talenta PUBLISHER

InJAR
Indonesian Journal of Agricultural Research
Journal homepage: https://injar.usu.ac.id

Optimizing shallot plant growth and plant nutrient through site-specific fertilizer dose evaluation

Jogy Hendro Pratama Solagracya*, Hamidah Hanum, and Sarifuddin
Magister of Agrotechnolgy, Faculty of Agriculture, Universitas Sumatera Utara, Indonesia
*Corresponding author: jogihendro068@gmail.com

ARTICLE INFO

Article history:
Received 02-07-2024
Revised 25-10-2024
Accepted 12-11-2024
Available online 28-03-2025

E-ISSN: 2615-5842
P-ISSN: 2622-7681

How to cite:
J. H. P. Solagracya, H. Hanum, and Sarifuddin, "Optimizing shallot plant growth and plant nutrient through site-specific fertilizer dose evaluation", *Indonesian J. Agric. Res*, vol. 8, no. 1, pp. 32–39, Mar. 2025.

http://doi.org/10.32734/injar.v8i1.17133

ABSTRACT

Shallots are a prominent horticultural commodity significantly influencing national inflation. In the West Aceh region, production of shallot was reduced cause of land degradation (low nutrient availability) that can be achieved by optimizing the application of N, P, K fertilizers and manure. This study aims to identify the optimal doses of fertilizers for shallot production, was conducted from July to September 2023 in Langung Village, West Aceh Regency, Aceh Province, using a Factorial Randomized Block Design. The first factor was the dosage levels of N, P, and K fertilizers (50%, 100%, 150%, and 200% of the Ministry of Agriculture's recommended doses: 150 kg/ha Urea, 150 kg/ha ZA, 185 kg/ha SP-36, and 100 kg/ha KCL), and the second factor was manure application rates (0 ton/ha, 15 ton/ha, and 30 ton/ha), with three replications. The results indicated that the optimal doses of N, P, K, and manure fertilizers for shallot production were found in the P3K2 treatment: 225 kg/ha Urea, 225 kg/ha ZA, 277.5 kg/ha SP-36, 150 kg/ha KCl, and 30 tons/ha manure with plant height at 8 Week after planting (WAP) 32.52 cm, bulb diameters 22.51mm, nutrient content of nitrogen 22.51, nutrient content of phosporus 0.21 and nutrient content of kalium 1.42.

Keywords: fertilizer optimization, land degradation, nutrient management, shallot production

1. Introduction

The prospects for the development of shallots in Indonesia are ranked first among ASEAN countries, with an increase in harvested area growth of 3.70% in 2010-2014 compared to the previous year. However, the Central Statistics Agency [1] recorded that shallot production in Aceh Province in 2021 decreased from 2020, reaching 10,136.00 tons. The amount of production is influenced by various factors such as land area, seeds, fertilizers, pesticides, irrigation systems, labor, climate, and others.

Meureubo District, West Aceh, has a total area of 112.87 km², with a total shallot harvest area of 2 hectares. Initial soil analysis data indicate that this area has conditions of low C-organic (1.67%) and total P (11.43 mg/100 g); very low total N (0.09%) and P-Bray I (5.23 ppm); medium K-dd (0.29 me/100 g) and total K (20.55 me/100 g); acidic pH (5.25) and sandy loam texture [2].

Appropriate fertilizer dosage is intended to meet the different needs of plants. Therefore, determining the right dosage and fertilization techniques is crucial. Although shallot cultivation has been conducted in West Aceh, the production results have been unsatisfactory [3]. According to the West Aceh Regency Agriculture and Horticulture Office, shallot production in West Aceh from 2019 to 2021 stagnated at 3 tons/ha. Hence, research on shallot plants is expected to help increase production in the region, where West Aceh Regency, particularly Meureubo District, has a potential horticultural planting area of 10 hectares [4].

Previous research shows that the response to N, P, and K fertilization on site-specific sandy soils did not significantly differ in plant height and bulb number, but tended to be higher compared to without fertilization [5]. K fertilization can increase plant height and bulb number, with a dose of 220 kg/ha-1 KCl being better than the control [6]. Additionally, the optimal fertilization dose based on the minus one test and response test for sandy soils is 220 kg/ha-1 KCl with N (Urea 150 kg/ha-1, ZA 250 kg/ha-1) and P (SP36 150 kg/ha-1) according to recommendations. This can be adapted to Langung Village, Meureubo District, which has sandy loam soil texture [7].

The use of manure improves the physical properties of the soil, enhancing infiltration, aeration, and percolation [8]. This condition increases oxygen supply for respiration and root growth due to better gas exchange, thereby supporting shallot growth and development. According to [9], organic matter can maintain water availability, nutrients, and increase microorganism activity, which can increase the bulb weight of shallot plants.

Research on shallot crop development efforts in Aceh province, especially West Aceh district, needs to be done to reduce the dependence of West Aceh people on shallots from other regions. The research includes the recommended doses of N, P and K fertilization on Shallot through the recommendations given by the Ministry of Agriculture so as to provide optimal production specific to the location of tsunami affected areas. This study aims to determine the evaluation of location-specific N, P and K fertilizer doses of shallots of Brebes variety in Langung village, Meureubo sub-district, West Aceh district.

2. Materials and Methods

2.1. Research sites

The research was conducted in Langung Village (with coordinates 4.1402094, 96.1606526), Meureubo Sub-district, West Aceh Regency, at an altitude of approximately 8 meters above sea level, from August to November 2023. The planting material used was shallot bulbs (*Allium ascalonicum* L.) of the Brebes variety. This study employed a Randomized Block Design (RBD) with two factors.

a. P1: 75 kg/ha Urea + 75 kg/ha ZA + 92.5 kg/ha SP-36 + 50 kg/ha KCl
b. P2: 150 kg/ha Urea + 150 kg/ha ZA + 185 kg/ha SP-36 + 100 kg/ha KCl
c. P3: 225 kg/ha Urea + 225 kg/ha ZA + 277.5 kg/ha SP-36 + 150 kg/ha KCl
d. P4: 300 kg/ha Urea + 300 kg/ha ZA + 370 kg/ha SP-36 + 200 kg/ha KCl

Factor 2 (K) was the dosage of manure with three levels:
a. K0: Without manure
b. K1: Application of 15 tons/ha of manure
c. K2: Application of 30 tons/ha of manure

2.2. Research implementation

The research was conducted in two phases: (1) the cultivation of shallots (*Allium ascalonicum* L.) with the application of four levels of N, P, K fertilizers (50%, 100%, 150%, and 200% of the recommended dosage) to establish fertilization recommendations, and (2) the collection of observational data and data analysis using SPSS Software.

2.2.1. Preparation

The preparation activities included soil processing and the application of manure. Soil processing began with clearing the area of weeds and debris, followed by soil loosening and the creation of blocks and experimental plots. This process resulted in a total of 36 experimental plots in the field. Each plot measured 120 cm x 120 cm, with a planting distance for shallots set at 20 cm x 20 cm, and each plot accommodated a total population of 25 plants.

2.2.2. Fertilization

Fertilization was carried out based on the application rates of N, P, and K, which were applied at four different levels corresponding to the experimental treatments. The basal P fertilizer, in the form of SP-36, was applied once, specifically one week before planting, by broadcasting and mixing it with the soil. The subsequent applications of N and K fertilizers were conducted twice, at 15 and 30 days after planting (DAP), with each application using half of the predetermined dose [10].

Indonesian Journal of Agricultural Research Vol. 08, No. 01 (2025) 32 – 39

2.2.3. Mulching

Mulching was performed after the formation of beds. Covering the beds with mulch in shallot cultivation is crucial, as this soil cover material can reduce soil temperature fluctuations, erosion rates, and inhibit weed growth, thereby contributing to the improvement of growth, development, and yield of shallots [11].

2.2.4. Plant maintenance

Plant maintenance activities included supplementary planting and pest and disease control. Supplementary planting was conducted until the shallots were less than two weeks old, replacing damaged or rotten seedlings with those of *the* same age from planting until 7 DAP. Pest control was done manually by removing and discarding pests found on the plants. Disease control was carried out by spraying fungicides, specifically Antracol 70 WP, in response to field conditions, such as symptoms of wilting and yellowing leaves caused by plant diseases. Irrigation was performed to ensure the plants did not suffer from water deficiency, avoiding excessive wetness. During rainy periods, irrigation was not necessary. From the initial growth stage until 7 DAP, irrigation was done daily; subsequently, until five days before harvest, it was performed every two days. Weeding was conducted manually based on weed presence in the field, simultaneously loosening the soil, typically before fertilization.

2.2.5. Observed Variables

The observational parameters in this study included growth characteristics such as plant height and bulb diameter, and nutrient content of the plants, specifically N, P, and K content.

2.3. Data analysis

Data analysis was conducted to determine the effect of treatments on the observed parameters. The observational data, such as plant height and stem diameter, were analyzed using analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) at a 5% significance level. The nutrient content of N, P, and K was not subjected to ANOVA analysis.

3. Results and Discussion

3.1. Plant height of shallots at 2, 4, 6, and 8 weeks after planting (WAP) under the application of NPK fertilizers and organic manure

The application of N, P, and K fertilizers and manure significantly affected plant height variables (Table 1). The application of manure at 15 and 30 tons/ha significantly increased plant height at 2 weeks after planting (WAP), although plant height with 15 tons/ha of buffalo manure did not differ significantly from the treatment without manure application. At 4 WAP, the application of manure at 15 and 30 tons/ha significantly increased plant height, but again, the plant height with 15 tons/ha of manure did not significantly differ from the treatment without manure application. The interaction of 50% recommended N, P, and K fertilizer application without manure resulted in the shortest plants, which only differed significantly from the treatment of 50% recommended N, P, K fertilizer with 30 tons/ha of manure, and 150% recommended N, P, and K fertilizer with 15 and 30 tons/ha of manure. The tallest plants were produced by the interaction of 50% recommended N, P, and K fertilizer with 30 tons/ha of manure, which differed significantly from all other interaction treatments. The table shows that plant height at 6 WAP significantly increased due to the application of 15 and 30 tons/ha of manure. Between K1 and K2, both were significantly different. The application of 15 tons/ha of manure did not result in a difference in plant height among treatments P1, P2, P3, and P4. However, with the application of 30 tons/ha of manure, there was a difference in plant height among the fertilization treatments, where P3 was significantly the highest among the two other treatments, and a decrease was observed in P4. At 8 WAP, the table shows that plant height significantly increased due to the application of 15 and 30 tons/ha of buffalo manure. Between K1 and K2, both were significantly different. The application of 15 tons/ha of manure did not result in a difference in plant height among treatments P1, P2, P3, and P4. However, with the application of 30 tons/ha of manure, there was a difference in plant height among the fertilization treatments as [12] said in her research, where P3 was significantly the highest among the two other treatments, and a decrease was observed in P4.

Indonesian Journal of Agricultural Research Vol. 08, No. 01 (2025) 32 – 39

Table 1. Plant height of shallots at 2, 4, 6, and 8 weeks after planting (WAP) under the application of NPK fertilizers and organic manure

Growth Stage	Fertilizers (N, P, and K)	Manure			Mean
		K0 No manure	K1 1 unit of manure	K2 2 units of manure	
		……..cm.……..			
2 (WAP)	P1	15.33	16.97	22.40	18.24
	P2	18.08	18.82	20.50	19.13
	P3	18.89	20.03	21.02	19.98
	P4	16.69	19.22	19.60	18.50
	Mean	17.25 b	18.76 b	20.88 a	
4 (WAP)	P1	22.86 c	27.72 bc	35.56 a	28.71
	P2	25.50 bc	25.33 bc	27.33 bc	26.06
	P3	26.36 bc	28.78 b	28.72 b	27.95
	P4	23.03 c	27.37 bc	26.50 bc	25.63
	Mean	24.44 b	27.30 a	29.53 a	
6 (WAP)	P1	25.75	32.08	37.50	31.78 a
	P2	27.06	33.53	34.72	31.77 a
	P3	33.39	33.58	38.44	35.14 a
	P4	24.31	28.33	30.72	27.79 b
	Mean	27.63 c	31.88 b	35.35 a	
8 (WAP)	P1	25.42	32.33	35.84	31.20 a
	P2	26.25	32.69	33.20	30.71 ab
	P3	28.87	33.65	35.06	32.52 a
	P4	26.65	26.58	31.47	28.26 b
	Mean	26.80 c	31.31 b	33.89 a	

Note: The numbers followed by different letters within the same row and column group indicate significant differences based on Duncan's Multiple Range Test at the 5% level

3.2 Mean diameter of shallot bulbs under application of N, P, and K fertilizers and organic manure

Based on the observational data and variance analysis results (Table 2), it is evident that bulb diameter significantly increased due to the application of 15 and 30 tons/Ha of buffalo manure fertilizer; however, there was no significant difference between treatments K1 and K2. Table 2 1 0 shows that without the application of manure fertilizer and with 15 tons/ha of manure fertilizer, there was no difference in bulb diameter among treatments P1, P2, P3, and P4. However, with 30 tons/Ha of manure fertilizer, there was a significant difference in production among fertilization treatments, with P3 showing the highest significant difference compared to other treatments, and P4 exhibiting a decrease in bulb diameter. The use of manure fertilizer is highly beneficial for improving the physical, chemical, and biological properties of soil, enhancing soil microorganism activity, and being environmentally friendly. Organic fertilizers from manure and rice straw improve soil quality by reducing soil bulk density by approximately 15.4–17.5%, and potassium absorption ranges from 0.07 to 0.28 grams of K per plant. Increasing the doses of N, P, and K fertilizers significantly increased N content in shallot bulbs (Table 2). The same was announced in [13] stated that the highest N content in bulbs was achieved with 200% application of recommended N, P, and K fertilizers, significantly differing from other treatments.

Indonesian Journal of Agricultural Research Vol. 08, No. 01 (2025) 32 – 39

Table 2. Mean diameter of shallot bulbs under application of N, P, and K fertilizers and organic manure

Fertilizers (N, P, and K)	Manure			Mean
	K0 No manure	K1 1 unit of manure	K2 2 units of manure	
	……..……mm……..…….			
P1	16.16	19.10	18.54	17.93
P2	15.78	19.04	18.66	17.83
P3	16.46	19.43	22.51	19.47
P4	16.77	18.67	18.55	17.99
Mean	16.28 b	19.06 a	19.56 a	

Note: The numbers followed by different letters within the same row and column group indicate significant differences based on Duncan's Multiple Range Test at the 5% level

3.3. Nitrogen nutrient analysis of shallots under various doses of N, P, and K fertilizers and organic manure

Based on the observation data and the results of variance analysis in Table 3, it shows that increasing the dose of N, P, and K increases the N nutrients in shallot bulbs significantly. The highest N nutrients were produced in the application of N, P, and K fertilizers at 200% of the recommendation and were significantly different from other treatments.

Table 3. Nitrogen nutrient analysis of shallots under various doses of N, P, and K fertilizers and organic manure

Fertilizers (N, P, and K)	Manure			Mean
	K0 No manure	K1 1 unit of manure	K2 2 units of manure	
	……..……%……..…….			
P1	1.61 (R)	1.56 (R)	1.65 (R)	1.61 b (R)
P2	1.70 (R)	1.90 (R)	1.78 (R)	1.79 b (R)
P3	1.67 (R)	1.95 (R)	1.80 (R)	1.81 b (R)
P4	2.06 (C)	1.98 (R)	2.64 (C)	2.23 a (C)
Mean	1.76 (R)	1.85 (R)	1.97 (R)	

Note: In each group, different letters following the numbers indicate significant differences based on Duncan's Multiple Range Test at the 5% level of significance; (R): Low; (C): Moderate

The increased growth and production of shallots due to nitrogen application are associated with the role of nitrogen in enhancing plant growth rates, promoting protein synthesis, and facilitating chlorophyll formation, resulting in greener leaf coloration. This aligns with [14] findings that nitrogen addition to the soil increases the presence of ammonium and nitrate ions in the soil solution, which plants absorb through root interception, diffusion, or mass flow processes. During the vegetative phase, plants actively absorb nitrogen in the forms of NO3- and NH4+. The increased nitrogen nutrient concentration in shallots is accompanied by enhanced plant height.

3.4 Phosphorus nutrient analysis of shallots at various doses of N, P, and K fertilizers and manure

The results of the analysis of variance in Table 4 show that increasing the dose of N, P, and K does not significantly increase the P nutrients in shallot bulbs. The highest P nutrients were produced in the application of N, P, K fertilizers at 200% of the recommendations and were not significantly different from the other treatments.

Indonesian Journal of Agricultural Research Vol. 08, No. 01 (2025) 32 – 39

Table 4. Phosphorus nutrient analysis of shallots at various doses of N, P, and K fertilizers and manure

Fertilizers (N, P, and K)	Manure			Mean
	K0 No manure	K1 1 unit of manure	K2 2 units of manure	
	…..……..……%…..……..……			
P1	0.19 (D)	0.16 (D)	0.20 (R)	0.18 (D)
P2	0.17 (D)	0.19 (D)	0.23 (R)	0.19 (D)
P3	0.20 (R)	0.18 (D)	0.21 (R)	0.19 (D)
P4	0.22 (R)	0.20 (R)	0.21 (R)	0.21 (R)
Mean	0.19 (D)	0.18 (D)	0.21 (R)	

Note: In each group, different letters following the numbers indicate significant differences based on Duncan's Multiple Range Test at the 5% level of significance; (R): Low; (C): Moderate

The nutrient content of phosphorus (P), as indicated by the analysis of variance (Table 4), showed that increasing doses of N, P, and K fertilizers did not significantly enhance phosphorus content in shallot bulbs. The highest phosphorus content in bulbs was achieved with the application of N, P, and K fertilizer at 200% of the recommended dose, which did not differ significantly from other treatments. Phosphorus concentration positively influenced plant biomass, and organic fertilizers facilitated phosphorus concentration by enhancing the availability of phosphorus from natural mineral rocks and organic matter decomposition. This finding aligns with [15] who reported that increased dry weight of plants indicates a positive relationship with phosphorus availability due to the application of organic materials (cow manure), which in turn enhances phosphorus concentration and plant nutrient uptake.

3.5 Potassium nutrient analysis of shallots under fertilization with N, P, and K fertilizers and organic manure

Based on the results of variance analysis in Table 5, it shows that increasing the dose of N, P, and K increases the K nutrient in shallot bulbs significantly. The highest K nutrients were produced in the application of N, P, and K fertilizers at 200% of the recommendation and were significantly different from other treatments.

Table 5. Potassium nutrient analysis of shallots under fertilization with N, P, and K fertilizers and organic manure

Fertilizers (N, P, and K)	Manure			Mean
	K0 No manure	K1 1 unit of manure	K2 2 units of manure	
	……..……%……..……			
P1	0.92 (C)	1.07 (B)	1.29 (B)	1.09 (B)
P2	1.15 (B)	1.36 (B)	1.48 (B)	1.33 (B)
P3	1.20 (B)	1.13 (B)	1.42 (B)	1.25 (B)
P4	1.22 (B)	1.34 (B)	1.71 (B)	1.42 (B)
Mean	1.13 b (B)	1.23 ab (B)	1.48 a (B)	

Note: Significant differences among treatments were identified by Duncan's Multiple Range Test at the 5% level of significance. Different letters following numbers within the same row and column indicate statistically significant differences. (C): Control; (B): Excess

The nutrient content of K, based on the analysis of variance (Table 5), indicates that increasing doses of N, P, and K significantly enhance K content in shallot bulbs. The highest K nutrient content in bulbs was achieved with the application of N, P, and K fertilizers at 200% of the recommended dosage, which significantly differed from other treatments. Soil nutrient concentrations of K increased K^+ concentrations in leaves, influencing stomatal opening, CO_2 fixation, and photosynthesis processes. The resulting photosynthate is crucial for plant energy production required in growth and meristematic cell division, contributing to increased organ weight and size. These findings align with [8], which demonstrated that potassium fertilizer

and organic materials from empty oil palm bunches significantly increase plant height and fresh weight, as potassium enhances enzyme activity in photosynthesis and respiration reactions, positively affecting shallot plant height increase and ATP synthesis in photosynthesis reactions.

4. Conclusion

The optimal doses of N, P, K, and manure fertilizers for shallot production in Langung Village, Meureubo District, West Aceh Regency, Aceh, were found in the P3K2 treatment: 225 kg/ha Urea, 225 kg/ha ZA, 277.5 kg/ha SP-36, 150 kg/ha KCl, and 30 tons/ha manure with plant height at 8 Week after planting (WAP) 32.52 cm, bulb diameters 22.51 mm, nutrient content of nitrogen 22.51, nutrient content of phosporus 0.21 and nutrient content of kalium 1.42. The combined application of NPK fertilizers and organic manure significantly increased plant height by 6 MST at manure doses of 15 and 30 tons/Ha. Among treatments, the combination of NPK fertilizer at 150% of the recommended dosage and 30 tons/ha of organic manure yielded the highest bulb diameter, significantly differing from other treatments. The application of N, P, and K fertilizers at 200% of the recommended dosage and 30 tons/ha of organic manure resulted in the highest nutrient content of N and K in plants compared to other treatments. To get high shallot production, it is better to use a dose of 30 tons/ha of manure and inorganic fertilizers in the form of Za = 130 Kg/Ha, SP36 = 220 Kg/Ha and KCL = 115 Kg/ha. It is necessary to conduct further research on the residual effects of manure and inorganic fertilizers on the availability of P in the soil.

References

[1] BPS Provinsi Aceh, "Provinsi Aceh Dalam Angka 2021," 2021.

[2] B. P. S. BPS, "Provinsi Aceh Dalam Angka 2021," *BPS Provinsi Aceh*, vol. 1, no. 1, pp. 1–687, 2021.

[3] N. Setyowati, I. A. Nugraha AR, W. Widodo, and Z. Muktamar, "Vermicompost Application on Shallot (Allium cepa, L.)," *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands*, vol. 12, no. 1, pp. 102–110, 2023, doi: 10.36706/jlso.12.1.2023.621.

[4] Kementerian Pertanian, *Peraturan Menteri Pertanian Nomor 40/Permentan/OT.140/4/2007 tentang Rekomendasi Pemupukan N, P, dan K pada Padi Sawah Spesifik Lokasi*. Indoesia, 2017, pp. 1–34.

[5] E. Hawayanti, J. T. Ibrahim, A. Sutanto, and M. Muchsiri, "Impact of suboptimal land on shallot plant growth : mini review," vol. 1, no. April, pp. 17–28, 2024.

[6] I. A. Candra, L. Lisdayani, and E. Samah, "Response of Growth and Production of Shallot (Allium ascalonicum L.) to Liquid Fertilizer and Cattle Manure," *Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering)*, vol. 12, no. 2, p. 268, 2023, doi: 10.23960/jtep-l.v12i2.268-276.

[7] R. Razali, Z. Nasution, R. Rahmawaty, and C. Hanum, "Effect of Soil Texture on the Productivity of Two Shallot Varieties," *Indonesian Journal of Agricultural Research*, vol. 06, no. 01, pp. 43–50, 2023, doi: 10.32734/injar.v6i01.8217.

[8] R. Kumalasari, E. Hanuddin, and M. Nurudin, "Increasing Growth and Yield of Shallot Using Nano Zeolite and Nano Crab Shell Encapsulated NK Fertilizer in Entisols and Inceptisols," *PLANTA TROPIKA: Jurnal Agrosains (Journal of Agro Science)*, vol. 10, no. 2, pp. 140–151, 2022, doi: 10.18196/pt.v10i2.12945.

[9] S.- Sutriana, T. Edy Sabli, S. Vaulina, and U. Muthmainnah Ulya, "Optimizing the Growth and Production of Shallots (Allium ascalonicum L) by applying Liquid Organic Fertilizer from Kampar River Fish Waste on Ultisol Soil," *Jurnal Agronomi Tanaman Tropika (Juatika)*, vol. 5, no. 2, 2023, doi: 10.36378/juatika.v5i2.2849.

[10] Widod, J. Rawibowo, and Marlin, "Aplikasi pupuk kandang dan biourine sapi terhadap pertumbuhan dan hasil bawang merah (Allium ascalonicum L.)," in *Seminar Nasional Pertanian Pesisir*, Jurusan Budidaya Pertanian Fakultas Pertanian Universitas Bengkulu, 2022, pp. 16–26.

[11] G. A. Sopha and A. M. Efendi, "Effect of different types of mulch on bulb yield of shallot," *E3S Web of Conferences*, vol. 306, pp. 3–9, 2021, doi: 10.1051/e3sconf/202130605004.

[12] N. Rahmawati and I. Ladewa, "Analysis of Shallot Growth and Production With Organic Fertilizer and Zeolite in Beach Sand Media," *Jurnal Penelitian Agronomi*, vol. 25, no. 1, pp. 13–18, 2023.

[13] N. Sumarni, R. Rosliani, and R. S. Basuki, "Respons Pertumbuhan, Hasil Umbi, dan Serapan Hara NPK Tanaman Bawang Merah terhadap Berbagai Dosis Pemupukan NPK pada Tanah Alluvial," *Jurnal Hortikultura*, vol. 22, no. 4, p. 366, 2016, doi: 10.21082/jhort.v22n4.2012.p366-375.

[14] T. K. Manik, P. B. Timotiwu, and Mua'ddin, "Shallot growth and yield supported by irrigation and nitrogen application in utilizing dry land area in Mesuji, Lampung Province, Indonesia," *Sains Tanah*, vol. 20, no. 1, pp. 100–113, 2023, doi: 10.20961/stjssa.v20i1.70711.

[15] Y. Hasanah, L. Mawarni, F. R. Wirawan, and I. Kurniawan, “The content of nitrogen, phosphorus and potassium of shallot (Allium ascalonicum L.) varieties with different method of cultivation and altitude,” *IOP Conference Series: Earth and Environmental Science*, vol. 1241, no. 1, 2023, doi: 10.1088/1755-1315/1241/1/012034.