Farmers' Response to the use of Organic Fertilizers on Butternut Squash in Pamekasan Regency

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Abstract— *Farmers still rely on chemical fertilizers for cultivating butternut squash in Pamekasan Regency. Agricultural extension programs have been conducted to educate farmers about the benefits of organic fertilizers for butternut squash plants. The objective of this study is to determine farmers' responses to the use of organic fertilizers in butternut squash cultivation. The research method employed is qualitative descriptive analysis. The results indicate that the adoption rate of organic fertilizers in butternut squash cultivation in Pamekasan Regency is low. Only 13% of butternut squash farmers use organic fertilizers as a supplement to chemical fertilizers, while 87% still rely entirely on chemical fertilizers. This low adoption rate is influenced by farmers' perceptions that organic fertilizers may reduce income, a lack of knowledge about organic fertilizer management, and dependence on chemical fertilizers, which are considered more practical. The factor influencing farmers' response to the use of organic fertilizers on butternut squash is farming experience.*

Keywords— Butternut Squash; Organic Fertilizers; Farmers' Responses.

I. INTRODUCTION

A healthy diet has been proven to have a positive impact on maintaining both physical and mental health in society (Özenoğlu et al., 2021). A healthy diet can be defined as a pattern of food intake that has beneficial effects on health or at least does not cause any harmful effects (Stevenson, 2017). The first step in adopting a healthy diet begins with balancing calorie intake and expenditure, limiting fat intake, switching from saturated fats to unsaturated fats, eliminating industrially produced trans fats, and restricting sugar and salt consumption (World Health Organization, 2019).

Butternut squash is a healthy food alternative that can be chosen by the community. In addition to being filling due to its high carbohydrate content, butternut squash is also beneficial for health as it contains a rich amount of fiber, vitamins A, C, and E, as well as essential minerals. These nutrients can boost the immune system and help fight free radicals. Additionally, the orange color of butternut squash indicates the presence of beta-carotene, which can help reduce the risk of cancer. Moreover, butternut squash contains B-complex vitamins such as niacin, folate, vitamin B6, pantothenic acid, and thiamine, as well as minerals like calcium, phosphorus, and copper (Logistik BPPI, 2016 in Kurniati et al., 2018).

One of the health benefits of butternut squash is its ability to help control blood sugar levels, which is attributed to the presence of ethanolic extract in the fruit (Junita et al., 2017; Marbun, 2022). Another benefit of butternut squash is its role as an antidiabetic (Adams et al., 2011; Chang et al., 2014), it helps in insulin production and improves pancreatic cells (Jin et al., 2013; Makni et al., 2010), additionally, the oil from butternut squash seeds, which contains chromium, plays a role in carbohydrate metabolism by enhancing chromium absorption (Glew et al., 2006).

The development of butternut squash cultivation has been growing in line with the healthy lifestyle adopted by society. This development primarily occurs in areas that meet the growth requirements of butternut squash, which include a temperature range of 18–30°C, humidity levels of 65%, and an elevation of 0–1200 meters above sea level (Lolliani, 2017).

Pamekasan Regency is one of the areas with characteristics that are suitable for the growth requirements of butternut squash. Pamekasan Regency is located at an elevation of 6–312 meters above sea level, with an average temperature ranging from

27.3°C to 28.9°C, and humidity levels between 44% and 98% (Badan Pusat Statistik, 2024). As a result, many farmers in Pamekasan Regency have started cultivating butternut squash.

The cultivation of butternut squash by farmers in Pamekasan Regency still relies heavily on chemical fertilizers. The use of chemical fertilizers on plants can increase the residue of chemicals on butternut squash fruit. Additionally, the use of chemical fertilizers on butternut squash crops also has an adverse impact on environmental degradation (Savci, 2012).

Based on this, the researcher is interested in providing education to farmers about the benefits of organic fertilizers for butternut squash. The researcher conducts extension activities based on trials using various types of organic fertilizers on butternut squash plants. The aim of this research is to determine farmers' response to the use of organic fertilizers on butternut squash.

II. METHODOLOGY

2.1 Location and Time of Research:

This research was conducted in Pamekasan District, Pamekasan Regency. The study took place in December 2024.

2.2 Method of Identifying Respondents:

The respondents in this study are butternut squash farmers in Pamekasan District, Pamekasan Regency. There are 15 butternut squash farmers in Pamekasan District, Pamekasan Regency. The census method was used to identify the respondents. This method was chosen because the research population is small, so all members of the population were selected as respondents.

2.3 Collecting Data Method:

Data for the study was collected through interviews and the completion of questionnaires by farmers. The researcher conducted a Focus Group Discussion (FGD) and distributed questionnaires during the FGD. The aim was to gain insights into farmers' responses to organic fertilizers and the challenges they face in its implementation. The questionnaire was used as an instrument to gather more detailed information about farmers' attitudes, knowledge, and readiness to implement the use of organic fertilizers on a larger scale.

2.4 Method of Data Analysis:

This study uses a qualitative descriptive analysis method to determine farmers' responses to the use of organic fertilizers on butternut squash. This method involves providing a detailed description of the farmers' responses based on the results of interviews and the completion of questionnaires by the farmers.

III. RESULT AND DISCUSSION

3.1 The Use of Organic Fertilizers on Butternut Squash by Farmers:

The use of organic fertilizers in butternut squash cultivation in Pamekasan Regency, prior to the socialization of the research findings, showed a low level of implementation among farmers. Out of the 15 farmers butternut squash, 87% (13 people) still rely on chemical fertilizers such as urea, NPK, and ZA, while only 13% (2 people) use a combination of organic fertilizers from cow manure and chemical fertilizers. This indicates that the use of organic fertilizers is still relatively rare, despite many farmers not fully realizing their benefits. Another reason is the farmers' mindset, which remains heavily reliant on chemical fertilizers, as they are considered more practical to use.

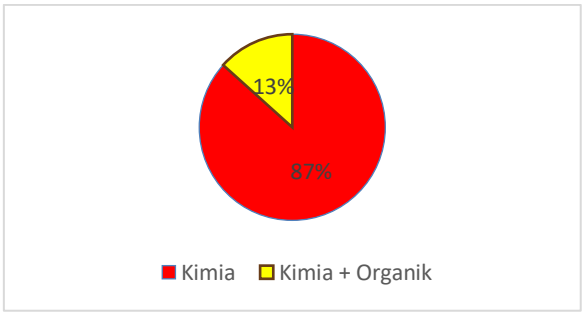

FIGURE 1: Percentage of Farmers Based on the Use of Organic Fertilizers (Primary Data 2024, processed)

The limited use of organic fertilizers by farmers is due to the belief that organic fertilizers may reduce their income. This is consistent with the findings of Wang et al. (2018), which showed that most farmers in developing countries prefer using

chemical fertilizers over organic fertilizers, primarily because they are concerned about losing income if they switch to organic fertilizers. The lack of interest among farmers in using organic fertilizers needs serious attention, especially considering the abundant availability of animal manure waste in the areas where these farmers are located.

Based on interviews with farmers who use a combination of fertilizers, they expressed that this method helps reduce fertilizer costs. For example, for a 500 square meter plot planted with 1,000 plants, around 50 kg of chemical fertilizer was previously required to achieve optimal yields. However, with the addition of organic fertilizer, farmers only need the same 50 kg of chemical fertilizer. The organic fertilizer itself is produced by the farmers using cow manure, so there are no additional costs for the organic fertilizer. Therefore, the use of organic fertilizers can reduce production costs, provide economic benefits to farmers, and decrease dependence on chemical fertilizers..

This is in line with research findings that the use of a combination of organic bioslurry fertilizer (200 mL/L) and chemical NPK fertilizer results in heavier butternut squash fruits compared to using chemical NPK fertilizer alone. In addition to fruit weight, organic fertilizers also play a role in determining fruit quality. Butternut squash plants treated with a combination of bioslurry organic fertilizer and NPK fertilizer produced sweeter fruits, with a sweetness level of 10.37 °Brix, while those treated with only chemical fertilizers reached a sweetness level of 8.5 °Brix. (Dermawan et al., 2020).

The results of the research on the testing of organic and chemical fertilizers indicate that the organic fertilizer made from goat manure provides the best results. Meanwhile, the use of NPK fertilizer did not show a significant difference compared to other types of manure fertilizers.

The results of this study, after the socialization efforts with butternut squash farmers, show that it has changed their perspective on the use of organic fertilizers. This is evidenced by the farmers' readiness to implement organic fertilizers on butternut squash crops. The reason for this is the abundant availability of organic fertilizers in Pamekasan Regency. Among the 15 farmers cultivating butternut squashs, 3 farmers have goats, 5 farmers have cattle, and all of them have chickens.

The main challenge in the implementation of organic fertilizers is that farmers are still accustomed to using chemical fertilizers. Many believe that using organic fertilizers may reduce their production yields. This is consistent with the findings of (Wang et al., 2018), which show that farmers prefer chemical fertilizers because they are concerned about losing income. The limited understanding of the long-term benefits of organic fertilizers, both from an economic and environmental sustainability perspective, poses a significant challenge. However, the use of organic fertilizers can reduce dependence on increasingly expensive chemical fertilizers, which have negative environmental impacts, such as groundwater contamination caused by excess chemical fertilizers that cannot be absorbed by plants.

The use of organic fertilizers in agriculture offers various benefits, as stated by butternut squash farmers who use a combination of organic and chemical fertilizers. Organic fertilizers are particularly essential during the vegetative phase of plants. Animal manure-based organic fertilizers, which contain nitrogen (N), are crucial for horticultural crops, including butternut squash. The nitrogen content in organic fertilizers is particularly needed during the vegetative phase of horticultural plants (Bergstrand, 2022). Plants treated with organic fertilizers during the vegetative phase tend to grow taller and have broader leaves.

In the socialization efforts, farmers were also provided with information on the benefits of using organic fertilizers as decomposing bacteria that enhance nutrient absorption by plants. Organic fertilizers contain microorganisms that can improve soil structure, increase its biological activity, and accelerate the decomposition of organic matter into nutrients that are more easily absorbed by plants. Regular use of organic fertilizers helps make the soil more fertile and prevents resistance to fertilizers, which is often observed with excessive use of chemical fertilizers. This allows the soil to maintain long-term fertility, increases the plant's ability to absorb nutrients, and supports environmentally sustainable farming practices.

Another challenge in the implementation of organic fertilizers on butternut squash in Pamekasan Regency is the low level of farmers' understanding regarding effective organic fertilizer management techniques. Although raw materials for organic fertilizers, such as livestock manure, are easily available, the process of producing high-quality organic fertilizers requires specific knowledge and skills that most farmers have not mastered. This becomes a barrier for them to produce organic fertilizers independently. On the other hand, the initial costs required for organic fertilizer production, although cheaper in the long run, can be a burden for farmers who are accustomed to the more practical and quicker use of chemical fertilizers.

In addition, the socialization regarding the production methods and benefits of organic fertilizers is still limited. Farmers, who are more frequently exposed to information about chemical fertilizers, are hesitant to switch to organic fertilizers without guarantees that the results will be comparable to those obtained from chemical fertilizers. However, in the long run, the use of

organic fertilizers can improve soil fertility and soil structure, allowing plants to absorb more nutrients, reduce dependence on chemical fertilizers, and enhance ecological balance. Therefore, in addition to socialization, it is crucial for relevant parties to provide technical training to farmers on the production, application, and benefits of organic fertilizers, so that farmers feel more confident and ready to adopt this technology in their cultivation practices.

3.2 Farmers' Response to the Use of Organic Fertilizers on Butternut Squash:

Farmers' response to the use of organic fertilizers was measured after they received extension services from the researcher regarding the benefits of using organic fertilizers on butternut squash. The farmers' response is a combination of knowledge, attitude, and behavior aspects towards the use of organic fertilizers on butternut squash.

The scoring method using a Likert scale was employed to determine the scores for each question based on the indicators of knowledge, attitude, and skills. Subsequently, a proportion test was conducted to assess the level of farmers' responses.

Farmers' responses were divided into three categories: low, medium, and high. A low response was categorized if the farmer's score fell within the interval of 8 to 20, a medium response was categorized within the interval of 21 to 33, and a high response was categorized within the interval of 34 to 46. Based on this categorization, the distribution of farmers' responses to the use of organic fertilizers on butternut squash is as follows:

TABLE 1
DISTRIBUTION OF FARMERS BASED ON FARMERS' RESPONSE

Categories	Number (people)	%
Low	0	0
Medium	13	87
High	2	13
Total	**15**	**100**

Source: Primary Data Analysis, 2024

Based on Table 1, it is known that 2 farmers, or 13%, had a high response to the use of organic fertilizers on butternut squash. Meanwhile, 13 farmers, or 87%, had a medium response to the use of organic fertilizers on butternut squash. No farmers had a low response to the use of organic fertilizers on butternut squash after the extension activities. This indicates that the extension activities were able to change the farmers' perspective on the use of organic fertilizers on butternut squash.

3.3 Factors Affecting Farmers' Response to the Use of Organic Fertilizers on Butternut Squash:

Farmers' response to the use of organic fertilizers on butternut squash is influenced by several factors, including the characteristics of the farmers and cultivation activities. The factors that influence farmers' response to the use of organic fertilizers on butternut squash in Pamekasan Regency are as follows:

TABLE 2
FACTORS AFFECTING FARMERS' RESPONSE TO THE USE OF ORGANIC FERTILIZERS

Variable	Regression Coefficient	t-value	Sig	Note
Gender	0,086	0,259	0,801	ns
Age	-0,003	-0,259	0,801	ns
Farming Experience	0,502	4,321	0,002	*
Farm Area	21,640	1,664	0,127	ns
Constant	0,778			
R *square*	0,786			
Adj. R *square*	0,700			
F-value	9,179			

Notes: * = significant (p-value < 0.05) | ns = not significant

The regression analysis results show an Adjusted R square value of 0.700. This means that 70 percent of the farmers' response to the use of organic fertilizers is explained by the independent variables, namely gender, age, duration of farming, and farm area. The remaining 30 percent is explained by other variables outside the model. The F-value is 9.179 with a significance of 0.002. This indicates that all independent variables together are able to explain the dependent variable.

Based on the results of the multiple linear regression analysis, it can be concluded that the variable of farming experience influences the farmers' response to the use of organic fertilizers on butternut squash crops. Meanwhile, the variables of gender, age, and farm area do not have an impact on the farmers' response to the use of organic fertilizers.

The regression coefficient for farming experience is 0.502 with a significance of 0.002. This means that for each additional year of farming experience, the farmers' response to the use of organic fertilizers on butternut squash increases by 0.502 units. In other words, as farming experience increases, the farmers' response to the use of organic fertilizers also improves.

Experienced farmers tend to have better cultivation techniques. This is in line with research that states farming experience significantly influences farmers' decision-making regarding organic farming (Puspasari et al., 2018).

Based on the data on farmer characteristics, the farmers who use organic fertilizers in butternut squash cultivation are those with five years of farming experience. This suggests that farmers with more experience have already applied the use of organic fertilizers to their butternut squash crops. They are familiar with the benefits of organic fertilizers on butternut squash.

IV. CONCLUSION

1. The use of organic fertilizers in butternur squash cultivation in Pamekasan Regency is still very low, with only 13% of farmers using it as a supplement to chemical fertilizers, while 87% of farmers rely entirely on chemical fertilizers. This low adoption rate is influenced by farmers' belief that organic fertilizers may reduce their income.
2. The extension activities conducted have successfully changed the views of some farmers in Pamekasan Regency, who are now more open to the use of organic fertilizers due to their abundant availability. However, the main challenges in its implementation are the limited understanding of organic fertilizer production techniques, the initial production costs, and the farmers' habit of relying on chemical fertilizers. Therefore, more intensive education and technical training are needed so that farmers can optimally adopt organic fertilizers for more sustainable agriculture.
3. The factor of farming experience significantly influences farmers' responses to the use of organic fertilizers on butternut squash.

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