The farmer behavior using pesticide in maize plantation

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Abstract. Pesticide is poisonous compound containing synthetic chemicals and popularly used by farmers in crop management. The harmful synthetic chemicals contained in pesticides are capable of rapidly killing target organisms. However, the continuous use of pesticides killing natural enemies as the potential agent to control insect pests. Another risks the pesticide residues become the main source of environmental pollution. The research objective is to determine the behavior of farmers using pesticides in maize plantation. The research was conducted in Tenri Pakkua village, Lappariaja district, Bone Regency, South Sulawesi from January to March 2020. The research activity used a survey method in the form of interviews using a questionnaire to 35 respondent farmers. The results showed about 97.15% of respondent control weeds using herbicides, about 2.85% of respondents control manual for the same weed. In addition, 62.86% of the respondent used herbicides for more than four years. The most insecticides used by respondents control insect pests in maize from the active ingredients: Permethrin (42.87%), Fipronil (14.29%), Lambda-cyhalothrin (11.44%) and Metomil (8.58%). The results showed that farmers prefer use pesticides in the form of herbicides and synthetic insecticides because the results are visible, they quickly kill the target organism, the application does not require special skills and is easy to obtain (commercially available).

1. Introduction

Maize (Zea mays L.) family Poaceae is a hearty plant production staple food in several countries. Maize is the primary source of carbohydrates in Central and South American. Besides rice and cassava, maize is an important staple food for people in several parts of Indonesia (for example, in Madura and Nusa Tenggara). Maize can be made into various foods, including soup, cakes, and various kinds of snacks. Apart from human consumption, the leaves and stems of maize are commonly used as animal feed. In addition to the leaves and stems, the dry cobs serve as friendly fuel. Maize seeds producing low-fat oil, starch, and raw material for industry (flour from seeds and cobs) [1]. Pulut is a type of local maize widely cultivated in South Sulawesi and several other areas in Indonesia. Pulut contains high levels of amylopectin, reaching 100%. When Pulut is cooked, the texture resembles glutinous rice [2]. Yellow maize is another variety of maize that is widely cultivated in South Sulawesi because sweet taste when processed [3, 4].

Plant growth is affected by pests, diseases, and critical environmental factors such as soil condition, humidity, temperature, light intensity, and water available. Farmer management techniques are one of the determinants of successfully cultivated crops. Common pests attacking maize are maize stem borer.
(Ostrinia furnacalis Guenee) [5], Helicoverpa armigera Hubn. And caterpillars (Plusia sp.) [6]. According to [7], maize is currently attacking by Fall Armyworm Spodoptera frugiperda caused destructive plant and yield losses. The vegetative phase is when maize is most susceptible to attack by S. frugiperda attacking plant shoots and leaves. This injury is blocking the photosynthesis process on maize. In addition to attacking maize, S. frugiperda larvae also live on spinach, beets, onions, carrots, and weeds (Ageratum conyzoides, Bidens pilosa, and Chenopodium album) that grow around the plantations.

The control measures using pesticides have been applied to weeds and pest insects. Pesticides as chemical control techniques are more popular among farmers because the process is fast, visible, easy applied, and marketing everywhere. Farmers always assumed the crops damage must be controlled as soon as possible using pesticides, especially insecticides. Farmers consider insecticides to be a saviour god from crop failure in one growing season even though the damage to cultivated plants occurs not only from the activity of plant-disturbing organisms but the presence of several other factors, namely: the negative impact of a lack of plant nutrition, the condition of the land where it is grown (salinity, temperature, humidity, and soil pH), flooding, drought, and varieties cultivated not according to altitude and others [8].

Pesticide is a toxic compound that contains synthetic chemicals and is popularly used by farmers in crop management. The harmful synthetic chemical contained in pesticides is capable of rapidly killing target organisms. However, the continuous use of pesticides killing natural enemies as the potential agent to control insect pests. Then pesticide residues become the primary source of environmental pollution. The research objective is to determine the behaviour of farmers using pesticides in maize cultivation. The benefit of research is the farmers' behaviour using pesticides to manage weeds and insect pests in maize.

2. Methodology

2.1. Site of research
The research was conducted in Tenri Pakkua village, Lappariaja district, Bone Regency, South Sulawesi, Indonesia from February to March 2020.

2.2. Interview of farmers
The research activities used a survey method in the form of interviews based on a questionnaire to 35 maize farmers as the respondents. Primary data were obtained and conducted by direct interviews with respondents. Secondary data were added from related agencies at the research location and direct observations in the maize plantation to support the primary data.

3. Results and discussion
Herbicide is a type of pesticide commonly used by farmers to kill weeds that grow on the field. The technique of control weeds by the respondent was presented in table 1.

| Techniques applied by respondents | Number of respondents | %    |
|----------------------------------|-----------------------|------|
| Synthetic herbicides             | 34                    | 97.15|
| Manual (hoe)                     | 1                     | 2.85 |
| Total                            | 35                    | 100  |

The results showed that 97.15% of respondents chose to control grass weeds used herbicides. Furthermore, 2.85% of respondents chose to control weeds manually by hoe. The herbicide used is a
synthetic chemical that is quickly killing grasses. In Indonesian villages, pesticides as commonly
commercial products sold freely at an agricultural shop.

According to [8], weed control commonly carried out by farmers is manually removed weeds by
hand because it does not require much money. When planting rice, farmers generally carry out manual
weed sanitation two times, each when the rice plants are 15-17 days after planting and 50-55 days after
planting. Weeds that grow in rice fields are easier to remove because the soil is soft and full of water.
The duration of herbicide used by respondents was presented in table 2.

| Periods of herbicide application | Number of respondents | %  |
|---------------------------------|-----------------------|----|
| Last 2 years                    | 10                    | 28.57 |
| 3 years                         | 3                     | 8.57  |
| More than 4 years               | 22                    | 62.86 |
| Total                           | 35                    | 100   |

Based on the results obtained in table 2, about 62.86% of the respondent used herbicides for more
than four years, about 28.57% used herbicides last two years, then 8.57% used herbicides for three years.
The herbicides used by respondent farmers are chemicals commercial products. According to [10]
suggested that the use of bokashi could inhibit weeds growth. These organic fertilizers contain specific
compounds that reduce the ability of weed seeds to sprout in the soil. Furthermore, the research results
by [11] found that mixed herbicides (cyhalofop-butyl and penoxsulam) at a dose of 1.5 L/ha provided
the highest efficiency for controlling Echinochloa crusgalli.

Besides using herbicides to control weeds in the maize field, respondents also used insecticides to
control insect pests. The type of active ingredients of insecticides used by respondents was presented in
table 3.

| Active ingredients of insecticides in maize plantation. | Number of respondents | Percentage (%) |
|--------------------------------------------------------|-----------------------|---------------|
| Permetrin 200g/L                                       | 15                    | 42.86         |
| Fipronil 50 g/l                                        | 5                     | 14.29         |
| Lambda-sihalotrin 25 g/l                              | 4                     | 11.44         |
| Metomil 40 g/l                                         | 3                     | 8.58          |
| Abamektin 20 g/l                                       | 2                     | 5.71          |
| Sipermetrin 189 g/l                                    | 2                     | 5.71          |
| Sipermetrin 100 g/l                                    | 2                     | 5.71          |
| Sipermetrin 50 g/l                                     | 1                     | 2.85          |
| Sipermetrin 30 g/l                                     | 1                     | 2.85          |
| Total                                                  | 35                    | 100           |

Table 3 presented the active ingredients of insecticides used by respondents in controlling insect
pests. Based on results of the interviews presented in table 3, the most widely used insecticides by
respondents to control insect pests in maize come from the active ingredients: Permethrin (42.86%), Fipronil (14.29%), Lambdacyhalothrin (11.44%) and Metomil (8.58%). The results showed that farmers prefer to use pesticides in synthetic herbicides and insecticides because the results are visible, practical, quickly kill the target organism, the application does not require special skills, and is more accessible (commercially available). According to [12], the application of insecticides containing chemical material has the potential to kill natural insect enemies, especially predators that prey on insect pests and poisonous to humans and other organisms around the maize plantations.

Chemical insecticides contain toxins damaging the nervous and respiratory systems that quickly kill insects. The research result of [13] reported that permethrin is the active ingredient in insecticides widely used worldwide to control insect pests. However, their toxicity is very high for humans and the environment. Then [14] reported beside permethrin, another insecticide such as fipronil with the active ingredient derived from the phenylfiranazole group is a poison attacked insect nervous system, causing seizures that lead to death. Lambdacyhalothrin comes from the pyrethroid group, and pyrethrin also attacked the nervous system. In the future, need more intensive socialization and counseling with the help from related agencies increasing farmer knowledge to manage maize plantation-based friendly environment.

4. Conclusion
We concluded that respondents control weeds using herbicides about 97.15%, and manually using hoe as much as 2.85%; respondents used herbicides for more than four years about 62.86%, about 28.57% using herbicides during the last two years, and 8.57% using herbicides in three years; and the most insecticides used by respondents with the active ingredients: Permethrin (42.86%), Fipronil (14.29%), Lambdacyhalothrin (11.44%) and Metomil (8.58%).

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