AGRIWAR JOURNAL
MASTER OF AGRICULTURAL SCIENCE WARMADEWA UNIVERSITY
E-ISSN: 2808-1137, **P-ISSN**: 2808-1323

Vol. 2, **No.** 2, **Dec 2022**, **Page** 49-54
DOI: https://doi.org/10.22225/aj.2.2.5940.49-54

The Effect of Compost and NPK Fertilizers on The Growth and Yield of Shallots

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Abstract
This study aims to determine the effect of compost fertilizer and NPK fertilizer on the growth and yield of Shallots. This research was conducted at the Local Waste Processing Site, Kusamba Village, Klungkung. This experiment used a randomized block design (RBD) with a factorial pattern consisting of 2 factors. The first factor was the dose of compost (T) consisting of 3 levels, namely: 5-ton ha^{-1} (T1), 10-ton ha^{-1} (T2), and 15-ton ha^{-1} (T3). The second factor is the dosage of NPK fertilizer (M) consisting of 3 levels: (M1) 150 kg/ha^{-1}, (M2) 300 kg/ha^{-1}, (M3) 450 kg/ha^{-1}. The interaction between compost treatment and NPK had a significant ($P<0.05$) to very significant ($P<0.01$) effect on all observed variables except fresh weight per clump. The highest fresh weight of tubers was obtained from the interaction between compost 5 tons ha^{-1} and NPK 150 kg ha-1 (T1M1) giving the highest fresh weight of tubers per clump, 41.44 g, significantly different or an increase of 45.13% compared to the fresh weight of tubers. The lowest per clump was the interaction of 15-ton ha^{-1} compost with NPK 450 kg ha^{-1} (T3M3), which was 31.25 g.

Keywords: *compost, NPK, inorganic fertilizer, organic fertilizer, shallots*

1. Introduction

Shallots are one of the spice vegetable commodities that have been cultivated by farmers for a long time because the prospects are very good and the economic value is quite high [1]. Shallots are also among the leading and national superior commodities that can be developed by increasing planting area, productivity, production, and quality [2]. The production of shallots in Indonesia in the last 5 years (2017 – 2021) has seen an increase which has been seen since 2017, at which time Indonesia only produced 1.47 million tons. This number continues to increase with an average increase of 8% per year. Indonesia's shallot production will reach 2 million tons in [3]. To meet the increasing demand for shallots, it is necessary to have a breakthrough in cultivation technology that can increase the production of shallots, namely through an organic technology approach. Therefore, one alternative to increase the productivity of shallots is to use organic fertilizers.

Compost is organic material that has undergone a weathering process due to interactions between microorganisms or spoilage bacteria that work in the organic material. The organic materials referred to in compost are grass, straw, remnants of twigs and branches, animal manure, fallen flowers, urine of livestock, and other organic materials. All of these organic materials will experience weathering caused by microorganisms that thrive in moist and wet environments. Some of the uses of compost are improving soil structure, strengthening the binding capacity of aggregate (nutrients) in sandy soil, increasing durability and water absorption, and improving drainage and pores in the soil. adding and activating nutrients [4]. Meanwhile, [5] showed that the compost dose of 7.5-15 tons ha^{-1} can increase plant height, fresh plant weight, and fresh plant weight of stover.

Pearl NPK fertilizer (16:16:16) is one of the inorganic fertilizers with a compound nature which has 16% macronutrients N, P, and K each [6]. This fertilizer is very good for supporting plant growth. In addition, the advantage is that the donated nutrients can meet plant nutrient needs [7]. According to research [8], using pearl NPK fertilizer can increase plant growth and accelerate growth. Based on the complete content of compost and NPK Mutiara which is needed by shallot plants, it is very important to know about the effect of giving compost and NPK on the growth and yield of shallots.

2. Materials and Methods

This research was conducted at the Local Waste Processing Site Gema Shanti Center in Karang Dadi Kusamba Village, Klungkung. The implementation time of this research starts from August – December 2021. The results of soil analysis at the research site can be seen in Table 1.

The materials used were local varieties of shallot seeds, compost, NPK Mutiara, silver black plastic mulch, organic pesticides from rounds and hoe, rapid rope, knife, machete, Bambu, scales, scissors, directions, sprayers, meters, buckets, mulch pits, plant drying ovens, stationery, and other documentation tools.

Used in this study was a randomized block factor (RBD) which was designed from 2 factors, namely: the first factor was compost dose (T) which consisted of 3 treatment levels, namely T1 = 5 tons ha^{-1}, T2 = 10 tons ha^{-1}, T3 = 15 tons ha^{-1}. While the second factor is the dose of NPK (M) which consists of 3 levels, namely M1 = 150 kg ha^{-1}, M2 = 300 kg ha^{-1}, and M3 = 450 kg ha^{-1}.

The variables observed were plant height, number of leaves, number of tubers per clump, fresh weight of tubers per clump, fresh weight of tuber per clump, oven dry weight per clump, oven dry weight per clump, and harvest index.

Table 1. Soil Analysis Results of Research Site

No	Analysis Type	Unit	Mark	Information
1	Texture			
	Sand	%	41.27	
	Dust	%	38.33	loamy sand
	Clay	%	20.41	
2	Water content			
	Air Dry	%	3.49	
	Dry Field	%	43.86	
3	pH H_2O		7.2	neutral
4	Electrical Conductivity	mmhos/cm	1.89	low
5	N-total	%	2.02	very high
6	C-organic	%	0.1	low
7	P-available	ppm	119.16	very high
8	K-available	ppm	250.34	high

Source = Laboratory of Soil Science, Faculty of Agriculture, Udayana University (2021).

The content of compost derived from the processing of Klungkung urban organic waste is shown in Table 2 below.

Table 2. Elemental Content in Compost Processed from Klungkung Urban Organic Waste.

No	**Analysis Type**	**Mark**
1	pH	7.3
2	Electrical Conductivity (mmhos/cm)	1.21
3	C organic(%)	20.63
4	N total (%)	0.62
5	P-available (ppm)	350.81
6	K-available (ppm)	426.17
7	C/ N Ratio	33.27
8	Air dry content	5.88

Source = Laboratory of Soil Science, Faculty of Agriculture, Udayana University (2021).

3. Results and Discussion

3.1. Results

The results of the statistical analysis of all observed variables in this study are presented in Figures 1-8. The results of the analysis of variance (ANOVA) on the effect of giving compost and NPK treatment (TM) on the observed variables are presented in Table 3. The interaction between compost treatment and NPK (T x M) had a significant ($P<0.05$) to very significant ($P<0.01$) effect on all observed variables except the fresh weight of stover per clump.

DOI: https://doi.org/10.22225/aj.2.2.5940.49-54

Table 3. The results of the significance of the treatment of compost (T) and NPK (M) and interactions (T x M) on the observed parameters

Variable	T	M	TM
1. Plant height (cm)	*	**	**
2. Number of leaves (sheet)	**	**	**
3. Fresh weight per clump (g)	*	*	ns
4. Fresh weight of tubers per clump (g)	**	**	**
5. Number of tubers per clump (tubers)	**	**	**
6. Oven dry weight of tubers per clump (g)	**	**	**
7. Oven dry weight per clump (g)	**	**	*
8. Harvest Index (%)	**	**	*

ns : Not significant (P ≥ 0.05), ** : Very influential (P < 0.01), * : significant effect (P < 0.05)

Table 3 shows that the interaction between compost treatment and NPK (TM) had a significant (P<0.05) to very significant (P<0.01) effect on all observed variables except the fresh weight of stover per clump. The results of the research on the effect of compost and NPK and their interactions on all observed variables are presented in Tables 4 and 5.

Table 4. Effect of compost and NPK doses on all observed variables.

Treatment	Plan height (cm)	Number of leaves (sheet)	Fresh weight of stovers per clump (g)	Fresh weight of tubers per clump (g)	Number of tubers per clump (tubers)	Oven dry weight of tubers per clump (g)	The dry weight of the oven stove (g)	Harvest index (%)
Compost (K)								
T1	35.74 a	30.44 b	54.56 b	41.44 b	7.87 a	1.49 a	3.04 a	49.12 b
T2	36.14 ab	30.31 b	48.23 a	36.22 a	8.35 a	1.62 c	3.39 b	47.54 b
T3	36.28 b	29.28 a	49.91 ab	34.87 a	9.04 b	1.58 c	3.27 c	42.56 a
LSD 5%		0.43	-	-	-	-	-	-
NPK (M)								
M1	36.53 b	30.93 c	49.30 a	38.81 b	8.91 b	1.54 a	3.31 a	48.03 a
M2	35.78 a	29.22 a	48.38 a	37.74 b	8.59 b	1.60 b	3.69 b	44.73 a
M3	35.86 a	29.89 b	55.03 b	35.98 a	7.67 a	1.54 a	3.16 a	49.36 b
LSD 5%	-	0.44	4.86	1.50	0.57	0.03	0.32	-

Note: The numbers followed by the same letter in the same factor mean that they are not significantly different in the 5% LSD test.

Table 5. Effect of Interaction between compost and NPK on all observed variables

Treatment	Plan height (cm)	Number of leaves (sheet)	Fresh weight of stovers per clump (g)	Fresh weight of tubers per clump (g)	Number of tubers per clump (tubers)	Oven dry weight of tubers per clump (g)	The dry weight of the oven stove (g)	Harvest index (%)
T1M1	35.41 a	30.55 ab	35.41 ab	32.98 a	33.79 a	32.98 a	34.06 a	33.25 a
T1M2	35.48 ab	28.75 abc	35.48 abc	32.12 ab	33.24 ab	32.12 a	33.61 ab	32.49 ab
T1M3	36.33 abc	32.03 de	36.33 de	34.18 bc	34.90 bc	34.18 b	35.14 ab	34.42 abc
T2M1	37.76 bcd	31.13 f	37.76 f	34.44 c	35.55 bcd	34.44 c	35.92 ab	34.81 abc
T2M2	35.68 cde	30.45 bcd	35.68 bcd	33.07 c	33.94 cd	33.07 c	34.23 ab	33.36 abcd
T2M3	34.99 de	29.36 a	34.99 a	32.17 d	33.11 cd	32.17 c	33.42 b	32.48 bcd
T3M1	36.42 de	31.10 e	36.42 e	33.76 de	34.64 cd	33.76 c	34.94 b	34.05 cd
T3M2	36.16 e	28.46 cde	36.16 cde	32.31 e	33.59 d	32.31 d	34.02 b	32.74 d
T3M3	36.26 f	28.29 de	36.26 de	32.27 f	33.60 e	32.27 e	34.04 c	32.71 e

Note: The numbers followed by the same letter on the same factor mean that they are not significantly different at the 5% level of the Duncan Multiple Range Test (DMRT).

Table 6. The value of the correlation coefficient between variables (r) due to the interaction effect of compost and NPK

	1	2	3	4	5	6	7	8
1	1							
2	0.38	1						
3	1.00**	0.38	1					
4	0.73	0.91*	0.73	1				
5	0.86*	0.79	0.86*	0.97**	1			
6	0.73	0.91*	0.73	1.00**	0.97**	1		
7	0.90*	0.74	0.90*	0.95**	1.00**	0.95**	1	
8	0.77	0.88*	0.77	1.00**	0.99**	1.00**	0.97**	1

r (0.05; 6; 1) = 0,811 r (0.01; 6; 1) = 0,917

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

** : Very significant (P < 0.01)

* : Significant (P < 0.05)

3.2 Discussion

The results showed that the interaction between compost 5 tons ha-1 and NPK fertilizer 150 kg ha-1 (T1M1) had the highest fresh weight of tubers per clump, 45.35 g, which was significantly different or increased by 45.13% compared to the fresh weight of tubers. The lowest per clump was 31.25 g in the interaction treatment between 15-ton ha^{-1} compost and 450 kg ha^{-1} NPK fertilizer (T3M3) (Figure 1). The high fresh weight of tubers per clump on the interaction of compost 5 tons ha^{-1} with NPK fertilizer 150 kg ha^{-1} (T1M1) was caused by the ability of compost and NPK to improve soil physical properties such as increasing soil porosity, ability to hold water and nutrients in the soil. The heavy volume of soil causes the soil to become more porous, loose, and crumbly. Such soil conditions encourage better absorption of nutrients by plant roots. No humus is formed naturally.

This is also supported by the correlation of tuber fresh weight per clump on the interaction of compost 5 tons ha^{-1} with NPK fertilizer 150 kg ha^{-1} (T1M1) showing a close relationship or giving a positive and significant correlation to the maximum number of leaves (r = 0.91*). and harvest index (r = 1.00*) (Table 6 and Figure 1).

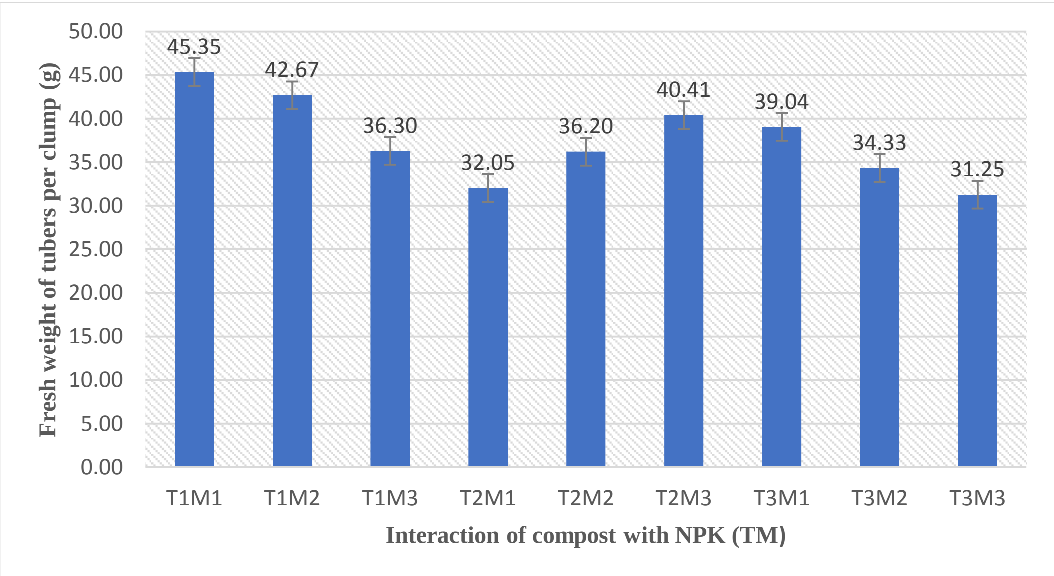

Figure 1. Fresh weight of tubers per clump on the interaction of compost with NPK

DOI: https://doi.org/10.22225/aj.2.2.5940.49-54

This is in line with the results of research [9, 10, 11, 12] that a compost dose of 10-15 tons ha^{-1} can increase plant growth and yield. Fertilizers are derived from plants and animals that have undergone an organic engineering process and contain nutrients needed by plants [13]. Organic fertilizers are needed to restore the physical properties of the soil and one type of organic fertilizer is compost.

Organic fertilizers are fertilizers that mostly or wholly consist of organic materials derived from plants and or animal wastes that have gone through an engineering process, which can be in solid or liquid form. The advantage of this organic fertilizer is that it can quickly overcome nutrient deficiencies in the soil [14].

According to Indriani [15] compost is the result of the fermentation or decomposition of organic materials such as plants, animals, or other organic waste. It can be said compost if the fermentation process has been going well, has no odor, and the physical form is like soil. Compost and humus are organic fertilizers from the results of weathering of tissues or plant materials or organic waste. Compost is formed by human intervention, while humus is formed naturally.

The function of nitrogen (N) nutrients in NPK fertilizers is to trigger overall growth, especially in stems, branches, and leaves, which play a role in the formation of leaves that are very useful for plants, form proteins, fats, and various organic materials [16, 17, 18]. Phosphorus (P) in NPK fertilizer functions for the growth of roots, seeds, and young plants, as well as raw material for the formation of assimilation and certain proteins, helping the development and maturation of seeds and fruit [19, 20]. Furthermore, potassium (K) in NPK fertilizer helps the formation of protein and carbohydrates, strengthens leaves, flowers, and fruit so that they do not fall easily, and this element is a source of strength in the face of drought and disease [21, 22, 23].

4. Conclusion

The interaction between compost dose and NPK had a significant to a very significant effect on all observed variables except the fresh weight of stover per clump. The highest fresh weight of tubers was obtained at the interaction dose of 5 tons ha^{-1} with NPK 150 kg ha^{-1}, which was 41.44 g significantly or an increase of 45.13% compared to the lowest fresh weight of tubers per clump at the interaction of compost 15 ton ha^{-1} with NPK 450 kg ha^{-1} which is 31.25 g.

Reference

[1] Firmanto, Bagus. 2011. *Praktis Bertanam Bawang Merah Secara Organik*. Bandung. Penerbit Angkasa.

[2] Taufik, M. (2012). Strategi pengembangan agribisnis sayuran di Sulawesi Selatan. *Jurnal Litbang Pertanian*, *31*(2), 43-50.

[3] Badan Pusat Statistik dan Direktorat Jenderal. 2014. *Produksi Bawang Merah Menurut Provinsi Tahun 2013-2019*, Berita Lengkap Provinsi Bali.Dewi, N. 2012.

[4] Susetya, D. 2016. *Panduan Lengkap Membuat Pupuk Organik***.** Pustaka Baru Press. Yogyakarta

[5] Situmeang, Y.P., Sudewa, K.A. Suarta, M., & Andriani, A.A.S. R. (2016). *Biochar and Compost Effect on the Growth and Yield of Sweet Corn.* Gema Agro, (16)36, 16-19

[6] Fahmi, N. 2014. *Pengaruh Pupuk Organik Dan Anorganik Terhadap Pertumbuhan Dan Hasil Kedelai (Glycine Max (L.)* Merril). J. Floratek 9: 53-62.

[7] Sinaga, R. A. R. (2019). *Pengaruh Pemberian Pupuk Kandang Sapi Dan Pupuk NPK Terhadap Pertumbuhan Dan Produksi Tanaman Kacang Tanah (Arachis Hypogaea L).*

[8] Fiolita, V., Muin, A., & Fahrizal. (2017). *Penggunaan Pupuk NPK Mutiara untuk Peningkatan Pertumbuhan Tanaman Gaharu Aquilaria spp pada Lahan Terbuka di Tanah Ultisol.* Jurnal Hutan Lestari, hlm. 850–857.

[9] Situmeang, Y. P., Adnyana, I. M., Subadiyasa, I. N., & Merit, I. N. (2015). Effect of dose biochar bamboo, compost, and phonska on the growth of maize (Zea mays L.) in Dryland. International Journal on Advanced Science, Engineering and Information Technology, 5(6), 433-439.

[10] Arthanawa, I. G. N., Astika, I. N., Darmawan, I. K., Yana, D. P. S., Situmeang, Y. P., & Sudita, I. D. N. (2022). The Effects of Organic and Inorganic Fertilizers on Red Chili Plants. *SEAS (Sustainable Environment Agricultural Science)*, *6*(1), 70-80.

[11] Seran, T. H., Srikrishnah, S., & Ahamed, M. M. Z. (2010). Effect of different levels of inorganic fertilizers and compost as a basal application on the growth and yield of onion (Allium cepa L.).

[12] Erana, F. G., Tenkegna, T. A., & Asfaw, S. L. (2019). Effect of agro-industrial wastes compost on soil health and onion yields improvements: study at field condition. *International Journal of Recycling of Organic Waste in Agriculture*, *8*(1), 161-171.

DOI: https://doi.org/10.22225/aj.2.2.5940.49-54

[13] Parnata, A. S. (2010). *Meningkatkan Hasil Panen dengan Pupuk Organik*. Agromedia Pustaka. Jakarta.

[14] Samad, S. 2008. *Manfaat dan kelebihan pupuk organik cair terhadap pertumbuhan dan produksi bawang merah (alium ascalanicum L.),* buletin penelitian. Lembaga Penelitian Universitas Hasanuddin.

[15] Indriani, Y.H. (2008). *Membuat Kompos Secara Kilat.* Penebar Swadaya. Jakarta.

[16] Osman, K. T. (2013). Plant nutrients and soil fertility management. In *Soils* (pp. 129-159). Springer, Dordrecht.

[17] Saragih, D. P. P., Ma'as, A., & Notohadisuwarno, S. (2019). Various Soil Types, Organic Fertilizers and Doses with Growth and Yields of Stevia rebaudiana Bertoni M. *Ilmu Pertanian (Agricultural Sci*, *3*(1), 57.

[18] Lupi, C., Morin, H., Deslauriers, A., Rossi, S., & Houle, D. (2013). Role of soil nitrogen for the conifers of the boreal forest: a critical review. *International Journal of Plant & Soil Science*, *2*(2), 155-189.

[19] Ernita, M. N., & Irawan, S. A. (2017). Green beans plant response (vigna radiata l) on liquid organic fertilizer (lof) NASA and NPK compound fertilizer. Proceeding *ICoSET*, *8*, 238.

[20] Roy, R. N., Finck, A., Blair, G. J., & Tandon, H. L. S. (2006). Plant nutrition for food security. *A guide for integrated nutrient management. FAO Fertilizer and Plant Nutrition Bulletin*, *16*, 368.

[21] Roy, R. N., Finck, A., Blair, G. J., & Tandon, H. L. S. (2006). Plant nutrition for food security. *A guide for integrated nutrient management. FAO Fertilizer and Plant Nutrition Bulletin*, *16*, 368.

[22] El Gayar, A. A study on: Nutrients in Sustainable Cropping Systems.

[23] Lingga, P. (2001). *Petunjuk penggunaan pupuk*. Niaga Swadaya.