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Effectiveness of Solid Compost and SP-36 Fertilizer Application On Red Onion Plants (*Allium ascalonium* L) Growth and Yield

Risna Duw Indri Yanti, Dini Hariyati Adam*, Yudi Triyanto, Novilda Elizabeth Mustamu
Labuhanbatu University
Jl. SM Raja No. 126 A KM 3.5 Aek Tapa, Labuhanbatu Regency, Sumatera Utara 21418, Indonesia
*Email : dinihariyatiadam@gmail.com

ABSTRACT

Shallots (*Allium ascalonicum* L.) are considered a national priority and high-value vegetable commodity that has the potential for development through expansion of cultivation area, improved productivity, enhanced production stability, and increased quality. The objective of this study was to assess the efficacy of administering solid compost and SP-36 fertilizer on the development and yield of Shallots (*Allium ascalonium* L). The study was organized using a 2-factor Randomized Block Design (RAK), with the provision of solid 0, 200, 400, and 900 grams per plant, and SP-36 0,20,40 and 80 grams per plant as the factors under consideration. The variables measured included the height of the plants, the quantity of bulbs, the weight of the bulbs, and the diameter of the bulbs. The findings of this research demonstrate that supplying solid compost at the same height as the plants affects the growth of shallots at 8 weeks after planting, resulting in the highest average value. Additionally, the application of SP-36 fertilizer at plant height also has a significant impact on shallot growth at the same 8-week post-planting stage, with the highest average value. Furthermore, it was observed that climate change can have an impact on the yield of shallots. Moreover, there is an interrelationship between the provision of solid compost and SP-36 fertilizer concerning the number of bulbs, bulb weight, and bulb diameter.

Keywords: *Growth, Production, Shallot (Allium ascalonicum L.), Solid, SP-36*

1. INTRODUCTION

Indonesia is characterized by its agricultural economy, with most citizens engaged in farming activities. This is corroborated by the ample expanse of unused land suitable for agricultural purposes in Indonesia and the favorable soil quality, which is rich in nutrients and facilitates plant growth. Vegetables are considered one of the foremost horticultural products within the agricultural industry in Indonesia. Vegetables are highly sought-after horticultural products due to their advantageous nutritional content, making them popular among the general public for their health benefits. Vegetables can be eaten in their natural state or subjected to processing, depending on the intended usage. Chili is a highly demanded vegetable commodity across all levels of society, leading to a significant market circulation volume.

Shallots, scientifically known as *Allium ascalonicum* L., are considered a top priority and superior national vegetable commodity with potential for development through the expansion of planting areas, increased productivity, enhanced production stability, and improved quality. Fertilization is a crucial technique in cultivating shallot plants to achieve optimal production. Organic or inorganic fertilizers can be utilized in the fertilization process for shallot plants.

In terms of nutritional content, 100 grams of red onions contain approximately 80-85% water, 1.5% protein, 0.3% fat, and 9.2% carbohydrates, along with other constituents such as iron, minerals, potassium, phosphorus, ascorbic acid, niacin, riboflavin, vitamin B, and vitamin C (Wibowo, 2007). Red onions have favorable market prospects, making them a national priority commodity. According to Rachmat, Sayaka, and Muslim (2012), the increasing demand for red onions is driven by population growth and the everyday culinary needs of the community. This situation creates a volatility between supply and demand, potentially leading to price fluctuations over time.

Efforts to increase local shallot production through cultivation techniques involve the application of SP 36 and solid fertilizers. These fertilizers enhance soil physical properties, enrich soil nutrients, and stimulate microbial activity. Manure in dry areas primarily aims to improve soil physical properties to enhance soil capacity, water retention, aeration, and drainage.

Shallots have promising market prospects and are considered national superior commodities. According to Rachmat, Sayaka, and Muslim (2012), the demand for shallots is increasing due to population growth and the essential role of shallots in daily cooking. This situation leads to fluctuations in supply and demand, resulting in price variations over time (Nasruddin et al.2021)

Shallots are one of the strategic horticultural commodities in North Sumatra, as nearly every household consumes them daily. Beyond enhancing flavor, many people consume shallots for their health benefits, which include vitamins, minerals, and antioxidants.

Global warming has led to unpredictable climate changes in recent years, presenting a significant threat to the development of shallot cultivation. Extreme weather fluctuations hinder plant growth, decreasing land quality and productivity. Therefore, it is crucial to conduct research aimed at developing varieties that can withstand dry environmental conditions, given that key shallot-producing regions such as North Sumatra, West Java, Central Java, and Sulawesi are characterized by arid climates.(Zamaniah, et al 2018)

The main problem of shallot farming when planting outside the season is the high risk of crop failure. The high risk of crop failure is caused by limiting factors related to the less favorable growing environment. The Central Statistics Agency (BPS) released the amount of shallot production in 2021 of 539,621 thousand tons; in 2022, the amount of shallot production also increased by 644,727 thousand tons, or there was an increase in the amount of production when compared to 2021 539,621 or around 3.58%.

The red onion market in North Sumatra is already dominated by imported red onions, such as those from India, Sri Lanka, the Philippines, Peking, Pakistan, and Thailand. Meanwhile, there were not as many local red onions (*Allium cepa* var. Ascalonicum) from Samosir as the imported varieties. This is certainly less profitable for local red onion farmers. In Paropo and Tongging, North Sumatra, farmers have planted imported red onion varieties from Thailand, the Philippines, and Sri Lanka in their areas, but only a few have planted the Samosir variety.

Solid waste is one of the solid wastes of PKS produced from processing oil palm fruit bunches (FFB) into CPO, which generally only piles up because its utilization is not optimal. Solid coconut waste on the increase in the number of leaves and the diameter of the stump. Reported that planted oil palms showed better growth after being given decanter solid treatment, which included height, diameter, number of leaves, and leaf area compared to those without decanter solid treatment (Maryani, 2018).

The waste produced by Palm Oil Processing Factories (PKS) can serve as an organic fertilizer to enhance the quality of oil palm seedlings, particularly solids. Solids refer to the solid residue from processing fresh fruit bunches (FFB) in palm oil factories to produce crude palm oil (CPO). These raw solids typically contain approximately 1.5% CPO oil (Efendi, Ramon, A. Wulandari, Sastro, & Nurhaita, 2020). By applying this waste product to oil palm plants, it is possible to improve the physical, chemical, and biological properties of the soil, thereby reducing the reliance on synthetic fertilizers (Dan, Tanaman, Glycine, Di, & Ultisol, 2021)

Solid compost is rich in essential nutrients like nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), and calcium (Ca) that are beneficial for plant growth in ultisol soil. A research study revealed that incorporating solid compost into planting media significantly influenced various growth parameters of oil palm seedlings in the pre-nursery stage, including seedling height, stem diameter, number of leaves, total leaf area, fresh weight, and dry weight. The optimal ratio for using solid compost in planting media was 50% solid compost and 50% ultisol topsoil. The study also indicated that solid compost has a dry matter content of 81.65%, with 12.63% crude protein, 9.98% crude fiber, 7.12% crude fat, 0.03% calcium, 0.003% phosphorus, 5.25% hemicellulose, 26.35% cellulose, and an energy content of 3454 kcal/kg.

Due to its high cellulose content, solid compost must undergo decomposition to release nutrients for plant uptake. This decomposition process can be accelerated through physical, chemical, and biological means, with biological treatment involving the addition of cellulolytic microorganism inoculum to enhance organic matter breakdown (Nursanti et al.2021)

The fertilizer SP-36 has a phosphorus content of 36% in the form of P2. The purpose of employing this phosphate fertilizer is to promote the early development of roots, flowers, and seeds, enhance the conversion of flowers into seeds, enhance plant resilience to pests and diseases, and enhance the quality of soil nutrients. Albani Baharuddin (2023) has conducted prior research examining the impact of rosk phosphate fertilizer on the growth and development of shallot plants. Their study reports on shallot plants' response to applying this specific fertilizer. According to Aini and Haryanto (2023), they conducted a study on the impact of different phosphate fertilizers on multiple varieties of shallots. However, there is a lack of specific findings regarding the effects of SP-36 fertilizer on shallot plants.

Fertilizer significantly enhances agricultural productivity, particularly in improving crop yields on soil with deficiencies in essential nutrients. Organic fertilizer encompasses substances derived from animal or fish waste. This research aimed to assess the efficiency of applying solid compost and SP-36 fertilizer in the development and production of shallot plants.

2. MATERIAL AND METHODS

This research was conducted in Sungai Dua Village, Sungai Kanan District, South Labuhanbatu Regency, North Sumatra Province, coordinates 1°47.458' N, 99°51.325' E. The study was carried out from January to March 2024. The materials used in this research included solid compost, fertilizer SP 36, and black soil. The tools employed for the research activities consisted of 5 kg polybags, hoes, scales, writing utensils, and label paper.

The RAK (randomized block design) was employed as the research design in this study. It involved two factors: Solid provision factor with four levels (Solid 0, 200, 400, and 900 gr/Plant) and SP-36 provision factor with four levels (SP-36 provision 0, 20, 40, and 80 gr/Plant).

The data analysis for this research utilized the mean values calculated in Microsoft Excel from Microsoft 365 and IBM SPSS Statistics version 29.0. The observed parameters included plant height, number of tubers, tuber diameter, and weight.

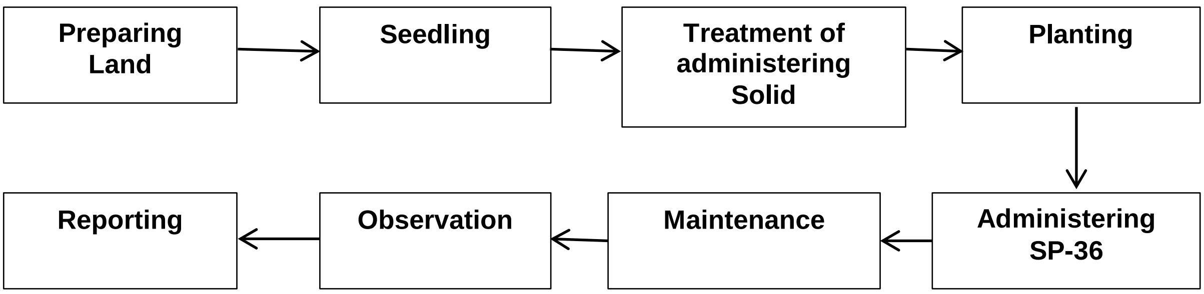

Figure 1. Research Flow Diagram

3. RESULT AND DISCUSSION

3.1 Plant Height

The outcomes of the average plant height observations, as presented in Figure 2, indicate that the application of solid compost in each treatment significantly influenced the growth of the plants. Specifically, the average plant height at 2, 4, 6, and 8 weeks after planting was measured at 54.925, 483.5, 134.875, and 150.75, respectively. In order to achieve the maximum average value during the post-planting period, it is necessary to reach its peak at 8 weeks after planting. While the application of solid compost does not yield a significant effect, it is evident that there is a variation in the average height of the plants across all treatments.

The results presented in Figure 3 demonstrate the average height of onion plants at different stages of growth. Specifically, at 2 MST, the average height is 58.475, at 4 MST it is 73.8, at 6 MST it is 136.275; and at 8 MST it is 153.85. This indicates that the highest average height occurs in the 8th week post-planting. While the application of solid compost does not yield a significant effect, there is a noticeable difference in the average height of plants across all treatments.

Plant height serves as a valuable growth variable, allowing for observing environmental and treatment effects on plants. An increase in plant height reflects the vegetative growth activity of the plant.

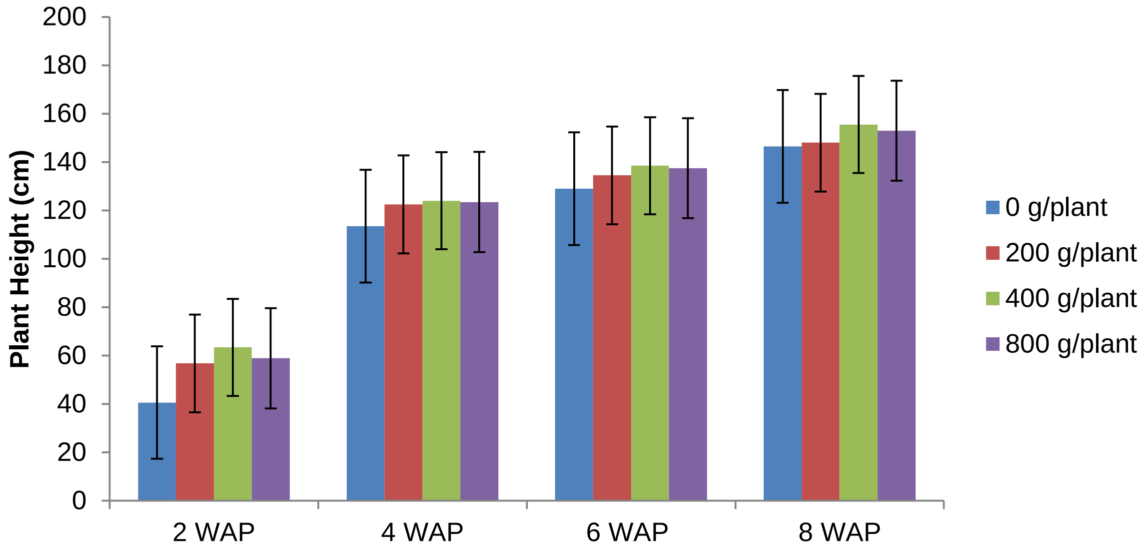

Figure 2. Average plant height of solid compost shallot

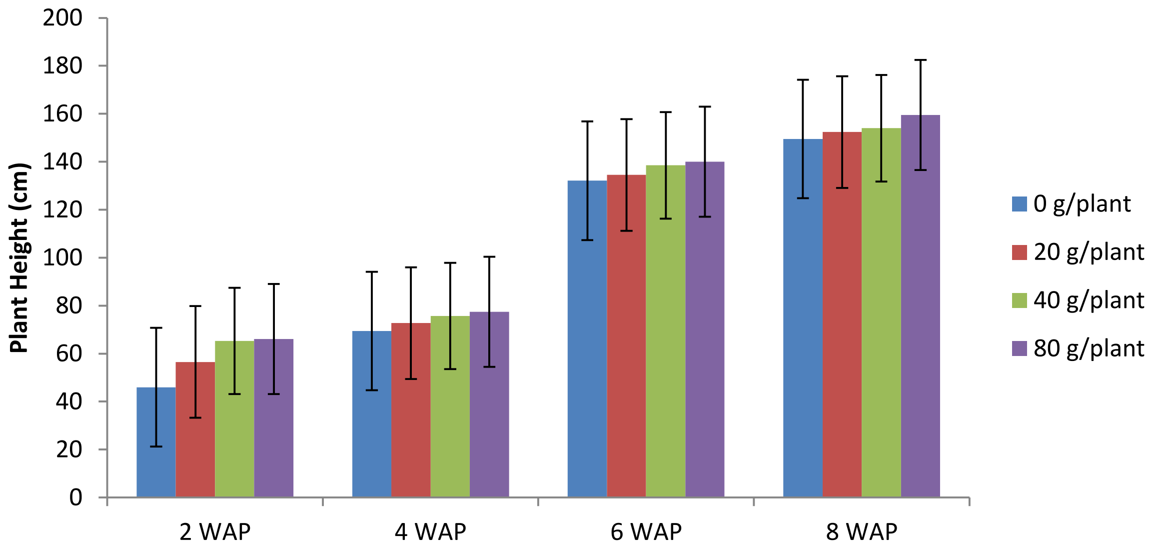

Figure 3. Average height of shallot plants using SP-36 fertilizer application

Andi (2015) suggests that adding compost can enhance the chemical characteristics of the soil, as well as its pH and organic carbon content. Additionally, Wildan et al. (2012) found that applying soil conditioners impacts plants' field capacity and growth, such as plant height, wet and dry weights, and leaf count. Organic materials play a crucial role in improving the properties of regosol soil, particularly its porosity, which helps maintain moisture availability for the uptake of fertilizer nutrients. Monitoring plant height is conducted to assess the growth rate of plants.

3.2 Total bulbs of shallot plants

The observation of the total number of bulbs of shallot plants shows the provision of solid compost and sp 36 fertilizer on the height of shallot plants. With the average growth of the number of bulbs of shallot plants can be seen in the Figure 4.

The number of tubers formed is affected by the variety and availability of nutrients, particularly potassium, which is essential for synthesizing amino acids and proteins from ammonium ions. This process enhances plant metabolism and cell elongation. Munawar (2011) highlighted the significance of phosphate in transporting assimilates from leaves to reproductive organs like fruits, seeds, and tubers through the phloem. This aids in improving the quality of fruits in terms of size, color, taste, and skin, which are crucial for storage and transportation. Nutrients are vital for plants to complete their life cycle. Phosphorus, a macronutrient, is required in significant amounts. Although phosphorus content in plants is lower than Nitrogen and Potassium, it is considered essential for life. This element is a fundamental component of all living cells and tends to accumulate in tubers, seeds, and growing points of plants (Syukur *et al.,* 2016).

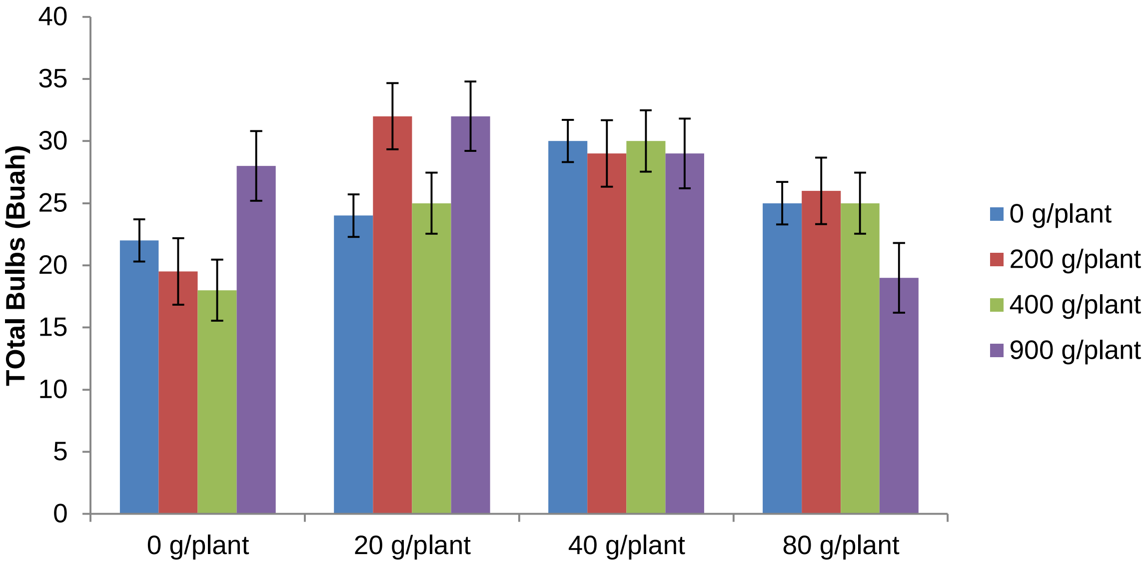

Figure 4. Number of Bulbs of shallot plants given Solid compost and SP-36 fertilizer

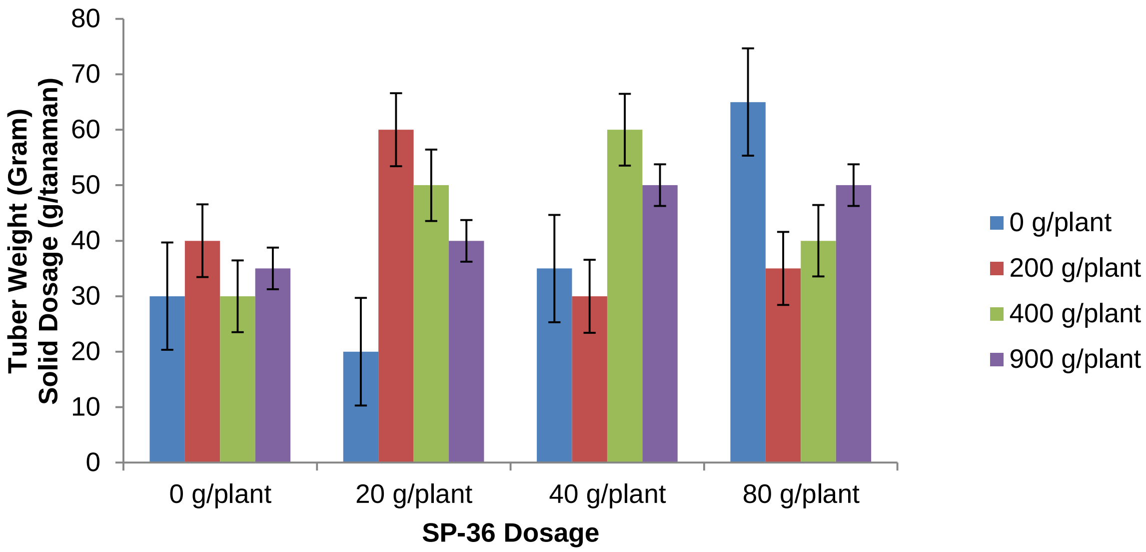

Figure 5. Total bulb weight of shallot plants given Solid compost and SP-36 fertilizer

Bulb weight refers to the weight of the plant post-harvest, measured just before the plant starts to wilt due to water loss. On the other hand, fresh crown weight represents the plant's total weight, excluding the roots, indicating the outcomes of plant metabolic processes (Salisbury 25 and Ross, 1995).

The development of shallot bulbs is significantly affected by Phosphate, supplied through SP 36 fertilizer and a blend of solid compost. According to Hanafiah (2010), phosphate within the plant's soil plays a crucial role in enhancing the activity of various growth enzymes and in carbohydrate metabolism, including starch formation, breakdown, translocation, nitrogen metabolism, and protein synthesis. Moreover, the adequate and balanced availability of potassium elements has a beneficial influence on the movement of assimilates from leaves to storage organs like shallot bulbs.

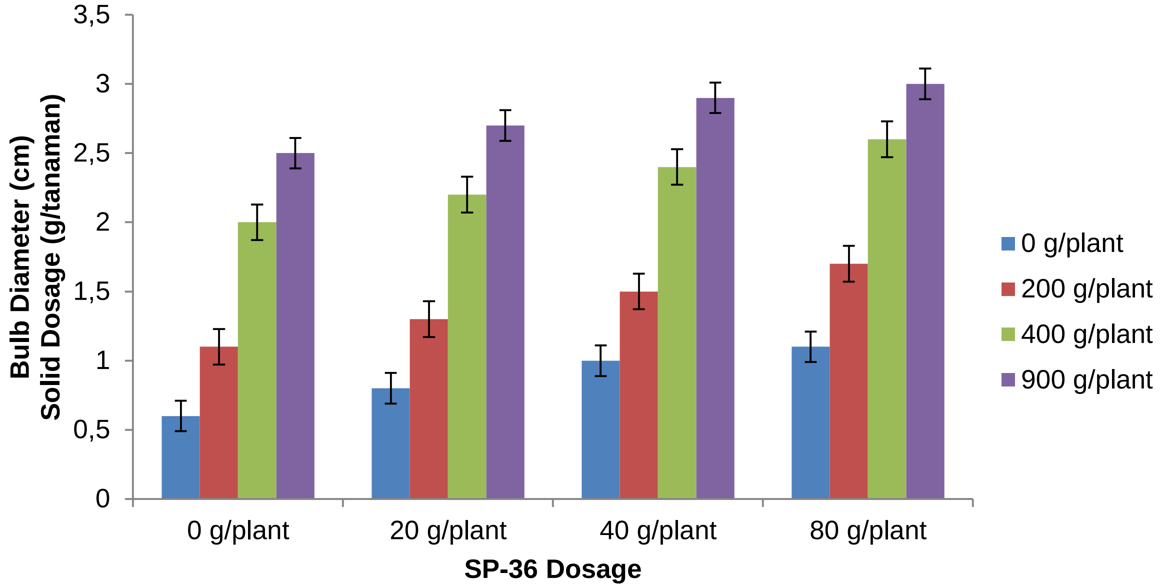

Figure 6. Bulb diameter of shallot plants treated with Solid compost and SP-36 fertilizer

The diameter of the red onion bulb of the Bima Brebes variety is, on average 2.4 cm and is classified as large. This result conforms to the opinion of Rahayu and Berlian (2004), the characteristics of the diameter of red onion bulbs that have quality 1 are a size of 1.7 cm or more than 1.7 cm.

4. CONCLUSION

The application of stable compost at the plant level significantly impacts the growth of shallots at 8 weeks post-planting, resulting in the highest average value. The utilization of SP 36 fertilizer at plant height demonstrates a notable influence on the growth of shallots at 8 weeks after planting, yielding the highest average value. Alterations can influence the production of shallots in climate conditions. An interplay exists between applying stable compost and SP 36 fertilizer concerning the number of bulbs, bulb weight, and bulb diameter.

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