the farmers regarding increase of pesticide dose

3.3. Managenent of pesticides of the farmers

The findings presented that most farmers in the two and three - rice crops collected the used bottles for selling to the vendors (24 and 15 households out of 30 households were interviewed, respectively). The number of households that disposed of pesticide bottles at the field has a large difference between the two areas. In the three - rice cultivation area, there were 10 out of 30 households were interviewedwould throw the bottles after use, while the throwing away did not occur in the two - rice growing area. The number of farmers treating pesticide packages and bottles by burying or burning accounted for 6 and 10 households out of 30 households were interviewed in the two and three - rice crops, respectively. As can be seen that the management methods of pesticide bottles and packages in the two cultivating areas were different. The majority of people in the two - rice crop area had a better awareness by not throwing away pesticide packaging but applying other measures to handle it, for examples, burial, burn or sell to vendors. These can be considered as the three most commonly used methods in the treatment of agricultural waste in the Mekong delta [3]. Neverthless, after being collected, the bottles and packages were stored with other wastes. At the storage location, the collectors did not guarantee that they would use labor protection when coming into contact with these hazardous wastes, so they are also easily exposed to toxic substances. Burning of pesticide containers and household wastes without proper treatment could generate toxic emissions into the environment such as dioxin [10]. Disposal of pesticides in household landfills is not an effective treatment method because the excessive amount of pesticides can go directly to underground water sources causing pollution of underground water [11].

3.4. Farmers's understanding on harmful effects of pesticides

The results of the study in Table 3 showed that 100 % (30 households) of the farmers in the two - rice growing area understood the harmful effects of the pesticides, but this was only 73.33 % in the three - rice cropping area. In addition, when asked about the option to use a pesticide that is highly effective on killing diseases, low cost, but it was banned and highly toxic; the choosing between (1) highly toxic, low - cost pesticides and (2) less toxic and high - cost pesticides. The results revealed that 100 % of the farmers in the two - rice area decided not to use banned - toxic pesticides; and 96.67 % of the farmers selected the less toxic and high - cost pesticides. There were 23.33 % of the farmers chose to use the banned and toxic pesticides. The percents of

farmers acknowledged the use of pesticides could pose threats to both human health and ecosystems accounted for 96.67 % (29 households out of 30 households were interviewed) and 86.67 % (26 households out of 30 households were interviewed) in the two and three - rice areas, respectively. In the two - rice growing area, 3.33 % of the farmers supposed that the pesticides only affect on environment and ecosystems. On the contrary, 13.33 % of the farmers in the three - rice growing area supposed that pesticides only influence on human health but not environment. This result signalized that there is limited knowledge of the farmers in the understanding the negative impacts of pesticides on human health and the environment.

Table 3. Farmers's understanding on harmful effects of pesticides

	Two - rice crops (%)	**Three - rice crops (%)**
Understanding the harmful effect		
Yes	100	73.33
No	0	26.67
Impact of pesticides		
Human health	0	13.33
Ecosystems	3.33	0
Both	96.67	86.67
Choosing to use pesticides with good insecticide and low cost, but it is banned and toxic		
Yes	0	23.33
No	100	76.67
Choose between (1) highly toxic, inexpensive and low - cost (2) less toxic, high - cost		
Highly toxic, inexpensive and low-cost	3.33	50
Less toxic, high - cost	96.67	50

On the other hand, the interview results showed that 100 % of farmers in the two - rice cropping area concerned about the toxicities of pesticides and knew how to apply protection measures in spraying pesticides to protect themselves. Most farmers (96.67 %) did not eat and drink during spraying pesticides and the farmers clean themselves carefully after the spraying. However, there was still a small proportion of farmers (3.33 %) still eat and drink during application of pesticides. In the three - rice growing area, the interview showed that farmers' awareness was still low; Up to 23.33 % did not care about the toxicity of the pesticides; 36.67 % of the farmers did not use labor protection. Only 63.33 % of farmers applied protection measures in the process of spraying pesticides. This was much lower compared to that practice in the two - rice growing area. The majority of the farmers in the two and three - rice growing areas participated in training or seminars on the use of pesticides accounting for 76.67 % and 83.33 %, respectively; a small percentage of households still did not have access to training/seminars (23.33 % and 16.67 %, respectively). Thus, the majority of farmers' awareness in the area where the rice crop is 2 crops/ year is higher than that in the area 3 crops/ year. Improper awareness of pesticides as well as concern about their toxicity and not taking measures to limit the harmful effects of pesticides. Besides, through the long-term farming process, people have to be exposed to pesticides every day, which is one of the reasons affecting the

health of farmers and the surrounding environment.

4. Conclusion

The findings showed that farmers had 10 to 40 years of rice cultivating experience, with limited areable land per household (< 1 ha). The toxic group II was commonly used in the two-rice growing area, while the group III and IV were commonly used in the three - rice crop areas. Pesticides use in the three - rice system was more diverse than those in the two - rice growing area. Most farmers in the areas of two and three - rice crops used pesticides according to the recommended doses. In the area of two - rice crops, pesticides were used at the higher dosage indicated on the label than in the three - rice cropping area. The results also presented that most farmers collected used bottles for selling to vendors in the two and three - rice growing areas. In general, the perception of the farmers in the two - rice growing regarding toxicity, dosage and management methods of pesticides was better than that of the farmers in the three - rice growing area. The risk of environmental pollution and health effects in the three - rice crops was higher than that in the two - rice crop system. The local authority should continue to propagate about the selection, use and management of pesticides to protect the environment and the health of people in the rice - growing areas, especially the three - rice growing area.

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