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Effect of Type of Organic Fertilizer and Dosage of Kno_3 on The Growth and Results Of Shallot Plant (*Allium ascalonicum* L.)

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Abstract

This research aims to determine the effect of providing types of organic fertilizer and doses of KNO3 on the growth and yield of shallot plants. This research was carried out in March-May 2023 at Subak Sampalan Dlod Margi, Jalan Raya Kusamba, Dawan, Klungkung. The design used was a Randomized Block Design (RAK) with 2 factors. The first factor uses 3 types of organic fertilizer, namely P1: rabbit manure 20 tons/ha, P2: Kerambitan Agro organic fertilizer 20 tons/ha, P3: TOS Lemeksari compost fertilizer 20 tons/ha and the second factor uses KNO3 which consists of 3 levels , namely K1: 50 kg/ha, K2: 100 kg/ha and K3: 150 kg/ha, thus obtaining 9 treatment combinations which were repeated 3 times. The interaction between the type of organic fertilizer and the dose of KNO3 (P×K) and the type of organic fertilizer (P) had no significant effect ($P \geq 0.05$) on all observed variables. The treatment dose of KNO3 (K) had a significant effect ($P < 0.05$) on the fresh weight of tubers per hill, the oven dry weight of tubers per hill and the harvest index; no significant effect ($P \geq 0.05$) on other variables. Giving a dose of KNO3 100 kg/ha (K2) gave the highest fresh weight and oven dry weight of tubers per hill, namely 65.16 g and 6.38 g; which increased by 77.64% and 90.44% when compared with the lowest fresh weight and oven dry weight of tubers per hill obtained when administering a KNO3 dose of 50 kg/ha (K1), namely 36.86 g and 3.35 g.

Keywords: Organic fertilizer, KNO3, shallot plant

1. Introduction

Shallot (*Allium ascalonicum* L.) is one of the most cultivated vegetable commodities, which can grow at an optimum altitude of 0-450 meters above sea level. Shallots are one type of vegetable that is used as a seasoning for everyday food and is also used as a traditional medicine as well as a source of several vitamins and minerals [13]. The results of the material analysis showed that 100 g of onion bulbs contained 1.5 g protein, 0.3 g fat, 9.2 g carbohydrates, 36 mg calcium, 40.0 mg iron, 0.03 mg B vitamins, 2.0 mg of vitamin C, and 88 g of water [2].

Shallot yields in Indonesia vary greatly from one region to another, this is due to differences in cultivated varieties. [13]. The Central Statistics Agency [3] states that shallot production in Bali in 3 years (2019-2020) has fluctuated every year, in 2019 shallots reached 19,687 tons, in 2020 it has decreased drastically to 14,207 while in 2021 it has increased by 9,008 tons so that production only reached 23,215 tons. One of the efforts to increase shallot production is by fertilizing. Fertilization can be interpreted as the provision of organic and non-organic materials to replace the loss of nutrients in the soil and to meet the nutrient needs of plants so that plant productivity increases. In addition, fertilization aims to improve soil conditions that are unfavorable or maintain good soil conditions for plant growth [11].

The effort that can be done to meet the nutrient needs of plants is to fertilize using organic fertilizers. Sentana [17] states that the presence of organic fertilizers will lead to a better ion binding and release system in the soil, so that it can support plant growth. The application of organic fertilizer can increase the efficiency of using inorganic fertilizer because organic fertilizer is slow-release. The

quality and composition of organic fertilizer varies depending on the basic compost material and the manufacturing process [8].

The ability of organic fertilizers to bind water can increase soil porosity thereby improving respiration and plant root growth. One type of organic fertilizer that is often encountered is manure. The nutrient content in manure is not too high, but this type of fertilizer has another function, which is to improve soil physical properties such as soil permeability, soil porosity, soil structure, water holding capacity and soil cations [14]. 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 [23]. This is because rabbit manure contains 21.18% organic C nutrients, 2.64% N, 0.088% P and 0.068% K. Kerambitan Agro fertilizer is also included as an organic fertilizer which has various benefits for soil and plants because it contains macro nutrients such as organic C 17.30%, N 0.91%, P_2O_5 2.16% and K_2O 2.19% and micro nutrients such as Fe and Zn. TOS Lemeksari compost fertilizer is compost derived from organic waste containing the nutrients organic C 21.06%, N 1.31%, P_2O_5 2.53% and K_2O 1.73%. Utilization of organic waste as compost can also be used to increase crop production. Much organic waste is produced from vegetable residues which are found in many traditional markets, urban garden leaf litter, and a small portion is produced from household waste [1].

KNO_3 fertilizer is a combination of the elements N (nitrogen) and K (potassium) in the form of K_2O. Nitrogen is the main component of the formation of chlorophyll, proteins, amino acids and enzymes. According to [19], the use of KNO_3 fertilizer at a dose of 450 kg/ha gave the best vegetative growth in plant height and number of leaves, as well as tuber yield per plot. This is because the main role of potassium is as an activator for the formation of carbohydrates which are needed in the reproductive phase of plants to produce better quality flowers and fruit, because the formation of sugar will be more perfect [5]. The N element in KNO_3 also plays a role in the cell division process so that the layers of leaves can form properly which then develop into shallot bulbs [24]. The purpose of this study was to determine the effect of the type of organic fertilizer and the application of KNO_3 on the growth and yield of shallots (*Allium ascalonicum* L.).

2. Material and Methods

This research is a field study conducted in paddy fields in Subak Sampalan Dlod Margi, Jalan Raya Kusamba, Dawan District, Klungkung Regency with an altitude of 15 meters above sea level. The time for conducting the research was from February 2023 to May 2023. The materials used in this study were local varieties of shallots, organic fertilizers such as rabbit manure, karambitan agro organic fertilizer and TOS compost, and red KNO_3 fertilizer. The tools used in this study were hoes, tractors, rakes, machetes, plastic buckets, tape measure, analytical scales, ovens, rulers, measuring cups, stationery and other tools that support this research.

This research was a factorial experiment with a randomized block design (RBD) consisting of 2 factors, namely the first factor was the type of organic fertilizer (P) and the second factor was the dose of KNO_3 (K), each of which consisted of 3 levels. The first factor is the type of organic fertilizer (P) which consists of 3 levels, namely:

P1 = Rabbit manure 20 ton/ha

P2 = Kerambitan agro organic fertilizer 20 ton/ha

P3 = Lemeksari compost 20 ton/ha

The second factor was the KNO_3 (K) dose treatment with 3 levels, namely:

K1 = 50 kg/ha

K2 = 100 kg/ha

K3 = 150 kg/ha

So that there were 9 combination treatments which were repeated 3 times, so that 27 experimental plots were needed. The implementation of the research included land preparation which began with tillage which was carried out twice, the first tillage was carried out using a tractor. After that, a second tillage was carried out using a hoe to destroy the soil and then it was leveled and then plots were made with a size of 1 m × 1 m with a mound height of 20 cm in a total of 27 plots. The distance used between plots was 30 cm while the distance between replicates was 50 cm. Planting is done in the afternoon, by cutting 1/3 of the end of the shallot. How to plant it by digging a hole as deep as 3 cm then inserting the seeds and covering it with fine soil and then covering it again with rice husks. The spacing used is 15 cm × 15 cm, each hole is filled with one shallot bulb, then watered until it is quite wet. The seeds used are the Bima variety. Seeds were obtained from a seed seller at the Galiran Market in the Klungkung area. Maintenance includes: watering, replanting, weeding. Irrigation is carried out according to field conditions, irrigation will be carried out if it is seen that the soil is dry or it can be done 2 times a week, irrigation is carried out by flooding the beds with irrigation water. Stitching is done 4 days after planting with the same seed. Weeding is done by pulling it out by hand and a small hoe which is done every 3 days. Harvesting is done at the age of 63 days after planting, harvesting is done by pulling it carefully.

To find out the effect of the treatment given, observations were made on the variables, namely plant height (cm), number of leaves (strands), number of tubers per clump (tubers), tuber fresh and oven dry weight per clump (g), fresh and oven dry weight per clump (g) and harvest index (%). Research data were analyzed using statistical analysis of variance according to the research design. A single treatment that has a significant to very significant effect, then proceed with the LSD test at the 5% level.

3. Results and Discussion

Based on the results of the analysis, the significance of the effect of the type of organic fertilizer (P) and the dose of KNO_3 (K) and the interaction (P×K) on all observed variables is presented in Table 1.

Table 1.
The significance of the effect of the type of organic fertilizer and the dose of KNO_3 on all observed variables.

No.	Variable	Treatment		
		Organic Fertilizer (P)	KNO_3 (K)	Interaction (P×K)
1.	Maximum plant height (cm)	ns	ns	ns
2.	Maximum number of leaves (strands)	ns	ns	ns
3.	Number of tubers per hill (tubers)	ns	ns	ns
4.	Fresh weight of tubers per hill (g)	ns	*	ns
5.	Tuber oven dry weight per hill (g)	ns	*	ns
6.	Fresh weight of stover (g)	ns	ns	ns
7.	Stove oven dry weight per clump (g)	ns	ns	ns
8.	Harvest index (%)	ns	*	ns

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

The interaction between the type of organic fertilizer with the dose of KNO_3 (P×K) and the type of organic fertilizer (P) had no significant effect (P≥0.05) on all observed variables. KNO_3 (K) dose

treatment had a significant effect (P<0.05) on tuber fresh weight per clump, tuber oven dry weight per clump and harvest index; no significant effect (P≥0.05) on other variables (Table 1). This is because nutrients derived from organic materials require soil microbial activity to change the form of complex organic bonds that cannot be utilized by plants into simple organic and inorganic compounds that can be absorbed by plants [4]. The highest tuber fresh weight per clump was obtained at the KNO_3 dose of 100 kg/ha (K_2), which was 65.16 g, which was not significantly different from the KNO_3 dose of 150 kg/ha (K_3), namely 63.49 g, an increase of 77.64% and 72.24% compared to the lowest fresh weight of tubers per clump obtained at the KNO_3 dose of 50 kg/ha (K_1), namely 36.86 g. The highest tuber oven dry weight per clump was obtained at the dose of KNO_3 100 kg/ha (K_2), which was 6.38 g, which was not significantly different from the dose of KNO_3 150 kg/ha (K_3), which was 6.30 g, an increase of 90. 44% and 88.05% compared to the lowest tuber oven dry weight per clump obtained at the KNO_3 dose of 50 kg/ha (K_1), namely 3.35 g.

Table 2

Effect of organic fertilizer type treatment and KNO3 dosage on plant height, number of leaves, number of tubers per hill, fresh and oven dry weight of tubers per hill, serial fresh and oven dry weight per hill and harvest index

Treatment	Maximum Plant Height (cm)	Number of Leaves (strands)	Number of tubers per hill (tubers)	Fresh weight of tubers per hill (g)	Fresh weight of stover (g)	Tuber oven dry weight per hill (g)	Stove oven dry weight per clump (g)	Harvest index (%)
Types of organic fertilizers (P)								
P1 (Rabbit manure 20 ton/ha)	35.99 a	26.23 a	9.97 a	47.44 a	15.42 a	4.17 a	2.00 a	65.10 a
P2 (Kerambitan agro organic fertilizer 20 ton/ha)	33.73 a	28.06 a	10.02 a	59.62 a	17.02 a	6.15 a	2.31 a	66.05 a
P3 (Lemeksari compost 20 ton/ha)	38.10 a	27.14 a	10.00 a	58.43 a	17.82 a	5.71 a	2.22 a	69.31 a
LSD 0,05	-	-	-		-		-	
Dose KNO_3 (K)								
K1 (50 kg/ha)	37.44 a	29.11 a	9.88 a	36.86 b	16.56	3.35 b	2.48 a	55.39 b
K2 (100 kg/ha)	32.27 a	24.87 a	10.09 a	65.16 a	16.42	6.38 a	1.84 a	72.36 a
K3 (150 kg/ha)	38.11 a	27.46 a	10.02 a	63.49 a	17.29	6.30 a	2.23 a	72.72 a
LSD 0,05	-	-	-	20.77	-	2.63	-	14.39

Information : The mean value followed by the same letter in the same treatment and the same column means that the difference is not significant in the 5% LSD test.

KNO_3 (K) dose treatment had a significant effect (P ≤0.05) on tuber fresh weight per clump, tuber oven dry weight per clump and harvest index; no significant effect (P≥0.05) on other variables (Table 1). The highest average tuber fresh weight per hill and oven dry weight per hill was obtained at the KNO_3 dose of 100 kg/ha (K_2), namely 65.16 g and 6.38 g, which were not significantly different from the KNO_3 dose of 150 kg/ha (K_2) namely 63.49 and 6.30 g which experienced an increase of

77.64% and 72.24% and 90.44% and 88.05% compared to the lowest tuber fresh weight per clump obtained at the dose of 50 kg KNO_3 /ha (K_1) namely 36.68 g and 3.35 g. The high fresh weight of tubers in the treatment of 100 kg/ha KNO_3 dose was supported by a significant to very significant correlation on the variable maximum plant height (r=0.988**), maximum number of leaves (r=0.941**) and gradual oven dry weight per clump (r=0.943**). Meanwhile, the high oven dry weight of tubers per clump in the treatment of 100 kg/ha KNO_3 dose was supported by a significant to very significant correlation in the number of tubers per clump (r=0.958**) and harvest index (r=0.999**) (Table 3). This is due to the element N contained in KNO_3 causing a chemical process that produces nucleic acids. It is this nucleic acid that plays a role in the cell nucleus in the process of cell division so that the formation of leaf layers can be properly formed which will then develop into shallot bulbs. Meanwhile, the high potassium content causes so many K+ ions that bind water in the plant's body that it accelerates the process of photosynthesis, so that the process becomes more optimal [24].

Table 3.

The value of the correlation coefficient between variables (r) is due to the KNO_3 dose.

	Plant height	Number of leaves	Oven dry weight of tubers per hill	Fresh weight of tubers per hill	Fresh weight of stover per clump	Oven dry weight is reduced per clump	Number of tubers per hill	Harvest index
1	1							
2	0.877*	1						
3	-0.428ns	-0.810ns	1					
4	0.988**	0.941**	-0.564ns	1				
5	0.697ns	0.266ns	0.349ns	0.577ns	1			
6	0.879*	1.000**	-0.808ns	0.943**	0.270ns	1		
7	-0.669ns	-0.944**	0.958**	-0.777ns	0.066ns	-0.943**	1	
8	-0.391ns	-0.785ns	0.999**	-0.530ns	0.388ns	-0.783ns	0.945**	1
		r (0.05, 6, 1) = 0,811			r (0.01, 6, 1) = 0,917			

Information :

1. Plant height
2. Number of leaves
3. Oven dry weight of tubers per hill
4. Fresh weight of tubers per hill
5. Fresh weight of stover per clump
6. Oven dry weight is reduced per clump
7. Number of tubers per hill
8. Harvest index

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

This is also supported by Bassiony's statement [12] that K fertilizer has an effect on increasing the oven dry weight of shallots per clump. Provision of high potassium fertilizer on shallot plants gives high results on total crop yield. These results are higher than the results of Sakdan et al. [15], namely shallots treated with 30 tons/ha of chicken manure and 200 kg/ha of KNO_3 only produced a fresh tuber weight of 51.80 g per clump. Application of N fertilizer with high doses did not provide significant results on shallot production. Shallot production increased only 32% when N fertilizer was applied, twice as high as the previous dose. In other words, applying high doses of fertilizer does

not guarantee an increase in yield [9]. The highest harvest index was obtained at the KNO_3 dose of 150 kg/ha (K_3), namely 72.72%, while the lowest harvest index was obtained at the KNO_3 dose of 50 kg/ha (K_1), namely 55.39%. The harvest index is a comparison of economic results with biological results in oven-dry conditions and then multiplied by 100%. Harvest index observations are carried out after harvest.

4. Conclusion

From this research it can be concluded:

1. The interaction between the type of organic fertilizer with the dose of KNO_3 (P×K) and the type of organic fertilizer (P) had no significant effect ($P \geq 0.05$) on all observed variables.
2. The highest tuber fresh weight per clump was obtained at the KNO_3 dose of 100 kg/ha (K_2), which was 65.16 g, which was not significantly different from the KNO_3 dose of 150 kg/ha (K_3), which was 63.49 g, an increase of 77.64 % and 72.24% compared to the lowest fresh weight of tubers per clump obtained at the KNO_3 dose of 50 kg/ha (K_1), namely 36.86 g.
3. The highest tuber oven dry weight per clump was obtained at the KNO_3 dose of 100 kg/ha (K_2), which was 6.38 g, which was not significantly different from the KNO_3 dose of 150 kg/ha (K_3), namely 6.30 g, an increase of an increase of 90.44% and 88.05% compared to the lowest tuber oven dry weight per clump obtained at the KNO_3 dose of 50 kg/ha (K_1), namely 3.35 g.

Suggestions that can be submitted are:

1. From the research results it can be suggested that KNO_3 dose of 100 kg/ha can increase the growth response and yield of shallot plants.
2. It is necessary to carry out further research with a more varied combination of organic fertilizer treatments in other places with different land conditions from the previous trial sites.

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