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THE ROLE OF BACILLUS SUBTILIS BACTERIA ON THE GROWTH AND PRODUCTION OF TWO VARIETIES OF SHALLOTS (ALLIUM ASCALONICUM L.) ASAL TRUE SHALLOT SEED

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ABSTRACT

Keywords: Shallots; TSS; Bacillus subtilis.

Increasing the production of shallots from True shallot seed (TSS) can be done using Bacillus subtilis bacteria. This study aims to determine the role of Bacillus subtilis bacteria on the growth and production of two shallot varieties (Allium et al.) from True Sallot Seed. This research was conducted on Jl. Bandar Meriah, Sukamaju village, Sunggal sub-district, Deli Serdang district, with a height of 30 MDPL. This research was conducted from December 2022 to March 2023. This study used a randomized block design with two factors and three replications. The first factor is a variety of types: Sanren F-1 and Lokananta. The second factor was Bacillus subtilis bacteria with four levels: 0 ml/tanaman, 5 ml/plant, 10 ml/plant, and 15 ml/plant. The results showed that the Lokananta variety had plant heights of 5 and 7 MSPT, number of leaves 4-7 MSPT, chlorophyll B, total chlorophyll, fresh tuber weight per sample, fresh tuber weight per plot, dry tuber weight per sample, and dry tuber weight per plot, Which is higher than the Sanren F-1 variety. Giving 15 ml of Bacillus subtilis bacteria/plant has tuber circumference, number of tubers per plot, the weight of fresh tubers per plot, the weight of dry tubers per sample, the weight of dry tubers per plot, which is higher than giving bacteria of 0 ml/plant, 5 ml/plant and 10 ml/plant.

Introduction

Shallots (Allium et al.) are vegetable commodities in the form of bulbs with high economic value. In Indonesia, the centers of shallot production in 2010-2014 were East Java, Central Java, West Java, and West Nusa Tenggara (Apriyani, Wahyuni, & Azzumar, 2021). The four production centers have contributed 86.24% to the average shallot production in Indonesia (Khedr, Kadry, & Walid, 2015).

One of the problems that must be solved is the lack of need for shallots for public consumption projections due to the availability of planting material (bulbs) that are difficult to obtain and tuber seeds that are not sterile. Using tubers is generally considered more practical and easy and has a high success rate. However, the use of tubers has many disadvantages, especially regarding the quality of the seeds; the price is not low, and the provision of tubers and the management of tubers, including their storage and distribution. The solution is to plant shallots from two varieties of seeds, namely the Sanren F-1 variety and the Lokananta variety (Safrizal, Nazimah, Amini, Nilahayati, & Hafifah, 2022).

Shallot productivity in Indonesia has decreased from 2015 to 2019, namely 10.06 tons/ha, 9.67 tons/ha, 9.31 tons/ha, 9.59 tons/ha, and 9.93 tons/ha. (Chieloka, Kussiy, &

Garba, 2020). The low productivity of shallots in Indonesia compared to their production potential is influenced by several factors: decreased soil fertility, microclimate change, high plant pest attacks, and seed quality (Sudaryono, Rahwanto, & Komala, 2020). Seed quality is the basis of crop production, so good preservation is essential for optimal results.

Based on research by (Azmi et al., 2023), shallots using Lokananta TSS have better growth than Sanren F-1. This is indicated by Plant Height, number of leaves, and leaf area compared to Sanren F-1. This phenomenon suggests that genetic and environmental factors influence plant growth. Although Lokananta varieties generally grow better in the highlands, the results of this study prove that Lokananta varieties can also adapt to the environment in the lowlands.

The advantages of TSS (True shallot seed) are high productivity (can reach 26 tons/ha) and the volume of seed needs small (± 7.5 kg/ha). In contrast, using tubers needs 1.5 tons/ha, cheaper transportation and storage costs, and a more durable shelf life (1-2 years), while the tubers can only last four months.

Seed quality is also affected by seed production conditions, cultivars, storage conditions, and post-harvest maintenance. At the time of storage, seed viability and vigor are influenced by several things, including genetic factors, biotic moisture content (microfloral), humidity, relative temperature, and organismal activity (diseases, fungi, insects, and rodents).

The prospect of shallots is currently excellent, indicated by increasing consumer demand and population. The average consumption of shallots is 2.57 kg/capita/year (2017), and with a population of North Sumatra of 14,262,147 people, the need for shallots reaches 36,653.7 tons/year (Rachman, 2021). Meanwhile, shallot production in 2017 amounted to 16,103 tons. This means that North Sumatra experienced a shortage of 20,550.7 tons. Therefore, it is necessary to accelerate the increase in shallot production to achieve self-sufficiency in shallots in Indonesia by planting shallots from seeds of the Sanren F-1 variety and Lokananta variety.

Bacillus subtilis is a saprophytic and soil bacterium that contributes to the nutrient cycle due to its ability to produce various enzymes. The industry has used these bacteria to produce proteases, amylases, antibiotics, and chemicals. B. subtilis PGPR bacteria is one of the antagonistic bacteria capable of inducing systemic or systemic-induced resistance in plants.

In the study of (Hersanti, Sudarjat, and Damayanti, 2019), Bacillus subtilis bacteria, which include plant growth-promoting rhizobacteria (PGPR) bacteria, can induce onion resistance to block pathogens from infecting plant tissues and provide signals for plants to become resistant. Bacillus subtilis bacteria is a biological control agent with advantages such as Plant growth-promoting Rhizobacteria (PGPR), which can function as a biofertiliser, biostimulant, decomposer, and protector. The bacterium Bacillus subtilis produces endospores useful for self-defence from extreme conditions. Bacillus subtilis bacteria are gram-positive bacteria often found in soil (Rachmat Wicaksono et al., 2016).

Bacillus subtilis bacteria and various other bacteria can dissolve potassium in the soil. Potassium solvent bacteria can release potassium from a mineral by producing organic acids, such as acetic, citric, oxalic, and so on (Sembiring & Sabrina, 2022).
The research results by (Pieterse et al., 2014) show that the application of earthworm types and various microbes, including Bacillus subtilis, has a noticeable influence on plant growth.

Research Methods

Place and Time

This research was carried out on Jl. Bandar Meriah, Sukamaju Village, Sunggal District, Deli Serdang Regency, with an altitude of 30 m above sea level. This research will be conducted from December 2022 to March 2023.

Materials and Tools

The materials used in the study were TSS seeds of onion Variets Sanren F-1 and Lokananta, Bacillus subtilis bacteria, and other necessary ingredients. The tools used are hoes, meters, ropes, drills, sample trackers, standard pegs, scales, measuring containers, measuring cups, manual callipers (Vernier calliper), hand sprayers, stationery, calculators, knives, rulers, and other tools that support the implementation of this research.

Research Methods

This study used a randomised group design with two factors and three repeats—first-factor Varieties with two grades: Sanren F-1 and Lokananta. The second factor is Bacillus subtilis bacteria, which has four levels: control, 5 ml/plant, 10 ml/plant, and 15 ml/plant.

Research Implementation

The implementation of the study included land processing and fertilisation application with NPK given one week before planting with treatment doses of N 16, P 16 and K 16 as much as 30 g per plot. Then, re-fertilization was carried out when the plants were 3 MST as much as 20 g per plot and when the plants were 6 MST as much as 10 g per plot. Treatment of Bacillus subtilis bacteria with four levels was carried out when the plant was 3 MST old. The parameters observed consist of plant height, number of tubers and weight. Plant height is calculated at observation 3-7 weeks after planting by calculating the plant height at the base of the stem from the ground to the tip of the leaf (Hendarto et al., 2021). After harvesting, the number of tubers was observed by calculating the number of tubers against five samples in each sample and the treatment plot (Ichwan et al., 2022). The calculation of tuber weight was observed after harvest by drying for seven days and then weighing plants on five samples on each treatment plot (Hendarto et al., 2021).

Results and Discussion

Plant Height

The results of observations on the height of onion plants, after experiments were carried out, showed in Table 1 that the treatment of the V1 variety (siren F-1) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in the height of 29.49 cm. In comparison, treating the F-1 siren variety by administering Bacillus subtillis bacteria 15 ml/plant resulted in a better height of 32.71 cm. Treatment of V2 varieties (Lokananta) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in a height of 31.91 cm. In comparison, V2 treatment (Lokananta) with administering Bacillus subtillis bacteria 15 ml/plant resulted in a better height of 32.15 cm.

Table 1
Plant height of two varieties of shallots (Allium ascalonicum L.) from True Shallot Seed with Bacillus subtilis bacteria treatment at 7 MSPT

Treatment	V1 (sanren F-1)	V2 (Lokananta)	Track
B0 (0ml/tanaman)	29,49a	31,91abc	30,70
B1 (5ml/tanaman)	30,01from	32,07abc	31,04
B2(10ml/tanaman)	31,31abc	32,42abc	31,86
B3(15ml/tanaman)	32,71abc	32,19abc	32,45
Track	30,88	32,15	

In Table 1, it can be seen that the combination of varietal treatment with Bacillus subtilis bacteria significantly affects plant height. On the Lokananta variety (V2). Bacillus subtilis 15 ml/plant (B3) has better plant height than the Sanren F-1 (V1) variety. In the Lokananta variety (V2), the administration of Bacillus subtilis 15 ml/plant differs markedly in increasing the number of tubers compared to the absence of the administration of Bacillus subtilis 0 ml/plant.

Based on the discussion above. This is in line with the research of Istiqomah et al. (2017); Bacillus subtillis and P. fluorescens, which are classified as RPTT, can increase the growth of tomato plants because they function to produce the hormone Indole-3-acetic acid (IAA). Furthermore, Wartono et al. (2014) stated that Bacillus subtillis positively influences plant growth.

Jumlah Umbi

The results of observations on the number of onion bulbs after experiments were carried out can be seen in Table 2 that the treatment of varieties V1 (siren F-1) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in the number of tubers as much as 175.17 tubers while the treatment of the F-1 siren variety with the administration of Bacillus subtillis bacteria 15 ml/plant resulted in a better number of tubers of 195.00 tubers. Treatment of V2 varieties (Lokananta) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in several tubers, as much as 176.67. In comparison, V2 treatment (Lokananta) with administering Bacillus subtillis bacteria 15 ml/plant resulted in a better number of tubers, 187.00.

Table 2
Number of bulbs of two varieties of shallots (Allium ascalonicum L.) from True Shallot Seed with Bacillus subtilis Bacteria treatment

Treatment	V1(sanren F-1)	V2(Lokananta)	Track
B0 (0ml/tanaman)	175,17a	176,67from	175,92
B0 (5ml/tanaman)	188,00abc	180,00abc	184,00
B0 (10ml/tanaman)	190,00abc	181,67abc	185,83
B0 (15ml/tanaman)	195,00abc	187,00abc	191,00
Track	187,04	181,33	

In Table 2, it can be seen that the combination of varietal treatment with Bacillus subtilis bacteria has a significant effect on the number of tubers. In the Sanren F-1 (V1) variety, the application of Bacillus subtilis 15 ml/plant (B3) has a better number of tubers than the Lokananta variety (V2). In the Sanren F-1 (V1) variety, the administration of Bacillus subtilis 15 ml/plant differs markedly in increasing the number of tubers compared to the absence of the administration of Bacillus subtilis 0 ml/plant.

Based on the discussion above, this aligns with research conducted by Despita et al. (2017), who found that adding new leaves always follows the formation of prospective onion bulbs. The period of formation of prospective tubers occurs until the age of 35 HST, and the following process focuses on filling the tubers.

Bobot Umbi

The results of observations on the weight of onion bulbs after experiments were carried out can be seen in Table 3 that the treatment of varieties V1 (siren F-1) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in a tuber weight of 930.00 g. In comparison, the treatment of varieties of Sanren F-1 with the administration of Bacillus subtillis bacteria 15 ml/plant resulted in a better tuber weight of 1035.83 g. Treatment of V2 varieties (Lokananta) with the administration of Bacillus subtillis bacteria 0 ml/plant resulted in a tuber weight of 950.00 g., In comparison, V2 treatment (Lokananta) with administering Bacillus subtillis bacteria 15 ml/plant resulted in a better number of tubers of 1037.92 g.

Table 3
Bulb weights of two varieties of shallots (Allium ascalonicum L.) from True Shallot Seed with Bacillus subtilis bacterial treatment

Treatment	V1 (sanren F-1)	V2(Lokananta)	Track
B0(0ml/tanaman)	930,00a	950,00from	940,00
B1(5ml/tanaman)	1043,33abc	1000,00abc	1021,67
B2(10ml/tanaman)	1053,33abc	1033,33abc	1043,33
B3(15ml/tanaman)	1116,67abc	1168,33abc	1142,50
Track	1035,83	1037,92	-

Table 3 shows that the combination of varietal treatment with Bacillus subtilis bacteria significantly affects tuber weight. On the Lokananta variety (V2). Bacillus subtilis 15 ml/plant (B3) has a better tuber weight than the Sanren F-1 (V1) variety. In the Lokananta variety (V2), the administration of Bacillus subtilis 15 ml/plant differs markedly in increasing the number of tubers compared to the absence of the administration of Bacillus subtilis 0 ml/plant.

Based on the research above, this aligns with research conducted by Olrh Husnihuda et al. (2017). Living PGPR utilizes root exudate to produce plant hormone IAA (indole acetic acid), and auxin helps plant cell elongation and growth of new cells and tubers. To increase the growth and production of shallots.

Conclusion

Giving Bacillus subtilis bacteria can increase the growth and production of onion plants, with the application of Bacillus subtilis bacteria 15 ml/plant in the Lokananta variety showing the highest average plant height of 32.15 cm. While observing the highest number of tubers, the results were found in applying Bacillus subtilize bacteria 15 ml/plant in the Sanren F-1 variety, which was 187.04 tubers. In the observation of the weight of plant tubers, the highest yield was found in applying Bacillus subtilize bacteria 15 ml/plant in the Lokananta variety, which was 1037.92 g. With this, it was found that administering Bacillus subtilis bacteria in two onion varieties, namely V1 (Sanren F-1) and V2 (Lokananta), could improve all observed parameters.

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