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Effect of clam shell waste and KNO3 on growth and yield of red onions (Allium ascalonicum L)

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ABSTRACT

The use of shellfish waste is expected to be a solution in reducing environmental pollution, because it contains important compounds such as calcium carbonate, calcium phosphate, $Ca(HCO_3)_2$, and Ca_3S which play a role in supporting plant growth. Meanwhile, KNO3 fertilizer functions as a source of essential macronutrients which are expected to increase the vegetative growth of shallots. The purpose of this study was to determine the effect of providing shellfish waste and KNO3 on the growth and production of shallots (Allium ascalonicum L.). This study used a Randomized Block Design (RBD) consisting of 2 factors, namely: shellfish factor, with 4 levels: C0: (control), C1: (5 g/polybag), C2: (7.5 g/polybag), C3: (10 g/polybag). The second factor was KNO3, with 4 levels: N0: (control), N1: (0.6 g/polybag), N2: (0.9 g/polybag) and N3: (1.2 g/polybag). Duncan's Multiple Range Test (DMRT) mean difference test at 5% confidence level was used with a linear model for the analysis of the combination of Randomized Block Design. The parameters measured were plant height (cm), number of leaves (strands), number of tillers (stems), number of tubers per sample (tuber), wet weight of tubers per sample (gram), wet weight of tubers per plot (gram) and leaf chlorophyll (unit). The results of this study showed that shell fertilizer had a significant effect on plant height and wet weight per sample, then KNO3 fertilizer had a significant effect on plant height, wet weight per sample, wet weight per plot and leaf chlorophyll. There was no interaction between shell fertilizer and KNO3 fertilizer on all parameters measured.

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1. INTRODUCTION

Shallots (*Allium ascalonicum* L.) are a horticultural commodity widely consumed by humans as a cooking spice after chilies. In addition to being a cooking spice, shallots are also sold in processed forms such as shallot extract, powder, essential oil, fried shallots, and even as a medicinal ingredient to lower cholesterol and blood sugar levels, prevent blood clots, lower blood pressure, and improve blood flow. As a horticultural commodity widely consumed by the public, the potential for shallot development is still wide open not only to meet domestic needs but also internationally (Suriani, 2012).

Shallots are a commodity with high market value. Currently, shallot production and cultivation centers need to be improved, given the increasing consumer demand, in line with population growth and increasing purchasing power. Given the ever-increasing demand for shallots, the industry offers bright prospects. Shallot consumption continues to rise, as evidenced by large imports and fluctuating prices. However, increased production has not been able to meet public demand. Intensification and extensification are possible approaches to increase shallot production and quality (Efendi dkk., 2017).

Indonesian shallot production reached 2 million tons in 2021, a 10.42% increase from 1.82 million tons the previous year. This figure declined to 1.98 million tons in 2022, while it remained at 1.98 million tons in 2023. Several factors, such as poor soil fertility, contributed to the decline in shallot production. One way to increase nutrient content and soil fertility for optimal crop yields is through proper cultivation techniques, particularly increased fertilization (Badan Pusat Statistik, 2023).

One way to improve soil fertility is by utilizing the abundant natural resources available, which can be used to improve soil and increase plant nutrients. Shellfish waste from the shellfish processing industry can be processed into fertilizer rich in calcium, phosphorus, and magnesium. When applied to plants in optimal amounts, it will enhance plant growth. The use of organic fertilizers can increase nutrient content and improve soil structure by stimulating the growth of microorganisms in the soil. Shellfish fertilizer contains 53.05% $CaCO_3$, 0.08% Na, 0.05% P, 0.05% Mg, 0.02% Fe, 16.36% Cu, 15.76% Zn, and 0.1% Si, all of which can increase nutrient content and improve the physical and chemical properties of the soil (Srifatriati, 2024).

Inorganic fertilizers have advantages, including being easily decomposed and readily absorbed by plants, resulting in more fertile plant growth. However, inorganic fertilizers have disadvantages, including being expensive, unable to address physical and biological soil damage, and excessive and inappropriate fertilization, which can cause environmental pollution. One suitable fertilizer for shallot cultivation is KNO_3 fertilizer. KNO3 fertilizer is a combination of N in the form of NO_3 and potassium in the form of K_2O (potassium Oxide), containing 45-46% K_2O in KNO_3 and 13% N. Potassium contained in the KNO3 compound is needed in greater quantities than other nutrients because potassium plays an important role as a catalyst in converting proteins into amino acids and carbohydrates, as well as in plant metabolism. The role of potassium in KNO_3 fertilizer is to transport the results of photosynthesis (assimilates) in the form of sugar and starch from the leaves to the roots, which will form tubers (Rohmadi dan Wijaya, 2022).

Based on the description above, this research is important to evaluate the effectiveness of applying shellfish waste fertilizer and KNO_3 fertilizer on the growth and yield of shallots. The novelty of this research lies in the utilization of shellfish waste as a source of organic-mineral fertilizer combined with inorganic KNO_3 fertilizer, so that it is expected not only to increase agricultural yields but also provide solutions in environmental waste management. This research is also expected to provide alternative fertilization strategies that are more efficient, environmentally friendly, and applicable for shallot farmers in various regions.

2. METHOD

This research was conducted on agricultural land at the University of Muhammadiyah North Sumatra, located in Percut Sei Tuan District, Jl. Ps. VI Dwikora, Sampali, Deli Serdang Regency, North Sumatra. The research was conducted from May to July 2025..

The materials used in this study were shallot seeds of the crown variety, shell waste fertilizer, KNO3 fertilizer, and topsoil in 25 x 30 cm polybags. The tools used in this study were a hoe, a watering can, a tape measure, a scale, raffia rope, scissors, an analytical balance, a SPAD, a mobile phone, and stationery.

This study used a factorial Randomized Block Design (RBD) with two factors: The first factor was Clam Shell Waste Fertilizer (C) consisted of four levels: C0: Control (no application); C1: 5 g/polybag; C2: 7.5 g/polybag; C3: 10 g/polybag (Elfarisna et al., 2024). The second factor was KNO3 (N) consisted of four levels: N0: Control (no application); N1: 0.6 g/polybag; N2: 0.9 g/polybag; N3: 1.2 g/polybag (Jamaluddin et al., 2021).

The research data were analyzed first using a factorial Randomized Block Design (RBD) to assess the performance of shallots (Allium ascalonicum). The second analysis used a combination analysis to compare treatments of shellfish waste and KNO3 fertilizer.

2.1 Research Implementation

2.1.1 Land Clearing

Land clearing was carried out a week before planting. The area was manually cleared of weeds growing around the experimental plot using a hoe. This was done to prevent any residue from previous cultivation processes from becoming a pest infestation for the plants to be planted. The area was leveled, particularly on undulating areas, to facilitate the arrangement of the planting media in polybags.

2.1.2 Planting Media Preparation

Topsoil and compost in a 4:1 ratio were used as the planting media, which was mixed thoroughly or loosened with a hoe before being filled into the polybags. After loosening the planting media, the next step was planting. When preparing the planting media, ensure that any weeds or roots in the soil or in the polybags are removed by separating them to limit weed growth and prevent the plants from being disturbed during their growth.

2.1.3 Polybag Filling

The polybags used were 25 cm x 30 cm. The first step was to prepare all the planting medium components, including topsoil and compost. This was done until the polybags were filled to the required volume. This was done to allow the plant roots to develop quickly and provide sufficient water.

2.1.4 Planting

Shallots were planted in the afternoon. The shallot bulbs to be planted were first selected for uniform size, followed by the removal of the outermost and dried skin. The sprouts of the bulbs were cut approximately one-third of the length, allowed to dry briefly, and then planted one bulb per planting hole in the polybag.

2.1.5 Application of Shell Waste Fertilizer

The shell waste fertilizer was applied one week before planting, consisting of doses of C0: control, C1: 5 g/polybag, C2: 7.5 g/polybag, and C3: 10 g/polybag. The purpose of pre-planting was to ensure complete decomposition by the soil or planting medium.

2.1.6 KNO3 Application

KNO3 fertilizer is applied when the plants are 2 weeks old after transplanting. The doses used are N0: control, N1: 0.6 g/polybag, N2: 0.9 g/polybag, and N3: 0.1.2 g/polybag, all applied simultaneously on the same day.

2.2 Plant Maintenance

2.2.1 Watering

Watering is done to maintain the water content of the shallot plants. Therefore, watering is done in the morning and evening using a watering can. Watering is done daily, and if it rains, watering is not done.

2.2.2 Weeding

Weeding is done manually by directly pulling weeds from each polybag around the plants. This is done to reduce competition for nutrients within the polybags.

2.2.3 Replanting

Weeding is carried out up to two weeks after planting, with plants of the same age and treatment as the sample plants.

2.2.4 Pest and Disease Control

Pest and disease control is carried out preventively, by keeping the land clean of weeds, which can serve as hosts for shallot pests. The pest found attacking shallot plants in this study was snails. Pest control was carried out mechanically (manually).

2.2.5 Harvesting

Shallots are harvested 60 days after planting, with the leaves beginning to wilt and turn yellow in about 70-80% of the plants, the base of the stem hardening, and some of the plants emerging above the ground. Harvesting is done by uprooting the entire plant. Shallots are harvested in the morning.

2.3 Observation Parameters

2.3.1 Plant Height (cm)

Plant height was measured on sample plants at 3, 5, and 7 WAP. Plant height was measured from the neck of the plant to the tip of the tallest leaf using a ruler or tape measure.

2.3.2 Number of Leaves (blades)

Leaves were counted on each clump. Observations were conducted at 3, 5, and 7 WAP.

2.3.3 Number of Tillers (pupils)

The number of tillers was observed at 3, 5, and 7 WAP by counting the number of tillers that emerged from each plant.

2.3.4 Number of Bulbs (tubers)

The number of tubers counted was the number of tubers obtained from each clump. This calculation was performed after harvest or when the plants were 8 WAP.

2.3.5 Wet Weight of Bulbs/Sample (g)

The wet weight of tubers per sample was obtained by weighing using an analytical balance after harvest, provided the plants were free of soil and debris. Wet Weight of Tubers per Plot (g)

The wet weight of tubers per plot can be obtained by weighing them using an analytical balance after harvest, provided the plants are clean of soil and debris.

2.3.6 Chlorophyll Content Analysis

Chlorophyll analysis was measured using a SPAD (Soil Plant Analysis Development) instrument. Chlorophyll distribution varies across leaves. Chlorophyll at the base of the leaf differs from chlorophyll at the tip, middle, and bottom of the leaf. This difference in chlorophyll content will indicate differences in leaf color. The greener the leaf, the higher the chlorophyll content.

3. RESULTS AND DISCUSSION

3.1 Plant Height (cm)

Observation data on plant height (cm) of shallots at 3, 5, and 7 weeks after planting (WAP) with the Clamshell Waste and KNO3 treatments can be seen in Table 1.

Table 1. Shallot Plant Height at 3, 5, and 7 weeks after planting with the Clamshell Waste and KNO3 treatments

Treatment	Week After Planting (WAP)		
	3	5	7
Clam shell fertilizer	....................................cm..		
C_0 (Kontrol)	28,08	31,40b	33,07b
C_1 (5 g/polybag)	27,44	31,21b	33,13b
C_2 (7,5 g/polybag)	28,16	32,52ab	34,18ab
C_3 (10 g/polybag)	28,61	33,23a	35,09a
KNO_3			
N_0 (Kontrol)	27,33	31,00	32,61b
N_1 (0,6 g/ polybag)	28,16	33,02	34,61a
N_2 (0,9 g/ polybag)	28,50	32,30	34,19a
N_3 (1,2 g/ polybag)	28,30	32,04	34,07a
C_0N_0	26,55	29,05	30,66
C_0N_1	27,89	32,50	33,72
C_0N_2	28,78	32,16	34,05
C_0N_3	29,11	31,89	33,83
C_1N_0	26,22	29,94	31,66
C_1N_1	28,11	31,72	33,27
C_1N_2	27,89	31,44	33,72
C_1N_3	27,55	31,72	33,89
C_2N_0	28,89	33,00	34,50
C_2N_1	29,22	34,27	36,00
C_2N_2	27,22	31,50	33,00
C_2N_3	27,33	31,33	33,22
C_3N_0	27,66	32,00	33,61
C_3N_1	27,44	33,61	35,44
C_3N_2	30,11	34,11	36,00
C_3N_3	29,22	33,22	35,33

Based on Table 1. Shows that the provision of shell waste has a significant effect on the height of shallot plants 5 and 7 WAP. The highest average value at the age of 7 WAP was shown by the C3 treatment (10 g/plant) which was 35.09, not significantly different from the C2 treatment (7.5 g/plant) 34.18 and significantly different from C1 (5 g/plant) 33.13 and C0 (control) which was 33.07 cm. The relationship between plant height and the provision of shell waste at the age of 5 and 7 WAP can be seen in Figure 1.

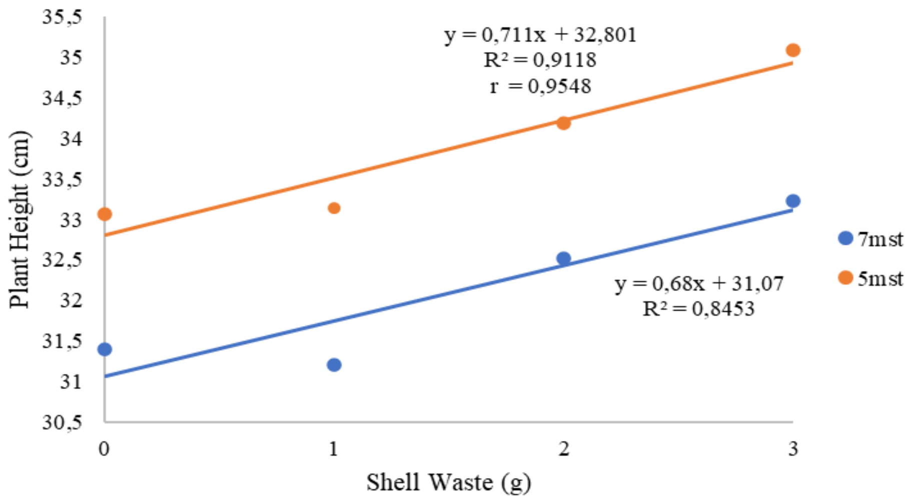

Figure 1. Plant Height and Shell Waste Treatment at 5 and 7 MST

Figure 1 shows that the addition of shellfish waste significantly affected the growth of shallot plants at 5 and 7 weeks post-plant growth, forming a positive linear relationship with plant height, with an average of 32.801 cm and a 0.711-fold increase with each increase in shellfish waste concentration. Shellfish waste contributed 95.48% to the height of red okra plants.

The effect of shellfish waste on plant height is thought to be due to the 98.89% Ca content of shellfish, which is essential for plant growth. This finding aligns with Soverda and Hermawati's (2009) statement that shellfish flour contains a significant amount of Ca, which plants require for vegetative growth. Ca2+ acts as a regulator of plant growth and development. As a divalent cation, the Ca2+ element plays a role in the formation of cell walls and cell membranes that play a role in the elongation of plant roots and stems. This is supported by the opinion of Sumaryo and Suryono (2000) who said that liming can increase the availability of Ca and Mg in the soil, thereby stimulating cell turgor and chlorophyll formation so that the photosynthesis process increases. The photosynthates produced will be translocated to plant organs, including stems, to increase plant height.

Based on Table 1. Shows that the provision of KNO3 has a significant effect on the height of shallot plants 7 WAP. The highest average value at the age of 7 WAP was shown by the N1 treatment (0.6 g/plant) which was 34.61, followed by the N2 treatment (0.9 g/plant) 34.19 and N3 (1.2 g/plant) 34.07 and was significantly different from N0 (control) which was 32.61 cm. The relationship between plant height and KNO3 treatment at the age of 7 WAP can be seen in Figure 2.

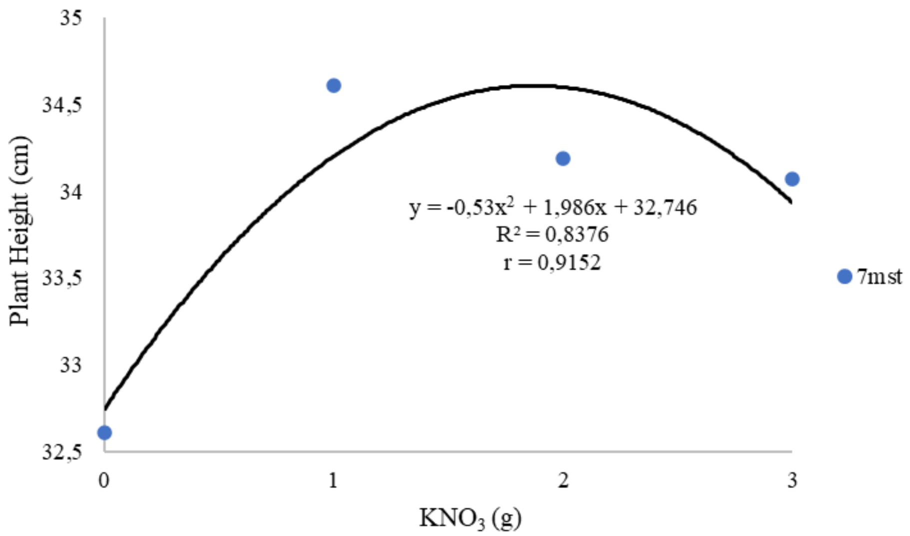

Figure 2. Relationship between plant height and KNO3 treatment at 7 WAP

Figure 2 shows that the administration of KNO3 at 7 weeks post-planting has a significant effect on plant height by forming a positive quadratic relationship. Showing a maximum value of 34.606 cm. The administration of KNO3 determines the height of shallot plants by 91.52%. The administration of KNO3 affects plant height, thought to be due to K2O in KNO3 46% and N 13%, which are nutrients that are needed to stimulate the growth of stems, branches, leaves and cell division. This is in accordance with the opinion of Pratama and Suhendri, (2025) this is due to the presence of K+ ions which are also increasing so that they support the ability to bind water. In addition, it also has an important role in cell turgidity, increasing osmotic pressure so that the stomata open fully and provide opportunities for more CO2 to enter which has an important role in photosynthesis which ultimately has a better effect on plant growth. According to Wijayanto and Sucahyo, (2019) stated that nitrogen is a limiting nutrient for plant height growth. Nitrogen deficiency causes stunted plant growth, slow growth, and chlorosis.

3.2 Number of Leaves (Sheets)

Observation data on the number of leaves (sheets) of shallots at 3, 5, and 7 weeks after planting (WAP) with the treatment of shellfish waste and KNO3 can be seen in Table 2.

Table 2. Number of leaves of shallots at 3, 5, and 7 weeks after planting (WAP) with the treatment of shellfish waste and KNO3

Treatment	Week After Planting (WAP)		
	3	5	7
	....................................helai.......................................		
Clam Shell Fertilizer			
C_0 (Kontrol)	13,47	21,72	24,44
C_1 (5 g/polybag)	13,33	21,83	24,27
C_2 (7,5 g/polybag)	13,11	21,50	24,08
C_3 (10 g/polybag)	14,52	24,19	26,47
KNO_3			
N_0 (Kontrol)	13,19	22,36	24,80
N_1 (0,6 g/ polybag)	13,52	21,44	23,77
N_2 (0,9 g/ polybag)	14,61	23,52	26,16
N_3 (1,2 g/ polybag)	13,11	21,92	24,52
C_0N_0	12,22	20,66	23,11
C_0N_1	12,78	20,33	22,66
C_0N_2	15,89	24,11	26,89
C_0N_3	13,00	21,78	25,11
C_1N_0	13,00	23,55	25,99
C_1N_1	13,33	21,11	23,66
C_1N_2	15,22	24,00	26,44
C_1N_3	11,77	18,66	21,00
C_2N_0	14,11	21,77	24,55
C_2N_1	13,77	21,44	23,89
C_2N_2	12,11	20,66	23,44
C_2N_3	12,44	22,11	24,44
C_3N_0	13,44	23,44	25,55
C_3N_1	14,22	22,89	24,89
C_3N_2	15,22	25,33	27,89
C_3N_3	15,22	25,11	27,55

Based on Table 2, it shows that giving shellfish waste with KNO3 has no significant effect on the number of leaves of shallot plants. The highest average number of leaves in the clam shell waste treatment was in the C3 treatment (10 g/polybag) at 26.47 strands, while the lowest average was in the C2 treatment (7.5 g/polybag) namely 24.08 strands, while the highest average in the KNO3 treatment was in N2 (0.9 g/plant) namely 26.16 strands and the lowest was in N1 (0.6 g/plant) namely 23.77 strands.

Even though the treatment has not provided significant results, there has been an increase every week, this is due to the content of the shells in the form of CaCO3 98.89%, N 1.66%, P 0.14%, K 0.89%, KNO3, K 46% and N 13% where the N content is a nutrient that is very necessary for the growth of a plant's leaves. This is in accordance with the opinion of Marschner, (2012) that nitrogen functions to support the formation of new tissue through its role in the synthesis of amino acids, proteins and chlorophyll, all of which are important in the leaf growth process. Sufficient nitrogen availability can accelerate leaf formation by increasing chlorophyll production and leaf surface area.

3.3 Number of Offshoots

Observation data on the number of Tillers of shallots at 3, 5, and 7 weeks after planting (WAP) with the clamshell waste and KNO3 treatment can be seen in Table 3.

Table 3. Number of Tillers of shallots at 3, 5, and 7 weeks after planting (WAP) with the clam shell waste and KNO3 treatment

Treatment	Week After Planting (WAP)		
	3	5	7
	....................................anakan....................................		
Clam Shell Waste			
C_0 (Kontrol)	4,33	6,05	6,97
C_1 (5 g/polybag)	4,41	5,97	7,08
C_2 (7,5 g/polybag)	4,25	5,86	6,83
C_3 (10 g/polybag)	4,66	6,50	7,72
KNO_3			
N_0 (Kontrol)	4,00	5,89	6,78
N_1 (0,6 g/ polybag)	4,39	5,94	6,58
N_2 (0,9 g/ polybag)	4,72	6,50	7,69
N_3 (1,2 g/ polybag)	4,55	6,05	7,55
C_0N_0	4,11	5,77	6,33
C_0N_1	4,33	5,55	6,22
C_0N_2	4,44	7,00	8,00
C_0N_3	4,44	5,89	7,33
C_1N_0	4,22	6,11	7,33
C_1N_1	4,11	5,77	6,44
C_1N_2	5,44	6,55	7,78
C_1N_3	3,88	5,44	6,78
C_2N_0	4,00	5,66	6,66
C_2N_1	4,66	6,33	6,89
C_2N_2	3,89	5,44	6,66
C_2N_3	4,44	6,00	7,11
C_3N_0	3,66	6,00	6,77
C_3N_1	4,44	6,11	6,78
C_3N_2	5,11	7,00	8,33
C_3N_3	5,44	6,89	9,00

Table 3 shows that the addition of shellfish waste and KNO3 had no significant effect on the number of shallots. The highest average number of shallots was found in the C3 treatment (10 g/polybag) at 7.72, while the lowest average was found in the C2 treatment (7.5 g/polybag) at 6.83. The highest average was found in the N2 treatment (0.9 g/plant) at 7.69, and the lowest was found in the N1 treatment (0.6 g/plant) at 6.58.

This suggests that genetic factors are a major determinant of shallot number. Variation in the number of shallots is strongly influenced by differences in variety, plant physiological capabilities, and genetic interactions with environmental factors. This is consistent with the literature by Sumarni et al. (2012), which states that each variety has a different innate potential for producing tillers. This genetic potential is closely related to the physiological and morphological characteristics of the plant, particularly the ability of the bulb to form lateral shoots through meristem activity. In accordance with the opinion of Herlina and Arinda, (2025), this genetic potential is still influenced by environmental factors, availability of nutrients, cultivation techniques, and climate conditions, so that the number of offspring produced is an interaction between the genotype and the environment.

3.4 Number of Bulbs

Observation data on the number of shallot bulbs at 8 weeks after planting with the clamshell waste and KNO3 treatment can be seen in Table 4.

Table 4. Number of shallot bulbs with the Clamshell waste and KNO3

KNO_3	Clam Shell Waste				Average N
	C_0	C_1	C_2	C_3	
8 WAP	....umbi..................................				
N_0	7,33	7,88	7,11	7,22	7,39
N_1	6,77	6,66	7,66	7,55	7,16
N_2	8,55	8,22	7,22	8,55	8,14
N_3	7,77	7,33	7,22	9,78	8,03
Average C	7,61	7,52	7,30	8,28	7,68

Table 4 shows that the addition of shellfish waste and KNO3 had no significant effect on the number of shallot bulbs. The highest average number of bulbs was found in the C3 treatment (10 g/polybag) at 8.28 bulbs, while the lowest average was found in the C2 treatment (7.5 g/polybag) at 7.30 bulbs. The highest average for the KNO3 treatment was found in the N2 treatment (0.9 g/plant) at 8.14 bulbs, and the lowest for the N1 treatment (0.6 g/plant) at 7.16 bulbs.

It is suspected that variety is a genetic factor that significantly determines a plant's ability to thrive, both in terms of vegetative and reproductive growth. Each variety has a different genetic makeup (genotype), thus exhibiting differences in morphological and physiological traits. This is in accordance with Ambarwati (2003) who stated that the number of bulbs formed by each variety varies. Each variety is a product of genetics and the environment, due to the genetic properties of a particular plant, the number of which will show a variety of appearances. According to Azmi et al., (2016), the character of the number of onion bulbs formed is greatly influenced by internal factors and very little by external or environmental factors because each plant has a different response because it is influenced by internal factors and the sensitivity of a tissue

3.5 Wet Weight of Bulbs per Sample (g)

Observation data on the wet weight per sample (g) of shallots at 8 weeks post-planting age treated with clamshell waste and KNO3 can be seen in Table 5.

Table 5. Wet weight per sample of shallots treated with clamshell waste and KNO3

KNO_3	Clam Shell Waste				Average
	C_0	C_1	C_2	C_3	N
8 WAP	......................................gram..................................				
N_0	18,89	24,00	26,89	21,22	22,75b
N_1	21,22	23,22	26,66	29,33	25,11ab
N_2	30,22	28,55	24,89	32,33	29,00a
N_3	23,78	25,33	25,55	34,55	27,30a
Average C	23,53b	25,28ab	26,00ab	29,36a	26,04

Based on Table 5, it shows that the administration of shellfish waste has a real influence on the wet weight per sample of shallot plants. The highest average value was shown by treatment C3 (10 g/plant) namely 29.36, not significantly different from treatment C2 (7.5 g/plant) 26.00 and C1 (5 g/plant) 25.28 and significantly different from treatment C0 (control) namely 23.53 cm. It can be seen that the relationship between wet weight per sample and the treatment of shellfish waste can be seen in Figure 3.

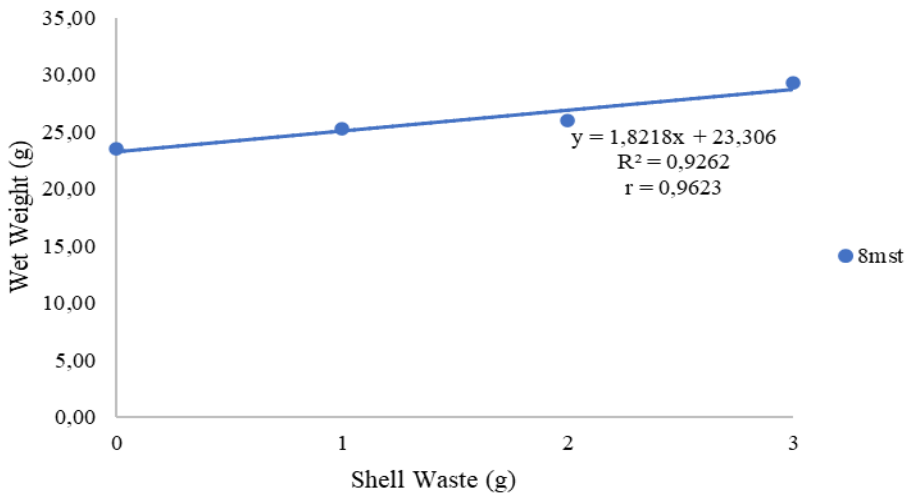

Figure 3. Relationship between wet weight per sample and mussel shell waste treatment.

Figure 3 shows that the provision of shellfish waste significantly affects the growth of fresh weight per shallot sample, forming a positive linear relationship on fresh weight per sample with an average of 23.306 g and will increase 1.8218 times with each increase in the concentration of Shellfish Waste. Shellfish Waste determines the fresh weight per sample by 96.23%. This is thought to be because shellfish shells are rich in CaCO3 98.89%, N 1.66%, P 0.14%, K 0.89%, which function as soil ameliorants. This improvement in soil conditions allows shallot roots to absorb nutrients more efficiently, especially nitrogen, magnesium, and potassium which play a direct role in the formation of chlorophyll and the process of photosynthesis. With increased photosynthetic activity, the production of assimilates in the form of carbohydrates will be higher, which are then allocated to storage organs, namely bulbs. This statement aligns with Mayrowani's (2012) opinion, which states that calcium (Ca) is a nutrient that can trigger the decomposition process of organic matter, transforming the organic compounds contained in the inorganic matter into mineral elements that can be absorbed by plants.

Table 5 shows that the application of KNO3 significantly affected the fresh weight of each shallot sample. The highest average value was shown by the N2 treatment (0.9 g/plant), at 29.00, followed by the N3 treatment (1.2 g/plant) at 27.30, and was not significantly different from the N1 (0.6 g/plant) at 25.11 and significantly different from the N0 (control) at 22.75 grams. The relationship between fresh weight per sample and KNO3 treatment can be seen in Figure 4.

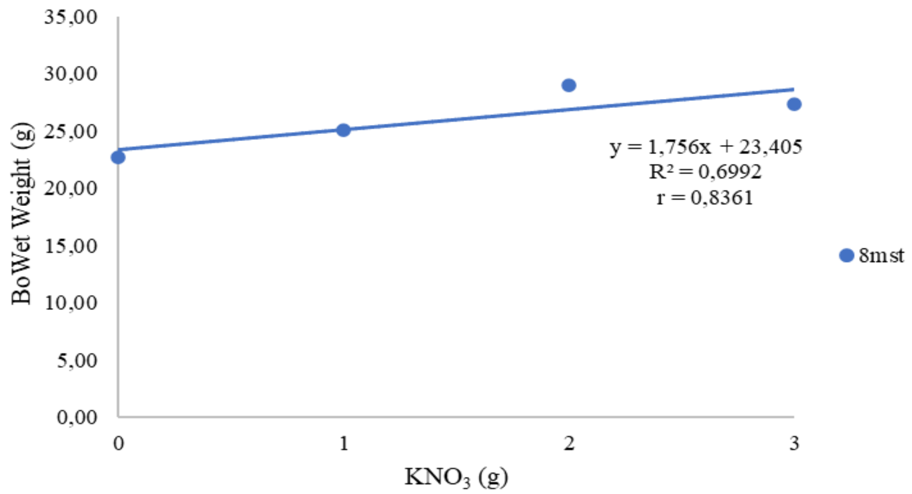

Figure 4. Relationship between wet weight per sample and KNO3 treatment.

Figure 4 shows that the administration of KNO3 significantly affects the growth of wet weight per shallot sample, forming a positive linear relationship on wet weight per sample with an average of 23.405 g and will increase 1.756 times with each increase in KNO3 concentration. KNO3 determines the wet weight per sample by 83.61%. Shallot plants really need large amounts of potassium to support bulb enlargement, therefore KNO3 fertilizer is very suitable for use because it contains 46% K_2O and 13% NO_3. This is in accordance with the lite ratur Utomo and Suprianto, (2019) high potassium content of 46% causes so many k+ ions to bind water in the plant body, which will accelerate the photosynthesis process, so that the process becomes more optimal. The results of this photosynthesis also stimulate the formation of larger bulbs. The N element contained in KNO3 causes a chemical process that produces nucleic acid. This nucleic acid plays a role in the cell nucleus in the cell division process so that the formation of leaf layers can be formed properly which then develop into shallot bulbs.

3.6 Fresh Bulb Weight per Plot (g)

Observation data on the fresh bulb weight per plot (g) of shallots at 8 weeks post-planting age with the clamshell waste and KNO3 treatment can be seen in Table 6.

Table 6. Fresh Bulb Weight per Shallot Plant Sample with the Clam shell Waste and KNO3 Treatment

KNO_3	Clam Shell Waste				Average N
	C_0	C_1	C_2	C_3	
8 WAP	....gram...................................				
N_0	19,92	23,92	25,00	19,67	22,13b
N_1	20,33	25,75	24,92	27,00	24,50ab
N_2	27,17	26,92	23,25	29,08	26,60a
N_3	23,83	23,50	23,25	30,00	25,15a
Average C	22,81	25,02	24,10	26,44	24,59

Based on Table 6. Shows that the provision of shellfish waste has no significant effect on the wet weight per plot of shallot plants. The highest average wet weight per plot of shellfish waste treatment is in the C3 treatment (10 g/polybag) of 26.44 grams, while the lowest average is in the C2 treatment (7.5 g/polybag) which is 24.10 grams. Although it has not achieved significant results, the provision of shellfish still provides a difference in results with no treatment, $CaCO_3$ 98.89%, N 1.66%, P 0.14%, K 0.89% contained in shellfish waste can affect plant growth. According to Sumarni, et al., (2010) that the provision of organic matter not only produces good soil physical conditions, but also provides organic matter from decay that can add nutrients to plants, as well as increase soil biological activity that can support plant growth. In accordance with the opinion of Hermansyah and Inoriah (2009), who stated that the more nutrients entering the plant, the more photosynthetic activity will increase, so that the resulting photosynthate will be translocated to other parts of the plant for use in plant growth.

Based on Table 6, it shows that the application of KNO3 has a significant effect on the fresh weight per plot of shallot plants. The highest average value was shown by the N2 treatment (0.9

g/plant), namely 26.60, followed by the N3 treatment (1.2 g/plant) at 25.15 and not significantly different from N1 (0.6 g/plant) at 24.50 and significantly different from N0 (control), namely 22.13 grams. The relationship between fresh weight per sample and KNO3 treatment can be seen in Figure 5.

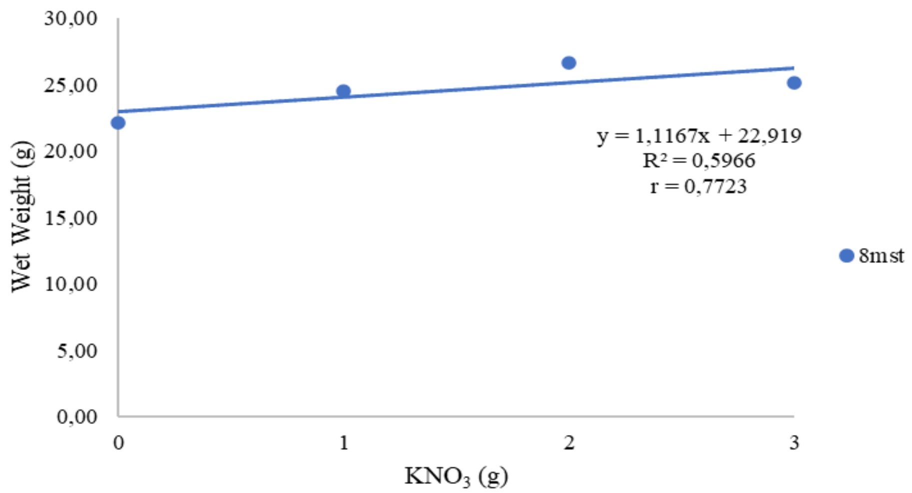

Figure 5. Relationship between fresh weight per plot and KNO3 treatment

Figure 5 shows that the administration of KNO3 significantly affected the growth of fresh weight per plot of shallots, forming a positive linear relationship with the fresh weight per plot with an average of 22.919 g and increasing by 1.1167 g for each increase in KNO3 concentration. KNO3 determines the fresh weight per plot by 77.23%. It is suspected that the KNO3 fertilizer content containing 46% K_2O and 13% NO_3 is able to meet the potassium needs of shallot bulbs. Potassium is thought to be absorbed by plants even though it exceeds the amount the plant itself needs. According to Novizan, (2002) potassium is absorbed by plants in large amounts or sometimes even exceeds the amount needed, especially in tuber plants, one of which is shallots. This is in accordance with the opinion of Reza, (2021) who stated that the potassium content in the treatment causes K+ ions that bind water in the plant body to accelerate the photosynthesis process. The results of this photosynthesis stimulate the formation of larger bulbs so that it can increase plant weight.

3.7 Leaf Chlorophyll (units)

The leaf chlorophyll content of shallot plants at 7 weeks after planting using shellfish waste and KNO3 can be seen in Table 7.

Table 7. Total leaf chlorophyll content of shallot plants at 7 weeks after planting using shellfish waste and KNO3

KNO_3	Clam Shell Waste				Average N
	C_0	C_1	C_2	C_3	
Umur 7 MsT	....unit..				
N_0	40,85	41,59	47,65	43,26	43,34b
N_1	41,70	45,20	45,11	47,94	44,99ab
N_2	47,21	43,49	52,52	44,51	46,93a
N_3	51,05	49,84	46,12	51,41	49,60a
Rataan C	45,20	45,03	47,85	46,78	46,22

Table 7 shows that the administration of KNO3 has a significant effect on the chlorophyll of shallot leaves. The highest average value was shown by the N3 treatment (1.2 g/plant) which was 49.60, followed by the N2 treatment (1.2 g/plant) 46.93 and was not significantly different from N1 (0.6 g/plant) 44.99 and significantly different from N0 (control) which was 43.34. The relationship between leaf chlorophyll and KNO3 treatment can be seen in Figure 6.

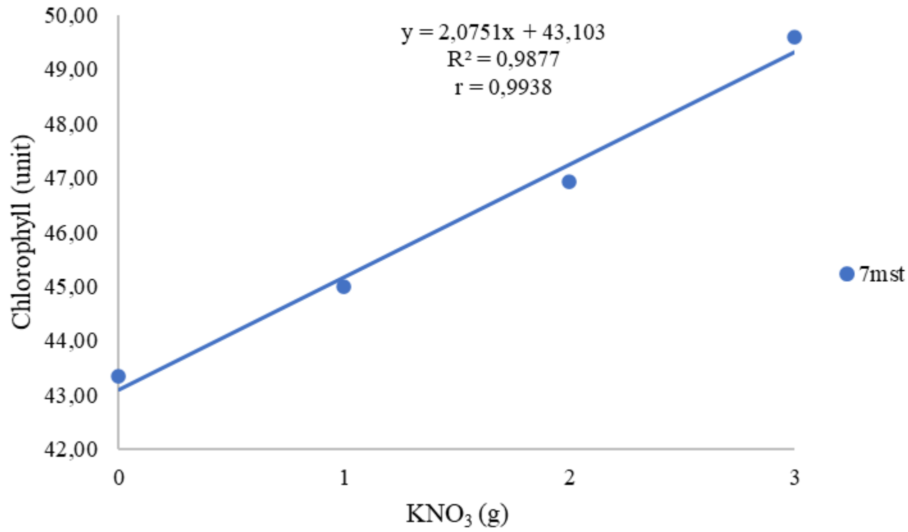

Figure 6. Relationship between leaf chlorophyll and KNO3 treatment.

Figure 6 shows that the provision of KNO3 significantly affects the chlorophyll of shallot leaves, forming a positive linear relationship with the leaf chlorophyll with an average of 43.103 units and will increase 2.0751 times with each increase in KNO3 concentration. KNO3 determines leaf chlorophyll by 99.38%. This is thought to be because nitrogen plays a major role as a component of the porphyrin ring in the chlorophyll molecule structure. Potassium nitrate (KNO_3) fertilizer contains nitrogen in the form of nitrate NO_3^- 13%, which is easily absorbed by plants and immediately utilized for the synthesis of organic compounds. This is in accordance with Wijaya's statement (2010) that the presence of high nitrogen (N) will make the leaf blades wider and the chlorophyll content higher, thus supporting vegetative growth, supported by Widiastoety's statement (2007) explaining that plant growth will be better if the solid N element of the plant can be fulfilled in the leaf growth process such as increasing leaf width, leaf chlorophyll, and increasing plant protein content.

4. CONCLUSION

The application of shellfish waste significantly affected the height of shallot plants at 5 and 7 weeks after planting (WAP) and the fresh weight per sample at the C3 dose (10 g/plant). KNO3 application significantly affected the height of shallot plants at 7 weeks after planting, the fresh weight per sample, the fresh weight per plot, and leaf chlorophyll. The interaction between the combination of shellfish waste fertilizer and KNO3 had no significant effect on any of the observed parameters.

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