The Effect of Manure Dosage on the Growth and Yield of Shallot Plants (*Allium ascalonicum L.*) in Subak Dangin Umah, Batubulan Kangin Village

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ABSTRACT

Shallots (*Allium ascalonicum L.*) are a strategic commodity whose productivity in Indonesia is often constrained by declining soil fertility due to the intensive use of inorganic fertilizers. As a sustainable solution, this study evaluated the effect of manure application on the growth and yield of shallots. The research utilized a Randomized Block Design (RBD) with four dosage treatments: D0 (0 tons/ha), D1 (10 tons/ha), D2 (20 tons/ha), and D3 (30 tons/ha). It was conducted in Subak Dangin Umah, Batubulan Kangin Village, Gianyar, Bali, from April to July 2025. Key variables measured included vegetative growth and yield per hectare. The analysis results showed that manure application had a significant effect on both growth and yield. Treatments D2 (20 tons/ha) and D3 (30 tons/ha) resulted in significantly higher vegetative growth and bulb yield compared to the control (D0). Fresh bulb weight increased significantly from 2.9 kg/plot (control) to 4.7 kg/plot (D2) and 5.0 kg/plot (D3). Although the 30 tons/ha dose produced the highest bulb weight, the yield increase was relatively small compared to the 20 tons/ha dose. Therefore, 20 tons/ha is recommended as the economically more efficient optimum dose. In conclusion, the use of manure not only boosts shallot yield but also supports soil quality improvement and the sustainability of the *subak* farming system in Bali.
Keywords: *Shallots, manure, optimum dose, growth, yield, Subak.*

1. INTRODUCTION

Shallots (*Allium ascalonicum* L.) are one of Indonesia's leading horticultural commodities with strategic economic value. This commodity is not only used as a primary seasoning in various cuisines but also serves as an important source of income for farmers across different regions. High demand for shallots from both household consumers and the industry drives the need for continuous production increases (Setiawan *et al.,* 2020). However, shallot productivity often faces constraints related to declining land quality due as a result of intensive cultivation practices. The use of high doses of inorganic fertilizers generally succeeds in increasing yield in the short term, but in the long run, it potentially reduces soil organic matter content, decreases fertility, and causes the degradation of the soil's physical and chemical properties. This condition can hinder the sustainability of shallot farming (Haryanto *et al.,* 2019).

Alternative, the use of organic fertilizers like manure is considered a solution that is expected to both improve soil quality and increase yields. Manure contains essential macronutrients, particularly nitrogen (N), phosphorus (P), and potassium (K), which play a crucial role in vegetative growth, bulb formation, and improving harvest quality. Furthermore, the organic

matter contained in the manure functions to improve soil structure, increase Cation Exchange Capacity (CEC), enhance the soil's water-holding capacity, and stimulate soil microorganism activity (Haryanto *et al.,* 2019).

Crop response to manure is highly dependent on the dosage applied. At low doses, manure may not be able to meet the plant's nutrient requirements optimally, whereas at excessively high doses, the yield increase is not always significant and can even lead to agronomic and economic inefficiency (Yuliana *et al.,* 2021). Therefore, research into the optimum manure dosage must be conducted to determine the most effective and efficient rate for enhancing shallot growth and yield. The local context is also a critical factor. In Bali, farming practices within the subak system emphasize the principles of sustainability and local wisdom in resource management. The utilization of manure from local livestock is aligned with the concept of eco-friendly agriculture, thus not only increasing agricultural output but also preserving the balance of the traditional farming ecosystem (Sudarta & Astika, 2022).

Therefore, research on the effect of various manure dosages on the growth and yield of shallots in Subak Dangin Umah, Batubulan Kangin Village, is relevant. The results of this study are expected to provide practical recommendations regarding the appropriate manure dosage, while supporting the productivity and sustainability of the subak-based farming system in Bali.

2. RESEARCH METODOLOGY

2.1 Research Location and Time.

The research was conducted on farmland within the Subak Dangin Umah system, Batubulan Kangin Village, Sukawati District, Gianyar Regency, Bali, from April to July 2025. The research site is located at an altitude of ±75 meters above sea level (masl) and has a wet tropical climate type, with an average temperature of 27–30∘C and average annual rainfall of 1800–2000 mm.

2.2 Materials and Equipment

1. Materials: Shallot seedlings of the Bima Brebes variety, cow manure, base fertilizers (Urea, SP-36, KCl according to recommendation), insecticides and fungicides (if required), and irrigation water.
2. Equipment: Hoe, analytical balance, tape measure, sprayer, stationery, and documentation camera.

2.3 The study employed a Randomized Block Design (RBD) with one factor, consisting of four manure dosage treatments and four replications, resulting in a total of 16 experimental units. The manure dosage treatments were:

- D0 = 0 tons/ha (control)
- D1 = 10 tons/ha
- D2 = 20 tons/ha
- D3 = 30 tons/ha

The size of each experimental plot was 2 m2 (1 m×2 m), with a planting distance of 20 cm×20 cm.

2.4 Research Implementation

1) Land preparation was carried out by hoeing the soil, clearing weeds, and constructing beds sized according to the treatment plots.
2) Manure application was performed according to the dose of each treatment, mixing it evenly into the soil before planting.

3) Planting was done using healthy shallot bulb seeds with a diameter of ±1.5–2 cm, planted at a depth of ±3 cm.
4) Crop maintenance included watering, weeding, and pest and disease control as needed.
5) Harvesting was conducted at approximately ±70 days after planting (DAP), characterized by 70–80% of the leaves collapsing and turning yellow.

2.5 Observed Variables

1) Plant height (cm) → measured from the base of the stem to the tip of the highest leaf at 30 DAP.
2) Number of leaves (sheets) → counting the number of leaves actively photosynthesizing at 30 DAP.
3) Fresh bulb weight per plot (kg) → weighing all harvested bulbs per plot.
4) Dry bulb weight per plot (kg) → bulbs were air-dried for 7 days then weighed.
5) Yield per hectare (ton/ha) → converted from the bulb weight per plot.

2.6 Data Analysis

The observed data were analyzed using Analysis of Variance (ANOVA) at the 5% significance level. If the results showed a significant effect, they were further analyzed using the Least Significant Difference (LSD) Test at 5% to determine the difference between treatments.

3. RELATED RESEARCH/LITERATUR REVIEW

Shallots (Allium ascalonicum L.) are one of the leading horticultural commodities with high economic value and are widely cultivated in Indonesia. Shallot production is influenced by genetic factors, environment, and cultivation techniques, including nutrient availability. Deficiencies in essential nutrients can reduce vegetative growth, bulb size, as well as the quality and storage life of the harvest. Therefore, the right fertilization strategy is crucial for determining shallot productivity (Setiawan *et al.,* 2020).

Manure plays a vital role in improving the soil's physical, chemical, and biological properties. The organic matter in manure can increase water-holding capacity, nutrient availability, and soil microbial activity. Furthermore, the content of nitrogen (N), phosphorus (P), and potassium (K) in manure supports vegetative growth and bulb formation. Applying manure at an appropriate dosage has been shown to increase the yield and quality of horticultural crops, including shallots (Haryanto *et al.,* 2019).

Crop response to manure generally increases with higher dosages; however, there is an optimum limit that must be considered. At low doses, manure may not sufficiently meet the nutrient requirements, while at excessive doses, the yield increase is not significant and may potentially be economically detrimental (Sudarta & Astika, 2022). Research on green mustard plants indicated that the highest dose (60 tons/ha) did produce maximum yield, but a slightly lower dose (30 tons/ha for water spinach) was considered the optimum dose that was both practical and economically profitable (Beja, 2017; Hilala *et al.,* 2023).

Some studies indicate that a combination of manure and inorganic fertilizers yields better results than using either alone (Yuliana et al., 2021). This combination is effective because organic fertilizers release nutrients slowly, improve soil physical properties, and increase soil organic matter, while inorganic fertilizers are quickly available to plants to meet urgent nutrient demands (Putra et al., 2020; Nooraminah, 2022). For instance, in rice cultivation, a combination of 75% basic inorganic fertilizer and 100% organic fertilizer proved to increase production by 39–59% (Putra et al., 2020).

In the subak fields in Bali, the practice of organic fertilization is important as it relates to soil and water conservation. Manure available from local livestock can be utilized efficiently to support sustainable agriculture. Research on optimal dosage at the local level, such as in Subak Dangin Umah, Batubulan Kangin Village, is crucial so that farmers can obtain practical recommendations that are suitable for the local agroecosystem conditions while preserving environmental balance (Sudarta & Astika, 2022).

4. RESULTS AND DISCUSSION

Figure 1. image of the number of onion bulbs from each treatment D0, D1, D2, D3
Source: personal documentation

4.1 Shallot Plant Growth

Observation results showed that manure application had a significant effect on both plant height and number of leaves at 30 days after planting (DAP). Plants in the 20 tons/ha (D2) and 30 tons/ha (D3) dosage treatments exhibited better growth compared to the control (D0) and low-dose treatment (D1). The average plant height at D3 reached 42.9 cm, which was significantly higher than the control (34.4 cm). The number of leaves also increased from 17.5 sheets (D0) to 23.5 sheets (D3). This result aligns with the research by Haryanto et al. (2019), which stated that manure is capable of improving nutrient availability and enhancing soil structure, thereby supporting the plant's vegetative growth. The nitrogen content in the manure aids in the formation of chlorophyll and vegetative tissue, while phosphorus supports root development and bulb initiation.

4.2 Fresh and Dry Bulb Weight

Manure application had a significant effect on fresh and dry bulb weight. The D3 (30 tons/ha) treatment produced the highest fresh weight, averaging 5.0 kg/plot (equivalent to ±25 tons/ha), whereas the D0 (control) treatment only yielded 2.9 kg/plot (±14.5 tons/ha). The dry bulb weight also increased

from 2.1 kg/plot (D0) to 3.8 kg/plot (D3). Yuliana et al. (2021) explained that higher organic fertilizer doses boost shallot yield because the organic matter content improves the availability of macro and micronutrients. However, it should be noted that the yield increase between the 20 tons/ha and 30 tons/ha doses was relatively small, which suggests that the 20 tons/ha dose can be considered more efficient both agronomically and economically.

4.3 Efficiency and Agronomic Implications

The increase in manure dosage correlated with an increase in yield; however, there is a point of efficiency that must be considered. In this study, the yield from the D2 (20 tons/ha) treatment was nearly comparable to D3 (30 tons/ha). Therefore, applying the 20 tons/ha dose can be recommended as the optimum dosage for the Subak Dangin Umah field. In addition to boosting yield, manure also improves long-term soil quality through the enhancement of organic matter content and soil microbial activity (Sudarta & Astika, 2022). These results are consistent with the view of Setiawan et al. (2020) that the integration of organic fertilizer with basic inorganic fertilization is more efficient than the singular use of inorganic fertilizers, especially within traditional farming systems like subak that prioritize sustainability. Thus, the application of manure not only provides direct benefits to shallot yield but also supports a sustainable agricultural system.

Table 1. Average growth and yield of shallots at various manure dosages

Treatment (Manure Dosage)	Plant Height (cm)	Number of Leaves (sheets)	Fresh Bulb Weight (kg/plot)	Dry Bulb Weight (kg/plot)
D0 (0 ton/ha)	34,4	17,5	2,9	2,1
D1 (10 ton/ha)	38,3	20,0	3,9	2,8
D2 (20 ton/ha)	41,4	22,0	4,7	3,5
D3 (30 ton/ha)	42,9	23,5	5,0	3,8

5. CONCLUSION

The research results indicate that manure application had a significant effect on the growth and yield of shallots (*Allium ascalonicum L.*) in Subak Dangin Umah, Batubulan Kangin Village. Increasing the manure dosage successfully improved plant height, number of leaves, fresh weight, and dry weight of bulbs compared to the treatment without manure. The 20 tons/ha (D2) and 30 tons/ha (D3) doses produced better vegetative growth and yield than the control (D0) and the low dose (D1). Given that the yield difference between the 20 tons/ha and 30 tons/ha doses was relatively small, the 20 tons/ha dose can be recommended as the more agronomically and economically efficient optimum dose. Overall, the use of manure is proven not only to enhance shallot yield but also to potentially improve long-term soil quality, thereby supporting the sustainability of the *subak*-based agricultural system in Bali.

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