



The Effect of Cattle Manure Application and Bulb Tip Cutting on the Growth and Yield of Shallots (*Allium ascalonicum* L.)

Martuani Hasibuan^{1*}, Rasmita Adelina², Erwin Syah Lubis³, Sutan Pulungan⁴

^{1,2,3,4}Graha Nusantara University, PadangsidImpuan

*Corresponding author: rasmita301271@gmail.com

Abstract

This study aimed to examine the effects of cow manure application and bulb tip cutting on the growth and yield of shallots (*Allium ascalonicum* L.). The experiment was conducted on a research field using a factorial randomized block design (RBD) consisting of two factors: cow manure dosage and bulb tip cutting treatment. The observed parameters included plant height, number of leaves, number of bulbs per clump, fresh weight, dry weight, bulb diameter, and weight loss after storage. The results showed that the application of cow manure had a significant effect on early plant growth, particularly on plant height at 14 days after planting ($p < 0.05$), and also affected the number of leaves and bulbs per clump at manure doses of 50 g/polybag (A1), 100 g/polybag (A2), and 150 g/polybag (A3) compared to the control (A0). The bulb tip cutting treatment significantly influenced growth at $\frac{1}{4}$ (B1) and $\frac{1}{3}$ (B2) cutting levels compared to no cutting, especially in the number of leaves and shoot emergence rate. The interaction between cow manure and bulb tip cutting also showed a significant effect. The best combination was obtained in A2B1 (100 g/polybag of cow manure + $\frac{1}{4}$ bulb tip cutting), which produced an average plant height of 39.17 cm, an average of 32.33 leaves at 35 days after planting, an average fresh bulb weight per clump of 159.67 g, and an average dry bulb weight per clump of 107.16 g. Therefore, this combination treatment can be recommended as a simple cultivation technique to enhance shallot productivity in low-fertility soils.

Keywords: Shallot, Cattle Manure, Bulb Tip Cutting

1. INTRODUCTION

Shallots (*Allium ascalonicum* L.) are a strategic horticultural commodity in Indonesia, widely used as a culinary spice and traditional medicinal ingredient, and have high economic value for smallholder farmers. The increasing population and diversification of food consumption have driven a continuous rise in shallot demand, which must be matched by improved and stable production throughout the year. At the national level, shallot production in 2023 reached 1,985,233 tons, slightly higher than 1,982,360 tons in 2022, whereas per capita consumption in 2023 was reported at 2.865 kg per year, indicating a relatively tight balance between supply and demand. Despite this growth, production fluctuations across seasons and regions, combined with postharvest losses, often lead to supply gaps and price instability, which encourage imports (Zaiful et al., 2025).

South Tapanuli Regency in North Sumatra Province has been identified as a potentially important shallot production area because of its agro-ecological conditions and government support through food estate programs. In this region, shallot production increased from 1,467 quintals in 2022 and 2,908.92 quintals in 2021 to 5,459 quintals in 2023, partly because of area expansion and intensification programs that included shallots as a priority commodity. Nevertheless, productivity in many farmer fields

History:

Received : December 20, 2025

Revised : January 19, 2026

Accepted : February 24, 2026

Published : February 28, 2026

Publisher: Inovasi Pratama Int. Press

Licensed: This work is licensed under a Creative Commons Attribution 4.0 License



remains below potential due to suboptimal soil fertility management, inappropriate seed handling, and vulnerability to biotic and abiotic stresses, particularly during the rainy season (Caniago & Nurasiah, 2024).

Conventional shallot cultivation has long depended on high doses of inorganic fertilizers to achieve short-term yield targets. However, excessive and prolonged use of chemical fertilizers can degrade the physical, chemical, and biological properties of soil, reduce soil organic matter, and increase environmental risks, including nutrient leaching and soil acidification. Recognizing these problems, there is a growing awareness among farmers, consumers, and policymakers of the importance of more sustainable production systems, including the wider use of organic inputs in agriculture. Organic fertilizers, such as compost and farmyard manure, can improve soil structure, enhance water-holding capacity, increase cation exchange capacity, and supply macro- and micronutrients needed for plant growth, thereby supporting more resilient and environmentally friendly horticultural systems (Muarif et al., 2022).

Cattle manure is one of the most abundant organic resources in rural areas of Indonesia. Adult cattle can produce approximately 30 kg of manure per day, which, if not properly managed, may become an environmental liability rather than an asset. When properly composted and applied to soil, cattle manure contributes nitrogen, phosphorus, and potassium, as well as organic matter that improves aggregate stability, porosity, and soil moisture retention, all of which are important for root development and nutrient uptake in shallot. Previous studies have shown that cattle manure can significantly increase plant height, leaf number, bulb number, and fresh and dry bulb weights in shallots and other crops, although the optimal dose may vary with soil type and management practices (Elsharkawy et al., 2025).

In addition to soil fertility management, seed quality and handling practices are critical determinants of shallot productivity. Farmers typically use bulb seeds of varying sizes and physiological ages, often without standardized selection and treatment, leading to heterogeneous plant stands and uneven growth patterns. Proper seed selection involves choosing healthy, single, medium-sized (approximately 1.5–4 cm in diameter), symmetrical bulbs from certified or quality-assured sources. Furthermore, bulb dormancy and pre-planting treatments influence the speed and uniformity of sprouting and subsequent vegetative development (Razali et al., 2023).

One practical technique used by farmers to manage bulb dormancy and stimulate early growth is bulb-tip cutting. Cutting off a portion of the bulb apex can break dormancy, facilitate the emergence of apical buds, and stimulate the differentiation of lateral buds, which may result in more shoots and, potentially, more bulbs per clump. Several studies have reported that cutting the bulb tip by approximately one-third can increase the number of leaves, tillers, and bulbs, as well as fresh bulb weight and overall productivity. However, excessive cutting that removes too much storage tissue can reduce the available reserves for initial growth, while no cutting may prolong dormancy and delay sprouting. Thus, determining an appropriate cutting intensity is essential to optimize the balance between dormancy breaking and the preservation of carbohydrate reserves (Cronje et al., 2022).

Although many studies have separately examined the effects of organic fertilizers and bulb tip cutting on shallot performance, there is still limited information regarding their combined effects under the specific agro-ecological conditions of upland areas in South Tapanuli. Interactions between nutrient availability from organic amendments and the

physiological response to bulb cutting may influence early vegetative growth, bulb initiation, and the final yield. For example, manure-amended soils may better support vigorous regrowth after cutting by supplying sufficient nitrogen and other nutrients for leaf expansion and photosynthesis, which, in turn, sustains bulb development (Aljuaid et al., 2025).

Based on these considerations, research was conducted to evaluate the effects of cattle manure dosage and bulb tip cutting on the growth and yield of shallots cultivated in polybags at 900 m above sea level in Kilang Papan Village, Sipirok. The specific problems addressed were as follows: (1) whether different doses of cattle manure significantly affect shallot growth and production; (2) whether different intensities of bulb tip cutting affect growth and production; and (3) whether there is a significant interaction between cattle manure dosage and bulb tip cutting intensity in determining shallot performance. We hypothesized that higher doses of cattle manure would improve growth and yield, moderate bulb tip cutting would increase sprouting and growth, and an appropriate combination of manure dose and cutting intensity would produce superior performance compared with single-factor treatments or the control.

The results of this study are expected to contribute to the literature both theoretically and practically. From an academic perspective, the findings enrich the body of knowledge on integrated nutrient and seed management in shallots, particularly under upland conditions and in the context of organic-based horticulture. From a practical standpoint, the results can serve as guidelines for farmers and local agricultural stakeholders in South Tapanuli in designing simple, low-cost cultivation practices to increase shallot productivity and income while maintaining soil health.

2. METHOD

The research was conducted in Kilang Papan Village, Sipirok, South Tapanuli Regency, North Sumatra Province, Indonesia, at an altitude of approximately 900 m above sea level. The site represents an upland environment with relatively cool temperatures and is part of an area targeted for horticultural development, including the cultivation of shallots. The experiment was conducted from February to April 2025, covering the period from land preparation to harvest and post-harvest observations.

Experimental design

The study employed an experimental approach using a factorial Randomized Block Design (RBD) with two factors: cattle manure dosage and bulb tip cutting. The first factor, cattle manure dosage (factor A), consisted of four levels: A0 = 0 g cattle manure per polybag (control), A1 = 50 g per polybag, A2 = 100 g per polybag, and A3 = 150 g per polybag. These rates correspond to approximately 0, 10, 20, and 30 tons ha⁻¹ when converted from field-scale recommendations to polybag units. The second factor, bulb tip cutting (factor B), also comprised four levels: B0 = no cutting, B1 = cutting one-quarter of the bulb length, B2 = cutting one-third of the bulb length, and B3 = cutting one-half of the bulb length (Creswell, 2021).

The combination of these two factors resulted in 16 treatment combinations (4 × 4). Each combination was replicated thrice, yielding a total of 48 experimental units. Each experimental unit consisted of one polybag containing one shallot plant as the observation sample, resulting in 48 sample plants. Polybags were arranged on the experimental plot with a spacing of 10 cm between polybags and 20 cm between treatment plots, while the distance between blocks was 30 cm to minimize inter-plot

interference. Treatments were randomly assigned within each block to reduce the influence of environmental heterogeneity.

Plant material and inputs

The plant material used in this study was shallot bulbs of the Batu Ijo variety, a cultivar commonly grown by farmers and adapted to the local conditions. Bulbs were selected to be healthy, free from visible diseases and mechanical damage, and of medium size appropriate for planting. Before planting, the bulbs were stored to complete the dormancy period and ensure readiness for sprouting (Arifah et al., 2025).

The cattle manure used in the experiment was sourced locally and composted prior to application to reduce phytotoxicity and stabilize nutrients. Manure provides organic matter and essential nutrients, such as nitrogen, phosphorus, and potassium, along with beneficial microorganisms. Additional inputs included Trichoderma as a biological agent to suppress soil-borne pathogens, water for irrigation, and basic tools such as hoes, knives, watering cans, measuring tapes, and digital scales.

Land preparation and polybag setup

The experimental site was cleared of weeds and debris before the arrangement of polybags. Soil used for filling the polybags was collected from the surrounding area, crushed to break up clods, and homogenized. Polybags measuring 30 cm × 30 cm were filled with soil, and cattle manure was incorporated according to the assigned treatment doses (0, 50, 100, and 150 g per polybag). The manure was thoroughly mixed with the soil to uniformly distribute organic matter and nutrients throughout the root zone.

After filling and mixing, the polybags were arranged on the prepared plot according to the experimental design. A period of several days was allowed to enable stabilization of the soil-manure mixture and the activity of soil microorganisms before planting. During this period, the soil in the polybags was kept moist but not waterlogged (Schatke et al., 2025).

Bulb cutting and planting

Bulb tip cutting treatments were applied immediately before planting. For B0, the bulbs were planted without cutting. For B1, B2, and B3, the apical part of the bulb was removed using a clean, sharp knife at approximately one-quarter, one-third, and one-half of the bulb length, respectively, measured from the tip to the base. Cutting was performed carefully to avoid damaging the basal plate where roots and buds originate and to maintain as much healthy tissue as possible at the lower part of the bulb.

After cutting, the bulbs were immediately planted in the center of each polybag at an appropriate depth so that the upper part of the bulb was slightly above the soil surface, facilitating sprout emergence and reducing the risk of rotting. Each polybag contained a single bulb as an experimental plant. Planting was carried out uniformly on the same day to minimize variations due to planting time.

Crop management

Standard agronomic practices for shallot cultivation were uniformly followed for all treatments. Irrigation was provided using watering cans, maintaining soil moisture at an adequate level without causing waterlogging, which could increase the risk of diseases. Weed control was performed manually by hand-weeding or shallow cultivation around the polybags to prevent competition for water and nutrients.

Pest and disease control was implemented as needed based on field observations, with a preference for environmentally friendly approaches. The application of Trichoderma was intended to enhance the biological control of soil-borne pathogens and support root

health. No additional inorganic fertilizers were applied because the study focused on the effects of cattle manure as the primary nutrient source.

Observed variables

Several growth and yield parameters were measured to evaluate the effects of cattle manure and bulb tip-cutting treatments. Plant height (cm) was recorded at 14, 21, 28, and 35 days after planting (DAP) by measuring from the soil surface to the tip of the longest leaf. The number of leaves per plant was also counted at the same observation times to assess the vegetative development.

At harvest, the number of bulbs per clump was counted to determine the effect of the treatments on bulb formation. Fresh bulb weight per clump (g) was measured immediately after harvest using a digital scale to evaluate the yield potential. The bulbs were then dried to a constant weight to obtain the dry bulb weight per clump (g), representing the marketable yield and storability. Weight loss during storage (percent) was calculated as the difference between fresh and dry weights, divided by fresh weight, and multiplied by 100 to indicate postharvest losses.

Data analysis

Data collected from the experiment were subjected to analysis of variance (ANOVA) appropriate for a factorial RBD using statistical software (SPSS version 25 for Windows). The linear model used can be expressed as

$$Y_{ijk} = \mu + A_i + B_j + (AB)_{ij} + \beta_k + \epsilon_{ijk}$$

where Y_{ijk} is the observation of the response variable for the i -th level of cattle manure dose, j -th level of bulb tip cutting, and k -th replication; μ is the overall mean; A_i is the effect of cattle manure dosage; B_j is the effect of bulb tip cutting; $(AB)_{ij}$ is the interaction effect between the two factors; β_k is the block effect; and ϵ_{ijk} is the random error term.

The significance of the main and interaction effects was evaluated at the 5% significance level. When ANOVA indicated significant treatment effects, mean separation was conducted using an appropriate post-hoc test (e.g., LSD or BNJ at 5%) to compare treatment means. In cases where the F-test showed no significant differences, treatment means were interpreted descriptively to examine trends and biological relevance.

The interpretation of the results considered both statistical significance and agronomic importance. Particular attention was paid to identifying treatment combinations that produced consistently high values of plant height, leaf number, bulb number, and fresh and dry bulb weights, while maintaining acceptable levels of weight loss during storage. These combinations were considered potential recommendations for shallot cultivation under similar conditions.

3. RESULTS AND DISCUSSION

Plant height

Table 1. Mean Plant Height at 35 Days After Planting (DAP) – A × B Interaction

Cattle Manure (A)	No Cutting (B0)	¼ Cutting (B1)	⅓ Cutting (B2)	½ Cutting (B3)	Mean A
A0 (0 g)	26.27 cm	22.87 cm	-	-	~26–34 cm

Cattle Manure (A)	No Cutting (B0)	¼ Cutting (B1)	⅓ Cutting (B2)	½ Cutting (B3)	Mean A
A1 (50 g)	-	40.40 cm	-	-	~35–40 cm
A2 (100 g)	-	39.17 cm	36.60 cm*	-	~36–40 cm
A3 (150 g)	-	-	-	-	~31–40 cm
Mean B	34.50 cm	34.54 cm	33.43 cm	30.92 cm	-

Baseline soil analyses revealed substantial heterogeneity across the treatment combinations (Table 1). The nitrogen content ranged from 0.25% (A₀B₀) to 0.47% (A₁B₂), indicating baseline nitrogen insufficiency across all treatments. Available phosphorus demonstrated considerable variation, with minimum values of 4.08 ppm (A₁B₀) and a maximum of 24.07 ppm (A₂B₁), suggesting inconsistencies in phosphorus bioavailability. Exchangeable potassium concentrations ranged from 0.30 me/100g (A₀B₀) to 1.22me/100g (A₁B₁), indicating potassium deficiency in the control treatments.

Plant height was significantly influenced by cattle manure dosage and its interaction with bulb tip cutting at certain observation periods. At 14 DAP, the mean plant height ranged from 8.83 cm to 27.27 cm across treatments, with the lowest values observed in the control without cattle manure (A₀) and the highest under the highest manure dose (A₃). The average plant height in A₀ ranged from 8.83 to 18.20 cm, indicating limited early vegetative growth in the absence of organic nutrients. In contrast, A₃ (150 g of manure per polybag) produced heights between 19.67 and 27.27 cm, with a mean of 23.29 cm, showing that higher manure doses enhanced early shoot elongation (Jasim & Kamal, 2022).

The positive effect of cattle manure on plant height can be attributed to improved soil structure and increased availability of macro- and micronutrients, especially nitrogen, which is critical for vegetative growth and chlorophyll formation. Organic matter from manure also stimulates root proliferation and microbial activity, leading to improved nutrient uptake. These findings are consistent with previous research reporting that cattle manure application improves vegetative growth parameters, such as plant height and leaf number, in shallots and other crops.

From the perspective of bulb tip cutting, treatments B₂ (one-third cutting) and B₃ (one-half cutting) generally produced greater plant height at 14 DAP than no cutting (B₀), suggesting that cutting facilitated faster sprout emergence and early shoot growth. The highest mean height at 14 DAP was recorded under B₃ with 21.84 cm, reflecting the strong dormancy-breaking effect of a deeper cutting. However, deeper cutting also removes more storage tissue and may compromise growth if not supported by adequate nutrients.

At 35 DAP, plant height was strongly influenced by manure dosage and its interaction with bulb cutting. Mean plant height varied from 26.27 cm in A₀B₀ to 40.40 cm in A₁B₁, indicating that the combination of moderate manure (50 g per polybag) and one-quarter

cutting (B1) provided a particularly favorable environment for sustained vegetative growth. In general, treatments A1, A2, and A3 produced taller plants than A0, confirming the importance of organic nutrient supply throughout the growth period of the plants. The relatively high performance of A1B1 suggests that, beyond a certain threshold, additional manure may not markedly increase plant height and that moderate cutting is sufficient to stimulate vigorous growth when nutrient availability is adequate (Muhammad Robiyansyah et al., 2025).

Number of leaves

Table 2. Mean Number of Leaves at 14 DAP – A × B Interaction

Cattle Manure (A)	No Cutting (B0)	¼ Cutting (B1)	⅓ Cutting (B2)	½ Cutting (B3)	Mean A
A0 (0 g)	6.33	9.33	7.00	13.00	8.91
A1 (50 g)	11.67	16.00	17.67	11.33	14.17
A2 (100 g)	10.33	18.00	15.00	13.67	14.25
A3 (150 g)	17.00	16.00	12.67	11.67	14.34
Mean B	11.33	14.83	13.08	12.42	12.92

The number of leaves per plant is an important indicator of photosynthetic capacity and potential assimilate production for bulbing. At 14 DAP, cattle manure significantly affected leaf number, with the highest mean leaf number (14.34 leaves) observed in A3, followed closely by A2 (14.25 leaves) and A1 (14.17 leaves), whereas the control A0 had only 8.91 leaves on average. This pattern clearly demonstrates that manure application increases early leaf proliferation, likely due to an improved nitrogen supply and overall nutrient balance.

The main effect of bulb tip cutting on leaf number at 14 DAP was not statistically significant, but there was a tendency for B1 (one-quarter cutting) to yield more leaves (14.83 leaves) than B0 (11.33 leaves) and the deeper cutting levels. Excessive cutting (B3) tended to reduce leaf number compared with moderate cutting, which may be due to reduced initial carbohydrate reserves in heavily cut bulbs. The interaction between manure and cutting was significant, with the combination A2B1 (100 g manure and one-quarter cutting) producing the highest mean leaf number (18 leaves), while A0B0 produced the lowest (6.33 leaves). This interaction indicates that the beneficial effect of bulb cutting on leaf formation is highly dependent on nutrient availability from manure. Without sufficient nutrients, cutting alone cannot compensate for the lack of resources (Indrabayu & Setiawan, 2023).

At 21 DAP, the trend continued, with manure showing a highly significant effect on leaf number. The highest mean leaf number was recorded in A2 (17.58 leaves), followed by A3 (17.16 leaves), whereas A0 produced only 11.75 leaves on average. Bulb cutting still did not show a significant main effect, but B1 again tended to outperform other levels with 17.17 leaves, indicating that moderate cutting remained favorable for leaf production. The interaction A2B1 yielded the highest number of leaves (20.67) at this stage, whereas A0B0 yielded the lowest (8.67 leaves).

At 28 and 35 DAP, manure continued to exert a strong influence on leaf number, whereas the effects of cutting were less pronounced. At 28 DAP, A2 produced the highest mean leaf number (23.67 leaves), followed by A3 (22.17 leaves), and A0 again had the lowest mean leaf number (14.25 leaves). By 35 DAP, A2 maintained the highest mean leaf number (26.50 leaves), with A3 slightly lower (24.92 leaves) and A0 still the lowest (15.58 leaves). Among the cutting treatments at 35 DAP, B1 resulted in the highest mean leaf number (25.83 leaves), whereas B3 recorded the lowest (19.75 leaves), reinforcing the advantage of moderate cutting over no or deep cutting.

The interaction at 35 DAP showed that A2B1 was particularly effective, achieving 32.33 leaves per plant, which was substantially higher than that of the other combinations. This high leaf number suggests a greater photosynthetic capacity and potentially higher assimilate availability for bulb enlargement. Overall, these results demonstrate that cattle manure doses of 100–150 g per polybag are optimal for maximizing leaf production, and that one-quarter bulb cutting further enhances leaf formation when combined with an adequate nutrient supply (Marpaung et al., 2025).

Number of bulbs per clump

Table 3. Mean Number of Leaves at 21 DAP – A × B Interaction

Cattle Manure (A)	No Cutting (B0)	¼ Cutting (B1)	⅓ Cutting (B2)	½ Cutting (B3)	Mean A
A0 (0 g)	8.67	11.67	10.67	16.00	11.75
A1 (50 g)	15.67	18.33	19.67	12.67	16.58
A2 (100 g)	14.33	20.67	18.67	16.67	17.58
A3 (150 g)	21.00	18.00	14.33	15.33	17.16
Mean B	14.92	17.17	15.84	15.17	15.77

The number of bulbs per clump is a key yield component that reflects the degree of tillering and bulb initiation. Analysis of variance showed that cattle manure, bulb tip cutting, and their interaction did not significantly affect bulb number per clump at the 5% significance level. Likewise, block effects were not significant, indicating relatively homogeneous environmental conditions across replications (Juliana et al., 2026).

Although no statistical differences were detected, descriptive analysis revealed some important trends. The mean number of bulbs per clump increased from 7.98 in the control (A0) to 11.54 in A1 (50 g per polybag), while A2 (9.74 bulbs) and A3 showed intermediate values. This suggests that moderate manure doses may be more efficient in stimulating bulb multiplication than either zero or higher doses, perhaps because of a better balance between vegetative growth and bulb differentiation. For bulb cutting, B2 (one-third cutting) had a slightly higher average bulb number (10.39 bulbs) than B0 (8.74 bulbs), B1, and B3, indicating that one-third cutting may favor bulb formation, even though the differences were not statistically significant.

The lack of significant treatment effects on bulb number per clump may indicate that this parameter is more strongly controlled by genetic factors and overall environmental conditions than by the specific manure and cutting treatments applied in this study. It is

also possible that the sample size and variability limited the statistical power to detect the differences. Nevertheless, the observed trends are consistent with previous findings that moderate levels of organic fertilization and bulb cutting can support higher bulb multiplication rates (Silvia et al., 2025).

Fresh bulb weight per clump

Table 4. Mean Number of Bulbs per Clump – Main Effects

Cattle Manure (A)	Mean Bulbs/Clump
A0 (0 g)	7.98
A1 (50 g)	11.54
A2 (100 g)	9.74
A3 (150 g)	Not significantly different

Fresh bulb weight per clump reflects the combined effects of bulb number and individual bulb size and is an important yield indicator. ANOVA results indicated that cattle manure significantly influenced fresh bulb weight, whereas bulb cutting and the interaction were not statistically significant. The control (A0) produced the lowest mean fresh bulb weight (98.33 g per clump), whereas A2 (100 g manure per polybag) achieved the highest mean (150.78 g per clump), with A1 and A3 yielding intermediate results.

These results suggest that 100 g of cattle manure per polybag was close to the optimal dose for maximizing fresh yield under the experimental conditions used in this study. Higher manure doses (A3) did not further increase fresh weight, possibly due to nutrient imbalances or diminished marginal returns at very high organic input levels. The beneficial effect of manure on fresh bulb weight aligns with its role in improving soil fertility, water status, and nutrient availability, which support vigorous vegetative growth and subsequent bulb enlargement (Suswati et al., 2025).

Although bulb cutting did not significantly affect fresh bulb weight as a main factor, B1 (one-quarter cutting) tended to produce a higher fresh weight (142.67 g per clump) than B0 (123.11 g), B2 (122.44 g), and B3. This trend suggests that moderate cutting enhances early growth and assimilate production without excessively reducing stored reserves, thereby contributing to a larger bulb size. In contrast, deeper cutting may compromise the plant's ability to sustain vigorous growth because of reduced carbohydrate storage in the bulb.

The interaction between A2 and B1 was particularly noteworthy, as this combination produced a high fresh bulb weight along with high plant height and leaf number, indicating a synergistic effect between optimal manure dosage and moderate cutting frequency. Although the interaction term was not statistically significant in the ANOVA, the agronomic implications are important, as this combination appears to offer a practical recommendation for farmers seeking to maximize their yield.

Dry bulb weight per clump and weight loss

Table 5. Mean Bulb Weight per Clump – Main Effects

Cattle Manure (A)	Fresh Weight (g/clump)	Dry Weight (g/clump)
A0 (0 g)	98.33	Lowest range
A1 (50 g)	~140	Moderate
A2 (100 g)	150.78 (highest)	Highest trend
A3 (150 g)	~130	High

Dry bulb weight per clump provides a measure of marketable yield and is directly related to the storage and transport potential. The analysis showed that neither cattle manure nor bulb cutting nor their interaction had a statistically significant effect on dry bulb weight at the 5% significance level. However, the mean values indicated a tendency for higher dry bulb weight in A2 and A3 than in A0, reflecting the general positive role of manure in supporting biomass accumulation and bulb filling.

The absence of significant differences may be due to variability in drying conditions, inherent variability among plants, or a relatively small sample size. Nonetheless, the observed trend suggests that organic fertilization with cattle manure contributes to improved dry yield, even if the effect was not strong enough to reach statistical significance under the conditions of this study.

Weight loss during storage, expressed as a percentage of the initial fresh weight, was not significantly affected by manure, cutting, or their interaction. This indicates that the treatments primarily influenced growth and yield rather than post-harvest physiological processes such as respiration and transpiration. From a practical standpoint, this means that the use of cattle manure and bulb cutting, within the ranges tested, does not negatively affect bulb storability (Abdelgawad et al., 2025).

Overall interpretation

Taken together, these results highlight the central role of cattle manure in enhancing shallot growth and yield under the upland conditions of Sipirok. Manure application at 100–150 g per polybag consistently increased plant height and leaf number during the vegetative phase and increased fresh bulb weight at harvest, although the effects on bulb number and dry weight were less pronounced. Bulb tip cutting, particularly at one-quarter of the bulb length, contributed to improved early vegetative growth and, in combination with adequate manure, resulted in high plant performance.

The interaction between manure and cutting was particularly evident in early growth parameters, such as plant height and leaf number at 14 and 21 DAP, as well as in plant height and leaf number at 35 DAP. The best combination identified was A2B1 (100 g cattle manure per polybag with one-quarter bulb cutting), which produced a high plant height (approximately 39–40 cm at 35 DAP), a large number of leaves (up to 32.33 per plant), and high fresh and dry bulb weights per clump. This combination appears to provide a balanced supply of nutrients and an optimal dormancy-breaking treatment, leading to vigorous growth and good yields.

From an agronomic viewpoint, these findings support the recommendation to adopt moderate doses of cattle manure combined with moderate bulb tip cutting as a simple,

low-cost technology for shallot cultivation, especially in areas with low soil fertility and limited access to chemical fertilizers. These results are consistent with those of previous studies emphasizing the importance of organic matter and appropriate seed treatments in sustainable shallot production.

Table 6 summarizes the key results for plant height at 35 DAP, leaf number at 35 DAP, number of bulbs per clump, and fresh and dry bulb weights per clump for the selected treatments.

Table 6. Selected growth and yield parameters of shallots under different cattle manure doses and bulb tip cutting intensities.

Treatment (A×B)	Cattle manure (g/polybag)	Bulb tip cutting	Plant height 35 DAP (cm)	Leaves 35 DAP (no.)	Bulbs per clump (no.)	Fresh bulb weight (g/clump)	Dry bulb weight (g/clump)
A0B0	0	None	26.27	15.67	6–8	98.33	lowest range
A1B1	50	¼ length	40.40	26.00	around 11–12	>140	moderate
A2B1	100	¼ length	39.17	32.33	up to 14	150.78	highest tendency
A3B3	150	½ length	>30	22.00	up to 17–18	>130	high tendency

Values are approximated from thesis tables and narrative; ranges reflect variability among replications.

4. CONCLUSIONS AND SUGGESTIONS

This study demonstrated that cattle manure application and bulb tip cutting substantially influence the growth and yield of shallots (*Allium ascalonicum* L.) under upland conditions in Sipirok, South Tapanuli. Cattle manure significantly increased early vegetative growth, as reflected by plant height and leaf number from 14 to 35 days after planting, with the most favorable responses generally obtained at doses of 100–150 g per polybag. Fresh bulb weight per clump was also significantly improved by manure, with 100 g per polybag identified as the most effective dose, whereas effects on bulb number, dry bulb weight, and weight loss during storage were less pronounced and not statistically significant. Bulb tip cutting did not significantly affect most yield components as a single factor, but moderate cutting at one-quarter of bulb length tended to enhance early growth and, in combination with manure, contributed to higher plant height, leaf number, and fresh bulb weight. Excessive cutting (half the bulb length) did not consistently improve performance and may reduce initial reserves, while no cutting often resulted in slower early growth. The interaction between cattle manure and bulb cutting was evident in several growth parameters, particularly plant height and leaf number at

14, 21, and 35 days after planting. The combination of 100 g cattle manure per polybag with one-quarter bulb cutting (A2B1) produced the best overall performance, characterized by high plant height, abundant leaves, increased bulb number, and high fresh and dry bulb weight per clump. Therefore, the application of 100 g cattle manure per polybag combined with one-quarter bulb tip cutting can be recommended as a practical and environmentally friendly technique to improve shallot productivity on low-fertility soils in upland areas similar to Kilang Papan Village, Sipirok.

5. ACKNOWLEDGE

The author thanks all the people and institutions that helped and funded this research.

6. REFERENCE

- Abdelgawad, K. F., Shehata, S. A., El-Metwally, I. M., El-Desoki, E. R., El-Rokiek, K. G., & Elkhawaga, F. A. (2025). Efficacy of pre-harvest weed control treatments on onion bulb storability. *Scientific Reports*, *15*(1), 6766. <https://doi.org/10.1038/s41598-025-89970-6>
- Aljuaid, A., Almuziny, M., Alharbi, A. A., Alomran, M. M., Alasmari, A., Alatawi, A., Alzuaibr, F. M., Alwutayd, K. M., Albogami, B. Z., Awad-Allah, M. M. A., & El Nagy, M. (2025). Nano-propolis and potassium silicate for enhancing vegetative growth, bulb yield and resistance to downy mildew, in onion (*Allium cepa* L.). *Cogent Food & Agriculture*, *11*(1). <https://doi.org/10.1080/23311932.2025.2578339>
- Arifah, S. M., Khasan, M. Y., Machmudi, M., Zakia, A., & Pangestika, P. (2025). Response to Some Varieties of Onion (*Allium ascalonicum* L.) in Manure Application with Different Doses. *Agrosains: Jurnal Penelitian Agronomi*, *26*(2), 99. <https://doi.org/10.20961/agsjpa.v26i2.97937>
- Caniago, A., & Nurasiah, N. (2024). Food Estate Policy in Humbang Hasundutan Regency, North Sumatra Province, from the Perspective of Masalah Mursalah. *Journal of Law, Politic and Humanities*, *4*(3), 289–294. <https://doi.org/10.38035/jlph.v4i3.353>
- Creswell, J. W. (2021). *Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.)*. SAGE Publications.
- Cronje, R. B., Hajari, E., Jonker, A., Ratlapane, I. M., Huang, X., Theron, K. I., & Hoffman, E. W. (2022). Foliar application of ethephon induces bud dormancy and affects gene expression of dormancy- and flowering-related genes in ‘Mauritius’ litchi (*Litchi chinensis* Sonn.). *Journal of Plant Physiology*, *276*, 153768. <https://doi.org/10.1016/j.jplph.2022.153768>
- Elsharkawy, S., Latif, H., Purnawarman, T., & Rahayu, P. (2025). Prevalence of *Escherichia Coli* O157 strain isolated from dairy cattle manure in Bogor, Indonesia. *Revista de Ciências Agroveterinárias*, *24*(3), 575–593. <https://doi.org/10.5965/223811712432025575>
- Indrabayu, I., & Setiawan, A. W. (2023). Effect of Nutrient Element and Leaf Cutting Year on Tea Quality At Unit Perkebunan (UP) Tambi Wonosobo. *Asian Journal of Social and Humanities*, *1*(11), 839–851. <https://doi.org/10.59888/ajosh.v1i11.95>
- Jasim, S. S., & Kamal, J. A.-K. (2022). The Effect of the Fungal Inoculation and Cow Manure and Dab Fertilizer in the Growth of Wheat Plant and the Availability of Iron and Zinc in the Soil. *IOP Conference Series: Earth and Environmental Science*, *1060*(1), 012011. <https://doi.org/10.1088/1755-1315/1060/1/012011>

- Juliana, D., Nurjanah, U., Marlin, M., Setyowati, N., & Iswanriyanto, A. (2026). Growth and Yield Response of Shallots (*Allium cepa* L.) on Sandy Soil Using Several Soil Ameliorant Compositions. *Asian Journal of Agricultural and Horticultural Research*, 13(1), 43–56. <https://doi.org/10.9734/ajahr/2026/v13i1434>
- Marpaung, C. A., Sudiarso, & Adi Setiawan. (2025). Growth, yield, and nitrogen use efficiency of shallots with plant growth-promoting rhizobacteria and cattle manure. *Jurnal Agronomi Indonesia (Indonesian Journal of Agronomy)*, 53(3), 385–396. <https://doi.org/10.24831/jai.533.68329>
- Muarif, S., Sulistyarningsih, E., Handayani, V. D. S., & Isnansetyo, A. (2022). Substituting Sargassum sp. Compost for Inorganic Fertilizer Improves the Growth and Yield of Shallot (*Allium cepa* L. Aggregatum Group). *Pertanika Journal of Tropical Agricultural Science*, 45(4), 867–880. <https://doi.org/10.47836/pjtas.45.4.02>
- Muhammad Robiyansyah, Nanik Lestariningsih, & Lilin Ika Nur Indah Sari. (2025). Effect of Soaking Duration Bulb in 75% Old Coconut Water on Growth and Yield of Bima Brebes Shallot (*Allium cepa* L.): Plant Height, Leaf Count, Bulb Number, Bulb Diameter, and Bulb Weight. *Science Education and Application Journal*, 7(2), 143–154. <https://doi.org/10.30736/seaj.v7i2.1267>
- Razali, Nasution, Z., Rahmawaty, & Hanum, C. (2023). Effect of Soil Texture on the Productivity of Two Shallot Varieties. *Indonesian Journal of Agricultural Research*, 6(01), 43–50. <https://doi.org/10.32734/injar.v6i01.8217>
- Schatke, M., Ulber, L., Kämpfer, C., & von Redwitz, C. (2025). Estimation of weed distribution for site-specific weed management—can Gaussian copula reduce the smoothing effect? *Precision Agriculture*, 26(2), 37. <https://doi.org/10.1007/s11119-025-10232-6>
- Silvia, S. P. S., Herawati, N., Nurfalah, R., Kusumawati, A., & Hervani, D. (2025). Impact of Sawdust and Chicken Manure Compost Mixture on The Growth and Yield of Sallot (*Allium ascalonicum* L.). *Jurnal Riset Perkebunan*, 6(2), 74–84. <https://doi.org/10.25077/jrp.6.2.74-84.2025>
- Suswati, D., Fadilla, U., Kusuma, E. W. W., & Nuriman, M. (2025). The Role of Boiler Ash and Chicken Manure on Macro Nutrient Availability and Growth of Maize (*Zea mays* L.) on Peat Soil. *Jurnal Biologi Tropis*, 25(4b), 294–304. <https://doi.org/10.29303/jbt.v25i4b.10621>
- Zaiful, Z. K., Faried, M., Syam'un, E., Mantja, K., Putri, R. W., Jalil, A., Wijaya, P., & Cennawati, C. (2025). Effect of boron priming on germination traits of shallot (*Allium ascalonicum* L.). *Advances in Horticultural Science*, 39(3), 205–214. <https://doi.org/10.36253/ahsc-17508>