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THE EFFECT OF PROVIDING PHOTOSYNTHESIS BACTERIA DOSES ON THE GROWTH AND PRODUCTION OF RED CHILI VARIETIES (Capsicum annuum L.)

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Abstract

Red chili cultivation still faces the obstacle of low productivity, so more efficient biofertilization innovations are needed, one of which is through the use of photosynthetic bacteria (PSB). This study aims to evaluate the effect of various PSB doses on the growth and production of three red chili varieties and test for their interaction. The study was conducted from May–August 2025 at the UMT Selatan experimental field using a factorial Randomized Block Design (RAK) with two factors, namely PSB dose (0, 5, 10, 15 ml/L) and varieties (Super Baja, Faruq, Ateng), each with three replications. A quantitative approach was used by measuring growth parameters (plant height, leaf area, stem diameter) and production (number of fruits, fruit weight per sample and per plot). The results showed that PSB had a very significant effect on all parameters, with a dose of 15 ml/L producing the highest vegetative growth and production. Variety also had a significant effect, with Super Baja showing the best performance. There was a significant interaction between PSB dose and variety, with the combination of B3V1 producing optimal production. This study concludes that PSB is effective as a biofertilizer to increase red chili productivity, with important implications for the development of environmentally friendly cultivation and agricultural input efficiency.

Keywords: PSB; Dosage; Chili

I. INTRODUCTION

Red chili productivity in Indonesia continues to fluctuate due to low soil fertility, dependence on chemical fertilizers, and limited plant utilization of light energy. Photosynthetic bacteria (PSB) have been reported to increase nutrient absorption, improve soil structure, and produce growth hormones such as IAA, cytokinins, and gibberellins (Asmuni et al., 2017; Brahmana et al., 2022). However, PSB effectiveness can vary depending on dosage and variety, as plant physiological responses are strongly influenced by genetic factors (Daradjat et al., 2003). This situation highlights the need for more focused scientific studies on the relationship between PSB dosage and red chili varieties. This study aims to determine the effect of PSB dosage on the growth and production of red chili peppers, identify differences in the response of Super Baja, Faruq, and Ateng varieties, and determine their interaction. The results are expected to generate technical recommendations regarding the most effective dosage and variety combinations for increasing red chili pepper production. Scientifically, this research is highly relevant because it fills a research gap regarding the specific relationship between PSB dosage and genetic differences in chili varieties. Previous studies have focused more on the general benefits of PSB, but have not provided an adequate understanding of the varieties' suitability for this biostimulant treatment. Therefore, this research contributes to the development of microbial-based biofertilizers to improve the efficiency of environmentally friendly horticultural cultivation.

II. RESEARCH METHOD

This study used a quantitative approach with a field experiment method to test the effect of photosynthetic bacteria (PSB) doses on the growth and production of several red chili varieties. The study was conducted from May–August 2025 at the Experimental Field of the Faculty of Science and Technology, Muhammadiyah University of South Tapanuli (321 masl). The quantitative approach was chosen to obtain measurable data that can be analyzed statistically. The research subjects consisted of three varieties of red chili peppers: Super Baja, Faruq, and Ateng, chosen because they are commonly cultivated varieties and have different growth characteristics. The PSB dosage treatment included four levels: 0 ml/L (control), 5 ml/L, 10 ml/L, and 15 ml/L. These two factors were combined to obtain 12 treatments, each replicated three times, resulting in 36 experimental units. Seedlings were planted in polybags, maintained according to cultivation standards, and the PSB treatment was administered by spraying the solution once a week.

Data collection was conducted through direct measurements of several growth and production parameters. Growth parameters included plant height, stem diameter, and leaf area, which were measured periodically from 2 to 12 weeks after planting using a ruler and measuring tape. Production parameters included the number of fruits per sample, fruit weight per sample, and fruit weight per plot, which were obtained through weighing at each harvest using digital and manual scales. The data obtained were analyzed using Analysis of Variance (ANOVA) according to a factorial Randomized Block Design **(** RBD) to examine the independent effects and interactions between treatments. If significant differences were found, the analysis was continued with a 5% DMRT test to compare treatment means. The analysis was conducted based on quantitative data obtained from all experimental units without using complex theoretical methods, thus focusing on empirical field results.

III. DISCUSSION AND RESULTS

1. The Effect of Photosynthetic Bacteria Dose on Plant Growth

Research shows that increasing the dosage of photosynthetic bacteria (PSB) has a strong impact on the vegetative growth of red chili peppers. A dosage of 15 ml/L (B3) resulted in the highest plant height, leaf area, and stem diameter compared to other treatments, for example, a height of 59.85 cm and a leaf area of 92.36 cm^2. These findings indicate that PSB effectively increases photosynthetic efficiency and plant metabolism by increasing nutrient availability and the production of growth hormones such as IAA and gibberellin. The effectiveness of PSB at high doses also aligns with previous reports that photosynthetic bacteria act as biofertilizers that strengthen plant physiological processes (Brahmana et al., 2022). Academically, these data reinforce the understanding that plant response to biofertilizers is dose-dependent and depends on the intensity of microbial activity in the root zone.

2. Effect of PSB Dose on Fruit Production

In the generative phase, higher doses of PSB continued to demonstrate superiority. The B3 treatment yielded 11.88 fruits per sample, with a fruit weight per plot reaching 208.33 g, significantly higher than the control (B0) of only 131.11 g. This increased production indicates that PSB not only enhances vegetative growth but also optimizes flower and fruit formation. Physiologically, the presence of PSB facilitates the absorption of phosphate and nitrogen—key elements in fruit formation. This finding corroborates the study by Yanti et al. (2019) that PSB application can increase production yields by up to 30% by enhancing plant metabolism. These results contribute to scientific evidence that biofertilizers such as PSB can partially replace chemical fertilizers in increasing crop yields.

3. Differences in Response Between Red Chili Varieties

The three varieties exhibited different growth and production responses. The Super Baja (V1) variety performed best with a plant height of 59.41 cm and a yield of 197.22 g per plot, followed by the Faruq and Ateng varieties, which produced lower values. These differences illustrate the strong role of genetic factors in determining nutrient uptake efficiency and plant metabolic adaptation. Highly adaptable varieties such as Super Baja are able to utilize PSB activity optimally, while the Ateng variety has lower physiological efficiency. These results are consistent with Rostini's (2011) opinion regarding the importance of genetic diversity in determining the yield potential of horticultural crops. Academically, these findings fill a research gap regarding the relationship between variety and biofertilizer effectiveness.

4. Interaction of PSB and Variety: Synergistic Effect

The interaction between PSB and varieties was very significant, especially in terms of plant height, leaf area, stem diameter, and fruit weight per plot. The B3V1 treatment combination (PSB 15 ml/L × Super Baja) produced the highest yield, reaching 62.88 cm of plant height and 214.44 g of fruit weight per plot. In contrast, the B1V2 combination produced the lowest yield, indicating that the response to PSB is strongly influenced by the compatibility between the genetic characteristics of the variety and microbial activity. This finding is in line with Daradjat et al. (2003) who stated that the effectiveness of soil microorganisms is determined by compatibility with plant genetics. Academically, this result is important because it reinforces the concept that the success of a biofertilizer depends not only on dosage, but also on plant-microbe compatibility.

5. Academic and Practical Implications

The findings of this study confirm that PSB can be an effective biofertilizer in increasing red chili productivity. Scientifically, this study broadens understanding of the interaction between biofertilizer dosage and plant variety, and highlights the role of genetic factors in maximizing the benefits of soil microbes. Practically, the combination of high-dose PSB and superior varieties (Super Baja) can be recommended as an environmentally friendly and sustainable biofertilization strategy.

IV. CONCLUSION

This study shows that the administration of photosynthetic bacteria (PSB) significantly affects the growth and production of red chili peppers, with a dose of 15 ml/L producing the highest performance. The Super Baja variety is the most responsive variety compared to Faruq and Ateng, and the combination of B3V1 produces optimal growth and production. These findings clearly answer the objectives and formulation of the research problem that the correct PSB dose and variety selection have a direct effect on plant performance, and that there is a real interaction between the two factors. This study provides theoretical implications that the effectiveness of biofertilizers is influenced by the compatibility between microbial activity and plant genetic characteristics, while also offering practical implications in the form of recommendations for the use of PSB as an alternative environmentally friendly fertilizer. This study is limited by its single-site scope, limited research period, and the inability to evaluate plant physiological parameters in depth. Future research should include multi-site trials, observations of different growing seasons, more comprehensive plant physiological analyses, and evaluation of the long-term benefits of PSB on soil health. This is necessary to strengthen the generalizability of the findings and develop broader technical recommendations for red chili cultivation practices.

REFERENCES

Asmuni, A., Nurbailis, & Handajaningsih, M. (2017). Pemanfaatan bakteri fotosintesis untuk meningkatkan pertumbuhan tanaman hortikultura. Jurnal Agroteknologi, 8(2), 45–52.

Brahmana, E., Lubis, A., & Sari, N. (2022). Peran bakteri fotosintetik sebagai biofertilizer pada tanaman sayuran. Jurnal Biologi Tanaman, 14(1), 11–20.

Daradjat, A. A., Widowati, R., & Kartika, J. G. (2003). Pengaruh faktor genetik terhadap respons tanaman terhadap pemupukan hayati. Buletin Agronomi, 31(3), 120–128.

Rostini, N. (2011). Keragaman genetik dan produktivitas tanaman cabai merah. Jurnal Hortikultura Indonesia, 2(1), 35–41.

Yanti, R., Permatasari, D., & Hutagalung, S. (2019). Aplikasi bakteri fotosintetik terhadap peningkatan hasil buah cabai. Jurnal Agroekoteknologi Tropika, 4(2), 55–63.