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Monitoring the Use of Synthetic Pesticides for Pest and Disease Control of Rice Plants in Tidal Marshlands

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Abstract: The majority of people in tidal marshland areas are farmers. Many of the crops grown by the community are food crops such as rice. Rice is one of the food crop commodities that has high economic value. In cultivating rice plants to improve the quality of production, farmers on tidal land currently use chemical pesticides as the most effective alternative source in controlling pests and diseases. This study aims to determine the various types of pests and diseases in rice plants, and the types of synthetic pesticides used by farmers in increasing awareness of the environment from good and proper agricultural practices. The research was conducted in 2023 during the rice season. The method of implementation was carried out by surveying 40 rice farmers in Air Salek District, Banyuasin Regency, namely interviewing according to the questionnaire. The results of the monitoring and interviews showed that the pests and diseases that attacked rice plants were False White Pest (*Cnaphalocrosis medinalis*), Rice Stem Borer, Brown Stem Leafhopper (*Nilaparvata lugens*), Armyworm (*Spodoptera litura*), Leaf Blast, and Neck Blast. There are two types of synthetic pesticides used to control pests and diseases, namely insecticides made from the active ingredient Klorpiripos with a percentage of 55% and 85% fungicides made from the active ingredient Trifloxystrobin 25%, Tebukunazol are in demand by farmers. In the application of synthetic pesticides farmers do not meet the standards due to the low education of farmers.

Keywords: *Tidal Marsh Land, Rice Crops, Pests and Diseases, and Synthetic Pesticides*

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1. INTRODUCTION

Tidal marshland is one of the lands that has a wetland ecosystem type characterized by a water regime that is mainly influenced by the ebb and flow of water from the surrounding river or sea. Tidal marshland has long been known as a potential agricultural cultivation land to be developed as a food-producing life support (rice, secondary crops, vegetables, and fruits) [1]. This land is widely spread in Indonesia, one of which is in Air Salek Subdistrict, Banyuasin Regency, South Sumatra Province, which is utilized by farmers as agricultural land for food crops, one of which is rice. Rice is the main staple food for the majority of the Indonesian population who consume rice[2]. Rice has a high percentage level of interest in the Indonesian population compared to other basic ingredients such as corn, tubers, and other cereals. This is one of the factors for the need for efforts to increase productivity[3]. [6]. In addition to damaging plants, aphids also serve as vectors for viruses such as the Cucumber Mosaic Virus (CMV) [7].

The control of aphids is often done using synthetic pesticides. This method of control can have a negative impact on the environment if used continuously. The residues left behind can contaminate soil and Until now, the problems faced in rice cultivation activities in tidal marshlands are increasingly diverse, such as global climate change which has an impact on climate

anomalies that encourage the development of pests and diseases that threaten the safety of rice plant growth [4]. Pests that are commonly found attacking rice plants include rice stem borers, brown stem leafhoppers (*Nilaparvata lugens*), green leafhoppers (*Nepotetix apicalis*), false white pests, armyworms (*Spodoptera* sp.), rats (*Rattus rattus* sp.) snails (*Pomacea canaliculata*) [5]. While diseases are bacterial leaf blight (*Xanthomonas campestris* pv.), pyricularia leaf spot (*Pyricularia grisea*), rice stem rot (*Helminthosporium sigmiodeun*), leaf sheath blight (*Rhizoctonia solani* Khun), reget stunt and grassy stunt [6].

In maintaining rice productivity stable from the attack of plant pest organisms, it is necessary to take control measures to reduce the population and intensity of attacks of both pests and diseases. One of the most common controls carried out by farmers is using chemical pesticides [7]. Indicators of motives for using chemical pesticides are understanding of the active substances contained, well-known, and easy to find in the market[8]. Therefore, it is necessary to make several efforts such as directly monitoring the distribution of chemical pesticide applications on tidal land. Considering the number of chemical pesticide products in circulation and the application of pesticides that are not wise such as the right dose, and right on target can be influenced by the level of education of farming experience and compliance with recommendations and information contained on pesticide labels so that it will affect resistance and recurrence for pests and diseases of rice plants, environmental damage, and the health of farmers as users [9]. Monitoring and surveillance activities are the main objective to obtain information about applying good and correct pesticides to reduce the number of attacks of pests and diseases of rice plants.

2. MATERIALS AND METHODS

This research was conducted in Air Salek Sub-district, Banyuasin Regency, South Sumatera Province, Indonesia. The method used was a survey by interviewing farmers and taking respondents by purposive sampling based on the main occupation of rice farming as many as 40 farmers. The types of data used are primary and secondary data. Primary data obtained through direct observation to the field and conduct direct interviews with farmers using a list of questions (Questionnaire) the use of pesticides during one growing season. Secondary data were obtained from related institutions. The data that has been obtained is analyzed descriptively which is presented to describe or describe the date collected using tables and figures.

3. RESULTS AND DISCUSSION

Descriptive Sampling Area

Tidal marshland is one of the centers of rice farming in Air Salek Subdistrict in Banyuasin Regency, South Sumatra Province, which consists of several types of overflow that vary from overflow types A, B, to C with the same topographic shape, namely 100% flat area. The land type of the area based on tidal inundation and groundwater conditions can be found as follows: Type A 60%, Type B 40% this means that it is strongly influenced by tidal overflows both directly and indirectly. The

climate is strongly influenced by the location of the coast with an average humidity level ranging from 26-34 degrees Celsius where the wet period is around October to March is very suitable for rice cultivation. Then followed by a moderate rainy season in general April-September, dry months in July-August, and many windy months in November-February. The amount of rainfall is quite high with an even distribution of rain throughout the year. Rainfall amounts to 1,650 mm - 3,202 mm with 110 - 168 rainy days per year. The soil type is formed from water silt clay and humus (organic matter) at the top, and

mineral clay at the bottom, with soil pH ranging from 3.5 -6.2.

General Characteristics of Farmers

A farmer is someone who is engaged in agriculture, mainly by managing the land to grow and maintain food crops, especially rice, with the hope of obtaining yields from these crops for their use or selling them to others. Farmer characteristics are elements that are inherent in farmers such as age, education, and land area of farmers in farming (Table 1).

Table 1. Distribution of characteristics of rice farmers in tidal marshland in Air Salek Sub-district

Characteristics	Indicator	Frequency	Percentage (%)
Farmer Age	21-40	12	30
	41-60	21	53
	>61	7	18
Total		40	100
Final Education Level	Elementary School	11	28
	Junior High School	14	35
	Senior High School	13	33
	Diploma / S1	2	5
Total		40	100
Land Area	1	3	8
	2	22	55
	3	11	28
	4	4	10
Total		40	100

Source: Primary data 2024

Table 1. shows that the results of the interview found that the characteristics of rice farmers in the tidal marshlands of Air Salek District are between 21 and 61 years old. Where in the highest category is at the age of 41-60 years, which is 53%, and the least in the age group >61 years, which is 18%. This shows that respondents have different age levels. Table 1 shows that most of the tidal swamp rice farmers are at a productive age. Farmers with productive age have good physical ability and mindset to absorb termine individual behavior in the use of good chemical pesticide applications [10]. This shows that the level of education owned by rice farmers in Air Salek District is still relatively low. The results of the interview showed that the percentage of the largest land area was 55% with an average area of 2 Ha/farmer. Rice fields owned by farmers are their land or inherited land from their parents.

new information and innovations as well as in rice cultivation. The education level of the respondents varies from elementary school to diploma/graduate level. The highest education level is Junior High School which is 35% and at least 5% in the Diploma / S1 education group. The level of formal education achieved by individuals is an increase in human resources in terms of knowledge and insight and can accept developing technology, but high formal education does not de-

Pests and Diseases of Rice Plants

The observation results showed that 6 types of plant pest organisms attacked rice plants in Air Salek Subdistrict, Banyuasin Regency.

Table 2: Types of pests that attack rice plants

Type of pest	Frequency (Farmers)	Percentage (%)
False Whitefly (*Cnaphalocrosis medinalis*)	26	65
Rice Stem Borer	12	30
Brown planthopper (*Nilaparvata lugens*)	5	13
Armyworm (*Spodoptera litura*)	5	13
Leaf Blast	40	100
Neck Blast	2	5

Source: Primary data 2024

The results of the study (Table 1) show that leaf blast is a plant pest organism that dominantly attacks rice plants in tidal marshlands in Air Salek District, reaching 100% of respondents. Leaf blast disease is caused by the fungal pathogen *Pyricularia oryzae*, the symptoms of the attack are spots on the leaves with elliptical or rhombus-shaped characteristics in the middle gray or whitish, and the edges are brown or brownish yellow [11]. False White Pest (*Cnaphalocrosis medinalis*) has a percentage of 65% of respondents attacking rice plants. False white pest attacks are characterized by symptoms of rolling leaves, and the presence of caterpillars that eat green leaf tissue in the leaf folds, leaving the leaf surface white [12]. Rice stem borers have a percentage of 30% of respondents, where this pest is one of the main pests that attack rice plants. The symptoms of attacks caused by rice stem borers are 2 types, namely deadhearts and whiteheads. Symptoms of sundep attack occur during the vegetative phase where it is seen that the tops of the leaves are yellow and easily pulled out. The symptoms of whiteheads attack occur in the generative phase where the rice grains become empty due to the process of filling the seeds do not run perfectly because of damage to the stem vessels [13]. Armyworms and brown planthoppers have the same percentage of 13%. Furthermore, followed by a percentage of 5% of respondents which is the lowest percentage of neck blast disease.

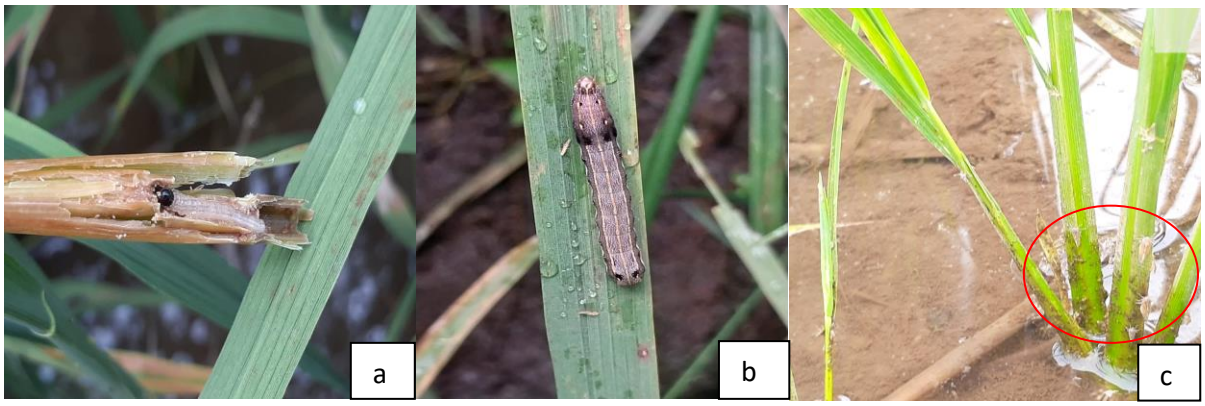

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Figure 1 :Rice Stem Borer (a), Armyworm (b), Brown Stem Worm (c), Leaf Blast (d), Neck Blast (e)

Use of Synthetic Pesticides

Pesticides are chemicals used to kill or control pests and diseases. One of the most popular pesticides for farmers is chemical pesticides. These chemical pesticides are effective in killing pests and diseases directly. The use of chemical pesticides by farmers in Air Salek Sub-district, Banyuasin Regency can be seen in Table 3.

Table 3. Types of Insecticides and Fungicides and active ingredients

Pesticide	Active ingredient	Frequency (Farmers)	Persentage %
Inseticide	Abamektin	11	50
	Klorpiripos	22	55
	BPMC	1	2.5
	Dimehipo	1	2.5
	Klorantinipol+tiametoksam	7	17.5
	Indoksakarb	1	2.5
	Metomil	1	2.5
	Dimehipo	6	15
	Pimetrozin	2	5
	Amamektin benzoat, lufenuron	12	30
	MIPC 60%	2	5
.			
Fungicide	Trifloksistrobin 25%,Tebukunazol	34	85
	Propineb 70%	11	27.5
	Difenokonazol	6	15
	Azoksistrobin dan Difenokonazol	2	5
	Metil Tiofanat	2	5

Source: Primary data 2024

Table 3 shows that based on the results of interviews obtained synthetic pesticides used by farmers in the Air Salek Subdistrict there are two types, namely insecticides and fungicides. The most common type of insecticide with a percentage of 55% is the active ingredient Klorpiripos. The fungicides that are most in demand by farmers for controlling rice plant diseases are the active ingredients Trifloxystrobin 25%, Tebukunazol has a percentage of 85%.

The following is more detailed information about several types of active ingredients of insecticides and fungicides used by farmers in the Air Salek subdistrict along with their characteristics and uses:

Insecticides

- Abamectin, a type of insecticide with contact, stomach, and systemic toxicity, is an acaricide. Effectiveness in controlling brown stem leafhoppers, rice stem borers, and armyworms.
- Chlorpyrifos and Sipermetrin, contact and stomach toxic insecticides. Effectiveness in controlling armyworms (*Spodoptera litura*).
- BPMC (Carbamate), a type of contact poison insecticide that reduces the activity of the blood cholinesterase enzyme, works as a neurotoxin. Effectiveness can control brown planthoppers (*Nilaparvata lugens*).
- Dimehipo, a type of contact, stomach, and systemic toxic insecticide. Effectiveness in controlling rice stem borer, brown planthopper, and false whitefly with fast-acting power.
- Chlorantinipol + Thiamethoxam, a type of contact and systemic toxic insecticide, in the form of a concentrated suspension. Effectiveness in controlling rice stem borer, false whitefly, and brown planthopper.
- Indoxacarb, a contact toxic insecticide that penetrates cell membranes and the waxy layer of plants. Effectiveness can control armyworms, quickly seep into plant tissue, and cause pests to stop eating, be paralyzed, and die within 2 days.
- Pimetrozin, a type of systemic poison insecticide. Effectiveness can inhibit the feeding activity of brown-stem leafhoppers in rice plants.
- Abamectin Benzoat + Lufenuron, a contact and stomach toxic insecticide. Effectiveness can control armyworms (Spodoptera spp.), causing pests to stop eating.

MIPC 60%, a type of contact and stomach poison insecticide. Effectiveness can control brown planthopper (Nilaparvata lugens).

Fungicides

- Trifloxystrobin and Tebukunazol, synthetic fungicides. Effectiveness in controlling leaf blast/broken neck, bacterial leaf blight, and brown spot by inhibiting sterol biosynthesis.
- Propinep 70%, a type of protective contact poison fungicide. Effectiveness can control various types of diseases on various crops.
- Difenoconazole, a type of systemic toxic fungicide. Effectiveness in controlling leaf spot, bacterial leaf blight, and stem rot in rice plants.
- Azoxystrobin and Difenoconazole, are types of systemic fungicides that work as protectants and curatives, and function as Growth Regulators (ZPT). Effectiveness in controlling midrib blight and blast disease in rice plants.
- Methyl Thiofanate, a type of preventive, curative, and systemic fungicide with a broad spectrum. Effectiveness can control leaf blast or panicle blast disease in rice plants.

Farmers in the Air Salek Sub-district use various types of insecticides and fungicides that are effective in controlling pests and diseases in rice plants. Insecticides such as Chlorpyripos, Abamectin, and Dimehipo

are popular for controlling major pests such as brown-stem leafhoppers, rice-stem borers, and armyworms. Fungicides such as Tebukunazol and Difenoconazole are used to control leaf and stem diseases in rice plants.

Figure 2 :Synthetic pesticide application in paddy fields

Pesticide application by farmers in the morning between 7:00 am and 9:00 am is a common practice. The pesticide mixing process is done directly in the field using water from rivers or wells. The amount of pesticide used varies depending on the type of formulation: liquid and powder/granule using different measures, namely bottle cap for liquid and spoon for powder/granule. According to [13] the use of pesticides must follow the six principles (6T) in the concept of integrated pest control. First, "right on target" requires farmers to use pesticides that are suitable for specific plant pest organisms. This requires understanding and observation of the types of plant pest organisms in their crops. Secondly, "right quality" requires the use of good quality pesticides that are officially registered and authorized by a competent authority, such as the Pesticide Commission. Farmers should check pesticide labels to ensure quality and make sure not to use unregistered, expired, damaged, or suspected counterfeit products. Thirdly, "the right type of pesticide" means choosing the type of pesticide that is recommended to control the specific plant pest organism in the crop in question. This choice should be based on the information provided on the pesticide label or package. Fourth, "right time" emphasizes the type of importance of applying pesticides at the right time, i.e. when plant pest organisms reach the control threshold. For example, pesticide application in the afternoon when the air temperature is lower and humidity is favorable. Fifth, "correct dosage or concentration" refers to the use of pesticides by the recommended dosage for the targeted crop and pest organisms. The use of the right dosage is important for control effectiveness and to avoid overdoses that are potentially harmful to the environment and health. Sixth, the "proper application method" requires farmers to follow the pesticide application instructions correctly. This includes proper application techniques so that the pesticide can work effectively and minimize risks to the environment and human health. By adhering to these principles, it is expected that pesticide use can be optimized to effectively control plant pest organisms while reducing negative impacts on the environment and health.

Based on the monitoring results, farmers in pesticide application often do not pay attention to the use of personal protective equipment (PPE), such as masks and gloves, as seen in Figure 2. According to

[14] showed that better knowledge about the risk of pesticide contamination can increase awareness to use of PPE completely. Nonetheless, the lack of complete PPE use is often caused by the discomfort farmers feel during the application process. This discomfort factor can stem from various things, such as the inability of personal protective equipment to provide comfort when used in hot and humid field working conditions, or the feeling of difficulty breathing when using a mask for a long time. In addition, there is also the possibility that the availability of suitable and quality PPE may also be an issue for some farmers. Increased awareness about the health risks associated with pesticide exposure and better education on how to use PPE effectively can help address this issue. Initiatives such as regular training on the correct use of PPE, providing farmers with PPE that is comfortable and suitable for their working conditions, and awareness campaigns on the importance of self-protection when using pesticides can all contribute to increasing the overall use of PPE in the field.

4. CONCLUSION

The tidal swamp land is the land used by the community for rice cultivation in Air Salek Sub-district, Banyuasin Regency. In rice cultivation, there are various types of pests and diseases such as False White Pest (Cnaphalocrosis medinalis), Rice Stem Borer, Brown Stem Leafhopper (Nilaparvata lugens), Armyworm (Spodoptera litura), Leaf Blast, and Neck Broken. To reduce the population and attack intensity of pests and diseases farmers use various types of synthetic insecticide and fungicide products. The application of synthetic pesticides is less considered by farmers such as not using complete personal protective equipment both masks and gloves. This is due to the lack of education of farmers and the lack of comfort in using personal protective equipment.

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