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The Effects of Plant Varieties and Liquid Organic Fertilizer (LOF) Concentrations on the Growth and Yield of Shallots (*Allium cepa* L.)

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ABSTRACT: Shallot (*Allium cepa* L.) is an economically and nutritionally significant horticultural crop, widely cultivated in Indonesia and essential for both household consumption and the culinary industry. Rising population and the expansion of the food sector have increased demand for shallots, highlighting the need for sustainable and stable production. Crop productivity is influenced by multiple factors, notably varietal selection and nutrient management. Each shallot variety exhibits distinct physiological traits and environmental adaptability, which directly affect growth performance and yield potential. Liquid organic fertilizer (LOF) has emerged as a promising strategy to enhance soil fertility, stimulate microbial activity, and provide essential nutrients in readily available forms for plant uptake. Its application can improve vegetative growth, bulb development, and overall yield; however, responses may vary depending on both the concentration of LOF and the specific shallot variety. Despite the recognized benefits, limited research has examined the combined effects of different shallot varieties and LOF concentrations under field conditions in Indonesia. This study aimed to evaluate the influence of selected shallot varieties and varying LOF levels on plant growth and yield, and to identify potential interactions between these factors. Results from this investigation are expected to inform optimal cultivar and fertilization strategies, supporting sustainable shallot production, enhancing crop productivity, and providing practical guidance for farmers and policymakers. The findings contribute to improving resource use efficiency, maintaining soil health, and promoting economically viable and environmentally sustainable horticultural practices.

KEYWORDS: shallot, variety, liquid organic fertilizer, growth, yield

INTRODUCTION

Shallot (*Allium cepa* L.) is a horticultural crop of considerable economic and nutritional significance, particularly in Southeast Asia, where it constitutes an essential component of both household and commercial culinary practices. In Indonesia, shallots are extensively cultivated and widely consumed, serving as a key ingredient in traditional dishes, processed foods, and the hospitality industry. The increasing population and the expansion of the food sector have resulted in a steady rise in shallot demand, underscoring the importance of ensuring consistent and sustainable national production. Reliable shallot yields are not only crucial for meeting domestic consumption but also for maintaining economic stability and supporting the livelihoods of smallholder farmers who rely heavily on this crop as a primary source of income (1, 2, 10, 15).

The productivity of shallots is influenced by a combination of genetic, environmental, and agronomic factors, with varietal selection being one of the most critical determinants of yield potential. Each shallot variety exhibits unique physiological traits, such as growth rate, bulb size, number of cloves, and tolerance to biotic and abiotic stresses. These traits affect the plant's ability to adapt to local environmental conditions, including soil properties, temperature, moisture availability, and altitude. Selecting varieties that are well-suited to the local growing conditions can enhance productivity, improve marketable quality, and reduce the risk of crop failure. Conversely, cultivating unsuitable varieties may lead to poor growth performance, increased susceptibility to pests and diseases, and reduced economic returns (2, 6, 9, 15).

In addition to varietal selection, effective nutrient management is fundamental for optimizing shallot growth and productivity. Adequate provision of macro- and micronutrients is essential for supporting vegetative growth, reproductive development, and bulb formation. While chemical fertilizers have traditionally been the mainstay of nutrient management, concerns regarding environmental sustainability, soil degradation, and long-term productivity have prompted increased interest in organic fertilization strategies. Among these, liquid organic fertilizer (LOF) has emerged as a promising approach due to its ability to improve soil fertility, enhance microbial activity, and supply nutrients in forms that are readily absorbed by plants. LOF typically derives from decomposed organic matter, compost, or animal manure and can be applied in liquid form, facilitating uniform nutrient distribution and rapid uptake by roots (1, 3, 4, 5, 11).

The application of LOF has been shown to influence multiple physiological processes in plants. By providing essential nutrients such as nitrogen, phosphorus, potassium, and secondary elements in soluble forms, LOF can stimulate root elongation, enhance leaf expansion, and promote flower and bulb development. Furthermore, LOF improves soil physical properties, increases water-holding capacity, and supports beneficial microbial populations, which play a pivotal role in nutrient cycling and disease suppression. Collectively, these effects can contribute to higher yields, improved crop quality, and greater sustainability of production systems. Nevertheless, the effectiveness of LOF is highly dependent on application rate and frequency; both excessive and insufficient application can negatively impact plant growth, nutrient use efficiency, and environmental safety (1, 3, 4, 7, 12).

Importantly, the response to LOF may vary among different shallot varieties due to inherent genetic differences in nutrient uptake efficiency, growth potential, and stress tolerance. Certain varieties may respond positively to moderate LOF application, exhibiting significant improvements in vegetative growth and bulb yield, while others may require higher concentrations or complementary nutrient sources to achieve similar outcomes. Understanding the interactions between variety and fertilization strategy is therefore essential for designing optimized crop management protocols that maximize productivity, reduce input waste, and minimize environmental impact. Despite the recognized potential of LOF, limited research has systematically examined how different shallot varieties respond to varying LOF concentrations under field conditions, particularly in Indonesia, where shallots play a crucial socio-economic role (6, 7, 8, 9, 13).

Global studies on shallot production emphasize the importance of integrated crop management practices, including varietal selection, balanced fertilization, proper irrigation, and pest and disease management. Research indicates that combining organic and inorganic nutrient sources can enhance bulb yield, quality, and post-harvest shelf life. National agricultural data from Indonesia reveal a steady increase in shallot production over the past decade, reflecting growing domestic consumption and government initiatives promoting sustainable agriculture. However, yield variability caused by environmental stress, suboptimal nutrient management, and the use of low-performing varieties remains a major challenge, highlighting the need for targeted research to develop efficient, evidence-based cultivation strategies (8, 11, 12, 14).

In response to these challenges, the present study was designed to investigate the effects of different shallot varieties in combination with varying concentrations of liquid organic fertilizer on growth and yield performance. The specific objectives are to: (1) assess the growth responses of selected shallot varieties to different LOF concentrations, (2) evaluate the impact of LOF application on key yield parameters, including bulb size, weight, and total production, and (3) examine potential interactions between varietal characteristics and fertilization regime to provide practical recommendations for optimizing shallot productivity. By systematically addressing these research questions, the study aims to contribute to the development of sustainable and profitable shallot production systems that align with national food security goals and support the economic welfare of smallholder farmers (3, 6, 7, 13).

In summary, shallot cultivation represents a vital component of Indonesia's agricultural landscape, with significant implications for nutrition, income, and food security. Integrating appropriate varietal selection with optimized liquid organic fertilizer application holds substantial potential for improving crop productivity, maintaining soil health, and ensuring sustainable production practices. By examining the interplay between variety and LOF concentration, this study provides valuable insights into best management practices, offering practical guidance for farmers, extension agents, and policymakers seeking to enhance the efficiency, resilience, and sustainability of shallot cultivation (1, 4, 8, 12, 14).

RESEARCH METHOD

The experiment was conducted from January to May 2023 in Medan Selayang, at an elevation of approximately 30 m above sea level. A factorial split-plot design was used, with shallot variety as the main-plot factor and LOF concentration as the subplot factor.

The main-plot factor consisted of three shallot varieties:

- V1: Tajuk
- V2: Maja
- V3: Brebes

The subplot factor consisted of three LOF concentrations:

- P1: 1 mL
- P2: 2 mL
- P3: 3 mL

Each treatment combination was replicated three times. Observed parameters included plant height, number of leaves,

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number of bulbs, bulb diameter, and fresh and dry bulb weights. Data were analyzed using analysis of variance (ANOVA), and significant differences among treatment means were compared using the least significant difference (LSD) test at $p \leq 0.05$.

RESULTS AND DISCUSSION

The analysis of variance revealed that shallot variety had a significant influence on plant height at 2 and 5 weeks after planting (WAP). Among the three varieties tested, V3 consistently exhibited superior growth performance, producing the tallest plants with an average height of 21.91 cm at 2 WAP and 30.67 cm at 5 WAP. These values were significantly higher than those recorded for V1 and V2, indicating that V3 possesses inherent genetic traits conducive to more vigorous early and later-stage growth. Although the differences in height among the varieties at 3 and 4 WAP were not statistically significant, V3 consistently demonstrated a tendency toward enhanced growth, suggesting that its superior growth potential is maintained throughout the vegetative development period (2, 6, 9, 15).

The effect of liquid organic fertilizer (LOF) treatments applied alone (P1, P2, P3) on plant height was not statistically significant at any of the observation points. This finding suggests that LOF, when applied independently of varietal differences, may not exert a sufficiently strong influence on height to produce detectable variations under the conditions of this study. However, the interaction between shallot variety and LOF concentration revealed notable differences in growth responses. Specifically, the combination of V3 with the highest LOF concentration (P3, 3 mL) produced the tallest plants at 5 WAP, reaching an average height of 30.33 cm. This result indicates that V3 responded most effectively to the higher LOF dosage, highlighting the importance of considering varietal characteristics when optimizing fertilization regimes. The lack of a significant effect of LOF alone, contrasted with the positive response of the V3P3 combination, reinforces the concept that genetic factors often play a more dominant role than environmental or nutrient interventions in determining early and mid-stage vegetative growth (1, 3, 4, 7, 12).

These findings are consistent with previous studies reporting that varietal genetics strongly influence growth parameters in shallots and other Allium species. Differences in plant height among varieties can be attributed to inherent variations in cell elongation, leaf expansion rates, and shoot vigor. The enhanced response of V3 to higher LOF concentrations may be associated with its greater nutrient uptake efficiency, allowing it to more effectively utilize the available nitrogen, phosphorus, potassium, and other micronutrients supplied by the liquid fertilizer. This interaction underscores the importance of integrating varietal selection with tailored fertilization strategies to maximize growth performance (2, 6, 8, 9, 13).

While LOF treatments alone did not significantly affect plant height, the combination of specific varieties with certain LOF concentrations produced variable results. For instance, V1 and V2 showed moderate responses to LOF, with slight increases in height under some treatment combinations, but these changes were generally not statistically significant. In contrast, V3 exhibited a clear positive response to the highest LOF concentration, suggesting that the effectiveness of LOF application is contingent upon the genetic characteristics of the variety. Such genotype × environment interactions are critical considerations in crop management, as they can determine the extent to which fertilization contributes to growth enhancement. This observation aligns with research in other horticultural crops, where varietal-specific responses to nutrient amendments have been documented (4, 5, 7, 11, 14).

The differential response among varieties may also be influenced by root system architecture. Varieties with more extensive root systems are likely to exploit nutrient-rich zones more effectively, thereby achieving greater growth. V3 may possess a more developed root network or higher root absorption capacity, enabling it to respond more robustly to LOF application. Additionally, LOF provides nutrients in a readily available form, which could accelerate metabolic processes such as photosynthesis and cell division, particularly in varieties that have a high nutrient demand during early vegetative stages (1, 3, 4, 5).

The results of this study suggest that while LOF can be a valuable supplement for shallot cultivation, its benefits are maximized when applied in conjunction with genetically superior varieties. Farmers aiming to increase plant height, and by extension potential bulb yield, should consider selecting high-performing varieties like V3 and pairing them with optimal LOF concentrations. Moreover, the observation that LOF alone did not significantly influence growth emphasizes the need for an integrated management approach that accounts for both genetic and agronomic factors (3, 6, 12, 14).

From a practical standpoint, these findings highlight the importance of customizing fertilization protocols based on varietal characteristics. Blanket application of fertilizers without regard to variety may result in suboptimal growth and inefficient resource use. The positive interaction between V3 and the highest LOF concentration suggests that targeted nutrient management can enhance early vegetative growth, which may translate into higher yields and improved economic returns. Additionally, understanding varietal responses to LOF can inform extension programs and recommendations for sustainable shallot production (7, 8, 11, 12).

Several studies have demonstrated the predominant influence of varietal genetics on shallot growth. For example, research on Allium species has shown that early growth rates, leaf elongation, and overall plant vigor are largely determined by inherent genetic traits rather than external inputs alone. However, other studies also indicate that organic fertilization, including liquid formulations, can improve growth when applied at appropriate rates. The current study's findings are in agreement with these observations, showing that while LOF alone may not produce significant height differences, its application in combination with a

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responsive variety like V3 can enhance plant development. This suggests that fertilizer management should be tailored not only to soil conditions and crop requirements but also to the specific variety being cultivated (1, 3, 4, 13, 15). The evaluation of plant height in this study demonstrates that varietal selection is a major determinant of growth performance in shallots. V3 consistently outperformed V1 and V2 in early and late vegetative stages, and its response to the highest LOF concentration indicates that the interaction between variety and fertilization is a critical factor in optimizing growth. While LOF alone did not significantly affect plant height, its targeted use in combination with a genetically superior variety can enhance vegetative development, supporting the premise that integrated management practices are essential for achieving high productivity in shallot cultivation (2, 6, 8, 12, 14).

Table 1. Average Plant Height (cm) of Shallots at 2, 3, 4, and 5 Weeks After Planting (WAP) as Affected by Variety and Liquid Organic Fertilizer (LOF) Treatments

Treatment	Plant Height (cm)			
	2 WAP	3 WAP	4 WAP	5 WAP
V1	13,87b	21,64	23,16	23,66a
V2	15,67b	20,38	26,85	27,58b
V3	21,91a	23,64	29,95	30,67c
P1	17,8	21,44	25,55	26,68
P2	17	22,59	27,75	28,99
P3	16,7	21,64	23,19	26,23
V1P1	14,09	20,00	20,80	23,13
V1P2	13,73	22,40	22,47	24,80
V1P3	13,80	22,53	22,67	23,06
V2P1	13,87	21,64	21,98	23,66
V2P2	16,60	20,07	25,92	26,59
V2P3	15,40	22,15	30,10	31,05
V3P1	15,00	18,91	24,52	25,10
V3P2	15,67	20,38	26,85	27,58
V3P3	22,60	24,23	29,25	30,33

Note: Numbers followed by the same letter within the same column are not significantlydifferent according to Duncan's Multiple Range Test at $p \leq 0.05$

Number of Leaves. The number of leaves in shallot plants was significantly influenced by varietal differences at 3 and 4 weeks after planting (WAP). Among the three varieties evaluated, V1 and V3 consistently produced more leaves than V2 during these observation periods. In particular, V3 exhibited the highest leaf count, recording an average of 22.04 leaves at 3 WAP and maintaining the lead with 22.58 leaves at 4 WAP. These results suggest that V3 possesses genetic characteristics conducive to greater vegetative development, which may contribute to enhanced photosynthetic capacity and subsequent growth. The superior leaf production of V1, although slightly lower than V3, indicates that this variety also exhibits relatively strong vegetative vigor compared to V2, which consistently produced the fewest leaves across the observed periods. The lower performance of V2 may reflect inherent limitations in leaf initiation or expansion, potentially affecting overall growth and yield potential (2, 6, 9, 15).

Application of liquid organic fertilizer (LOF) alone did not produce statistically significant differences in leaf number at any observation point. This outcome indicates that, while LOF supplies essential nutrients in soluble forms, its impact on leaf proliferation may be limited when not combined with varietal traits that predispose plants to higher vegetative growth. Nevertheless, the combination of specific varieties with LOF concentrations revealed notable trends. For example, the V3P3 combination, which involved the V3 variety treated with the highest LOF concentration (3 mL), consistently produced the greatest number of leaves, reaching an average of 23.87 leaves at 5 WAP. This finding suggests a synergistic effect between the genetic vigor of V3 and the nutrient availability provided by LOF, which together enhance leaf initiation and expansion (1, 3, 4, 7, 12).

In contrast, the V3P1 combination, representing the lowest LOF concentration applied to V3, consistently recorded the lowest leaf counts among V3 treatments. This disparity highlights the importance of nutrient availability in fully realizing the vegetative potential of high-performing varieties. The results indicate that the effectiveness of LOF is contingent upon both the variety's genetic capacity for leaf production and the concentration of nutrients supplied. Varieties with inherently higher vigor, such as V3, are more capable of utilizing additional nutrients to stimulate leaf growth, whereas varieties with lower inherent vigor, such as V2, show minimal response to the same treatments (4, 5, 7, 11, 14).

The observed differences in leaf production among varieties and treatments align with previous studies demonstrating that leaf number is closely associated with genetic factors and the plant's capacity to assimilate nutrients. Leaves are the primary organs responsible for photosynthesis, and a higher leaf count generally translates to increased energy capture, which supports both vegetative and reproductive growth. In shallots, early leaf development is particularly critical, as it sets the foundation for subsequent bulb formation and overall yield. Therefore, varieties like V3, which exhibit rapid and sustained leaf production, are likely to achieve superior growth and productivity under optimized nutrient management (1, 3, 4, 13, 15).

The interaction between variety and LOF also underscores the importance of integrated crop management strategies. While LOF alone did not significantly enhance leaf number, its combination with responsive varieties demonstrated measurable benefits, particularly at higher concentrations. This finding suggests that fertilization practices should be tailored not only to soil nutrient status but also to the specific variety being cultivated. Targeted nutrient application that considers varietal characteristics can maximize vegetative development, improve photosynthetic efficiency, and potentially enhance bulb yield (7, 8, 11, 12).

From a practical perspective, these results provide valuable guidance for shallot cultivation. Farmers aiming to increase vegetative growth and leaf production should prioritize high-performing varieties such as V3 and combine them with appropriate LOF concentrations. Such integrated management practices can optimize nutrient use efficiency, support robust vegetative growth, and ultimately contribute to higher yields. Additionally, understanding varietal responses to fertilization can inform extension services and agronomic recommendations, promoting more efficient and sustainable shallot production (3, 6, 12, 14).

The evaluation of leaf number in this study indicates that varietal selection is a primary determinant of vegetative growth in shallots. V3 consistently produced the highest number of leaves, and its response to the highest LOF concentration highlights the synergistic potential of combining genetically vigorous varieties with optimal fertilization. Although LOF alone did not significantly influence leaf production, its targeted application in conjunction with responsive varieties can enhance vegetative development, supporting the overall growth, productivity, and sustainability of shallot cultivation systems (2, 6, 8, 12, 14).

Table 2. Average Number of Shallot Leaves at 2, 3, 4, and 5 Weeks After Planting (WAP) as Affected by Variety and Liquid Organic Fertilizer (LOF) Treatments.

Treatment	Number of Leaves.			
	2 WAP	3 WAP	4 WAP	5 WAP
V1	16,80	20,04a	21,64a	22,76
V2	14,87	14,53b	15,67b	14,87
V3	18,58	22,04a	22,58a	23,92
P1	17,78	18,18	19,73	18,80
P2	15,69	18,36	20,58	21,97
P3	16,78	20,09	19,58	20,78
V1P1	18,07	18,87	20,00	20,80
V1P2	14,20	19,67	22,40	23,57
V1P3	18,13	21,60	22,53	23,90
V2P1	16,80	20,04	21,64	22,76
V2P2	16,13	14,20	16,60	17,61
V2P3	13,53	13,93	15,40	16,77
V3P1	14,93	15,47	15,00	16,10
V3P2	14,87	14,53	15,67	16,83
V3P3	19,13	21,47	22,60	23,87

Note: Numbers followed by the same letter within the same column are not significantly different according to Duncan's Multiple Range Test at $p \leq 0.05$

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Number of Bulbs. The number of bulbs per clump was significantly influenced by shallot variety. Among the three varieties tested, V1 produced the highest average number of bulbs, with 27.53 bulbs per clump, followed closely by V3 with 24.80 bulbs, both of which were significantly greater than V2, which yielded only 19.27 bulbs per clump. These results indicate that V1 possesses superior generative potential, reflecting a stronger capacity for bulb formation compared to the other varieties. While the application of liquid organic fertilizer (LOF) alone did not result in statistically significant differences in bulb number, the combined effects of variety and LOF suggested a trend in which the highest LOF concentration (P3) slightly enhanced bulb production in V1 and V2. This observation highlights the importance of varietal genetics in determining reproductive output and suggests that nutrient supplementation may further optimize generative yield when applied to responsive varieties. Overall, V1 demonstrated the greatest potential for high bulb production, emphasizing the role of varietal selection in maximizing shallot productivity (1, 3, 6, 7, 9, 12, 15).

Table 3. Average Number of Shallot Bulbs as Influenced by Variety and Liquid Organic Fertilizer (LOF) Treatments

	LOF			Mean value
Variety	P1	P2	P3	
V1	28,00	25,40	29,20	27,53a
V2	19,40	17,60	20,80	19,27b
V3	24,40	26,60	23,40	24,80a
Mean value	23,93	23,20	24,47	

Note: Numbers followed by the same letter within the same column are not significantly different according to Duncan's Multiple Range Test at p ≤ 0.05

Bulb Diameter (mm). Bulb diameter in shallots was not statistically affected by either varietal differences or the application of liquid organic fertilizer (LOF). Nonetheless, when considering mean values, distinct trends emerged among the varieties. Variety V3 consistently produced the largest bulbs, averaging 23.12 mm in diameter, followed by V2 at 22.33 mm, and V1 with the smallest average diameter of 18.79 mm. These observations suggest that inherent genetic traits of each variety play a predominant role in determining bulb size, with V3 showing the strongest potential for bulb enlargement (2, 6, 9, 15).

Although LOF treatments alone did not significantly alter bulb diameter, specific interactions between variety and LOF application revealed noteworthy patterns. In particular, the combinations of V2P1 and V3P1 produced the largest bulb diameters, reaching 29.02 mm. This indicates that the P1 LOF concentration may facilitate bulb enlargement in varieties already genetically predisposed to form larger bulbs. The mechanism behind this response may involve improved nutrient availability and enhanced metabolic activity during the bulb development phase, allowing the plants to allocate more resources to cell expansion and storage tissue formation (1, 3, 4, 7, 12).

These findings highlight the importance of considering both genetic potential and fertilization strategy when aiming to optimize bulb size in shallot cultivation. While varietal characteristics primarily dictate bulb diameter, targeted nutrient management through LOF application can enhance the growth of bulbs in responsive varieties. This emphasizes that integrated approaches combining suitable variety selection with appropriate fertilization regimes are essential for achieving improved bulb quality and marketable size, ultimately contributing to higher economic returns for farmers (3, 6, 8, 12, 14).

Table 4. Average Bulb Diameter of Shallot Sample Plants as Influenced by Variety and Liquid Organic Fertilizer (LOF) Treatments

	LOF			Mean value
	P1	P2	P3	
V1	20,54	13,05	22,77	18,79
V2	29,02	18,52	19,46	22,33
V3	29,02	18,69	21,64	23,12

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Fresh Bulb Weight (g). Fresh bulb weight in shallots was significantly influenced by varietal differences. Among the varieties evaluated, V3 produced the highest fresh bulb weight, averaging 616.00 g, which was substantially greater than that observed in V1 (399.00 g) and V2 (390.67 g). These results indicate that V3 possesses a superior capacity for biomass accumulation in bulbs, reflecting its greater potential for high-yield production. The enhanced fresh weight of V3 may be attributed to its genetic traits, which favor more efficient nutrient assimilation, larger bulb size, and greater allocation of assimilates to storage organs (2, 6, 9, 15).

The interaction between variety and liquid organic fertilizer (LOF) concentration further influenced fresh bulb weight, with the V3P3 combination yielding the highest value at 673 g. This suggests that the highest LOF concentration (P3) can effectively enhance bulb biomass in varieties with high inherent productivity, likely by providing readily available nutrients that support cell expansion and metabolic activity during bulb development. In contrast, V1 and V2 showed less pronounced responses to LOF application, indicating that the effectiveness of nutrient supplementation depends on the genetic potential of the variety (1, 3, 4, 7, 12).

Overall, these findings underscore the importance of selecting high-performing varieties in combination with optimal fertilization strategies to maximize fresh bulb weight. Targeted LOF application in genetically superior varieties such as V3 can improve bulb biomass, supporting higher yields and greater economic returns for shallot cultivation (3, 6, 8, 12, 14).

Table 5. Average Fresh Bulb Weight of Shallots as Influenced by Variety and Liquid Organic Fertilizer (LOF) Treatments

Variety	LOF			Mean value
	P1	P2	P3	
V1	344,00	399,00	454,00	399,00a
V2	431,00	397,00	344,00	390,67b
V3	594,00	581,00	673,00	616,00b

Note: Numbers followed by the same letter within the same column are not significantly different according to Duncan's Multiple Range Test at $p \leq 0.05$

Dry Bulb Weight. Dry bulb weight of shallots was significantly influenced by varietal differences. Among the tested varieties, V3 produced the highest dry bulb weight, averaging 524.33 g, which was significantly greater than that recorded for V1 (300.00 g) and V2 (308.33 g). This finding indicates that V3 has superior capacity for dry matter accumulation, reflecting more efficient photosynthate translocation and conversion into storage organs. The higher dry weight of V3 suggests enhanced physiological performance, including better carbohydrate partitioning, metabolic efficiency, and overall plant vigor, compared with the other varieties (2, 6, 9, 15).

While the application of liquid organic fertilizer (LOF) alone did not result in statistically significant differences in dry bulb weight, the interaction between variety and LOF concentration revealed notable trends. Specifically, LOF treatments P2 and P3 appeared to slightly enhance dry weight accumulation in V3, suggesting that nutrient supplementation can support biomass development in varieties that are genetically predisposed to high productivity. In contrast, V1 and V2 showed minimal response to LOF application, highlighting that the effectiveness of fertilization depends on the intrinsic potential of the variety (1, 3, 4, 7, 12).

Overall, the results emphasize the importance of varietal selection in achieving optimal dry matter production in shallot cultivation. V3 consistently outperformed the other varieties in accumulating dry biomass, indicating its suitability for high-yield systems. Additionally, while LOF alone may not significantly increase dry weight, its strategic application in responsive, high-performing varieties can further enhance dry matter accumulation, supporting improved yield quality and greater economic returns. These findings underscore the value of integrating varietal selection with targeted nutrient management to maximize productivity and efficiency in shallot production (3, 6, 8, 12, 14).

Table 6. Average Dry Bulb Weight of Shallots as Affected by Variety and Liquid Organic Fertilizer (LOF) Treatments

Variety	LOF			Mean
	P1	P2	P3	
V1	255,00	316,00	329,00	300,00b
V2	352,00	325,00	248,00	308,33b

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V3	521,00	506,00	546,00	524,33a
Mean	376,00	382,33	374,33	

Note: Numbers followed by the same letter within the same column are not significantly different according to Duncan's Multiple Range Test at $p \leq 0.05$

CONCLUSION

The findings of this study indicate that shallot varieties had a significant influence on multiple growth and yield traits, with the Brebes variety showing superior performance across most parameters. Liquid organic fertilizer (LOF) applied at concentrations of 1-3 mL did not produce statistically significant effects on any measured traits, and no significant interaction was observed between variety and LOF concentration. Based on these results, the Brebes variety is recommended for cultivation under the conditions of this study, while the 3 mL LOF treatment showed only a non-significant trend toward improved growth and yield.

SIGNIFICANCE STATEMENTS

The findings of this study highlight that the Brebes shallot variety demonstrated the highest productivity among the varieties evaluated, indicating its strong suitability for local cultivation under the conditions tested. Its superior growth and yield performance reflect inherent genetic traits that support both vegetative vigor and generative potential, making it a reliable choice for farmers seeking to optimize shallot production. Although liquid organic fertilizer (LOF) was applied at concentrations of 1-3 mL, these treatments did not produce significant effects on plant growth or yield, suggesting that minimal application rates may be sufficient to sustain optimal performance. Moreover, the absence of a significant interaction between variety and LOF concentration indicates that Brebes maintains consistent productivity across varying fertilization levels, further emphasizing its adaptability and robustness. These insights provide practical guidance for enhancing shallot cultivation efficiency, promoting resource effective fertilizer use, and supporting more sustainable horticultural practices. Overall, this study underscores the importance of selecting high-performing varieties to achieve reliable yields while maintaining environmentally and economically sustainable farming systems.

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REFERENCES

1. Panataria, L. R., Saragih, M. K., & Sitorus, E. (2024). *Effect of Watering Time and Liquid Organic Fertilizer Concentration on the Growth and Production of Shallots (Allium ascalonicum L.)*. Journal of Agriculture. DOI: 10.47709/joa.v3i03.4931
2. Mutia, Y. D., Thesiwati, A. S., & Ermawati, E. (2024). *The Production of Shallots (Allium ascalonicum L.) in Response to the Application of Liquid Organic Fertilizer From Marine Fish Waste and Tithonia*. JERAMI : Indonesian Journal of Crop Science, 6(2), 43–47. DOI: 10.25077/jijcs.6.2.43-47.2024.
3. Safrudin, A., & Wachid, A. (2015). *Effect of Liquid Organic Fertilizer and Cuttings of Bulbs on Growth and Production of Shallots (Allium ascalonicum L.)*. Nabatia, 12(1), 12–21. DOI: 10.21070/nabatia.v12i1.1592.
4. J. H. Purba, P. S. Wahyuni, Zulkarnæn, N. Sasmita, I. G. D. Yuniti, & N. P. Pandawani. (2020). *Growth and yield response of shallot (Allium ascalonicum L. var. Tuktuk) from different source materials applied with liquid biofertilizers.* Nusantara Bioscience, 12, 127–133. DOI: 10.13057/nusbiosci/n120207
5. Rosmiah, R., Palmasari, B., & Marlina, N. (2023). *Applying Types Of Solid And Liquid Organic Fertilizer Dosages To Onion (Allium ascalonicum L.) Production.* JUATIKA (Jurnal Agronomi Tanaman Tropika), 6(2). DOI: 10.36378/juatika.v6i2.3574.
6. Arif, S. H., & Riadi, F. H. M. (2024). *Improving growth and productivity of shallot (Allium ascalonicum L.) applied using organic and inorganic fertilizer.* ZF Dergi — Ege University Journal of Agriculture, 61(3). DOI: 10.20289/zfdergi.1385019.
7. Putra, A. I., Waluyo, B., & Nihayati, E. (2021). *Yield and Its Components of Shallot (Allium ascalonicum L.) Influenced by the Application of Amino Acid Fertilizer And Triacontanol.* Research Journal of Life Science.

8. Purwanti, S., Utomo, B., & Mulyono, J. S. (2019). *Application of Petrovita Liquid Fertilizer on the Growth and Yield of Shallot Plants (Allium ascalonicum L.).* Agro Bali: Agricultural Journal.
9. Cristina, E. F., Inonu, I., & Khodijah, N. S. (2022). *Utilization of Liquid Organic Fertilizer of Pineapple Peel Waste for Shallots Cultivation (Allium ascalonicum L.).* Jurnal Lahan Suboptimal : Journal of Suboptimal Lands, 11(1), 1–13. DOI: 10.36706/jlso.11.1.2022.570.
10. Sholihah, S. M., & Hamawi, M. (2024). *Pengaruh Kombinasi Pupuk Organik Cair Termodifikasi Silika dan Varietas Terhadap Produktivitas Bawang Merah (Allium ascalonicum L.)*. Agrotech Science Journal. DOI: 10.21111/agrotech.v10i2.13136.
11. Balai, U. H., & Erfandi, D. (2016). *Perbaikan Sifat Tanah dan Peningkatan Hasil Bawang Merah (Allium cepa grup Aggregatum) dengan Menggunakan Mulsa dan Bahan Pembenah Tanah.* Jurnal Hortikultura Indonesia. DOI: 10.29244/jhi.10.3.200-213.
12. Ruhimat, R., Djajakirana, G., & Antonius, S. (2020). *Pengaruh Pemberian Kompos Pada Pertumbuhan dan Produktivitas Tanaman Bawang Merah (Allium cepa L.).* Jurnal Ilmu Pertanian Indonesia. DOI: 10.18343/jipi.28.4.534.
13. Purnamasari, R. T., Sulistyawati, & Hidayanto, F. (2022). *Respon pertumbuhan dan hasil tanaman bawang merah (Allium ascalonicum) terhadap pemberian kompos limbah krisan.* Agrivet : Jurnal Ilmu-Ilmu Pertanian dan Peternakan. DOI: 10.31949/agrivet.v12i2.11888.
14. Sekolah Tinggi Ilmu Pertanian Amuntai - Mahdiannoor, M., Murjani, & Isma. (2023). *Pertumbuhan dan Hasil Tanaman Bawang Merah (Allium ascalonicum L.) pada Berbagai Dosis Pupuk Kandang Kotoran Sapi dan PGPR Akar Bambu.* Rawa Sains: Jurnal Sains STIPER Amuntai. DOI: 10.36589/rs.v9i2.103.
15. Husain, I., Rahim, Y., & Rahman Yusuf, A. (2024). *Growth and Production of Shallot Plants (Allium ascalonicum L.) Tajuk Varieties at Various Doses and Concentrations of Black Soldier Fly Kasgot and PGPR Bamboo Roots.* Jurnal Penelitian Pertanian Terapan, 24(1), 28–38. DOI: 10.25181/jppt.v24i1.3014

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