Aisar Novita

Plant Growth Promoting Rhizobacteria (PGPR) Test and Several Doses

Quick Submit
Quick Submit
Universitas Muhammadiyah Sumatera Utara

Document Details

Submission ID
trn:oid:::1:3159440647

Submission Date
Feb 19, 2025, 7:57 AM GMT+7

Download Date
Feb 19, 2025, 8:41 AM GMT+7

File Name
at_Manure_on_the_Growth_and_Yield_of_Sweet_Corn_Zea_mays_L..pdf

File Size
217.3 KB

6 Pages

3,776 Words

19,163 Characters

5% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Small Matches (less than 35 words)

Exclusions

- 4 Excluded Sources

Match Groups

4 Not Cited or Quoted 4%
Matches with neither in-text citation nor quotation marks

0 Missing Quotations 0%
Matches that are still very similar to source material

1 Missing Citation 1%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

3% Internet sources
1% Publications
2% Submitted works (Student Papers)

Integrity Flags

1 Integrity Flag for Review

Replaced Characters
18 suspect characters on 3 pages
Letters are swapped with similar characters from another alphabet.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **4** Not Cited or Quoted 4%
  Matches with neither in-text citation nor quotation marks
- **0** Missing Quotations 0%
  Matches that are still very similar to source material
- **1** Missing Citation 1%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

- 3% Internet sources
- 1% Publications
- 2% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Student papers	
University of Central Florida		1%
2	Internet	
jurnal.uns.ac.id		1%
3	Internet	
jurnal.harianregional.com		1%
4	Internet	
jurnal.um-palembang.ac.id		1%
5	Publication	
Lihong Zhai, Yunqi Tang, Mingfei Dong, Gengshen Chen, Yang Wang, Feng Teng, J...		<1%

Contributions of Central Research Institute for Agriculture
Vol. 19, No. 1, January 2025, pp. 32~37
ISSN: 2962-9217, DOI: 10.59651/ccria
Published by: Central Research Institute for Agriculture (CeRIA)

Plant Growth Promoting Rhizobacteria (PGPR) Test and Several Doses of Goat Manure on the Growth and Yield of Sweet Corn (Zea mays L.)

Efrida Lubis[1*], Mahi Ansarda[1], Aisar Novita[1], Rini Sulistiani[1], Hilda Julia[1], Bunga Raya Ketaren[2]
[1]Faculty of Agriculture, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia
[2] Department of Agricultural Technology, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia

Article Info

Article history:

Received : Nov 03, 2024
Revised : Dec 21, 2024
Accepted : Jan 28, 2025

Keywords:

Goat manure;
Plant Growth Promoting Rhizobacteria;
Sweet Corn.

ABSTRACT

Soil fertility is one of the contributing factors to the low sweet corn production in Indonesia. This study aims to determine the growth and yield of sweet corn (Zea mays saccharata Sturt) using the organic PGPR test and several doses of goat manure. It employed a factorial Randomized Block Design (RBD) with three replications and two treatment factors. The first factor was PGPR, categorised as follows: P_0: no PGPR (control), P_1: 20 ml/liter of water, P_2: 30 ml/liter of water, and P_3: 40 ml/liter of water. The second factor was goat manure, categorised as follows: K_0: no goat manure (control), K_1: 1 kg/plot, K_2: 1.5 kg/plot, and K_3: 2 kg/plot. The findings showed that the use of PGPR had no significant effect on the growth and yield of maize. The application of goat manure at a dose of 2 kg/plot significantly affected plant height, number of leaves, leaf area, stem diameter, flowering age, cob length, cob diameter, seeds quantity per row, cob weight per plant, and sweetness level. There was no interaction between the combination of PGPR and goat manure on the growth and yield of maize.

Corresponding Author:

Aisar Novita
Faculty of Agriculture, Universitas Muhammadiyah Sumatera Utara
Jl. Muhtar Basti No. 3, Kota Medan, Sumatera Utara 20226
Email: aisarnovita@umsu.ac.id

1. INTRODUCTION

Sweet corn (*Zea mays* saccharata Sturt) is a crop with high commercial value that has a shorter harvest period, making its cultivation highly profitable. Sweet corn plants are increasingly growing and extensively consumed by Indonesian people. Sweet corn, abundant in carbohydrates and various nutrients (vitamins, fiber, and minerals), is favored by consumers for its unique taste and pleasant flavor (Xiao et al., 2024).

The current use of inorganic fertilizers, particularly as improperly formulated, leads to a depletion of soil nutrients, resulting in nutritional imbalances, structural degradation, and low soil microbiology. According to (Kurniati, 2020), the continuous use of inorganic fertilizers leads to soil damage, environmental pollution from residual substances, a degradation of organic materials, and a decline in microorganisms essential for nutrient provision, ultimately resulting in diminished land productivity. So as to address this issue, it is essential to make improvements through organic PGPR, acidifing the soil microenvironment and significantly affecting it to increase heavy metal tolerance in plants. The specified PGPR strain significantly contributes to the volatilization and

biomethylation of heavy metals, increasing its availability and mobilization (Sun et al., 2024). Furthermore, Yield characteristics and yield components as well as growth characteristics was strongly influenced by environmental factors (Novita & Siregar, 2024).

Goat manure is relatively accessible as a primary nutrition source in organic cultivation. Moreover, it is cost-effective, ecologically sustainbale, and, most importantly, increases soil fertility while providing essential nutrients for plant growth. One of the agricultural technology innovations that can increase plant productivity while minimizing ecosystem damage involves the use of non-pathogenic bacteria derived from plant roots (*rhizobacteria*), which are classified into the Plant Growth Promoting Rhizobacteria (PGPR) group (Komansilan et al., 2023). adding fermented goat urine POC is one way to increase cucumber production as it provides balanced nutrients for plant growth and productivity. Thus, it is necessary to examine the effects of KCl fertilizer and goat urine on Japanese cucumber production (Lubis et al., 2022).

PGPR is a bacterium that lives and actively colonizes the root area of plants. Its presence can provide benefits for plant growth by facilitating the absorption and mobilization of various nutrients in the soil. (Nafiah, 2016) state that PGPR comprises several types of rhizobacteria, some of which function as plant growth stimulants or biological agents for controlling disease, thereby increasing plant productivity.

PGPR will function optimally as supplemented with organic fertilizers. Providing adequate organic resources will enable bacteria to proliferate, thereby ensuring their survival in the rhizosphere area and allowing them to perform their tasks and roles effectively (Lehar, Salli, et al., 2018). (Lehar, Arifin, et al., 2018) posited that the direct use of PGPR into the soil is believed to facilitate the degradation of organic matter in the soil, which subsequently transforms into nutrients for microbial proliferation. This study aims to improve the growth and yield of sweet corn plants through the use of organic PGPR and goat manure, thereby minimizing the ongoing reliance on inorganic fertilizers, which can severly degrade agricultural land. It is harmful not only to the land and vegetation but also to the farmers. This study seeks to determine the growth and yield of sweet corn (*Zea mays* saccharata Sturt) plants using organic PGPR tests and several doses of goat manure. It produces morphological characters of sweet corn using the PGPR test and varying doses of goat manure.

2. METHOD

This study was conducted on the land owned by the Faculty of Agriculture, Universitas Muhammadiyah Sumatera Utara, at Jl. Sampali, Percut Sei Tuan Subdistrict, Deli Serdang Regency, North Sumatera, situated at a height of ± 27 meters above sea level. This research was conducted from April to June 2023.

The materials used in this study included Paragon variety sweet corn seeds, water, goat manure, and organic *Plant Growth Promoting Rhizobacteria* (PGPR) containing microorganisms (*Rhizobium* sp., *Lactobacillus* sp., *Acetobacter* sp., *Aspergillus* sp., Penicillium sp., and *Trichoderma* sp.). The tools used were hoes, machetes, measuring devices, rulers, plastic ropes, scissors, sample signs, watering cans, scales, measuring cups, refractometers, varnier calipers, cameras, and stationery.

This study employed a Factorial Randomized Block Design (RBD) with two factors. A randomized block design is a restricted randomized design, wherein experimental units are initially organized into homogeneous blocks, followed by the random assigned treatments to these units within the blocks. The primary benefit of this design is that, once executed properly, it provides more precise results (Palaniswamy, 2020). The first factor was the concentration of organic *Plant Growth Promoting Rhizobacteria (*PGPR) consisting of four levels, *viz.* P0 = no PGPR (control), P1 = 20 ml/liter of water, P2 = 30 ml/liter of water, and P3 = 40 ml/liter of water. The secound factor was goat manure (K) comprising four levels, *viz.* K0 = no goat manure (control), K1 = 1 kg/plot, K2 = 1.5 kg/plot, and K3 = 2 kg/plot. The findings were further analyzed using the Analysis of Variance (ANOVA) followed by Duncan's Mean Difference Test (DMRT), with a linear model of Factorial Randomized Block Design (RBD) as follows:

$$Y_{ijk} = \mu + \gamma_i + \alpha_j + \beta_k + (\alpha\beta)_{jk} + \varepsilon_{ijk} \text{ ..... (1)}$$

Notes:
Y_{ijk} : observational results of factor P at level j and factor K at level k in repetition i
μ : erroneous
γ_i : the impact of the i-level block

ISSN 0126-1894 (Print), 2962-9217 (Online)

P_j : the impact of the factor of giving P level j
K_k : the impact of the K level assignment factor to k
$(PK)_{jk}$: the impact of the combination of giving P level j and giving K level k
E_{ijk} : the impact of errors from the factors of giving P level j, K level k, and block i
Linear model of Factorial Randomized Block Design (RBD) as shown in Eq. 1.

The parameters observed were plant height, stem diameter, and flowering age. Plant height was measured from the base of the stem to the growing point using a meter. Plant height was measured starting from 2 weeks after planting to 8 WAP. Stem diameter was measured using a caliper at the base of the stem. Stem diameter was measured at the ages of 2, 4 and 6 WAP. Flowering age was calculated from the appearance of the first flower on each sample plant.

3. RESULTS AND DISCUSSION

3.1 Plant Height (cm)

Based on the analysis of variance, PGPR treatment and the interaction of the two treatments had no significant effect on plant height metrics. However, goat manure treatment had a significant effect on plant height at 6 and 8 WAP. Table 1 presents the average plant height.

According to Table 1, the provision of PGPR had no significant effect on plant height metrics at 2, 4, 6, and 8 WAP. Despite the lack of statistical response, there was an observable increase; the highest average data was recorded at the P3 level (203.50 cm), while the lowest was at the P1 level (203.06 cm). This aligns with the assertion of (Fitri et al., 2020) that the ultisol soil used in this study had a pH of 5.50 (acidic) and had not undergone liming, resulting in its continued acidity. Table 1 indicates that the provision of PGPR (Plant Growth Promoting Rhizobacteria) to corn plants results in variable plant height growth; in general, there was no significant difference in the vegetative growth of corn plants treated with PGPR (Plant Growth Promoting Rhizobacteria) due to the acidic soil pH, which hinders the development of N-fixing bacteria.

Table 1. Plant Height with PGPR Test Treatment and Goat Manure at 2, 4, 6 and 8 WAP

Treatment	Weak After Planting (WAP)			
	2	4	6	8
PGPR				
		……..(cm)……		
P_0	34.81	84.44	166.48	203.06
P_1	34.42	84.47	162.72	202.25
P_2	32.67	83.56	165.00	202.75
P_3	31.86	83.62	168.24	203.50
Goat Manure				
K_0	32.00	83.39	162.61 d	200.69 d
K_1	33.25	83.42	163.25 c	202.78 c
K_2	33.92	84.23	166.99 b	203.50 b
K_3	34.58	85.06	169.60 a	204.58 a
Interaction (PxK)				
P_0K_0	33.33	82.78	162.78	201.00
P_0K_1	32.89	83.56	166.67	204.78
P_0K_2	36.67	86.22	163.67	202.78
P_0K_3	36.33	85.22	172.83	203.67
P_1K_0	32.33	82.33	162.22	201.22
P_1K_1	32.56	82.56	158.33	198.33
P_1K_2	36.56	86.00	163.67	205.00
P_1K_3	36.22	87.00	166.67	204.44
P_2K_0	31.89	81.89	160.67	200.67
P_2K_1	33.44	83.44	163.67	203.00
P_2K_2	31.78	81.78	166.22	203.22
P_2K_3	33.56	87.11	169.44	204.11
P_3K_0	30.44	86.56	164.78	199.89
P_3K_1	34.11	84.11	164.33	205.00
P_3K_2	30.67	82.93	174.41	203.00
P_3K_3	32.22	80.89	169.44	206.11

Description: Numbers followed by distinct letters within the same column exhibit substantial differences as per the 5% DMRT test.

Goat manure treatment on corn plants significantly affected plant height metrics at 6 and 8 WAP. The optimal outcomes in goat manure administration occurred at the K3 level with a dose of 2 kg/plot (204.58 cm), which was substantially different from the K2 level (203.50 cm), K1 (202.78 cm), and the K0 level, which exhibited the lowest plant height growth (200.69 cm). Figure 1 illustrates the correlation between corn plant height and goat manure treatment at 6 and 8 WAP.

The height of plants at 6 and 8 WAP with goat manure treatment showed a positive linear correlation, represented by the following equations: for 6 WAP, ŷ = 162.06 + 2.1714x with r value = 0.85, and for 8 WAP, ŷ = 200.73 + 1.9175x with r value of 0.96. The K3 level had the highest tendency with a dose of 2 kg/plot, measuring 204.58 cm at 8 WAP. The application of goat manure significantly influenced plant height growth due to its nutritional content. This is in accordance with the statement of (Washaya & Washaya, 2023) that goat manure possesses properties that do not damage the soil, provide macro and micronutrients, increase water retention, promote soil microbiological activity, boost cation exchange capacity, and improve soil structure. The nutritional content of goat manure comprises 64% water, organic matter N (31%), P2O5 (0.7%), K2O (0.4%), CaO (0.4%), and C/N (20-25%). The presence of nutrients in the soil and their efficient uptake by plants affected the growth of plant height.

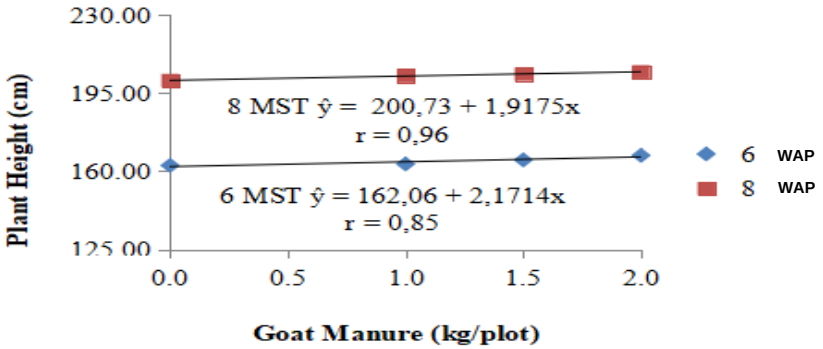

Figure 1. Correlation between Plant Height and Goat Manure Treatment at 6 and 8 WAP

3.2 Stem Diameter (mm)

The analysis of variance indicated that PGPR treatment and the interaction of the two treatments had no significant effect on stem diameter. Nonetheless, goat manure treatment exerted a substantial impact at 6 WAP.

Table 2. Displays the statistics on the average stem diameter.

Treatment Goat Manure	PGPR				Average
	P_0	P_1	P_2	P_3	
			(cm)		
K_0	3.00	3.17	3.22	3.22	3.15 c
K_1	3.22	3.17	3.33	3.50	3.31 bc
K_2	3.67	3.56	3.61	3.11	3.49 b
K_3	3.78	3.78	3.94	3.67	3.79 a
Average	3.42	3.42	3.53	3.38	

Description: Numbers followed by distinct letters within the same column exhibit substantial differences as per the 5% DMRT test.

According to Table 2, the provision of PGPR had no significant effect on stem diameter at 4, 6, and 8 WAP. Despite the lack of statistical response, there was an observable increase in stem diameter measures. The highest average measurement was at the P2 level (3.53 cm), while the lowest was at the P3 level (3.38 cm). The use of goat manure significantly influenced stem diameter metrics at 6 WAP. The optimal outcomes occurred at the K3 level with a dose of 2 kg/plot (3.79 cm), which was considerably distinct from the K2 level (3.49 cm). However, the K2 level did not exhibit a significant difference from the K1 level (3.31 cm) and K0 (3.15 cm), which had the lowest stem diameter growth. Figure 2 illustrates the correlation between stem diameter and goat manure treatment.

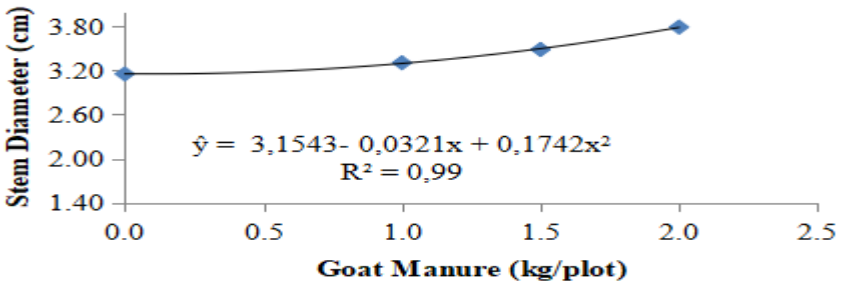

Figure 2. Correlation between Stem Diameter and Goat Manure Treatment at 6 WAP

36 ISSN 0126-1894 (Print), 2962-9217 (Online)

According to Figure 2, the stem diameter in response to goat manure treatment exhibited a positive quadratic correlation, represented by the equation ŷ = 3.1543 - 0.0321x + 0.1742x2, with r value of 0.99. The highest tendency was observed at the K3 level with a dose of 2 kg/plot (3.79 cm).

Goat manure influences the growth of stem diameter in corn plants, likely due to its composition of macro and micronutrients. Nutrients available in the soil in quantities suitable for plant needs provide optimal plant growth outcomes. This aligns with the assertion of (Hidayati et al., 2021) that the use of organic fertilizer can establish a nutritional balance in the soil and improve its physical quality by augmenting the soil texture, porosity, and structure. The increase in stem diameter is attributed to the availability of nitrogen nutrients, optimizing nutrition absorption. Elevated N content improves plants greenness, facilitating efficient photosynthetic processes, which in turn affects plant diameter. An increase in N content accelerates plant growth, resulting in a large stem diameter.

3.3 Flowering Age (day)

The analysis of variance indicated that the PGPR treatment and the interaction of the two treatments had no significant effect on flowering age. Nonetheless, the goat manure treatment had a significant effect. Table 3 presents the statistics on the average flowering age.

Table 3. Flowering Age with PGPR and Goat Manure Treatment

Treatment Goat Manure	PGPR				Average
	P_0	P_1	P_2	P_3	
			……(hari)……..		
K_0	48.89	49.44	49.78	48.44	49.14 a
K_1	47.22	46.89	49.22	46.78	47.53 b
K_2	48.89	47.22	46.44	45.11	46.92 c
K_3	46.67	45.33	47.00	46.56	46.39 d
Average	47.92	47.22	48.11	46.72	

Notes: Numbers followed by distinct letters within the same column exhibit substantial differences as per the 5% DMRT test.

According to Table 3, the provision of PGPR had no significant effect on flowering age. Despite the lack of statistical response, there was an observable increase in each treatment. The average duration for the fastest flower emergence was at the P3 level (46.72 days), while the slowest was at the P2 level (48.11 days). The provision of goat manure significantly affected the flowering age metrics. The optimal outcomes were at the K3 level with a dose of 2 kg/plot (46.39 days), which was significantly different from the K2 level (46.92 days), K1 (47.53 days), and K0 (49.14 days), the latter exhibiting the longest flowering age. Figure 3 illustrates the correlation between flowering age and goat manure treatment.

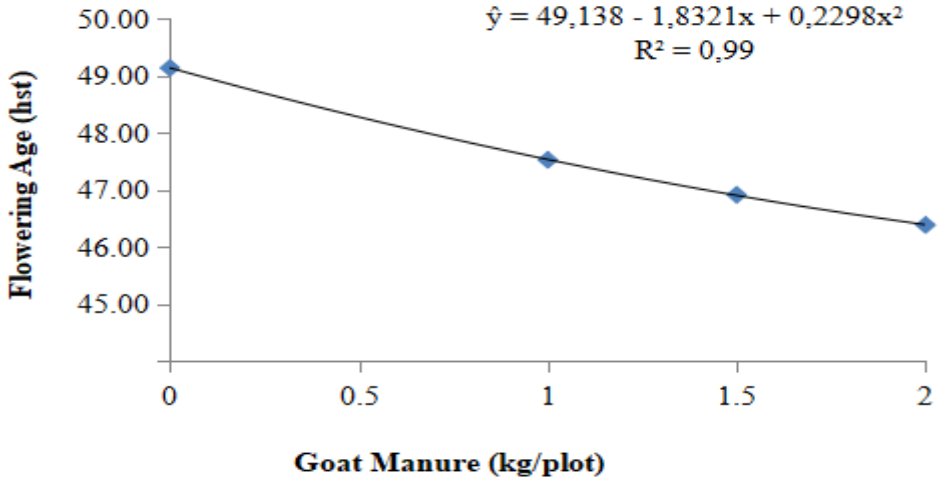

Figure 3. Correlation between Flowering Age and Goat Manure Treatment

According to Figure 3, the flowering age in response to the goat manure treatment exhibited a negative quadratic correlation, represented by the equation ŷ = 49.138 - 1.8321x + 0.2298x2, with r value of 0.99. The K3 level, with a dose of 2 kg/plot, had the most rapid floral emerging propensity, occurring in 46.39 days.

Goat manure enhances the flowering process in corn plants by enriching the soil with nutrients, e.g., nitrogen, phosphorus, and potassium. Additionally, goat manure contains hormones that promote the growth of plant parts, including leaves and stems, and accelerate flowering age. It can also improve soil fertility, hence optimizing plant growth. This aligns with (Rukudzo, 2017; Sitepu, 2019) statement that goat manure fertilizer possesses benefits due to its elevated nutritional content, including organic matter N (31%), P2O5 (0.7%), and K2O (0.4%), CaO (0.4%), and C/N (20-25%). The macronutrients contained in goat manure are available to plants, facilitating healthy vegetative growth. Goat manure is one of the organic fertilizers readily available in ample amounts, particularly in environments that breed numerous goats, and it possesses a high nutritional content. Organic fertilization can be done by adding goat manure, which possesses a higher potassium concentration and lower moisture content relative to other manures (Ilham et al., 2023).

4. CONCLUSION

The provision of PGPR had no significant effect on the growth and yield of corn plants. The provision of goat manure at a dose of 2 kg/plot had a significant effect on plant height, stem diameter, and flowering age. There was no significant interaction between the combination of PGPR and goat manure on the growth and yield of corn plants.

REFERENCES

Fitri, N. F., Okalia, D., & Nopsagiarti, T. (2020). Uji konsentrasi PGPR (Plant Growth Promoting Rhizobakteri) asal akar bambu dalam meningkatkan pertumbuhan dan produksi tanaman jagung (Zea mays L) pada tanah ultisol. *Green Swarnadwipa: Jurnal Pengembangan Ilmu Pertanian*, *9*(2), 285–293.

Hidayati, S., Nurlina, N., & Purwanti, S. (2021). Uji pertumbuhan dan hasil tanaman sawi dengan pemberian macam pupuk organik dan pupuk nitrogen. *Jurnal Pertanian Cemara*, *18*(2), 81–89.

Ilham, B. W., Atikah, T. A., Zubaidah, S., Syahid, A., & Asie, K. V. (2023). GROWTH RESPONSE OF BANJAR SIAM ORANGE (CITRUS NOBILIS LOUR VAR. MICROCARPA HASSK) SEEDS TO FERTILIZER OF GOAT MANURE AND NPK IN RED YELLOW PODSOLIC SOIL. *Russian Journal of Agricultural and Socio-Economic Sciences*, *142*(10), 135–140.

Komansilan, O., Paulus, J. M., & Rogi, J. E. X. (2023). Pemberian Plant Growth Promoting Rhizobacteria (PGPR) Untuk Meningkatkan Produksi Padi Gogo Dan Jagung Dalam Sistem Tumpang Sari. *Jurnal Mipa*, *12*(1), 1–10.

Kurniati, F. (2020). Potensi Pupuk Hijau Turi Mini (Sesbania rostrata Brem) Dalam Bidang Pertanian. *Media Pertanian*, *5*(1).

Lehar, L., Arifin, Z., & Sine, H. M. C. (2018). Pemanfaatan Plant Growth Promoting Rhizobacteria (PGPR) Dalam Meningkatkan Pola Pertumbuhan Bawang Merah Lokal (Allium Ascalonicum L) Sabu Raijua NTT. *Partner*, *23*(1), 646–656.

Lehar, L., Salli, M. K., & Sine, H. M. C. (2018). Aplikasi pupuk organik dan Trichoderma sp terhadap hasil tanaman kentang (Solanum tuberosum L.) di dataran tinggi. *Jurnal Ilmiah Hijau Cendekia*, *3*(2), 29–34.

Lubis, E., Novita, A., Bahri, K., & Gandaseca, S. (2022). KCl FERTILIZER AND GOAT Urine EFFECT ON PRODUCTION OF JAPANESE CUCUMBER PLANTS (Cucumis sativus var. Japonese). *International Journal of Biosciences and Biotechnology*, *10*(1), 26. https://doi.org/10.24843/ijbb.2022.v10.i01.p03

Nafiah, V. (2016). *Kajian PGPR (Plant Growth Promoting Rhizobacteria) pada Berbagai Tingkat Aplikasi Nitrogen Terhadap Tanaman Padi Gogo (Oryza sativa L.) Varietas Situ Bagendit.* Universitas Brawijaya.

Novita, A., & Siregar, L. A. M. (2024). Evaluation of Vetiver (Vetiveria zizanioides L.) ecotype growth on root production in salinity. *IOP Conference Series: Earth and Environmental Science*, *1413*(1), 12033.

Palaniswamy, U. (2020). Randomized Complete Block Design. *Handbook of Statistics for Teaching and Research in Plant and Crop Science*, 401–424. https://doi.org/10.1201/9781482277814-29

Rukudzo, D. A. (2017). *Characterization of livestock manures biochar and their effect on soil chemical properties and crop growth under glasshouse conditions*. University of Fort hare.

Sitepu, N. (2019). Pengaruh Pemberian Pupuk Cair Urin Kambing Etawa terhadap Pertumbuhan Bawang Merah. *BIOEDUSAINS: Jurnal Pendidikan Biologi Dan Sains*, *2*(1), 40–49.

Sun, W., Shahrajabian, M. H., & Soleymani, A. (2024). The Roles of Plant-Growth-Promoting Rhizobacteria (PGPR)-Based Biostimulants for Agricultural Production Systems. *Plants*, *13*(5), 613.

Washaya, S., & Washaya, D. D. (2023). Benefits, concerns and prospects of using goat manure in sub-Saharan Africa. *Pastoralism*, *13*(1), 28.

Xiao, Y., Xie, L., Li, Y., Li, C., Yu, Y., Hu, J., & Li, G. (2024). Impact of low temperature on the chemical profile of sweet corn kernels during post-harvest storage. *Food Chemistry*, *431*, 137079.