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Application of Organic Fertilizer Types in Intercropping System Red Onions with Chilli

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application;
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Abstract

The research aims to obtain intercropping results by providing organic fertilizer combined with planting patterns. The research was conducted in the Subak Sampalan Delod Margi rice fields, Dawan District, Klungkung. This is a factorial experiment with a Randomized Block Design (RAK) consisting of two factors, namely the type of organic fertilizer (J), 3 levels J1 = Kerambitan agro organic fertilizer; J2 = rabbit cage fertilizer; J3 = Lemeksari compost fertilizer and planting pattern, 3 levels, namely P1 = monoculture; P2= intercropping 1:1; P3= intercropping 2:1. The results showed that the interaction of organic fertilizer type with planting pattern had no significant effect on all observed variables. The highest fresh weight of onion bulbs per hill and fresh weight of cayenne pepper fruit were obtained with the Kerambitan Agro organic fertilizer type, increasing by 10.93% and 10.64% compared to the rabbit manure type. The intercropping system is more profitable than monoculture because land productivity is higher and various commodities are produced, saving production facilities, and the risk of failure is reduced. The highest fresh weight of shallot bulbs per cluster and fresh weight of cayenne pepper were obtained in the 2;1 intercropping planting pattern, increasing by 12.33% and 9.37% compared to the monoculture planting pattern.

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1 Introduction

In an effort to increase food availability in the new normal era and reduce the rate of inflation, the government, in this case the Ministry of Agriculture (Kementan), has prepared a strategy that includes managing planting patterns better. Apart from that, the availability of land is increasingly limited due to the development of residential areas, non-food plantations and infrastructure development, which has the impact of limited productive land (Baharuddin & Sutriana, 2019; Gardner et al., 1991; Novizan, 2002; Geisseler et al., 2022). The development of appropriate technology in the agricultural sector, both in the fields of food crops, horticulture and plantations, with the creation of an agribusiness climate is very beneficial and profitable. The solution that can be used to overcome land limitations and develop appropriate technology is the intercropping pattern. Intercropping is planting two or more types of plants on a plot of land at the same time. Intercropping cropping patterns are often associated with sustainable agricultural systems, where the use of fertilizers and pesticides is more efficient, reduces erosion, conserves land, stabilizes the biology of the soil and obtains greater stability and diversity of results compared to monoculture planting (Warman & Kristiana, 2018). Intercropping is a double cropping system in which two or more different types of plants are planted simultaneously at relatively the same or different times by planting alternately and at regular distances on the same plot of land (Yuliartini & Kartini, 2021). The intercropping cropping pattern has several advantages compared to the monoculture cropping pattern. Determining the main crops and intercrops will be the basis for determining the intercropping system to be used and the timing of planting of the main crops and intercrops. It is hoped that choosing the right commodity can produce a positive relationship between plants. Despita et al. (2020), added that intercropping will improve ecological balance, increase resource utilization, increase product quality and quantity, and reduce plant damage by pests, diseases and plant weeds. Plant selection is something that needs to be considered to minimize negative interactions based on consideration of the need for sunlight, nutrients and the plant root system (Pracaya, 2011).

To increase crop yields using an intercropping system, sufficient nutrient availability is required so that plants can grow and produce good results so that competition between plants in absorbing nutrients is not at a detrimental level. Return to organic by utilizing waste to improve the green environment. Organic fertilizer is the result of the decomposition of organic materials which are broken down by microbes, so that they can provide the nutrients needed by plants for plant growth and development (Susetya, 2016). Apart from containing complete nutrients, organic materials also play an important role in improving the physical, chemical and biological properties of the soil so that they can maintain and increase soil fertility, as well as reduce dependence on inorganic fertilizers (Musnamar, 2003). Shallots and cayenne peppers are strategic commodities in Indonesia that are needed by people every day and are used for various purposes such as cooking spices, medicines and industry, besides that they can increase the rate of inflation in society. In order to meet the need for shallots and chilies, one way is intensification through intercropping patterns (Baharuddin & Sutriana, 2019).

The objectives of the research are (1) to obtain higher crop yields by providing organic fertilizer combined with an intercropping system; (2) found a type of organic fertilizer that can increase the yield of intercropping plants that are suitable for the environment in which they grow; (3) obtaining diversity and stability of results which has an effect on increasing farmers' income and (4) applying appropriate technology and other components in integrated cultivation in a sustainable production system.

2 Materials and Methods

The research was conducted in rice fields in Subak Sampalan Delod Margi, Dawan District, Klungkung Regency, starting in February - June 2023. The research method used a Factorial Randomized Block Design, consisting of two factors, namely the type of organic fertilizer (J) consisting of 3 levels: J1 = Kerambitan Agro Organic Fertilizer; J2 = Rabbit manure; J3 = Lemeksari compost fertilizer and planting pattern consisting of 3 levels, namely P1 = monoculture (shallots, cayenne pepper); P2= intercropping 1:1; J3= intercropping 2:1. So we got 9 combination treatments repeated 3 times, so 27 experimental plots were needed. The research implementation included land preparation, making 27 plots measuring 2 x 2 m with a bund height of 20 cm, distance between plots of 30 cm and between replications of 50 cm; planting is done in the afternoon, for shallot seeds, before planting, cut off 1/3 of the tip, then plant it to a depth of 3 cm and plant it between the chili plants; with planting pattern rules according to the treatment, namely monoculture, 1:1 intercropping and 1:2 intercropping, then covered with soil and sprinkled with husks so that it is not exposed to direct sunlight and rain. Chili plants are planted at a spacing of 50 x 50 cm with a depth of 10 cm. Organic fertilizer treatment is given 3 days before planting. Maintenance includes watering, replanting, weeding and controlling pests and diseases. Harvesting is carried out after the shallot plants are 60 days old, chili plants are harvested in stages according to harvest criteria. The variables observed in shallot and chili plants included plant height, number of leaves, number of onion bulbs, number of chili fruit, fresh weight of the bulbs, and fresh weight of the chili fruit. The data was analyzed statistically using diversity analysis.

3 Results and Discussions

The results of the statistical analysis of all observed variables showed that the significance of the type of organic fertilizer (J) and planting pattern (P) and their interaction (JxP) on the observed variables was presented in Table 1.

Table 1
The significance of the type of organic fertilizer (J) and planting pattern (P) and their interaction (JxP) on the observed variables

No	Variable	Treatment		Interaction
		Types of Organic fertilizer (J)	Planting pattern (P)	
1	Maximum shallot plant height (cm)	*	**	ns
2	Maximum number of red heat leaves (pieces)	*	*	ns
3	Number of tubers per hill (tubers)	ns	**	ns
4	Fresh weight of shallot bulbs per cluster (g)	**	**	ns
5	Maximum chili plant height (cm)	ns	ns	ns
6	Number of chili plant leaves (strands)	ns	ns	ns
7	Number of chili pepper plants (fruit)	*	*	ns
8	Fresh weight of chili pepper plant fruit (g)	*	**	ns

Information: ns = Unreal influence (P≥0,05)
* = Have a real impact (P<0,05)
** = Very real impact (P<0,01)

From Table 1, the interaction between organic fertilizer type and planting pattern has 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 the number of bulbs and fresh weight of shallot bulbs per cluster; number of chilies per plant; significant effect (P<0.05) on fresh weight of chilies per plant and no significant effect (P≥0.05) on other treatments. Planting pattern system had a significant effect (P<0.05) on maximum shallot plant height, number of bulbs and fresh weight of shallot bulbs per cluster; had a very significant effect (P<0.01) on the number of fruits and

fresh weight of chilies per plant and had no significant effect (P≥0.05) on other treatments. . The average values of the variables observed for the type of organic fertilizer (J) and planting pattern (P) and their interaction (JxP) are presented in Table 2 and Table 3.

Table 2
The average value of shallot plant variables observed in the type of organic fertilizer (J) and planting pattern (P)

Treatment	Plant height Maximum (cm)		Number of leaves Maximum (sheet)		Number of clumps (tubers)		Fresh weight clumps (g)	
Types of Organic Fertilizer								
K1	40.52	a	40.50	a	9.44	a	80.11	a
K2	34.19	b	35.06	b	9.37	a	72.22	b
K3	37.32	ab	37.56	ab	9.33	a	79.77	a
BNT 5 %	4.43		5.30		-		7.52	
Inorganic Fertilizer								
N1	34.62	b	39.29	a	9.42	b	71.17	b
N2	39.13	a	36.85	ab	10.62	a	79.75	a
N3	40.58	a	33.52	b	9.32	b	71.83	b
BNT 5 %	4.43		5.30		1.05		7.52	

Table 3
The average value of the chili plant variables observed in the type of organic fertilizer (J) and planting pattern (P)

Treatment	Plant height Maximum (cm)		Number of leaves Maximum (sheet)		Number of clumps (tubers)		Fresh weight clumps (g)	
Types of Organic Fertilizer								
K1	75.50	a	79,50	a	45.75	a	143.56	a
K2	77.85	a	82.75	a	41.71	b	129.75	b
K3	78.80	a	79.25	a	44.83	a	140.55	a
BNT 5 %	-		-		2.95		9.08	
Planting Pattern								
N1	77.85	a	69.25	a	42.83	b	132.93	b
N2	77.30	a	70.75	a	45.96	a	145.39	a
N3	73.20	a	72.50	a	41.75	b	135.80	b
BNT 5 %	-		-		2.95		9.08	

Information: The average values followed by the same letter in the same treatment and column are not significantly different at the test level BNT 5%.

The type of organic fertilizer and planting system have an influence on the results of intercropping shallots and cayenne peppers. Intercropping creates a complex agroecosystem, which includes interactions between different types of plants. The competition that occurs is not at a detrimental level and shows the efforts of plants to obtain the same resources. This is in line with the statement by Gascho & Parker (2001), that intercropping can increase the amount of production per area per unit of time, can reduce the risk of crop failure, increase the productivity of land use, time and resources available during one planting season, producing one output. in value means high economic value.

The highest fresh weight of shallot bulbs per cluster was obtained from the Kerambitan Agro organic fertilizer type, namely 80.11 g, which was not significantly different from the Lemeksari compost fertilizer type, namely 79.77 g, an increase of 10.45% compared to the rabbit drum fertilizer type, namely 72.22 g (Table 3.2) (Kumar et al., 2006; Andersen et al., 2017; Fossen et al., 1998; Sari & Sjah, 2016). The highest

number and weight of cayenne pepper fruit was obtained when applying Kerambitan Agro organic fertilizer, namely 45.75 pieces and 143.56 g, an increase of 9.7% and 10.64%, not significantly different from the Lemeksari compost fertilizer type, namely 44.83 pieces and 140.55 g, an increase of 7.48% and 8.32% compared to other types of fertilizer. rabbit drums, namely 41.71 pieces and 140.55 g (Table 3.3). This is because Kerambitan agro fertilizer and Lemeksari compost fertilizer are organic fertilizers made from fermented cow manure, cocopeat and burnt husks as well as a mixture of fermented lemekan leaves which improve soil structure, increase cation exchange capacity, increase water retention capacity and contain macro and micronutrients so that they are available and can be absorbed by intercropping shallots with cayenne pepper for growth and development. Organic fertilizer can improve the system of binding and releasing ions in the soil, so that it can support plant growth. The ability of organic fertilizer to bind water can increase soil porosity thereby improving respiration and plant root growth. Organic fertilizer can also stimulate beneficial soil microorganisms, for example rhizobium, mycorrhiza and bacteria. This is supported by the research results of Yuliartini & Kartini (2021), which found that the application of liquid organic fertilizer with a concentration of 150 ml.l-1 gave an increase in shallot bulb yields of 35.28% compared to the lowest yield at a liquid organic fertilizer concentration of 25 ml.l. -1 ; and the research results of Yuliartini et al. (2021), it was found that the application of 20 tons.ha-1 organic Kerambitan fertilizer gave the highest fresh weight of red onion bulbs per hill and fresh weight of red chilies per plant, namely 85 g and 202.56 g, an increase of 20.28% and 26.59 % .

The highest number and fresh weight of shallot bulbs per cluster were obtained in the 2;1 intercropping planting pattern, namely 10.62 bulbs and 79.95 g, an increase of 12.74% and 12.33% compared to the monoculture planting pattern, namely 9.42 bulbs and 71.17 g (Table 5.3). The highest number and weight of cayenne pepper fruit was obtained in the 2:1 intercropping pattern, namely 45.76 fruit and 145.39 g, an increase of 7.3% and 9.37% compared to the monocropping pattern, namely 42.83 fruit and 132.93 g (Table 5.5). The intercropping system is generally more profitable than the monoculture system because land productivity is higher, the types of commodities produced are diverse, the use of production facilities is economical and the risk of failure can be minimized (Jannoura et al., 2014; Ghosh et al., 2009; Xia et al., 2013; Jannoura et al., 2013). Intercropping shallot plants with chili plants is appropriate because they have different morphologies. Intercropping should be done between plants that have different roots, plant height, leaf shape, canopy, and harvest age. The roots of chili and shallot plants are different, namely, shallots have fibrous roots and chilies have tap roots. Shallots have shallower roots than chili plants. Based on plant height, shallot plants are lower than chili plants (Setiyowati et al., 2010; Sutriana & Baharuddin, 2019; Senesi, 1989; Lee, 2010; Suriani, 2019). Sunlight that escapes from chili plants can be absorbed by shallot plants. The relatively small shape of chili leaves and a canopy that is not too wide allows shallot plants to receive light according to their needs so that shallot production in an intercropping cropping pattern can produce production that is no different from a monoculture cropping pattern. Based on the age of the plant, shallots can be harvested at 2 months of age and the chili plants are still entering the generative phase, so the shallot plants do not interfere with the generative phase of the chili plants. According to Raza et al. (2019), the intercropping pattern between shallot plants and chili plants can be applied with various planting patterns, namely 2:1 strips, zig-zag planting of shallots between chilies and mixed planting. This planting pattern provides good growth and production of shallots. The intercropping planting pattern has several advantages, namely saving labor, saving time and can provide multiple benefits, reducing the risk of crop failure. Ansar et al. (2019), the production of intercropping shallots with chilies at several planting distances states that the intercropping planting pattern provides more profitable income than monoculture crops. Farmers' income can be doubled by selecting commodities with high economic value.

4 Conclusion

From the research it can be concluded:

1) The interaction of organic fertilizer with planting patterns has no significant effect (P≥0.05) on all observed variables

2) The highest fresh weight of shallot bulbs per cluster and fresh weight of cayenne pepper fruit were obtained with the Kerambitan Agro organic fertilizer type which increased by 10.93% and 10.64% compared to the rabbit manure type.
3) The intercropping system is generally more profitable than the monoculture system because land productivity is higher, the types of commodities produced are diverse, the use of production facilities is economical and the risk of failure can be reduced. The highest fresh weight of shallot bulbs per cluster and fresh weight of cayenne pepper were obtained in the 2;1 intercropping planting pattern, increasing by 12.33% and 9.37% compared to the monoculture planting pattern.

The suggestions put forward in this research are:

1) To increase the yield of intercropping shallots and chilies, organic fertilizers such as Kerambitan Agro and Lemeksari compost can be applied and a 2:1 intercropping pattern can be applied to further increase land productivity.
2) Further research needs to be carried out on different places and technological inputs.

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