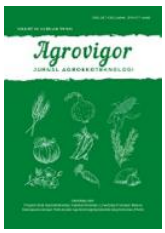
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Article

Effect of Shade and Various Types of Animal Manure Fertilizer on the Yield of Shallot (*Allium ascalonicum* L.) Lokananta Variety of True Shallot Seed (TSS) in Ultisol Soil

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ABSTRACT

Shallot is an important horticultural commodity. Shallot production is influenced by variety, planting material, environment, growing media, and nutrient availability. Optimal sunlight intensity and appropriate nutrient types are essential to achieve high yields. Adequate nutrients can be obtained through the application of animal manure to the growing media. This study aimed to determine the effect of shading and types of animal manure on the yield of Lokananta shallot variety from True Shallot Seed (TSS) grown in Ultisol soil. The research was conducted on Ultisol soil in Pangkalpinang City, Bangka Belitung Islands Province, from April to September 2024. A split-plot design arranged in a Randomized Complete Block Design (RCBD) was used. The main plot was shading treatment (with shading and without shading), and the subplot was types of animal manure (chicken, cattle, goat, swiftlet, and bat manure). Data were analyzed using Fisher's test and the Honestly Significant Difference (HSD) test at a 95% confidence level. The results showed that the treatment without shading produced the best agronomic characteristics of TSS-grown shallots in terms of number of leaves, number of tillers, stem diameter, and number of bulbs across different animal manure types in Ultisol soil. The combination of chicken manure and no shading yielded the best plant characteristics in terms of number of leaves, number of tillers, fresh weight, and dry weight in Ultisol soil. The application of chicken manure showed superior performance in number of tillers, stem diameter, and fresh weight.

INTRODUCTION

Shallot is one of the leading horticultural commodities in Indonesia that has high economic value. According to BPS (2023), national shallot production reached 1,985,233 tons. This production figure increased from the previous year which only recorded a production figure of 1,982,360. BPS Babel (2023), this production result was followed by an increase in shallot production in the Bangka Belitung Islands which reached 1,757 quintals in 2023. This production figure increased from 2022 which only recorded a production figure of 787 quintals. The increase in production is influenced by the use of the type of planting material and the quality of planting material.

Onion cultivation can be through propagation with bulbs and seeds or True Shallot Seed (TSS). The disadvantages of cultivation using bulbs are more planting material, seed-borne pathogens, require storage space, inefficient place and time, and degeneration of yield potential when seeds are used continuously. TSS as seed can produce healthier plants (free of viruses and seed-borne diseases) and higher productivity compared to conventional seed tubers. The use of seed origin (TSS) leads to fewer seed requirements (3-6 kg/ha) compared to seed bulbs (1-1.5 tons/ha), lower production costs, easier storage and transportation, producing healthier and disease-free plants (Syam'un *et al*., 2017). The productivity of using shallot seed origin from TSS reaches 17.1-23.3 tons/ha, while from seedling bulbs reaches 14.3-20.9 tons/ha. The disadvantage of using TSS is that the seeds must be sown first and the harvest age in the field is longer (Thoriqussalam & Damanhuri, 2019).

Onion seeds are generally sown by farmers in the shade, so they need acclimatization before being transferred to the field. Information on the adaptability of TTS to shade is important to know. Shallot plants require sunlight intensity (Widodo & Nasution, 2016). Research results Sari *et al*. (2022), mentioned that shallot plants can grow optimally at 70% light intensity.

The selection of planting material in shallot cultivation is one of the important factors in determining the growth rate and yield of plants. Seeds are a determining factor in increasing plant productivity, therefore planting materials must have good quality. The use of quality seeds can increase yields up to 15-25% (Sugiartini *et al*., 2015). According to Widodo *et al*. (2024), shallots with uniform bulb size, undamaged skin, shiny dark red color, and free from pest and disease attacks are considered to have high quality.

Crop yields are influenced by genetic factors or differ between varieties. Lokananta variety is one of the superior varieties that has disease resistance and high yield potential. Lokananta variety has resistance to extreme weather conditions, pest and disease attacks (Maharani *et al*., 2024). Askari-Khorasgani & Pessarakli (2019), said shallots grown from TSS have more stable production, higher yields, free from pests and diseases, lower seed volume, cheaper production costs, and no special transportation and storage for TSS. Kurnia *et al*. (2023), explained other advantages such as high productivity, disease resistance, and good adaptation to various agroclimatic conditions in Indonesia. Besides varieties, shallot yield is influenced by soil type. Ultisol soil types dominate on Bangka Island. Ultisol soils have a horizon of iron deposition, aloxide and spodic organic matter (Kharolina *et al*., 2023). Rahmawati *et al*. (2018), stated that this soil is poor in organic matter and high in acidity. Basuki *et al*. (2018), ultisol soils have an acidity level (pH) of 4.3-4.9 (very acid to acid) and soil organic C value of 0.13%-1.12% (very low to low). Ultisol soils are classified as nutrient poor in N, P and K.

Applying animal manure can improve soil quality as it provides nutrients to optimize shallot growth. Animal manure provides macro (nitrogen, phosphorus, potassium, calcium, and sulfur) and micro (iron, zinc, boron, cobalt, and molybdenium) elements. Animal manure fertilizer functions to increase water resistance, soil microbiological activity, cation exchange capacity value and improve soil structure (Yuliana *et al*., 2017). Each type of animal manure fertilizer has a different nutrient content. Primary nutrients contained in fresh chicken manure are 1.5% N, 1.0% P_2O_5, and 0.5% K_2O while 3 dried chicken manure contains 4.5% N, 3.5% P_2O_5, and 2.0% K_2O. The macro nutrient content of N, P and K from goat manure is 0.95% N, 0.36% P_2O_5, 1.00% K_2O and 87% water, while cow manure contains 92% water, 0.60% N, 0.15% P_2O_5 and 0.45% K(2) O (Arifah, 2013). According to Kurniawan *et al*. (2023), the nutrient content contained in swallow dung is N-total 8.26%, P-total 2.9%, and K-total 1.04%. Bat manure contains nitrogen (N) 7-17%, phosphorus (P) 8-15%, and potassium (K) 1.5-2.5% as well as other macronutrients such as calcium, magnesium and sulfur (Tangguda *et al*, 2022).

Appropriate animal manure fertilizer can increase the growth and yield of shallot plants. Research results Budianto *et al*. (2015), showed that chicken manure fertilizer at a dose of 10 tons/ha was able to increase plant height, number of leaves, number of bulbs, and bulb production. The results of research Sakti & Sugito (2018), giving cow manure as much as 30 tons/ha can increase the yield of oven-dried bulbs, fresh weight of bulbs, oven-dried bulb weight, bulb diameter and number of bulbs. Romadi (2020), in his research giving goat manure 15 tons/ha, the results were able to increase plant height, number of leaves, tuber diameter, plant wet weight, plant dry weight, and tuber weight. According to Anam *et al*. (2023), bat dung fertilizer at a dose of 10 tons/ha gives a real effect on plant height, number of leaves, number of tubers and wet and dry weight of tubers. Sumardi & Laude (2024), said the application of swallow dung fertilizer at a dose of 10 tons/ha was able to increase plant height, fresh weight and wet weight of tubers. The use of the right type of animal manure fertilizer will increase the yield of shallot plants.

The novelty value of this research is the use of shade for shallots. Currently, there has been no research testing the right type of manure for shallots planted on ultisol soil. The aim of this research was to determine the effect of shade on the growth and yield of shallots grown from TSS seeds and to determine the appropriate type of manure to increase shallot growth and yield.

MATERIALS AND METHODS

The research was conducted from March to September 2024. The research site was Ultisol soil type located on Tanjung Bunga Street, Sinar Bulan Village, Pangkalpinang City, Bangka Belitung Islands Province.

The main ingredients of the research were shallot bulb seeds of Lokananta variety derived from Lokananta shallot botanical seeds from the Directorate General of Horticulture and kendang fertilizer (chicken, goat, cow, swallow, and bat manure). Other materials were 50 cm polybags, agricultural lime, TSP, NPK, MKP, fungicides, insecticides, and 65-75% paranet. Tools used were hoe, ruler, scales, 2.5 liter paint bucket, digital scales, vernier caliper, paddle, camera, and stationery.

The study used Split Plot Design with Randomized Block Design (RBD) environment design. The main plot was shade (with shade and without shade). Subplots were the type of animal manure (chicken, cow, goat, swallow and bat manure). Each treatment was divided into 5 groups and there were 5 plant samples.

The nursery was conducted using a soil block nursery system. After 42 days of nursery age or 6 weeks, the seedlings were ready to be transferred for planting into polybags filled with ultisol soil media. Ultisol soil, animal manure fertilizer and agricultural lime were mixed with a volume ratio of 3:1:0.4 or equivalent to 7.5:2.5:1 (liter) in each 50x60cm polybag. The dose of manure is 1 liter per polybag. After the media was mixed and put into polybags, it was watered with water once a day and left for 1 week until the pH of the media was neutral ranging from 5.5-7.

Planting is done without damaging the roots, by lifting the following soil block and planting or immersing it into the media in the prepared polybag. Each polybag was planted with 5 seedlings, with a pattern of 1 in the center and 4 on the sides forming a rectangle, with a spacing of about 20 cm. The total number of media in polybags prepared was 50 polybags, consisting of 25 polybags placed in a shaded area and 25 polybags placed in a non-shaded area. The 25 polybags consisted of MA, MS, MKb, MW, and MKlr, 5 polybags each. Each polybag consisted of 5 seedlings.

Watering intensity was carried out twice a day in the morning and evening for 10 days after planting (HST), followed by watering once a day (morning) until 42 HST or during the growth/vegetative period, and watering every other day during the tuber formation period or entering the generative phase > 42 HST. Fertilization is carried out in several stages with the following types and doses of fertilizers:

1. Stage I at the age of 10 HST, with NPK 16:16:16 as much as 150 kg/ha or 15 grams/m^2 (3 grams/polybag);
2. Phase II at 21 HST, with NPK 16:16:16 as much as 150 kg/ha or 15 grams /m^2 (3 grams / polybag);
3. Stage III at the age of 30 HST, with NPK 16:16:16 as much as 150 kg / ha or 15 grams /m^2 (3 grams / polybag);
4. Stage IV at the age of 35 HST. with MKP as much as 100 kg / ha or 10 grams /m^2 (2 grams / polybag);
5. Stage V at the age of 49 HST, with MKP as much as 100 kg/ha or 10 grams /m^2 (2 grams / polybag); and
6. Stage VI as additional fertilizer at the age of 59 HST, with MKP as much as 100 kg/ha or 10 grams/m^2 (2 grams/polybag).

In the plant maintenance stage, manual weeding of weeds is carried out. Pest/disease management is carried out with an integrated system, by means of continuous observation and the use of pesticides that are good and correct or as minimal as possible, paying attention to environmental health thresholds. Harvesting of shallot bulbs is done simultaneously at the age of 70 HST, by manually pulling out the entire plant up to the roots of the plant.

Observation of shallot plants was carried out 70 HST or 1 week before harvesting the plants. The characters observed were plant height (cm), number of leaves (strands), stem diameter (mm), number of tillers (stems), number of bulbs (fruit), diameter of bulbs (cm), wet weight (grams) and dry weight (grams). Data analysis in this study used Fisher's test and Honestly Significant Difference (HSD) significantly different test α 0.05.

RESULTS AND DISCUSSION

Based on the results of analysis of variance (Table 1), it was found that the interaction between shade and type of animal manure fertilizer (A×B) gave a significant or very significant effect on several parameters of growth and yield of shallot varieties Lokananta seed origin (TSS) on ultisol soil media. The shading factor has a very significant effect on the characters of plant height, number of leaves, stem diameter, and number of bulbs, and has a significant effect on the number of tillers. The animal manure fertilizer type factor has a very significant effect on the number of leaves and stem diameter, and has a significant effect on the number of tillers, tuber diameter, and wet weight. The results of the interaction between shade and type of animal manure fertilizer had a very significant effect on plant height, number of leaves and number of tillers and had a significant effect on wet weight and dry weight.

The results of the HSD test of shading on the growth and yield characters of shallot Lokananta variety from seed (TSS) on ultisol soil (Table 2), showed that plants without shading showed better results in the number of leaves, number of tillers, stem diameter, and number of bulbs. However, plant height characters were higher in the shade treatment, while tuber diameter, wet weight and dry weight were not significantly different between treatments.

The significant effect of shading on several plant morphological characters indicates that light intensity plays an important role. Shade affects the photosynthesis process which has an impact on plant height and leaf formation (Hazizah et al., 2021). Plants under shade tend to experience etiolation, so plants are taller, but the number of leaves tends to be less than without shade (Widiastuti, 2020). Shade is thought to be able to modify light intensity and microclimate temperature, thereby increasing plant cell elongation.

The effect caused by shade treatment is a reaction resulting from the interaction of plants with the environment. Each plant has a different reaction to the influence of the environment around it. That each character or variable of shallot growth has different results on the effect of shade treatment between variables one to another (Ekawati & Saputri, 2020).

The treatment without shading (non-shade) gives good results on the parameters of the number of leaves, the number of tillers, the diameter of the bulbs, and the number of bulbs. Without shading, optimal sunlight intensity accelerates photosynthesis thus increasing the number of leaves and tiller 6 formation (Sari *et al*., 2022). Meanwhile, shading causes internodus elongation (shade avoidance effect), so plants appear taller (Alhidayah *et al*., 2024; Dewi & Ariffin, 2019). The greater number of tubers under no-shade conditions is closely related to greater photosynthetic energy for generative growth (Pangestuti & Zahrah, 2021).

The effect of direct exposure to sunlight has a good effect on several characters of shallot growth and yield. According to Mahmudi *et al*. (2017), sunlight in optimum conditions has an important role in the growth and development of shallot plants through the process of photosynthesis, some of the results of the photosynthesis process of shallots are allocated in the formation of plant organs, one of which is the leaf organ. Explained in Wahyuningsih *et al.* (2018), the results of photosynthesis from the source organ or source organ will be utilized by plants as a source of energy in the formation of other plant organs. The ability of plants to produce food sources through photosynthesis will be distributed to all parts of the plant that need sink organs and will affect plant productivity.

Table 1. Variance analysis of characteristics of shallot variety Lokananta (TSS) on ultisol soil against types of animal manure fertilizer in shaded and unshaded areas.

Character	Shade		Animal manure fertilizer		Interaction		KK (%)
	F-hit	P-Value	F-hit	P-Value	F-hit	P-Value	
Plant Height (cm)	23.64	0.0083**	1.70	0.1748 ns	5.88	0.0012**	4.26(T)
Number of Leaves (blade)	24.95	0.0075**	4.40	0.0060**	13.01	0.0000**	27.20
Number of tillers (stem)	13.46	0.0214*	2.84	0.0402*	10.29	0.0000**	16.55
Trunk Diamter (mm)	94.53	0.0006**	5.34	0.0021**	3.88	0.0111 ns	10.13
Tuber Diameter (mm)	1.82	0.2484 ns	2.68	0.0495*	0.97	0.4381 ns	5.40(T)
Number of Tubers (fruit)	134.43	0.0003**	0.79	0.5419 ns	2.42	0.0688 ns	21.54(T)
Wet Weight (g)	0.10	0.7641 ns	2.69	0.0489*	3.74	0.0132*	20.41(T)
Dry Weight (g)	0.27	0.6275 ns	0.27	0.0948 ns	3.04	0.0309*	22.93(T)

Notes: F-hit= F calculated, F-prob= probability value, *= significant effect, **= Very significant effect, ns= no significant effect, KK= Coefficient of variation, (T)= Transformation Data.

Table 2: Results of Differential Test of Treatment Mean (HSD) of Shade on Characteristics of Red Onion Lokananta Variety (TSS) on Ultisol Soil

Character	Factor	
	Shade	Without Shade
Plant Height (cm)	6.99 a	6.51 b
Number of Leaves (blade)	19.22 b	27.35 a
Number of tillers (stem)	1.95 b	2.27 a
Trunk Diamter (mm)	6.82 b	9.78 a
Tuber Diameter (mm)	4.68 a	4.58 a
Number of Tubers (fruit)	2.05 b	2.57 a
Wet Weight (g)	7.01 a	7.07 a
Dry Weight (g)	5.11 a	5.23 a

Notes: Numbers followed by the same letter in the same row indicate the effect is not significantly different at the significantly different in the HSD test (α 0.05)

Sufficient sunlight intensity can increase photosynthetic activity, thus supporting optimal vegetative growth and tuber formation. This is in accordance with the opinion of Haryandi *et al*. (2018), that sunlight plays an important role in photosynthesis and accumulation of plant yields. According to Forniawan *et al*. (2017), the light intensity factor significantly affects the number of tillers, the number of bulbs in shallot plants. However, the highest plant height was found in the shaded treatment. This phenomenon can be explained through the physiological response of plants to light deficiency, where the hormone auxin responds by increasing stem elongation (etiolation) so that plants can access morelight.

The use of 75% paranet shade gave the highest results of plant height characters compared to the no-shade factor. The character of plant height produced by the effect of shade treatment is the reaction of growth hormones in response to the influence of sunlight due

to shading. The auxin hormone will work faster to elongate the stem in an effort to find and get more light. According to Firdaus *et al*. (2017), shallot plants based on physiological reactions belong to the type of C3 plant, where the photosynthate of shallot plants produced is not stored in the form of starch in storage organs. Explanation in Ekawati & Saputri (2020), that the photosynthate produced by shallots is revamped in the physiological process of photorespiration for the process of growth and development of shallot plants. Photosynthate translocation that occurs in shallots is a factor that causes partially produced photosynthates not stored in storage organs such as bulbs, so that the shade treatment does not give a real effect on yield characters.

The use of inorganic fertilizers in this study was to provide macronutrients for plants. This is because the ultisol soil used in this study is classified as suboptimal. The low pH of this soil results in some macro and micronutrients being unavailable to plants.

The results of the HSD further test on animal manure fertilizer (Table 3), showed that there was no significant difference between animal manure fertilizer treatments on the characters of plant height, number of bulbs, and dry weight. When compared with other animal manure fertilizer treatments, it is known that bat manure fertilizer produces the highest number of leaves, swallow manure fertilizer produces the largest tuber diameter, and chicken manure fertilizer produces the heaviest wet weight. Chicken and bat manure fertilizers both showed the best data on the number of tillers and stem diameter characters.

The provision of organic matter in the form of animal manure or animal manure is an effort to provide nutrients in increasing the growth of shallot plants in ultisol soil media. According to research Isma & Mahdiannoor (2020), the application of animal manure fertilizer has a good effect on the growth of shallot plants. Different types of animal manure fertilizers contribute varied nutrients, especially the content of N, P, and K which are very instrumental in the formation of leaves, stems, and bulbs (Fausi *et al*., 2022).

Table 3. Test Results of Differential Treatment Mean (HSD) of Animal Manure Fertilizer on the Characteristics of Red Onion Lokananta Variety (TSS) on ultisol soil.

Character	Animal manure fertilizer				
	Chicken	Cow	Goat	Swallow	Bat
Plant Height (cm)	6.87 a	6.70 a	6.75 a	6.58 a	6.85 a
Number of Leaves (blade)	26.35 ab	20.55 c	22.76 bc	18.22 c	28.55 a
Number of tillers (stem)	2.28 a	2.11 ab	2.07 ab	1.82 b	2.26 a
Trunk Diamter (mm)	9.01 a	7.39 b	8.14 ab	8.28 ab	8.69 a
Tuber Diameter (mm)	4.69 ab	4.55 ab	4.47 b	4.81 a	4.61 ab
Number of Tubers (fruit)	2.47 a	2.39 a	2.19 a	2.14 a	2.33 a
Wet Weight (g)	8.08 a	7.15 ab	6.36 b	6.28 b	7.33 ab
Dry Weight (g)	6.03 a	5.21 a	4.50 a	5.09 a	5.02 a

Notes: The number followed by the same letter in the same column shows the effect is not significantly different in the HSD test (α 0.05).

Fast-decomposing chicken manure fertilizer usually contains high nitrogen which promotes vegetative growth (Purba *et al*., 2021; Syahmani, 2022). The interaction between shade and manure fertilizer shows that optimal environmental conditions (shade + N-rich fertilizer) can synergistically increase growth (Syarifudin *et al.,* 2020). This is in accordance with the research of Khadijah *et al*. (2021), the results of the wet weight growth parameter of shallot plants showed a significantly different effect on the treatment of chicken manure fertilizer. According to Ritonga *et al*. (2022), the use of chicken manure fertilizer has a good effect on soil fertility and supports the growth of shallot plants, where chicken manure fertilizer contains 0.80% P 2O 5, 1.00% Nitrogen and 0.40% K 2O.

Bat manure fertilizer is rich in phosphorus and potassium which promotes the formation of strong leaves and stems (Putri *et al*., 2022). Chicken manure increases biomass due to nitrogen content and fast decomposition (Syarifudin *et al*., 2020). The content of

macro and micro nutrients in animal manure fertilizers affects the vegetative and generative growth of plants (Supriadi *et al*., 2017). The content of swallow manure fertilizer contains very high nutrients and is good for the soil, including C-Organic content 50.46%, N/total 11.24%, and C/N ratio 4.49 with pH 7.97, Phosphorus 1.59%, Potassium 2.17%, Calcium 0.30%, Magnesium 0.01% (Iqbal & Ulpah, 2022).

The treatment of goat manure fertilizer showed the largest tuber diameter character compared to other treatments. In accordance with research which states that the use of goat manure fertilizer has a significant effect on the growth of shallot plants (Priyadi *et al*., 2021). According to Novitasari & Caroline (2021), the quality of goat manure fertilizer has an average value of C-organic 23.19%, Nitrogen 1.99%, Phosphorus 1.35%, Potassium 1.82%, C/N Ratio 13.38 and Moisture content 34.31%. The content of elements possessed by goat manure fertilizer is a factor that affects the growth of shallot plants.

The results of the Treatment Mean Difference Test (HSD) of the interaction of shade treatment with animal manure fertilizer on the characters of shallot Lokananta variety (TSS) on ultisol soil (Table 4), showed that the combination of treatment without shade (Non-Shade) with chicken manure fertilizer (MA) gave the highest results on the number of leaves, number of tillers, wet weight, and dry weight.

Table 4. Results of Differential Test of Treatment Means (HSD) Interaction of Shade Treatment with animal manure fertilizer on the characteristics of shallot varieties Lokananta (TSS) on ultisol soil.

Character	Shade /Non	Animal manure fertilizer				
		Chicken	Chicken	Chicken	Chicken	Chicken
Plant Height (cm)	Shade	6.78 abc	7.22 a	7.09 a	6.75 abc	7.12 a
	Non	6.93 ab	6.18 c	6.40 bc	6.42 bc	6.63 abc
Total Leaf (blade)	Shade	11.90 c	20.30 c	25.29 bc	18.77 c	19.83 c
	Non	40.80 a	20.80 c	20.23 c	17.67 c	37.27 ab
Number of Tubers (fruit)	Shade	1.58 c	2.22 abc	2.13 bc	1.91 c	1.90 c
	Non	2.94 a	2.00 bc	2.02 bc	1.73 c	2.67 ab
Stem Diameter (mm)	Shade	6.76 a	6.5 a	7.2 a	6.36 a	7.28 a
	Non	10.62 a	8.28 a	9.08 a	10.20 a	10.74 a
Tuber Diameter (mm)	Shade	4.67 a	4.68 a	4.58 a	4.76 a	4.70 a
	Non	4.71 a	4.43 a	4.37 a	4.86 a	4.53 a
Total Tuber (fruit)	Shade	1.89 a	2.27 a	1.98 a	2.18 a	1.91 a
	Non	2.78 a	2.51 a	2.41 a	2.09 a	3.04 a
Weigh Wetness (g)	Shade	7.25 ab	8.33 ab	7.09 ab	5.97 ab	6.72 ab
	Non	8.92 a	5.97 ab	5.63 b	6.60 ab	7.95 ab
Weight Dry Weight (g)	Shade	5.38 ab	6.08 ab	5.09 ab	5.02 ab	4.57 ab
	Non	6.68 a	4.34 ab	3.91 b	5.16 ab	5.46 b

Description: Numbers followed by the same letter in the same character indicate no significant difference in the HSD test (α 0.05).

The results showed that the no-shade treatment combined with the application of chicken manure fertilizer gave the most positive effect on the vegetative growth of shallot variety Lokananta from seed (TSS) in ultisol soil. This treatment was able to produce the highest number of leaves and tillers, as well as a relatively large stem diameter compared to other treatments. Shade-free conditions provide maximum sunlight intensity which is very important in supporting the photosynthesis process. According to (Zega *et al*., 2024), Optimal photosynthesis produces enough energy for plants to form vegetative organs such as leaves, tillers, and stems. The fulfilled sunlight supported by nutrients supplied from chicken manure fertilizer provides optimal growth in shallot plants (Yelni, 2019). According to research by Umari *et al.* (2018), organic fertilizer treatment combined with non-

shade treatment provides an increase in the growth of shallot plants.

In addition to the light factor, the use of chicken manure fertilizer also contributes greatly to the results achieved. Chicken manure fertilizer has a high nitrogen content and a low C/N ratio, so it decomposes faster and its nutrients are more easily available to plants (Saepudin *et al*., 2025). Nitrogen itself is an essential nutrient that plays a role in the formation of chlorophyll, amino acids, and proteins, all of which are important in supporting plant tissue growth, including the number of leaves and tillers (Chofifawati *et al*., 2024). Therefore, the combination of high light availability and sufficient nitrogen supply from chicken fertilizer can create ideal conditions for shallot vegetative growth.

The interaction between high light intensity from the no-shade environment and abundant nutrient content from animal manure fertilizers, especially chicken and bat, proved to be effective in improving vegetative growth of seed-origin Lokananta variety shallots in ultisol soils. This shows the importance of managing the growing environment and applying the right organic fertilizer in an effort to increase the productivity of horticultural crops, especially shallots. In general, the no-shade treatment combined with chicken manure fertilizer produced the best plant growth and yield responses in most parameters, especially the number of leaves, number of tillers, stem diameter, and bulb weight. This indicates that full light intensity and nutrient availability from chicken manure fertilizer provide optimal conditions for the growth of Lokananta (TSS) shallot varieties in ultisol soils.

CONCLUSION

The no-shade treatment gives the best characteristics of shallot plants of seed origin (TSS) on the number of leaves, number of tillers, stem diameter, and number of bulbs with various animal manure fertilizers in ultisol soil. The treatment with chicken manure fertilizer and without shading showed the best characteristics of shallot plants of seed origin (TSS) on the number of leaves, number of tillers, wet 9 weight and dry weight in ultisol soil. The chicken manure fertilizer treatment showed the best characteristics on the number of tillers, stem diameter, and wet weight.

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AUTHORS CONTRIBUTIONS

The first author is responsible for research planning and design, data collection, and analysis of results. The first author also wrote most of the chapters in this paper. The second and third authors contributed as supervisors and provided direction and guidance throughout the research process until the formation of this work. All authors collaborate on the final revision to ensure the suitability and overall quality of this scientific work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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