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Effect of Watering Frequency and Organic Fertilizer on The Growth and Yield of Ground Nut

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Abstract
Groundnut (*Arachis hypogaea*) is one of the commodities with high economic value; however, weather anomalies can affect plant water availability, which in turn impacts groundnut production and productivity. If water availability is not balanced with proper fertilizer application, plant growth may be inhibited. This study aims to determine the role of watering frequency and organic fertilizer on the development and yield of groundnut. The research was conducted at the Laboratory of the Faculty of Agriculture, Sebelas Maret University, located in Sukosari Village, Jumantono District, Karanganyar Regency, over a period of four months from December 2024 to March 2025. The method used was a factorial Randomized Complete Block Design (RCBD), consisting of two factors and three replications. The first factor was watering frequency (once a day, once every two days, once every three days, and once every four days). The second factor is the organic fertilizer dosage (0, 10, 20, and 30 tons ha-1). Data were analyzed using Analysis of Variance (ANOVA) at a 95% significance level, followed by Duncan's Multiple Range Test (DMRT) at a 95% significance level. Regression analysis was performed to determine the recommended dosage, and correlation analysis was used to identify relationships between observed variables. The result showed that watering once every three days resulted in the best 100-seed weight. Watering once a day resulted in the best dry biomass weight. Organic fertilizer dose of 20 t.ha^{-1} produced the best plant height, leaf area, leaf area index, number of pods, fresh pod weight, dry pod weight, number of seeds, and seed weight. Organic fertilizer dose of 30 t.ha $^{-1}$ produced the best number of leaves at 5 Weeks After Planting (WAP), number of nodes at 5 WAP, and flowering age. Interaction between watering once a day and an organic fertilizer dose of 20 t ha-1 produced the best dry biomass weight.

Keywords: Alfisol; biomass; Leguminosae; nutrient uptake; slow release.

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Introduction

Groundnut (*Arachis hypogaea*) is one of the commodities with high economic value. In addition to its high nutritional content, the financial prospects of Groundnut are also considered very promising, as they can be processed into various products that add economic value in the food industry. This, in turn, can drive an increase in farmers' income across different regions (1). The Indonesian population widely consumes groundnuts, and thus, the demand for groundnuts continues to rise each year in line with population growth. However, this increasing demand is not supported by a corresponding increase in production (2). Several factors, including climate change and insufficient nutrient availability, can cause the decline in Groundnut production.

Water availability can be affected by weather anomalies, which may lead to either water scarcity or excess, thereby influencing the production and productivity of groundnut. Water stress can hinder the opening of leaf stomata, which in turn affects the plant's physiological processes and ultimately its yield (3). One of the factors contributing to the decline in peanut production is insufficient water availability during the growth process, which significantly impacts peanut yield (4).

Water is the main component of active tissues, cell growth, and the maintenance of cell turgor (5). If water availability is not balanced with the proper application of fertilizers, plant growth will be inhibited (6). Water and fertilizer are two essential and interrelated factors that significantly influence plant growth. Water acts as the solvent, while fertilizer serves as the solute. Water functions to dissolve and transport the nutrients contained in fertilizers, whereas fertilizers provide the essential nutrients plants need for growth, development, and production.

Fertilization is a common alternative to support efforts in increasing peanut yield, especially in nutrient-deficient soils (7). Organic fertilizer has advantages because it not only improves soil fertility but also enhances the physical, chemical, and biological properties of the soil (8). The fertilizer used in this study is cow manure. Compared to other types of manure, cow manure contains a higher fiber content, which helps loosen the soil, improves its texture, facilitates plant growth, and provides both macro- and micronutrients. This study aims to determine the appropriate watering frequency and organic fertilizer dosage for the development and yield of groundnut.

Materials and Methods

This study was conducted on Alfisol soil at the Faculty of Agriculture Laboratory, Sebelas Maret University (UNS), located in Sukosari Village, Jumantono Sub-district, Karanganyar Regency, for a duration of four months, from December 2024 to March 2025. The research site is situated at the coordinates 7º37’829”

and 110º56’901” E. The initial soil analysis was conducted at the Agricultural Instrument Standardization Center (BSIP) in Yogyakarta. Data collection and measurement of results were conducted at the Laboratory of Ecology and Plant Production Management, Faculty of Agriculture, UNS. Tissue analysis was performed at the Laboratory of Soil Chemistry and Fertility, Faculty of Agriculture, UNS..

The materials used in this study were groundnut seeds of the Kancil variety and cow manure fertilizer. The tools employed included 35 × 35 cm polybags, an oven, and an analytical balance. The experimental design used was a factorial Randomized Complete Block Design (RCBD) with two factors and three replications. The first factor was watering frequency (once every 1, 2, 3, and 4 days). The second factor was the application of organic fertilizer dosages (0, 10, 20, and 30 tons·ha^{-1}). The observed variables included plant height, number of leaves, number of nodes, flowering age, leaf area, leaf area index, fresh shoot weight, dry shoot weight, number of pods, fresh pod weight, dry pod weight, number of seeds, seed weight, weight of 100 seeds, as well as tissue analysis and NPK uptake of plants. Data were analyzed using Analysis of Variance (ANOVA) at a 95% confidence level, followed by Duncan’s Multiple Range Test (DMRT) at a 95% confidence level. Regression analysis was employed to determine the recommended fertilizer dosage, and correlation analysis was conducted to investigate the relationships among the observed variables.

Results and Discussion

General Research Conditions

Optimal environmental conditions can enhance the growth rate and yield of groundnut. The environmental factors that need to be considered include air temperature, humidity, and light intensity. The average temperature at the research site was 30.9°C, with a maximum of 36.4°C and a minimum of 27.1 °C. The air humidity at the site was 68%, with the highest recorded humidity at 83% and the lowest at 59%. The average light intensity at the research site was approximately 11,660 lux, with the lowest recorded intensity at 4,960 lux and the highest at 22,440 lux.

Based on the initial soil analysis, the soil used had a pH of 6.85, which is classified as neutral. The organic C content was 0.14%, categorized as low. The total N content was 0.70%, which is considered high. The available K content of the soil was 157 ppm, also classified as high. The P_2O_5 content was six ppm, which falls into the low category. The C/N ratio of the soil was 2, which is considered very low. Alfisol soil is a type of soil with low fertility, making it less suitable to support agricultural activities (9). An effort to improve the nutrient content of the soil is the application of cow manure, which contains 1.24% N, 1.41% P_2O_5, 1.56% K_2O, 21.21% organic C, a C/N ratio of 17.03%, and a pH of 6.56.

Table 1. Plant height, number of leaves, number of nodes, and flowering age of Groundnut under different watering frequencies and organic fertilizer dosages

Treatment	Plant Height (cm)	Number of Leaves (leaves)	Number of Nodes (units)	Flowering Age (DAS)
Watering Frequency (days interval)				
1	37,85±4,17	19,41±3,95	15,66±3,16	33,35±4,35
2	38,50±2,37	21,04±3,56	16,62±2,09	33,35±4,35
3	37,51±3,51	20,79±2,95	16,70±2,42	33,83±2,72
4	36,70±2,36	20,08±2,87	16,54±2,80	32,66±3,45
Organic Fertilizer Dosage (ton·ha^{-1})				
0	34,24±2,76	17,33±2,71	13,95±2,08	35,58±3,60
10	37,97±2,74	20,87±3,16	16,75±2,64	32,66±3,66
20	39,19±2,59	21,45±3,17	16,87±1,72	33,25±3,17
30	39,17±1,75	21,66±2,50	17,95±2,24	31,50±3,45
Interaction	-	-	-	-
Significance				
Watering Frequency	1,37	0,77	0,53	0,26
Organic Fertilizer Dosage	13,34	5,86	6,55	3,44
Interaction	1,75	0,38	0,46	1,06
Coefficient of Variation (%)	5,89	14,27	14,10	9,64

Notes: DAS = Days After Sowing; (–) indicates no interaction.

Plant Height

Based on the results of variance analysis (Table 1), watering frequency had no significant effect on plant height, and there was no interaction between watering frequency and organic fertilizer application. The organic fertilizer dosage had a significant impact on groundnut yield at 5 weeks after planting (WAP). Duncan's multiple range test showed that the application of 20 tons·ha^{-1} of organic fertilizer resulted in a significantly greater plant height at 5 WAP compared to 0 tons·ha^{-1}. (10) stated that plants absorb the availability of soil nutrients and play a vital role in supporting different stages of plant growth and development.

Number of Leaves

Based on the results of variance analysis (Table 1), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of various organic fertilizer dosages had a highly significant impact on the number of peanut leaves at 5 weeks after planting (WAP). Duncan's multiple range test showed that the application of 30 tons·ha^{-1} of organic fertilizer resulted in a significantly higher number of leaves at 5 WAP compared to 0 tons·ha^{-1}. (11) stated that leaves require nitrogen (N), which plays an essential role in chlorophyll formation.

Number of Nodes

Based on the results of variance analysis (Table 1), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of organic fertilizer dosages had a highly significant impact on the number of groundnut nodes at 5 weeks after planting (WAP). Duncan's multiple range test showed that the application of 30 tons·ha^{-1} of organic fertilizer resulted in a significantly higher number of nodes at 5 WAP compared to 0 tons·ha^{-1}. Organic fertilizer contains both macro- and micronutrients. According to (12), macro- and micronutrients can increase plant height and the number of nodes.

Flowering Age

Based on the results of variance analysis (Table 1), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of various organic fertilizer dosages had a substantial impact on the flowering age of groundnut. Duncan's multiple range test showed that the application of 30 tons·ha^{-1} of organic fertilizer significantly affected the flowering age compared to 0 tons·ha^{-1}. According to (13), flowering age can be influenced by the sufficient availability of nutrients such as nitrogen, phosphorus, and potassium.

Table 2. Leaf area, leaf area index, fresh shoot weight, and dry shoot weight of Groundnut under different watering frequencies and organic fertilizer dosages

Treatment	Leaf Area (cm^2)	Leaf Area Index	Fresh Biomass Weight (g)	Dry Biomass Weight (g)
Watering Frequency (days interval)				
1	40,28±6,22	1,38±0,37	50,46±11,78	11,61±2,04
2	45,97±4,43	1,56±0,39	41,85±9,79	9,67±1,61
3	39,19±6,13	1,44±0,26	37,32±6,79	8,45±2,05
4	40,86±4,45	1,46±0,28	41,14±5,96	10,26±1,47
Organic Fertilizer Dosage ($ton \cdot ha^{-1}$)				
0	40,43±3,44	1,11±0,16	40,21±7,65	10,01±1,97
10	41,19±3,80	1,52±0,28	42,12±10,58	10,43±1,68
20	42,95±5,31	1,63±0,33	44,29±12,26	10,56±2,25
30	46,33±5,98	1,58±0,24	44,15±9,17	10,45±1,91
Interaction	-	-	-	+
Significance				
Watering Frequency	0,55	1,04	5,80	3,44
Organic Fertilizer Dosage	4,65	10,15	0,70	0,27
Interaction	0,42	0,24	1,73	2,53
Coefficient of Variation (%)	10,65	17,48	18,70	15,62

Notes: (+) indicates interaction; (–) indicates no interaction.

Leaf Area

Based on the results of variance analysis (Table 2), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of various organic fertilizer dosages had a highly significant impact on the leaf area of groundnut. Duncan's multiple range test showed that the application of 20 $tons \cdot ha^{-1}$ of organic fertilizer resulted in a significantly larger leaf area compared to the application of 0 $tons \cdot ha^{-1}$. This indicates that the application of organic fertilizer increases the leaf area of groundnuts. According to (14), nitrogen (N) plays a vital role in enhancing plant growth and yield, as well as producing wider and greener leaves.

Leaf Area Index

Based on the results of variance analysis (Table 2), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of various organic fertilizer dosages had a highly significant impact on the leaf area index of groundnut. Duncan's multiple range test showed that the application of 20 $tons \cdot ha^{-1}$ of organic fertilizer resulted in a significantly higher leaf area index compared to the application of 0 $tons \cdot ha^{-1}$. Organic fertilizer contains NPK, which is essential for leaf growth. According to (15), nutrient availability influences the leaf area index as it affects leaf expansion.

Dry Shoot Weight

Based on the results of variance analysis (Table 2), organic fertilizer application had no significant effect, whereas watering frequency had a significant impact on the dry shoot weight of groundnuts. The results of Duncan's multiple range test showed that different watering frequencies had a substantial effect on dry shoot weight, with watering once a day being significantly different from the other watering frequencies. According to (16), the high daytime temperatures and low humidity in the greenhouse can increase the transpiration rate. Daily watering can reduce transpiration by fulfilling water requirements, thereby enhancing photosynthesis and influencing plant dry weight. (16) further stated that higher dry shoot weight indicates better plant growth and development.

Based on the results of the variance analysis (Table 2), there was an interaction between watering frequency and organic fertilizer dosage on the dry shoot weight of groundnut. Both water and nutrients are essential for photosynthesis and physiological processes. According to (17), plant dry weight can increase as a result of physiological processes during growth. If one of these factors is insufficient, plant growth will be inhibited. (18) also explained that sufficient water availability helps plant roots absorb nutrients more effectively.

Table 3. Number of pods, fresh pod weight, and dry pod weight of Groundnut under different watering frequencies and organic fertilizer dosages

Treatment	Number of Pods (units)	Fresh Pod Weight (g)	Dry Pod Weight (g)
Watering Frequency (days interval)			
1	9,58±3,29	11,7±4,26	9,65±3,25
2	9,25±2,09	11,05±2,82	10,01±2,45
3	9,08±3,78	12,21±5,82	11,39±4,85
4	9,75±2,45	11,49±3,32	10,03±2,59
Organic Fertilizer Dosage (ton·ha^{-1})			
0	8,08±1,83	9,59±3,04	8,50±1,93
10	9,25±2,49	12,13±3,39	10,59±2,02
20	11,25±4,03	13,775±5,66	12,35±5,30
30	9,08±2,07	10,95±2,95	9,64±2,03
Interaction	-	-	-
Significance			
Watering Frequency	0,17	0,24	0,78
Organic Fertilizer Dosage	3,30	3,17	3,52
Interaction	1,09	1,38	0,98
Coefficient of Variation (%)	26,88	29,76	29,21

Notes: (–) indicates no interaction.

Number of Pods

Based on the results of variance analysis (Table 3), watering frequency had no significant effect, and no interaction was found between watering frequency and organic fertilizer application. However, the application of different organic fertilizer dosages had a substantial impact on the number of peanut pods. The results of Duncan's multiple range test showed that the application of organic fertilizer at a dosage of 20 tons·ha^{-1} had a significantly different effect compared to the dosage of 0 tons·ha^{-1}. This finding is supported by (19), who stated that nitrogen (N) plays a role in the vegetative growth of plants, phosphorus (P) contributes to flower and fruit formation, and potassium (K) plays a role in improving fruit quality in plants.

Fresh Pod Weight

Based on the results of variance analysis (Table 3), watering frequency had no significant effect, and no interaction was observed between watering frequency and organic fertilizer application. However, the application of different organic fertilizer dosages had a significant impact on fresh pod weight. The result of Duncan's multiple range test indicated that the application of organic fertilizer at a dosage of 20 was significantly different from the dosage of 0 tons·ha^{-1}. According to (20), the availability of nutrients influences pod formation. Adequate nutrient availability supports the photosynthesis process, and the assimilates produced are translocated to the pods, thereby increasing the fresh weight of groundnut pods.

Dry Pod Weight

Based on the results of variance analysis (Table 3), watering frequency had no significant effect, and no interaction was found between watering frequency and organic fertilizer application. However, the application of different organic fertilizer dosages significantly affected the dry pod weight of groundnut. The results of Duncan's multiple range test showed that the application of organic fertilizer at a dosage of 20 tons·ha^{-1} (39.19 g) was significantly different from the dosage of 0 tons·ha^{-1}. According to Siahaan and (21), the absence of nutrient application can inhibit seed formation and result in lower pod weight. (22) stated that nutrient availability can improve the quality and yield of crops. Similarly, (23) explained that nutrient availability is closely related to pod formation and filling.

Table 4. Number of seeds, seed weight, and weight of 100 seeds of Groundnut under different watering frequencies and organic fertilizer dosages

Treatment	Number of Seeds (units)	Seed Weight (g)	Weight of 100 Seeds (g)
Watering Frequency (days interval)			
1	18,00±6,11	7,66±2,92	42,64±11,28ab
2	17,00±3,64	6,76±1,55	39,80±4,94b
3	17,66±7,22	8,175±3,53	46,04±8,05a
4	17,91±3,92	7,00±2,23	37,32±6,46b
Organic Fertilizer Dosage (ton·ha^{-1})			
0	15,66±3,47b	6,02±1,72b	37,08±7,84
10	17,91±3,96ab	7,53±1,45ab	43,09±8,13
20	21,00±7,69a	8,88±4,03a	40,5±6,52
30	16,00±3,49b	7,175±1,95ab	45,14±9,73
Interaction	-	-	-
Significance			
Watering Frequency	0,11	0,86	3,04
Organic Fertilizer Dosage	3,34	2,93	2,62
Interaction	1,30	1,08	1,26
Coefficient of Variation (%)	26,28	32,20	17,97

Notes: (–) indicates no interaction.Number of Seeds

Based on the results of variance analysis (Table 4), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of different organic fertilizer dosages had a substantial impact on the seed weight of groundnut. Duncan's multiple range test showed that the application of 20 tons·ha^{-1} of organic fertilizer resulted in a significantly higher number of seeds compared to 0 tons·ha^{-1}. According to (24), organic fertilizer improves soil structure, making it easier for peanut pods to form, which provides a suitable environment for seed development. (25) reported that nitrogen (N) is required in larger amounts during seed filling, and a deficiency in N reduces seed development. (26) stated that nutrient deficiencies can hinder overall plant growth and development.

Seed Weight

Based on the results of variance analysis (Table 4), watering frequency had no significant effect, and there was no interaction between watering frequency and organic fertilizer application. The application of different organic fertilizer dosages had a substantial impact on peanut seed weight. Duncan's multiple range test showed that the application of 20 tons·ha^{-1} of organic fertilizer resulted in a significantly higher seed weight compared to 0 tons·ha^{-1}. According to (27), nitrogen (N) plays a role in increasing peanut yield. (28) reported that the availability of N and K can promote weight gain. Nitrogen absorbed by the plant serves as an essential building material for leaves and seeds, thereby increasing dry seed weight. (29) stated that phosphorus (P) is essential for seed formation; a deficiency can cause empty pods and shriveled seeds. The application of 20 tons·ha^{-1} produced the best seed weight, as excessive organic fertilizer can reduce plant productivity. (30) noted that over-fertilization may lead to plant wilting.

Weight of 100 Seeds

Based on the results of variance analysis (Table 4), organic fertilizer application had no significant effect, and no interaction was observed between watering frequency and organic fertilizer application. However, watering frequency had a significant impact on the weight of 100 peanut seeds. Duncan's multiple range test showed that watering every 3 days resulted in a significantly higher weight of 100 seeds compared to watering frequencies at other intervals. This indicates that a moderate watering frequency, neither too frequent nor too infrequent, can increase the weight of 100 peanut seeds. According to (31), plants require water, but excessive or insufficient watering can cause stress, negatively affecting growth and yield. (32) reported that water deficiency reduces the weight of 100 seeds, as seeds may not fully develop and are smaller than usual.

Plant Tissue NPK

The results of tissue analysis for nitrogen (N) showed the highest N content in plants treated with 20 tons·ha^{-1} of organic fertilizer. According to (33), nitrogen can be lost from the soil through three pathways:

leaching via drainage, volatilization, and plant uptake. The tissue analysis for phosphorus (P) revealed the highest P content in plants treated with 30 tons ha^{-1} of organic fertilizer. (34) reported that P is absorbed more by plants during the generative phase than during the vegetative phase. The tissue analysis for potassium (K) revealed the highest K content in plants treated with 10 tons ha^{-1} of organic fertilizer. According to (35), potassium is not absorbed extensively by plants due to its high mobility in the soil.

Plant NPK Uptake

The results of nutrient uptake analysis showed that nitrogen (N) uptake was highest in plants treated with 20 tons·ha^{-1} of organic fertilizer and lowest in plants treated with 0 tons·ha^{-1}. According to (36), nitrogen in the soil is highly mobile, which can lead to significant losses and reduce plant uptake of nitrogen. Phosphorus (P) uptake was highest in plants treated with
30 tons·ha^{-1} of organic fertilizer and lowest at 0 tons·ha^{-1}. (37) reported that plant P uptake can be influenced by N uptake, as absorbed nitrogen stimulates root growth, enabling more effective P absorption from the soil. (38) emphasized that phosphorus cannot be substituted by other nutrients, making adequate P uptake crucial for plant growth. Potassium (K) uptake was highest in plants treated with 10 tons·ha^{-1} of organic fertilizer and lowest at 0 tons·ha^{-1}. (39) stated that increased soil K availability improves root development and plant biomass, thereby enhancing K uptake by plants.

Correlation Analysis

The correlation coefficient is a numerical value that describes the strength and direction of the relationship between two variables. Generally, it ranges from -1 to +1. A correlation value of 0 indicates no linear relationship between the two variables. Based on the correlation analysis, peanut plant height showed a powerful relationship with leaf area (r = 0.852) and leaf area index (r = 0.847). This suggests that taller plants tend to have larger leaf areas and higher leaf area indices. The number of peanut leaves had a robust correlation with the number of nodes (r = 0.892) and leaf area index (r = 0.947), indicating that an increase in leaf number is associated with more nodes and a higher leaf area index. (40) stated that the number of leaves is directly proportional to plant height, so taller plants develop more stem nodes, which results in more leaves. The number of peanut pods showed a robust correlation with fresh pod weight (r = 0.908), dry pod weight (r = 0.857), number of seeds (r = 0.941), and seed weight (r = 0.831). This suggests that more pods are associated with higher fresh and dry pod weights, a greater number of seeds, and heavier seed weights. An increase in pod number generally leads to higher fresh and dry pod weights. (41) reported that larger pod size and shape influence higher yield weight. Additionally, a higher number of pods is usually accompanied by an increase in seed number. According to (42), the number of pods affects pod weight because the number of pods influences the total weight. (43) noted that seed weight is affected by seed size, which is determined during pod filling.

Conclusion

Watering every 4 days resulted in the highest fresh shoot weight, watering every 3 days produced the best weight of 100 seeds, and watering every day resulted in the highest dry shoot weight. An organic fertilizer dosage of 20 tons·ha^{-1} produced the best results for plant height, leaf area, leaf area index, number of pods, fresh pod weight, dry pod weight, number of seeds, and seed weight. An organic fertilizer dosage of 30 tons·ha^{-1} resulted in the highest number of leaves at 5 weeks after planting (WAP), number of nodes at 5 WAP, and optimal flowering age. The interaction between daily watering and an organic fertilizer dosage of 20 tons·ha^{-1} produced the highest dry shoot weight.

References

[1] Irfan S, Aliyah M, Nurdin D. Uji efektivitas berbagai dosis dan interval waktu pemberian poc lamun terhadap pertumbuhan dan produksi tanaman kacang tanah (Arachis hypogea L.). J Agroterpedia. 2022;1(2):182-189.

[2] Viqqih AJ, Qibtiyah M, Istiqomah. Penerapan macam pemberian pupuk dan dosis pupuk majemuk dalam pertumbuhan dan produksi kacang tanah (Arachis hypogaea L.). Agroradix. 2022;5(2):49-56.

[3] Yodhia Y, Rahmawati R, Lubis RM. Pengaruh cekaman air terhadap pertumbuhan dan hasil tanaman kedelai (Glycine max L.) pada tanah ultisol. Agriland: J Ilmu Pertanian. 2020;8(2):165-175.

[4] Hasanah IH, Erdiansyah I. Pengaruh inokulasi Rhizobium spp terhadap pertumbuhan dan hasil kacang tanah pada cekaman kekeringan. Agropross.

2020;2(1):108-114.
[5] Manurung H, Kustiawan W, Kusuma IW, et al. Pengaruh cekaman kekeringan terhadap pertumbuhan dan kadar flavonoid total tumbuhan tabat barito (Ficus deltoidea Jack). J Hort Indonesia. 2019;101:55-62.
[6] Syahrizal LD, Sahari P, Haryanto ET. Pengaruh dosis pupuk organik dan dolomit terhadap pertumbuhan dan hasil tanaman kacang tanah. Agrosains: J Penelitian Agronomi. 2014;16(1):25-28.
[7] Hisani W, Mallawa AMI. Peningkatan produksi tanaman kacang tanah (Arachis hypogaea L.) dengan pemanfaatan pupuk organik cair (POC) dari kulit pisang, cangkang telur serta limbah rumput laut. J Perbal. 2017;5(3):55-64.
[8] Santos AAC, Oliveira AJ de, Oliveira TC, et al. A cultura do Arachis hypogaea L. Uma revisão. Res Society Development. 2021;10(2).
[9] Nagaraju K, Prasad TNVKV, Chari MS, et al. Effects of soil application of nanobiochar-based nitrogen and potassium fertilizers on the growth and yield of groundnut (Arachis hypogaea L.). J Soil Sci Plant Nutrition. 2024;24(3):5759-5771.
[10] Abdillah MH. Memperbaiki serapan hara dengan aplikasi bahan organik untuk meningkatkan resistensi tanaman cabai terhadap virulensi kutukebul. J Agronomi Indonesia (Indonesian J Agron). 2022;49(3):280-287.
[11] Mastur, Syafaruddin, Syakir M. Peran dan pengelolaan hara nitrogen pada tanaman tebu untuk peningkatan produktivitas tebu. Perspektif. 2015;14(2):73-86.
[12] Nurhayati DW, Sarwono AE, Hariyono B. Pengaruh pupuk organik dan anorganik terhadap produksi dan kandungan minyak wijen serta kelayakan usaha tani di lahan pasir pantai. Buletin Tanaman Tembakau, Serat & Minyak Industri. 2013;5(1):31-39.
[13] Okalia D. Pengaruh kompos jerami padi terhadap pertumbuhan dan produksi kacang hijau (Phaseolus radiatus L). J Riset Indragiri. 2022;1(2):112-122.
[14] Amitasari. Pertumbuhan tanaman sawi caisim (Brassica juncea L.) secara hidroponik pada media pupuk organik cair dari kotoran kelinci dan kotoran kambing. Skipsi. Universitas Muhammadiyah Surakarta, Surakarta. 2016.
[15] Pramono D, Natawijaya D, Suhardjadinata. Pengaruh jenis pupuk organik dan pupuk npk terhadap pertumbuhan dan hasil kedelai edamame (Glycine max L. Merril). Media Pertanian. 2023;8(2):59-71.
[16] Kiik K, Kefi A, Rusae A. Pengaruh bahan mikroorganisme lokal (mol) dan frekuensi pemberiannya terhadap pertumbuhan dan hasil tanaman kedelai. Bul Agrohorti. 2023;11(2):266-276.
[17] Nugraha R, Islami T. Pengaruh dosis rhizobium dan pupuk kandang kambing pada pertumbuhan dan hasil tanaman kacang tanah (Arachis hypogea L.). PLANTROPICA: J Agri Sci. 2021;1:21-29.
[18] Wahyuni F, Ansar M. Pengaruh interval pemberian air terhadap pertumbuhan tanaman selada (Lactuca sativa L.). e.J. Agrotekbis. 2024;12(5):1096-1105.
[19] Oktavianti AM, Izzati, Parman S. Pengaruh pupuk kandang dan npk mutiara terhadap pertumbuhan dan produksi kacang panjang (Vigna sinensis L.) pada tanah berpasir. Bul Anatomi dan Fisiologi. 2017;2(2):236-241.
[20] Setyawan F. Pengaruh SP-36 dan asam humat terhadap pertumbuhan dan produksi tanaman kedelai (Glycine max L). Buana Sains. 2020;19(2):1-6.
[21] Siahaan FI, Sudiarso. Pengaruh dosis pupuk kascing dan frekuensi pembumbunan terhadap pertumbuhan dan hasil tanaman kacang tanah (Arachis hypogea L.). J Produksi Tanaman. 2018;6(7):1380-1388.
[22] Kusumiyati K, Sutari W, Raniska N. Respons pertumbuhan, hasil, dan kualitas hasil buncis tegak terhadap pemberian berbagai dosis kompos dan interval panen pada inceptisols Jatinangor. Kultivasi. 2016;15(2):92-98.
[23] Saputra MY, Mawandha HG, Swandari T. Pertumbuhan dan produksi buncis (Phaseolus vulgaris L.) dengan pemberian pupuk tandan kosong kelapa sawit dan NPK growth. Agroista. 2018;2(2):151-161.
[24] Nurmi Aziz A, Mooduto SB. Pertumbuhan dan hasil tanaman kacang tanah (Arachis hypogaea L.) dengan aplikasi pupuk organik arang sekam dan kandang ayam. J Produksi Tanaman. 2023;11(10):786-792.
[25] Donggulo CV, Lapanjang IM, Made U.

Pertumbuhan dan hasil tanaman padi (Oryza sativa L.) pada berbagai pola jajar legowo dan jarak tanam. Agroland J Ilmu-Ilmu Pertanian. 2017;24(1):27-35.

[26] Suhada I, Ayu IW, Aprila FW. Pengaruh dosis pupuk cair batuan silikat terhadap pertumbuhan dan hasil pada berbagai varietas cabai rawit (Capsicum frutescens L.). J Agroteknologi. 2022;2(2):15-26.

[27] Noor MF, Mahdiannoor M, Adriani F. Respon pertumbuhan dan hasil tanaman kacang tanah terhadap pemberian dosis pupuk hayati di lahan podsolik. Rawa Sains: J Sains Stiper Amuntai. 2018;8(1):591-600.

[28] Sugari D, Islam T. Pengaruh pupuk organik dan waktu penyiangan gulma terhadap pertumbuhan dan hasil tanaman kacang tanah (Arachis hypogaea L.). J Produksi Tanaman. 2018;6(11):2815-2822.

[29] Hartanti A, Yumadela J. Korelasi pertumbuhan dan hasil tanaman kacang tanah (Arachis hypogaea L.) terhadap konsentrasi dan frekuensi pemberian larutan MOL (Mikroorganisme Lokal) bonggol pisang kepok (Musa paradisiaca). J Agroteknologi. 2017;1(2):8-18.

[30] Rehatta H, Marasabessy DA, Gea MS. Pengaruh konsentrasi dan frekuensi pemberian pupuk organik cair terhadap pertumbuhan tanaman dan produksi sawi samhong (Brassica juncea L.). J Budidaya Pertanian. 2024;20(1):40-53.

[31] Andriyani LZ, Daeng B, Muyan Y, Payi J. Respon pertumbuhan dan hasil tanaman kacang tanah terhadap perbedaan dosis pupuk kotoran sapi. J Agrotek. 2022;10(1):27-32.

[32] Sujinah, Jamil A. Mekanisme respon tanaman padi terhadap cekaman kekeringan dan varietas toleran. Iptek dan Tanaman Pangan. 2016;11(1):1-7.

[33] Patti PS, Kaya E, Silahooy C. Analisis status nitrogen tanah dalam kaitannya dengan serapan N oleh tanaman padi sawah di Desa Waimital, Kecamatan Kairatu, Kabupaten Seram Bagian Barat. Agrologia. 2018;2(1):51-58.

[34] Hermawan MK, Sofyan ET, Machfud Y. Kombinasi pupuk N, P, K dengan pupuk organik granul (POG) untuk meningkatkan P-tersedia dan serapan hara jagung (Zea mays L.) pada typic eutrudept. J Agrotek Indonesia. 2018;3(2).

[35] Setiawati MR, DS Utami, R Hindersah, et al. Pemanfaatan limbah pertanian dalam menurunkan dosis pupuk anorganik, meningkatkan populasi Azospirillum sp., nitrogen tanah, serapan nitrogen, dan hasil jagung pada Inceptisols Jatinangor. Soilrens. 2021;19(1):9-19.

[36] Rahayu RD, Mindari W, Arifin M. Pengaruh kombinasi silika dan asam humat terhadap ketersediaan nitrogen & pertumbuhan tanaman padi pada tanah berpasir. Soilrens. 2022;19(2):23.

[37] Darmestawan MS, Herlambang S, Arbiwati D. Pengaruh pupuk urin domba dan biochar tempurung kelapa terhadap serapan N dan P tanaman pakcoy di lahan pasir pantai samas. J Tanah dan Air (Soil Water J). 2023;19(2):86.

[38] Çiftçi S, Suna GÜLEN. Functional components of peanuts (Arachis hypogaea L.) and health benefits: A review. Future Foods. 2022;5:100140.

[39] Batalipu NIR, Darman S, Amelia R. Serapan hara K pada tanaman cabai merah besar (Capsicum annum L.) terhadap pemberian bokasi pada entisols sidera. Agrotekbis: J Ilmu Pertanian. 2023;11(3).

[40] Hoang TTH, Do DT, Nguyen HN, Do TN, Bell RW. Improving irrigation, potassium, and sulphur use efficiency of peanut (Arachis hypogaea) in tropical sandy soils. Int J Plant Product. 2022;16(3):385-395.

[41] Silalahi E, Widaryanto E. Pengaruh beberapa jarak tanam terhadap pertumbuhan dan hasil tiga varietas kacang tanah (Arachis hypogaea L). J Produksi Tanaman. 2019;7(6):978-985.

[42] Topan MT, Rajiman, Megawati S. Pengaruh varietas terhadap hasil kacang panjang (Vigna unguiculata L.) di tanah regosol. Agrienvi. 2024;18(2):63-69.

[43] Singh S, Dave P, Choudhary H. Botanical compositions for the management of sucking and lepidopteran pests of groundnut (Arachis hypogaea L.) under field conditions. Biopesticides Int. 2024;20(1).