Jurnal Pertanian Tropik ISSN NO: 2356- 4725/p- ISSN : 2655-7576
Vol.10.No.2.2023 (1):1-7 DOI: 10.32734/jpt.v10i2, Agustus.9830

Efficiency of Nitrogen Fertilization in Shallots *(Allium ascalonicum,.L)* with the Addition of Cow Manure

Efisiensi Pemupukan Nitrogen Pada Tanaman Bawang Merah (*Allium ascalonicum,*.L) dengan Penambahan Pupuk Kandang Sapi

Muhammad Juwanda
Fakultas Sains dan Teknologi, Universitas Muhadi Setiabudi,
*Corresponding author : muhammad.juwanda@gmail.com

ABSTRACT

This research was accomplished to establish the influence of nitrogen fertilizer and cow manure on the growth, yield, and efficiency of shallot plants growth. This study was accomplished in the rice fields of Brebes, Brebes Regency. This study is a factorial experiment using a randomized block design (RAK) with two factors. The first factor is the application of nitrogen fertilizer 2/3 N (ZA) + 1/3 N (Urea) which consists of 4 levels, there are 0 N kg/ha (N0); 100 N kg/ha (N_1); 200 N kg/ha (N_2) and 300 N kg/ha (N_3). The second factor is the application of organic material cow manure with 4 levels there are 0 t/ha (K_0); 10 t/ha (K_1); 20 t/ha (K_2) and 30 t/ha (K_3). There were 16 treatments, each action was repeated three times. Plant height, number of leaves, leaf area (g), number of tillers per plant, number of tubers per plant, fresh plant weight per clump (g), tuber weight per clump (g), dry tuber weight per clump (g), dry weight plants per clump (g), tuber volume per clump (mL), N uptake (g), fertilization efficiency N (%). Observational data were analyzed with the F test to establish diversity and if there were significant difference it was continued with Ducan's test with an error rate of 5%. The findings exposed that the administration of nitrogen dose of 200 kg N/ha increased growth and the yield of shallots was the best compared to other treatments. The best efficiency of N fertilization in the application of nitrogen fertilizer 100 kg N/ha.
Keywords: shallot, nitrogen, dose, efficiency, fertilizer

ABSTRAK

Penelitian ini dilaksanakan untuk mengungkapkan pengaruh pemberian pupuk nitrogen dan kandang sapi terhadap pertumbuhan, hasil, dan efisiensi pertumbuhan tanaman bawang merah. Penelitian ini diselenggarakan di lahan sawah Brebes, Kabupaten Brebes. Penelitian ini mempergunakan rancangan acak kelompok (RAK) dengan dua faktor. Pertama faktor pemberian pupuk nitrogen 2/3 N (ZA) + 1/3 N (Urea) yang meliputi 4 taraf yakni 0 N kg/ha (N_0); 100 N kg/ha (N_1); 200 N kg/ha (N_2) dan 300 N kg/ha (N_3). Faktor ke dua ialah pemberian bahan organik pupuk kandang sapi dengan 4 taraf yakni 0 t/ha (K_0); 10 t/ha (K_1); 20 t/ha (K_2) dan 30 t/ha (K_3). Terdapat 16 perlakuan setiap perlakuan diulangi sebanyak tiga kali. tinggi tanaman, jumlah daun, luas daun (g), jumlah anakan per tanaman, jumlah umbi per tanaman, bobot segar tanaman per rumpun (g), bobot umbi per rumpun (g), bobot umbi kering per rumpun (g), bobot kering tanaman per rumpun (g), volume umbi per rumpun (mL), serapan N (g), efisiensi pemupukan N (%). Data hasil pengamatan dianalisa dengan uji F untuk mengetahui keseragamannya dan bilamana ada perbedaan nyata diteruskan dengan Uji Duncan dengan tingkat kesalahan 5%. Pada penelitian diperoleh hasil bahwasanya pemberian dosis nitrogen 200 kg N/ha mampu meningkatkan pertumbuhan dan hasil tanaman bawang merah yang terbaik dibanding dengan perlakuan yang lain. Efisiensi pemupukan N yang terbaik pada pemberian pupuk nitrogen 100 kg N/ha.

Kata kunci : bawang merah, nitrogen, dosis, efisiensi, pupuk

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v10i2, Agustus.9830

PENDAHULUAN

Shallots (*Allium ascalonicum*, L) are one of the leading vegetable products of great importance to the community both in terms of economic value and high nutritional content. Almost all household dishes use shallots as a complementary seasoning. The increasing population in Brebes Regency causes the need for shallots to increase, but the available land is getting narrower because many paddy fields have been converted into factories. Efforts to increase production output need to be carried out to meet increasing consumption needs (Permana et al., 2021).

The productivity of shallots in Brebes Regency has decreased from 2013 to 2020 by 12.23 t/ha to 7.79 t/ha (BPS Kabupaten Brebes, 2021). The research results by Juwanda et al (2020) presented that the content of N-total and organic matter (C-organic) was low in the shallot plantations in Brebes. This can be the cause of the decreased productivity of shallots in Brebes. Consequently, efforts should be made to increase the production of shallots by means fertilization. Fertilization is done by adding nitrogen fertilizer (Urea and ZA) and organic fertilizer in the form of cow manure on shallot plants.

Fertilization aims to meet the amount of nutrient needs that are not suitable in the soil, so that production increases. Fertilization efficiency must be carried out, because excess or inappropriate application of fertilizer can adversely affect plants and the environment and is a waste which means increasing inputs. Fertilization must follow the six principles, namely: the right amount, type, method, place, time, and adapted to the nature/type of soil (Lihiang and Lumingkewas, 2020).

Cow manure is organic fertilizer derived from fermented cow manure. The aplication of cow manure should increase the organic matter in the soil. The main purpose of using organic fertilizers is to improve the physical, biological and chemical qualities of the soil so that soil productivity becomes optimum. The use of chemical fertilizers alone is only able to provide one or more nutrients for plants (Indriyati, 2018). Nitrogen (N) is a nutrient that is needed by shallot plants, especially in the vegetative growth phase, which will increase the amount of chlorophyll in the leaves so that the leaf area increases. Lack of N nutrients can cause chlorosis in leaves, leaf tissue becomes dead and dry and plant growth becomes stunted (Triadiawarman, 2022). The application of cow manure and nitrogen fertilizers is supposed to increase the efficiency of nitrogen absorption so that maximum shallot yields are obtained. According to Supadma et al (2020), combined application of inorganic chemical fertilizers and organic fertilizers can encourage the growth and yield of shallots. This study goals to establish the influence of giving doses of nitrogen fertilizer and cow manure on growth, yield, and efficiency of N uptake in shallot plants.

MATERIALS AND METHODS

The research was carried out on Vertisol soil at an altitude of 50 meters above sea level in Brebes Village, Brebes Regency, Central Java. This study is a factorial experiment applying a randomized block design (RAK). The first factor is the application of nitrogen fertilizer 2/3 N (ZA) + 1/3 N (Urea) which consists of 4 levels, namely 0 kg N/ha (N_0); 100 kg N/ha (N_1); 200 kg N/ha (N_2) and 300 kg N/ha (N_3). The second factor is the application of cow manure organic matter with 4 levels, there are 0 t/ha (K_0); 10 t/ha (K_1); 20 t/ha (K_2) and 30 t/ha (K_3). There were 16 treatments, each treatment was repeated three times. Tools and materials include: hoe, ruler, electric oven, digital scale, paper, shallot seeds of Bima Brebes variety, urea fertilizer, pesticides, ZA, SP36, KCl. The observed variables are number of leaves, plant height, leaf area (g), number of tillers per plant, number of bulbs per plant, fresh weight of plants per clumps (g), tuber weight per clump (g), dry weight of plants per clump (g), dry tuber weight per clump (g), tuber volume per clump (mL), N uptake (g), fertilizer efficiency N (%).

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v10i2, Agustus.9830

The formula for the efficiency of N fertilization (Siregar and Marzuki, 2011):

$$En = \frac{Sn}{NT+Npo+Npb} x100\%$$

Keterangan : En = N . Fertilization Efficiency (%); Sn = N absorption of shallot (kg N/ha); NT = N available in soil (kg/ha); Npo = N available in organic fertilizer (kg/ha); Npb = N is available in artificial fertilizers.

Observational data were analyzed by F test to conclude diversity and if there was a significant differences it was continued by Duncan's test with an error rate of 5%.

RESULTS AND DISCUSSION

The findings of data analysis presented that the application of nitrogen fertilization had an affect on all observed variables but the dose of cow manure did not influence all observed variables on growth and yield. The influence of nitrogen dose on growth and yield of shallots was independent of the dose of cow manure given (Tables 1, 2 and 3).

Table 1. The average value of plant height, leaf area, number of leaves, number of tillers and number of tubers with nitrogen fertilizer treatment and cow manure dose.

Treatment	Growth Observation Variable				
	Plant height (cm)	Number of leaves	Leaf area (cm^2)	Number of tillers	Number of tubers
Nitrogen Fertilizer					
0 kg/ha (N_0)	25,11 d	12,86 c	28,55 d	4,63 c	4,29 c
100 kg/ha (N_1)	33,72 c	19,37 b	50,14 c	5,59 b	5,01 b
200 kg/ha (N_2)	38,41 a	26,37 a	65,89 a	7,10 a	6,94 a
300 kg/ha (N_3)	36,57 b	24,89 a	61,22 b	6,83 a	6,63 a
cow manure					
0 ton/ha (K_0)	33,15	21,52	50,68	5,88	5,56
10 ton/ha (K_1)	33,59	21,76	51,23	6,05	5,81
20 ton/ha (K_2)	33,86	20,26	52,02	6,27	5,90
30 ton/ha (K_3)	33,21	19,96	51,87	5,94	5,60
CV	5,69%	13,12%	7,04%	9,61%	9,47%

Note: The numbers in the same column and row followed by the same letter are not significantly different at the 5% level based on the DMRT test

The findings revealed that shallot plants with application of nitrogen fertilizer 200 kg N/ha were able to increase plant growth, but the subsequent dose of fertilizer to 300 kg N/ha increased shallot plant growth not as well as plants fertilized with 200 kg N/ha (Table 1). Shallots that were given nitrogen fertilizer at 200 N kg/ha showed an increase in crop yields, but the addition of the next dose to 300 kg N/ha intensified the yield of shallots not as well as plants fed with fertilizers at 200 kg N/ha. The best or highest N uptake was accomplished with nitrogen fertilizer application of 200 N kg/ha, but not significantly different from the uptake of N in plants fertilized at doses of 300 kg N/ha (Tables 2 and 3).

The findings revealed that the application of cow manure does not effect the

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v10i2, Agustus.9830

growth of shallots plants, because manure had not been able to show its benefits in one planting period (Table 1). The benefits of manure will be seen more or less after two planting periods. Giving organic fertilizer at one planting period will not affect plant growth (Agussalim, 2016). According to Indriyati (2018), the application of organic fertilizer to vegetable crops has no effect on plant growth.

Table 2. The average value of plant fresh weight per clump, plant dry weight per clump, tuber fresh weight per clump, tuber dry weight per clump, and tuber volume per clump with nitrogen fertilizer treatment and dose of cowshed.

Treatment	Result observation variable					
	Plant fresh weight per clump (g)	plant dry weight per clump (g)	tuber fresh weight per clump (g)	tuber dry weight per clump (g)	tuber volume per clump (ml)	
Nitrogen Fertilizer						
0 kg/ha (N_0)	13,59 c	6,67 c	10,24 c	6,05 c	10,54 c	
100 kg/ha (N_1)	27,13 b	15,04 b	20,5 b	13,87 b	20,75 b	
200 kg/ha (N_2)	38,21 a	21,29 a	26,05 a	19,54 a	26,37 a	
300 kg/ha (N_3)	36,75 a	19,02 ab	23,2 ab	17,26 ab	23,33 ab	
cow manure						
0 ton/ha (K_0)	27,78	14,15	19,01	12,79	18,79	
10 ton/ha (K_1)	29,62	15,38	20,55	14,12	21,33	
20 ton/ha (K_2)	31,02	16,91	20,98	15,29	20,92	
30 ton/ha (K_3)	27,27	15,59	19,45	14,52	19,96	
CV	25,45%	36,24%	29,17%	39,13%	29,15%	

Note: The numbers in the same column and row followed by the same letter are not significantly different at the 5% level based on the DMRT test

The application of nitrogen fertilizers up to a dose of 200 N kg/ha could growth the number of leaves, plant height, and leaf area to a maximum of 38.41 cm; 26.37 leaves and 65.89 cm2 but the addition of the next dose to 300 kg N/ha shallot plant growth is not as good as the additional dose of 200 kg N/ha for plant height to 36.57 cm, and leaf area of 61.22 cm2 (Table 1). This happened because the addition of nitrogen fertilizer to 200 kg N/ha had reached the optimum limit for nitrogen fertilization, the plants had fulfilled the need for nitrogen but if it was added again to 300 kg N/ha, the excessive application had an impact on plant growth inhibition.

Excessive nitrogen elements will produce mushy/weak plants, acidify the reaction of the soil as a result of the application of ZA $(NH_4)_2SO_4$ fertilizer (3/4 of the amount of N fertilizer given) and harm plants, because it will bind other nutrients so that it will be difficult to absorb by plants. plant. Nitrogen is a primary macro element which is the main component of various compounds in the plant body. Growing plant must contain nitrogen to form new cells. Photosynthesis produces O2 and carbohydrates, but this process cannot take place to produce nucleic acids and proteins if nitrogen is not obtainable (Firmansyah et al., 2017).

The lowest yields for plant height, leaf area, and number of leaves were obtained on shallot plants without nitrogen fertilizer, which was an average of 25.11 cm; 12.86 leaves and 28.55 cm2. Shallot plants without nitrogen fertilizer generally experience symptoms of nitrogen deficiency such as stunted growth,

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v10i2, Agustus.9830

yellowing of the leaves, and the addition of relatively few tillers (Table 2).

The application of nitrogen fertilizer affected the number of tubers and the number of tillers (Table 2). The addition of a dose of nitrogen fertilizer up to 200 kg N/ha increased the number of tillers of shallot plants to an average of 7.10 tillers, but the addition of the next dose to 300 kg N/ha encouraged the number of tillers not to be significantly different from giving 200 kg N/ha. Without nitrogen fertilizer the number of tillers produced was 4.63 on average. The number of tillers is closely related to the number of tubers. The use of nitrogen fertilizer up to 200 N kg/ha increased the number of bulbs of shallot plants to an average of 6.94 bulbs but was not significantly different from that of shallot plants that were fertilized up to 300 kg N/ha. The lowest number of tubers was obtained in plants that were not given nitrogen fertilizer, which was an average of 4.29 bulbs (Table 2).

The analysis results revealed that the fresh weight of plants, dry weight of plants per clump, fresh weight of tubers per clump, dry weight of tubers per clump, and volume of tubers per clump at the highest growth phase were obtained at 200 N kg/ha fertilization, which were 38.21 respectively. g; 21.29 g; 26.05 g; 19.54 g; and 26.37 ml, but not significantly different from plants fertilized at a dose of 300 N kg/ha. The lowest yields were obtained on shallot plants without nitrogen fertilizer, each with an average of 13.59 g; 6.67 g; 10.24 g; 6.05 g and 10.54 ml (Table 3).

Plant dry weight describes the amount of plant dry matter. Dry matter is a form of photosynthate accumulations in plants which is supported by the amount of nutrients that are absorbed so that an increase in the amount of photosynthate will increase plant dry matter. The function of N during the growth phase is to assist in the formation of photosynthate which will then be used to form new cells, cell extension so that the growth of plant vegetative organs will run optimally. In addition, N also affects leaf area. The increase in leaf area of plants has a close relationship with the role of N, which is one of the elements forming chlorophyll. The increased content of leaf chlorophyll content will increase the rate of plant photosynthesis which will further increase the formation of photosynthate (Murni and Purnamayani, 2019).

Lack of nitrogen fertilizer in shallot plants in the treatment without nitrogen fertilizer caused less nitrate to be absorbed by plants so that less nitrate would be reduced to ammonium which caused low nitrate reductase activity. The ammonium produced will be used for metabolic processes in plant growth. A small amount of nitrogen causes plant growth to be not optimal so that the dry weight produced by plants will be low.

The highest nitrogen uptake was obtained in shallot plants with nitrogen fertilizer application of 200 kg N/ha, which was an average of 0.164 g/plant, but the uptake was not different with the addition of nitrogen dose to 300 kg N/ha. The lowest nitrogen uptake was obtained in shallot plants without nitrogen fertilizer, which was an average of 0.049 g/plant (Table 3).

The efficiency of nitrogen fertilization is closely related to the uptake of nitrogen by plants, as well as the amount of fertilizer applied. The best or highest efficiency of nitrogen fertilization in this study was obtained on shallots with nitrogen fertilizer application of 100 kg N/ha, but not significantly different wtih fertilization of 200 kg N/ha and without application of nitrogen fertilizer with an average absorption of 44.73 %; 38.8% and 39.21%, while the lowest was obtained in shallots with nitrogen fertilizer application of 300 kg N/ha, which was an average of 28.79%. This is because the onion plants with nitrogen fertilizer application of 300 kg N/ha, a lot of fertilizer is lost including due to leaching and evaporation (volatilization) in the form of ammonia gas so that fertilization is less effective and inefficient (Table 3).

ISSN NO: 2356- 4725/p- ISSN : 2655-7576
DOI: 10.32734/jpt.v10i2, Agustus.9830

Table 3. The average value of N uptake, and the N . fertilization efficiency with nitrogen fertilizer treatment and cow manure dose.

Treatment	Fertilization	
	N uptake (g/plant)	N . fertilization efficiency (%)
Nitrogen Fertilizer		
0 kg/ha (N_{0})	0,049 c	39,21 a
100 kg/ha (N_{1})	0,123 b	44,73 a
200 kg/ha (N_{2})	0,164 a	38,8 a
300 kg/ha (N_{3})	0,165 a	28,79 b
Cow manure		
0 ton/ha (K_{0})	0,121	39,56
10 ton/ha (K_{1})	0,127	38,66
20 ton/ha (K_{2})	0,125	37,19
30 ton/ha (K_{3})	0,128	36,11
CV	16,88%	20,69%

Note: The numbers in the same column and row followed by the same letter are not significantly different at the 5% level based on the DMRT test

CONCLUSION

Applying nitrogen fertilizer can increase the growth and yield of shallot plants. The best vegetative and generative growth will determine the best crop yields as obtained with a nitrogen application of 200 kg N/ha. Application of nitrogen fertilizers up to 300 kg N/ha did not increase yields as well as appliying nitrogen fertilizers up to 200 kg N/ha.

REFERENCES

Agussalim. 2016. Efektivitas Pupuk Organik Terhadap Produktivitas Tanaman Kakao Di Sulawesi Tenggara. *Jurnal Pengkajian dan Pengembangan Teknologi Pertanian*. 19 (2) : 167 – 176.

Badan Pusat Statistik Kabupaten Brebes. 2021. *Produktivitas Bawang Merah di Kabupaten Brebes*. Publikasi Statistik Indonesia.

Firmansyah, I., M. Saykir., dan L. Lukman. 2017. Pengaruh Kombinasi Dosis Pupuk N, P, dan K Terhadap Pertumbuhan dan Hasil Tanaman Terung (*Solanum melongena* L.) . *J.Hort*. 27 (1) : 69 – 78.

Indriyati, L.T. 2018. Efektivitas Pupuk Organik dan Anorganik pada Pertumbuhan dan Hasil Brokoli (Brassica oleracea var. italica). *Jurnal Ilmu Pertanian Indonesia.* 23 (3) : 196 – 202.

Juwanda, M., Sakhidin, Saparso, and Kharisun. 2020. Soil Properties and Sulfur-Oxidizing Bacterial Diversity in Response to different Planting Patterns of Shallot (Allium ascalonicum). *Biodiversitas.* 21 (6) : 2832 – 2839.

Lihiang, A dan S. Lumingkewas. 2020. Efisiensi Waktu Pemberian Pupuk Nitrogen terhadap Pertumbuhan dan Produksi Jagung Lokal Kuning. *Jurnal Sainsmat*. IX (2) : 144 – 158.

Murni, W.S dan R. Purnamayani. 2019. Upaya Efisiensi dan Peningkatan Ketersediaan Nitrogen dalam Tanah pada Tanaman Bawang Merah (*Allium ascalonicum* L) melalui Pemberian Mikoriza Arbuskular. Prosiding Seminar Nasional Lahan Suboptimal, "Smart Farming yang Berwawasan Lingkungan untuk Kesejahteraan Petani". Balai Pengkajian Teknologi Pertanian, Jambi.

Permana, D.F.W., A.H. Mustofa., L. Nuryani., P.S. Kristiaputra dan Y. Alamudin. 2021. Budidaya Bawang Merah di Kabupaten Brebes. Jurnal Bina Desa. 3 (2) : 125 – 132.

Siregar, A dan Marzuki, I. 2011. Efisiensi Pemupukan Urea Terhadap Serapan N Dan Peningkatan Produksi Padi Sawah (*Oryza Sativa*. L.). Jurnal Budidaya Pertanian. 7 (2) : 107 – 112.

Supadma,A.A.N., I.M. Dana., dan I.D.M. Arthagama. 2020. Peningkatan Hasil Bawang Merah dan Perubahan Sifat Kimia Tanah dengan Pemupukan Berimbang Semi Organik pada Tanah Inceptisol. *Agrotrop.* 10 (1) : 67 – 76.

Triadiawarman, D., D. Aryanto dan J. Krisbiantoro. 2022. Peran Unsur Hara Makro Terhadap Pertumbuhan Dan Hasil Bawang Merah (*Allium Cepa* L.). *Jurnal Agrifor.* 21 (1) : 27 – 32.