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Application of Organic and Inorganic Fertilizer Against Results Onion Plants with Chillies

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Abstract

Intercropping is a crop cultivation system where more than one plant is planted in one planting area, this is used to maximize land function and increase farmers' income. The aim of the study was to obtain the response of growth and yield of intercropping to reducing doses of inorganic fertilizers with organic fertilizers, in order to obtain the optimal dosage mix. The research was conducted in rice fields in Subak Rapuan, Banjar Tarukan, Mas Village, Ubud, Gianyar. This experiment is a factorial experiment with a Randomized Block Design (RAK) which consists of two factors, namely organic fertilizer kerambitan agro (K) consisting of 4 levels: K0 = 0 ton.ha-1; K1 = 10 ton.ha-1 ; K2 = 20 ton.ha-1; K3 = 30 ton.ha-1and the dose of NPK Mutiara fertilizer consisted of 3 levels, namely N1= 100 kg.ha-1 ; N2= 200 kg.ha-1 N3= 300 kg.ha-1 . The results showed that the interaction of organic fertilizers with inorganic fertilizers had no significant effect (P≥0.05) on all observed variables. The fresh weight of shallot bulbs per clump and the highest fresh weight of chili fruit per plant were obtained from the application of organic fertilizers Kerambitan Agro 20 tons.ha-1, namely 85 g and 202.56 g, increased by 20.28% and 26.59% compared to the application of organic fertilizers Kerambitan Agro 0 tons. ha-1 are 70.67 g and 160.01 g. The application of NPK fertilizer 200 kg.ha-1 gave a higher fresh weight of shallot bulbs per clump, namely 79.83 g, which increased by 6.19%, as well as fresh weight of chilies, which was 187.80 g, an increase of 5.55% compared to the application of NPK fertilizer at 100 kg.ha-1.

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1 Introduction

The development of appropriate technology in agriculture followed by the creation of a climate, limited land can be useful and profitable with the solution being the application of intercropping cropping patterns, which are associated with sustainable agricultural systems, where the use of fertilizers and pesticides is more efficient, reduces erosion, land conservation, biological stability soil and obtain greater yield stability and diversity than monoculture cultivation (Warman & Kristiana, 2018). Shallots are a spice vegetable used as a delicacy in cooking according to the tongue of the Indonesian people. Almost all Indonesian dishes use onions as one of the seasonings (Wibowo, 1991). The government is intensifying and encouraging farmers to return to planting crops that are needed by the community, because the need for onions in Indonesia is still an important record in advancing agricultural production. One of them is the intensification of horticultural lands through intercropping patterns, namely planting shallots between chili plants. Chili plant is one of the popular vegetable commodities and has high value and has high nutritional content. Almost all households in Indonesia consume chilies every day, not only for household consumption but also in the food processing industry. To increase yields with an intercropping system, it is necessary to have sufficient availability of nutrients so that plants can grow and give good results, so competition between plants in nutrient absorption is not at a detrimental level. Nutrients can be obtained from organic and inorganic fertilizers. Organic fertilizers are the result of the decomposition of organic materials that are broken down by microbes, so that they can provide nutrients needed by plants for plant growth and development. Organic matter in addition to containing complete nutrients, 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 (Baharuddin & Sutriana, 2019). The provision of organic fertilizers needs to be balanced with inorganic fertilizers. How large the dose of organic fertilizer given combined with inorganic fertilizer has an effect on the yield of plants with an intercropping system. The results Yuliartini & Kartini (2021), obtained that the fresh weight of shallot bulbs per clump and the highest fresh weight of okra fruit per plant was obtained at a dose of NPK Mutiara 300 kg.ha-1, namely 58.77 g and 171.63 g, an increase of 23.59% and 15.08% compared to the dose of NPK Mutiara 100 kg.ha-1, namely 47.55 g and 149.14 g (Mejia et al., 2007; Surh & Lee, 1996).

2 Methodology

The research was conducted in paddy fields in Subak Rapuan, Banjar Tarukan, Mas Village, Ubud, Gianyar, starting from January-August 2021. The research method used a factorial randomized block design, consisting of two factors, namely organic kerambitan agro fertilizer (K) consisting of 4 levels: K0 = 0 ton.ha-1; K1 = 10 ton.ha-1 ; K2 = 20 tons.ha-1; K3 = 30 ton.ha-1 and the dose of NPK Mutiara fertilizer consisted of 3 levels, namely N1 = 100 kg.ha-1; N2= 200 kg.ha-1 N3= 300 kg.ha-1 . So that 12 combination treatments were obtained 3 times, so 36 experimental plots were needed. The implementation of the research included land preparation, making plots measuring 2 x 2 m as many as 36 plots with a mound height of 20 cm, a distance between plots of 30 cm and between replications of 50 cm; planting is carried out in the afternoon, for shallot seeds before planting, cut the ends of 1/3 of the next part planted with a depth of 3 cm with a spacing of 15x15 cm,, planted in rows of chili planted with a spacing of 60x60 cm The treatment of organic fertilizer is given 1 week before planting while inorganic fertilizers are given 2 times, namely 7 days after planting. and 35

hst. according to treatment. Maintenance includes watering, replanting, weeding and controlling pests and diseases. Harvesting is done after the onion plants are 60 days after planting, for chili plants are harvested in stages according to the harvest criteria. Variables observed in shallot and chili plants were plant height, number of leaves, number of onion bulbs, number of chilies, fresh weight of bulbs and fresh weight of chilies. The data were analyzed statistically by using analysis of variance (Eze et al., 2018; Gimeno-García et al., 1996).

3 Results and Discussions

The results of statistical analysis of all observed variables, obtained the significance of the doses of organic fertilizers (K) and NPK 16:16:16 (N) and their interactions (KxN)) on the observed variables are presented in Table 3.1.

Table 3.1
Significance of Dose of Organic Fertilizer (K) and Inorganic Fertilizer (N) and their interaction (KxN) on all observed variables

No	Variable	Treatment		Interaction
		Organic Fertilizer Dosage (K)	Inorganic fertilizer (N)	
1	Fresh weight of onion bulbs per clump (cm)	ns	*	ns
2	Maximum number of red heat leaves (strands)	ns	ns	ns
3	Number of tubers per clump (tuber)	**	*	ns
4	Fresh weight of onion bulbs per clump (g)	**	ns	ns
5	Maximum chili plant height (cm)	ns	ns	ns
6	Number of chili plant leaves (strands)	ns	ns	ns
7	Number of chilies per plant (fruit)	**	**	ns
8	Fresh weight of chili per plant (g)	**	**	ns

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

From Table 3.1, it can be seen that the interaction of the dose of organic fertilizer for organic kerambiatn agro with NPK 16:16:16 (KxN) fertilizer had no significant effect (P≥0.05) on all observed variables. The dose of Kerambitan Agro organic fertilizer (K) had a very significant effect (P<0.01) on the number of bulbs and fresh weight of shallot bulbs per clump; the number of fruits and fresh weight of chilies per plant and had no significant effect (P≥0.05) on other treatments. The dose of NPK 16:16:16 had a significant effect (P<0.05) on the maximum shallot plant height and the number of bulbs per clump; had a very significant effect (P<0.01) on the number of fruits and fresh weight of chilies per plant and no significant effect (P≥0.05) on other treatments. The average values of the observed variables on the dose of organic fertilizer (K) and 16:16:16 NPK fertilizer (N) and their interactions are presented in Table 3.2 and Table 3.3 (Swamy & Gowda, 2006; Yang et al., 2022).

Table 3.2
The average value of onion plant variables observed at doses of organic fertilizer (K) and inorganic fertilizer (N)

TREATMENT	Maximum plant height. (cm)	Number of leaves Max. (sheet)	Number of Bulbs / clumps (tubers)	Fresh weight of tubers/ clump (g)
Organic fertilizer				
K0	37.56 a	36.28 a	9.22 c	70.67 c
K1	38.81 a	38.50 a	10.44 b	74.11 c
K2	39.19 a	35.56 a	11.67 a	79.22 b
K3	40,52 a	38.56 a	12.33 a	85.00 a
BNT 5 %	-	-	0.69	4.61
Inorganic Fertilizer				
N1	37.62 b	36.29 a	10.42 a	79.83 a
N2	39.16 ab	36.85 a	10.92 ab	79.83 a
N3	40.28 a	38.52 a	11.42 a	79.83 a
BNT 5 %	2.05	-	0.79	-

Table 3.3
The average value of chili plant variables observed at doses of organic fertilizer (K) and inorganic fertilizer (N)

TREATMENT	Maximum plant height. (cm)	Number of leaves Max. (sheet)	Number of fruit/plant (fruit)	Fresh weight of tubers/ clump (g)
Organic fertilizer				
K0	91.16 a	154.61 a	21.56 c	160.01 d
K1	93.99 a	172,50 a	23.06 b	177.17 c
K2	93.78 a	172.06 a	23.61 ab	193.76 b
K3	88.79 a	172.22 a	24.11 a	202.56 a
BNT 5 %	-	-	0,99	5.81
Inorganic Fertilizer				
N1	92.78 a	174.83 a	21.71 c	177.93 b
N2	90.33 a	169.71 a	23.17 b	183.39 ab
N3	92.68 a	159.00 a	24.38 a	187.80 a
BNT 5 %	-	-	1.14	6.71

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.

The dose of Organic and Inorganic Fertilizer has a very significant effect on the intercropping yield of shallots and chilies. Increasing the dose gives the yield of intercropping plants that are increasing as well. Intercropping creates a complex cropping agroecosystem, which includes interactions between different plant species. The competition/competition that occurs is not at a disadvantageous level and shows the efforts of plants to obtain the same resources. This is in line with the statement that intercropping planting can increase the amount of production per unit area of time, can reduce the risk of crop failure, increase land use productivity, time and available resources during one growing season, produce one output in terms of value. high economic value (Amin et al., 2011; Senesi, 1989).

The highest number and fresh weight of shallot bulbs per clump were found in the application of organic fertilizer Kerambitan Agro 20 ton.ha-1, namely 12.33 bulbs and 85 g, an increase of 33.73% and 20.28% compared to the application of organic fertilizer Kerambitan Agro 0 ton.ha-1, namely 9.22 tubers and 70.67 g (Table 3.1). The highest number and fresh weight of chili fruit was obtained from the application of organic

fertilizer Kerambitan Agro 20 ton.ha-1, namely 24.11 pieces and 202.56 g, increased by 11.83% and 26.59% compared to the application of organic fertilizer Kerambitan Agro 0 ton.ha-1, namely 21.56 pieces and 160.01 g (Table 3.2). This is because rambitan agro fertilizers are organic fertilizers 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 so that they are available and can be used. absorbed by intercropping shallots and chilies for growth and development (Walling & Vaneeckhaute, 2020; Wang et al., 2018).

This is in line with the opinion Suliasih et al. (2010) that the provision of organic matter plays a role in improving soil structure so that air aeration and water movement are smooth, thereby increasing the absorption of water in the soil and being able to increase the available nutrients for plants, and increasing the population and activity of soil microbes so that it effects on growth and yield. This is supported by the results of research Yuliartini et al. (2021), which found that the application of liquid organic fertilizer with a concentration of 150 ml.l-1 gave an increase in the yield of shallot bulbs by 35.28% compared to the lowest yield at a concentration of 25 ml.l-1 of liquid organic fertilizer; and the results of the study showed that giving a dose of rabbit compost 15 tons.ha-1 gave an increase in fresh weight of onion bulbs by 73.48% compared to a dose of rabbit compost 0 tons.ha-1 (Thyagaraju, 2016; Giler & Cedeño, 2020).

The application of 200 kg.ha-1 NPK fertilizer gave higher number and weight of tubers per clump, namely 11.42 bulbs and 79.83 g which increased by 9.59% and 6.19%, as well as the number and weight of chilies, namely 24.38 pieces and 187.80 g which increased by 12.29 % and 5.55% compared to the application of 100 kg.ha-1 NPK fertilizer (Table 3.1 and Table 3.2). As the dose of fertilizer increased, there was an increase in growth in shallot and chili intercropping, although it was not significantly different because as the plants matured, the root system developed properly and completely, so that the plants were increasingly able to absorb nutrients in the form of anions and cations which contains the elements N, P and K contained in the NPK fertilizer. According to the opinion Sutedjo (2008), that for vegetative and generative growth of plants, nutrients are needed, especially N, P and K. N is needed for the formation of carbohydrates, proteins, fats and other organic compounds. Element P plays a role in the formation of the generative parts of plants (Gascho et al., 2001).

The application of inorganic NPK fertilizers plays a role in meeting the nutrient needs of intercropping shallots with chilies, especially N, P, and K nutrients. Meanwhile, organic fertilizers, in addition to containing N, P, and K elements, also contain abundant micro-nutrients and are required for growth. plant. Several studies have proven that the use of organic fertilizers can reduce the use of inorganic fertilizers. Saha et al. (2013), added that the application of organic fertilizers with inorganic fertilizers in addition to saving the use of inorganic fertilizers, preventing nutrient imbalances, can also reduce the risk of environmental pollution, increase soil fertility and increase crop yields.

4 Conclusion

From the research it can be concluded:

1. The interaction of organic fertilizers with inorganic fertilizers had no significant effect (P≥0.05) on all observed variables
2. 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
3. Agro 0 ton.ha-1 ie 70.67 g and 160.01 g.
4. The application of 200 kg.ha-1 NPK fertilizer gave a higher fresh weight of tubers per clump, namely 79.83 g which increased by 6.19%, as well as the weight of chilies, which was 187.80 g, an increase of 5.55% compared to the application of 100 kg.ha-1 NPK fertilizer.

The suggestions put forward in this research are:

1. To increase the yield of intercropping shallots and chilies, 20 ton.ha-1 organic fertilizer and 100 kg.ha-1 inorganic fertilizer can be applied.
2. Further research needs to be done on different places and technological inputs

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References

Amin, A. A., Gharib, F. A., El-Awadi, M., & Rashad, E. S. M. (2011). Physiological response of onion plants to foliar application of putrescine and glutamine. *Scientia horticulturae*, *129*(3), 353-360. https://doi.org/10.1016/j.scienta.2011.03.052

Baharuddin, R., & Sutriana, S. (2019). Pertumbuhan dan produksi tanaman tumpangsari cabai dengan bawang merah melalui pengaturan jarak tanam dan pemupukan npk pada tanah gambut. *Dinamika Pertanian*, *35*(3), 73-80.

Eze, S., Palmer, S. M., & Chapman, P. J. (2018). Soil organic carbon stock in grasslands: Effects of inorganic fertilizers, liming and grazing in different climate settings. *Journal of environmental management*, *223*, 74-84. https://doi.org/10.1016/j.jenvman.2018.06.013

Gascho, G. J., Hubbard, R. K., Brenneman, T. B., Johnson, A. W., Sumner, D. R., & Harris, G. H. (2001). Effects of broiler litter in an irrigated, double-cropped, conservation-tilled rotation. *Agronomy Journal*, *93*(6), 1315-1320.

Giler, J. J. G., & Cedeño, C. N. P. (2020). Elaboration of bovine manure biodigester for biogas transformation to electric power. *International Research Journal of Management, IT and Social Sciences*, *7*(5), 32-37. https://doi.org/10.21744/irjmis.v7n5.967

Gimeno-García, E., Andreu, V., & Boluda, R. (1996). Heavy metals incidence in the application of inorganic fertilizers and pesticides to rice farming soils. *Environmental pollution*, *92*(1), 19-25. https://doi.org/10.1016/0269-7491(95)00090-9

Mejia, E., Ding, Y., Mora, M. F., & Garcia, C. D. (2007). Determination of banned sudan dyes in chili powder by capillary electrophoresis. *Food Chemistry*, *102*(4), 1027-1033. https://doi.org/10.1016/j.foodchem.2006.06.038

Saha, R., Saieed, M. A. U., & Chowdhury, M. A. K. (2013). Growth and yield of rice (Oryza sativa) as influenced by humic acid and poultry manure. *Universal Journal of Plant Science*, *1*(3), 78-84.

Senesi, N. (1989). Composted materials as organic fertilizers. Science of the Total Environment, 81, 521-542. https://doi.org/10.1016/0048-9697(89)90161-7

Suliasih, S., Widawati, S., & Muharam, A. (2010). Aplikasi pupuk organik dan bakteri pelarut fosfat untuk meningkatkan pertumbuhan tanaman tomat dan aktivitas mikroba tanah. *Jurnal Hortikultura*, *20*(3).

Surh, Y. J., & Lee, S. S. (1996). Capsaicin in hot chili pepper: carcinogen, co-carcinogen or anticarcinogen?. *Food and Chemical Toxicology*, *34*(3), 313-316. https://doi.org/10.1016/0278-6915(95)00108-5

Sutedjo, M. (2008). Pupuk dan Cara Pemupukan Kandang. *PT. Rineka Cipta. Jakarta*.

Swamy, K. R. M., & Gowda, R. V. (2006). Leek and shallot. In *Handbook of herbs and spices* (pp. 365-389). Woodhead Publishing. https://doi.org/10.1533/9781845691717.3.365

Thyagaraju, N. (2016). Water pollution and its impact on environment of society. *International Research Journal of Management, IT and Social Sciences*, *3*(5), 1-7. Retrieved from https://sloap.org/journals/index.php/irjmis/article/view/360

Walling, E., & Vaneeckhaute, C. (2020). Greenhouse gas emissions from inorganic and organic fertilizer production and use: A review of emission factors and their variability. *Journal of Environmental Management*, *276*, 111211. https://doi.org/10.1016/j.jenvman.2020.111211

Wang, Y., Zhu, Y., Zhang, S., & Wang, Y. (2018). What could promote farmers to replace chemical fertilizers with organic fertilizers?. *Journal of Cleaner Production*, *199*, 882-890. https://doi.org/10.1016/j.jclepro.2018.07.222

Warman, G. R., & Kristiana, R. (2018, October). Mengkaji sistem tanam tumpangsari tanaman semusim. In *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning* (Vol. 15, No. 1, pp. 791-794).

Wibowo, S. (1991). *Bud. Bawang & Bombay*. Niaga Swadaya.

Yang, J., Duan, Y., Liu, X., Sun, M., Wang, Y., Liu, M., ... & Li, R. (2022). Reduction of banana fusarium wilt associated with soil microbiome reconstruction through green manure intercropping. *Agriculture, Ecosystems & Environment*, *337*, 108065. https://doi.org/10.1016/j.agee.2022.108065

Yuliartini, M. S., & Kartini, L. (2021, April). Models Application of Fertilization on Onion and Okra Cropping Pattern as A Barier Plant. In *WARDS 2020: Proceedings of the 3rd Warmadewa Research and Development Seminar, WARDS 2020, 21 December 2020, Denpasar-Bali, Indonesia* (p. 76). European Alliance for Innovation.

Yuliartini, M. S., Kartini, L., & Wirajaya, A. A. N. M. (2021). Arrangement of Growing Space in Rows and Application of Liquid Organic Fertilizer to Intercropping Yields of Onions and Soybeans. *International Journal of Life Sciences*, *5*(2), 59-65.

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