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Application of Organic Fertilizer to Shallot Yields in Various Mulches

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A B S T R A C T

Shallot is a superior commodity cultivated by farmers intensively, contains substances that are beneficial to health and is used as a cooking spice.. Utilization of waste and returning to organic can improve the environment where it grows so that the availability of nutrients can increase shallot crop yields. This study aims to find the type of organic fertilizer and mulch that gives high yields for shallots. . This research was a factorial experiment with a randomized block design (RBD) consisting of two factors, namely the type of organic fertilizer (J) consisting of 3 levels, namely 30 tons ha-1 rabbit manure (J1); chicken manure 30 tons ha-1 (J2) and organic fertilizer karambitan agro 30 tons ha-1 (J3) and the various types of mulch (M) consisted of 3 levels, namely straw mulch (MJ), husk mulch (MS), and plastic mulch (MP). The research was conducted in rice fields in Subak Sampalan Delod Margi, Dawan District, Klungkung Regency . The highest tuber fresh weight per clump and per hectare to be obtained in the 30 ton ha-1 rabbit manure treatment, namely 73,61 g and 7,36 tons, when compared to the lowest results in the 30 ton ha-1 chicken manure treatment ie weighing 44,90 g and 4,49 tons experienced an increase of 63,94% and 63,92%. The highest fresh weight of tubers per clump and per hectare were obtained from husk mulch, namely 67,50 g and 6,75 tons, which increased by 48,38% and 48,35%, compared to plastic mulch, namely 45,49 g and 4,55 tons.

INTRODUCTION

Shallot (Allium ascalonicum L.) is a horticultural vegetable plant which has many benefits, namely as a food flavoring and as a traditional medicine. The content in shallots such as carbohydrates, fatty acids, sugar, protein, minerals and fat is needed by the human body [1]. Shallot production in Bali in 3 years (2019-2021) has experienced ups and downs every year. In 2019 shallot production reached 19,687 tons, experienced a very drastic decrease in 2020, namely 14,207 tons and in 2021 it has increased to 23,215 tons. The shallot production center is located in Bangli Regency, Songan Village [2]. To intensify and encourage farmers to plant crops which are the needs of the community, because the demand for onions in Indonesia has so far been an important record for advancing agricultural production. Returning to organic and utilizing waste is an option, namely various types of organic fertilizers and straw ,husk mulches so that they can improve the environment in which they grow [3,4].

Organic fertilizers are the result of the decomposition of organic materials broken down by microbes, so they can provide the nutrients needed by plants for plant growth and development. Besides containing complete nutrients, organic matter also plays an important role in improving the physical, chemical and biological properties of the soil so that it can maintain and increase soil fertility and reduce dependence on inorganic fertilizers [5, 6]. The use of organic fertilizers needs to be increased and given priority not only to increase soil fertility, but also to help create sustainable and safe agro-ecosystems for human health. and is able to hold a lot of water so that ground water is formed which is beneficial for plants, because it will make it easier for plant roots to absorb nutrients for their growth and development [5,6,7]. Rabbit manure is a part of organic fertilizer which has many benefits for soil fertility because it has complete macro and micro nutrients. Rabbit manure is a good source of manure because it contains nutrients N, P and K which are good enough for soil fertility. Rabbit manure contains nutrients such as N 2.62%, P 2.48%, K 1.86% [8.9]. Chicken manure has good potential, because apart from playing a role in improving the physical, chemical and biological properties of the soil, chicken manure also has high N, P and K content. The results of the study stated that a dose of 30 tons ha-1 gave the best results on the growth and yield of shallot plants. compared to 20 tons ha-1 and 10 tons ha-1[10]. Kerambitan agro fertilizer is an organic fertilizer with the basic ingredients of fermented cow manure, cocopeat and roasted husks which improve soil structure, increase cation exchange capacity, increase water retention and contain macro and micro nutrients. The highest fresh weight of shallot bulbs per clump and fresh weight of chili fruit per plant was obtained from the application of organic fertilizers Kerambitan Agro 20 ton.ha-1 namely 85 g and 202.56 g, increased by 20.28% and 26.59% compared to the application of organic fertilizers Kerambitan [7].

Mulch is a material used on the soil surface to manipulate the plant environment and is an attempt to modify water balance, temperature, soil moisture and suppress weed growth and create conditions suitable for plants,

so that plants can grow and develop properly [11,12]. Mulch is divided into two, namely organic and inorganic mulch. Organic mulches are plant residues such as rice husks and straw, while inorganic mulches include artificial materials such as silver black plastic [13,15]. Technically, the use of mulch can provide benefits, including saving water use by reducing the rate of evaporation from the soil surface, minimizing soil temperature fluctuations so that it benefits the growth of onion plants and soil microorganisms, reducing the rate of soil erosion both due to raindrops and can inhibit the rate of weed growth [14,16]. This study aims to find the type of organic fertilizer and mulch that gives high yields for shallots.

THEORETICAL FRAMEWORK

Intercropping is a plant cultivation system where more than one plant is planted in one planting area. This system is used to maximize land function and is expected to increase land productivity and also increase farmer income. Efforts to increase fruit horticulture production are carried out through intensification, extensification and diversification which are carried out in an integrated, harmonious manner and while maintaining the preservation of natural resources and the environment to achieve resilient agricultural conditions [11] Efforts to extensify or expand agricultural land on the decreasing number of productive lands from year to year due to the use of land for non-agricultural purposes, such as for housing, industrial offices and so on. Meanwhile, intensification efforts often experience obstacles, due to the implementation of inappropriate technology packages in the use of chemical fertilizers and pesticides at much higher doses from the recommended dose, which can reduce farming efficiency and cause negative impacts on the environment. The intercropping pattern is the planting of more than one plant at the same time or during the planting period, in the same place. In the intercropping planting pattern, there are principles that must be taken into account, namely: plants planted in intercropping should have different ages or growth periods, have different needs for Environmental factors such as air, humidity, light and plant nutrients have an allelopa influence This dual farming system is very suitable for our farmers with limited land in tropical areas, so that they can maximize production with low external input while minimizing risks and conserving natural resources. Apart from that, there are other advantages of this system:

a. reducing soil erosion or loss of cultivated land
b. improving water management on agricultural land, including increasing the supply (infiltration) of air into the soil so that air reserves for plant growth will be greater. Lots. available
c. fertilize and improve the structure of the soil
d. increase the usability of the land so that farmers' income will also increase
e. be able to save labor
f. avoid seasonal decline because the land can be planted continuously,
g. tillage does not need to be done repeatedly

h. reduces the population of pests and plant diseases
i. enriches the nutrient content of nitrogen and other organic materials.

With this intercropping system, apart from farmers being able to harvest more than once a year with a variety of commodities (yield diversification), the risk of crop failure can also be reduced, crop intensity can increase and utilization of available air, sunlight and nutrient resources will be more efficient. The LEISA system is implemented on the basis of two-way participatory planning and in its implementation continuous active, participatory assistance is carried out as an accelerated evolutionary process. This system can be chosen either as the final terminal for agricultural activities or as a transition system towards further development. This must be based on the condition of the island in terms of its biophysical and socioeconomic components. It is estimated that small numbers can carry out agricultural development not only to increase productivity but also to increase the sustainability function towards agricultural continuity as well as the longing for life between generations. Initially agriculture in tropical areas depended on natural resources, knowledge, skills and local institutions.

METHODS

The research was conducted on land in Subak Sampalan Delod Margi, Dawan District, Klungkung Regency, starting from Januari - Mei 2023. This research was a factorial experiment with a basic randomized block design (RAK) consisting of 2 factors, namely the first factor was the type of organic fertilizer (J) which consists of 3 levels, namely rabbit manure 30 tons ha-1 (J1); chicken manure 30 tons ha-1 (J2) and organic fertilizer karambitan agro 30 tons ha-1 (J3). While the second factor is various types of mulch (M) which consists of 3 levels, namely straw mulch (MJ), husk mulch (MS), and plastic mulch (MP). So that there were 9 combination treatments repeated 3 times, so 28 experimental plots were needed. The research implementation included land preparation, making 28 plots measuring 1 x 1 m with mound heights of 20 cm, spacing between plots of 30 cm and between replicates of 50 cm; planting is done in the afternoon, for shallot seeds before planting the ends are cut 1/3 part then planted to a depth of 3 cm with a spacing of 15x15 cm. Treatment of organic fertilizer types was given one week before planting while plastic mulch was installed the day before planting and straw and husk mulch were given at planting time. Maintenance includes watering, replanting, weeding and controlling pests and diseases. Harvesting is done after the shallot plants are 60 HST. The variables observed were plant height, number of leaves, number of tubers, fresh weight and oven dry weight of tubers per clump, stover fresh and oven dry weight per clump, fresh weight of tubers per hectare and harvest index. The data were analyzed statistically using analysis.

RESULTS

The results of statistical analysis of all observed variables, obtained the significance of the types of organic fertilizer (J) and mulch (M) and their interactions (JxM)) on the observed variables are presented in Table 1

Table 1. Significance of Types of Organic Fertilizer (J) and Mulch (M) and their interactions (JxM) for all variables

No	Variables	Treatment		
		Type of organic fertilizer (J)	Type of mulch (M)	Interaction (JxM)
1	Maximum plant height (cm)	*	ns	ns
2	Maximum number of leaves (strands)	*	ns	ns
3	Number of tubers per clump (tubers)	ns	ns	ns
4	Fresh weight of tubers per clump (g)	**	*	ns
5	Tuber oven dry weight per clump (g)	ns	ns	ns
6	Fresh weight per clump (g)	ns	ns	ns
7	Gradual oven dry weight per clump (g)	ns	ns	ns
8	Fresh weight of tubers per hectare (tonnes)	*	*	ns
9	Harvest index (%)	ns	ns	ns

Description : ns = Influence not significant (P≥0,05)
* = Significantly influential (P<0,05)
** = Very significant effect (P<0,01)

The interaction between the type of organic fertilizer and mulch (JxM) had no significant effect (P>0.05) on all observed variables. The type of organic fertilizer (J) had a very significant effect (P<0.01) on fresh weight of tubers per hill; had a significant effect (P<0.05) on maximum plant height, maximum number of leaves and tuber fresh weight per hectare and had no significant effect (P>0.05) on other variables. The type of mulch (M) had a significant effect (P<0.05) on fresh weight of tubers per clump, fresh weight of tubers per hectare, and had no significant effect (P>0.05) on other variables (Table 1).

The average value of the variables observed in the type of organic fertilizer (J) and mulch (M) (Table 2).

Table 2. The average value of the variables observed in the type of organic fertilizer (J) and mulch (M)

	Maximum plant height (cm)	Maximum number of leaves (strands)	Number of tubers per clump (tubers)	Fresh weight of tubers per clump (g)	Tuber oven dry weight per clump (g)	Fresh weight per clump (g)	Gradual oven dry weight per clump (g)	Fresh weight of tubers per hectare (tonnes)	Harvest index (%)
Type of organic fertilizer									
Rabbit manure (J1)	41,16 a	42,17 a	8,05 a	73,61 a	5,34 a	8,35 a	5,94 a	7,36 a	80,66 a
Chicken manure (J2)	35,61 b	35,14 b	7,34 a	44,90 c	5,31 a	9,01 a	6,09 a	4,49 b	73,88 a
Kerambitan Agro fertilizer (J3)	38,94 ab	37,56 b	8,06 a	57,28 b	5,41 a	10,68 a	6,81 a	5,73 ab	76,11 a
BNT 0,05	4,71	4,60	-	7,52	-	-	-	2,17	-
Type Of Mulch									
Straw Mulch (M_j)	39,49 a	34,10 a	7,17 a	57,20 a	5,81 a	8,59 a	5,85 a	5,72 ab	78,38 a
Plastic Mulch (M_p)	37,04 a	34,98 a	7,16 a	45,49 b	4,36 a	8,30 a	6,01 a	4,55 b	76,18 a
Husk Mulch (M_s)	38,54 a	33,67 a	7,40 a	67,50 a	5,47 a	9,74 a	5,12 a	6,75 a	79,94 a
BNT 0,05	-	-	-	7,52	-	-	-	2,17	-

Note: The average value followed by the same letter in the same treatment and column, is not significantly different at the 5% BNT test level.

DISCUSSION

The highest tuber fresh weight per clump and per hectare was obtained for the type of rabbit manure, namely 73.61 g and 7.36 tons; followed by kerambitan agro fertilizer of 57.28 g and 5.73 tons and the lowest was chicken manure, namely 44.90 g and 4.49 tons (Tabel 2). This is due to the application of organic fertilizers can improve the physical, chemical and biological properties of the soil and cause more availability of nutrients in the soil. Rabbit manure has the advantage of being able to increase plant resistance to attack by a number of plant-disturbing organisms and can increase the activity of microorganisms in the soil which can help increase soil fertility, increase the nutrient content in the soil, help maintain soil moisture, contain macro and micro nutrients which have very good effect on the improvement of soil physical properties and especially soil biological properties, and is safe to use in large quantities and does not damage the environment. This is supported by [8] rabbit manure is one of the solid organic fertilizers, which can add nutrients to the soil, can also add humus, improve soil aggregates and encourage the life of soil microorganisms. Besides that [9] stated that rabbit manure contains elements of N, P, K which are 2.72%, 1.1% and 0.5% higher respectively than other livestock manure. N is the main nutrient for plant growth, which is generally indispensable for the formation or growth of vegetative parts of plants such as leaves, stems and roots and plays a role in photosynthesis,

namely the formation of chlorophyll, P plays a role in various physiological processes in plants such as photosynthesis and respiration, availability of K play a role in the activity of various enzymes essential in photosynthetic reactions [5].

The higher tuber fresh weight was supported by plant height and higher number of leaves in rabbit manure. Increasing plant height and number of leaves will lead to increased photosynthesis so that the resulting photosynthate is translocated to increase tuber fresh weight per clump and fruit weight per plant. Increasing the interception of sunlight by the leaves to produce photosynthate and in further development this photosynthate will be transferred to plant organs that actively carry out metabolic processes so that growth becomes better and will further affect plant yields [7]. Kerambitan agro fertilizer gives higher yields than chicken manure, because it is an organic fertilizer with fermented cow manure, cocopeat and roasted husks which improve soil structure, increase cation exchange capacity, increase shelf life. water and contains macro and micro nutrients so that they are available and can be absorbed by intercropping shallots with chilies for their growth and development. This is in line with the opinion [4,6] that the provision of organic matter plays a role in improving soil structure so that air aeration and water movement is smooth, thereby increasing the absorption of water in the soil and being able to increase the nutrients available to plants, and increase the population and activity of soil microbes thereby affecting growth and yield. This is supported by the results of research [17] which found that the application of liquid organic fertilizer with a concentration of 150 ml.l-1 gave an increase in shallot bulb yield of 35.28% compared to the lowest yield at a concentration of 25 ml.l-1 liquid organic fertilizer; and the results of research [4] found that the dose of 15 ton.ha-1 rabbit compost gave a 73.48% increase in fresh weight of shallot bulbs compared to a dose of 0 ton.ha-1 rabbit compost. and the results of the study [18] found that the dose of rabbit compost 15 ton.ha-1 gave the fresh weight of onion bulbs an increase of 73.48%

The highest tuber fresh weight per clump and per hectare was obtained for husk mulch, namely 67.50 and 6.75 tons, which was not significantly different from straw mulch, namely 57.20 g and 5.72 tons, and the lowest was obtained for plastic mulch, namely 45.49 g. and 4.55 tons (Tabel 2). The high fresh weight of tubers per clump and per hectare is caused because rice husk mulch and straw mulch are organic type mulches that are capable of decomposing and decomposing so that they turn into humus which can fertilize the soil so that nutrients in the soil become available and can be absorbed for growth and increase onion yield. This is supported by the opinion [16] which states that straw and husk mulch have different advantages than plastic mulch. Straw mulch and husk mulch showed the lowest soil temperature compared to no mulch or silver black plastic mulch, this was because the heat received by the husk and straw mulch did not immediately penetrate the soil and exchange with free air immediately occurred [14]. Straw and husk mulches are mulches made from materials such as plant residues and this mulch is classified as a type of organic mulch. Straw is cut into small pieces with the aim of installing

mulch on the ground evenly and nothing is missed. Straw and husk mulches have different advantages than plastic mulches. This is influenced by the decomposition or mulch of straw and husks which can decompose because they are organic, decaying material will turn into humus which helps fertilize the soil [15, 16]. Husk mulch and straw mulch function to suppress weed growth, maintain soil aggregates from being hit by rainwater, reduce soil surface erosion, prevent water evaporation and protect the soil from sun exposure, can also help improve soil physical properties, especially soil structure so as to improve soil aggregate stability and can control pests and diseases in shallot plants[14,15].

CONCLUSIONS AND RECOMMENDATIONS

From this research it can be concluded:

1. The interaction between the type of organic fertilizer and mulch (JxM) had no significant effect (P>0.05) on all observed variables.
2. The highest tuber fresh weight per clump and per hectare to be obtained in the 30 ton ha-1 rabbit manure treatment, namely 73,61 g and 7,36 tons, when compared to the lowest results in the 30 ton ha-1 chicken manure treatment ie weighing 44,90 g and 4,49 tons experienced an increase of 63,94% and 63,92%.
3. The highest fresh weight of tubers per clump and per hectare were obtained from husk mulch, namely 67,50 g and 6,75 tons, which increased by 48,38% and 48,35%, compared to plastic mulch, namely 45,49 g and 4,55 tons.

The recommendations that can be put forward are:

1. To increase the yield of onion plants, 30 tons.ha-1 of rabbit manure can be given and chaff and/or straw mulch.

FURTHER STUDY

There has been no real interaction between the treatments given, because each treatment is independent so further research needs to be carried out at different times and places with larger land areas. And or It is necessary to carry out further research at different places and technological inputs.

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