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Utilization of Banana Pseudostem Liquid Fertilizer and NPK Fertilizer in Enhancing the Growth and Production of Sticky Corn

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Abstract:
Corn production in Jember has been declining every year due to soil fertility degradation caused by the unbalanced use of synthetic chemical fertilizers. Reducing fertilizer doses and adding POC (liquid organic fertilizer) made from banana pseudostems are expected to be a solution. The aim of this research is to examine the response of corn plants to the application of banana pseudostem liquid organic fertilizer (POC) concentrations and NPK doses. This study will be conducted from July to December 2024 using a factorial randomized block design (RBD). The first factor is the NPK fertilizer dosage, which consists of: 225 kg/ha, 200 kg/ha, and 175 kg/ha. The second factor is the concentration of banana pseudostem POC with control level, 200 ml/l, 250 ml/l, and 300 ml/l. The parameters observed included plant height, number of leaves, stem diameter, cob diameter, cob length, dry weight of the cob, sweetness content, and 100-seed weight. The results of this study show an interaction, particularly in stem diameter, where the best results were found in the treatment of 175 kg/ha + control with a result of 1.96 cm. It was found that the NPK dose of 175 kg/ha produced the best results in plant height (156.12 cm), number of leaves (10.29 leaves), and cob diameter (52.7 mm).

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INTRODUCTION

Corn is classified as a cereal or grain plant. This plant can grow in areas with temperate to hot climates (Syamsia and Idam, 2019). The production of dry corn in 2023 was 14.777 million tons, a decrease of 1.75 million tons, or 10.61 percent, compared to 2022, when production was 16.53 million tons (BPS, 2024). One of the problems causing this is low soil fertility, which contributes to the decline in corn production (Thamrin and Hama, 2022).

The application of fertilizer in corn cultivation can improve soil fertility, resulting in optimal quantitative and qualitative yields. However, continuous use of chemical fertilizers can lead to a decline in soil fertility over time. This can reduce soil aggregates and decrease soil microbial activity (Siregar, 2022). On the other hand, excessive application of inorganic fertilizers can cause soil pH to become acidic (Su'ud and Lestari, 2018). Efforts to maintain and increase land productivity and nutrient content are made through the use of organic fertilizers. Liquid organic fertilizers have the advantage that their nutrients are more readily absorbed by plants than those in manure or compost. One type of liquid organic fertilizer that can be utilized is banana pseudostem liquid organic fertilizer.

POC banana pseudostems have many benefits for plants. POC banana pseudostems contain beneficial microbes that have the potential to decompose organic matter, stimulate growth, and act as agents for controlling plant pests and diseases, as well as containing N (1.3%), P (0.02%), and K (3.01%) (Sitompul et al. 2023). Anggraini's (2015) research shows that toapplying banana pseudostem POC on mustard plants significantly affects plant height, leaf number, and plant weight per plant. In corn plants, the use of banana pseudostem POC can increase the average stem diameter and the weight of sweet corn (Kartana et al. 2021). Similarly, in chili plants, POC can increase stem diameter, fruit quantity, fruit weight, and production (Putra et al. 2021).

In this study, the use of banana pseudostem POC is expected to subsidize nutrient requirements by reducing NPK dosage. However, the response from the interaction of both on corn plants needs to be further investigated. Therefore, the research titled "The Effect of Banana Pseudostem POC on the Growth and Production of Sticky Corn (Zea mays var. Ceratina)" needs to be conducted.

METHOD

The research titled "The Effect of Banana Pseudostem Liquid Organic Fertilizer on the Growth and Production of Sticky Corn (Zea mays var. ceratina)" was conducted over four months, from July to October 2024, in Antirogo Village, Sumbersari District, Jember Regency, East Java, on land at an altitude of 146 meters above sea level. This study used a factorial Randomized Block Design (RBD) with two treatment factors: four levels of banana pseudostem liquid organic fertilizer (POC) concentration and three levels of NPK Phonska fertilizer dosage. The follow-up test used is DMRT (Duncan's Multiple Range Test). The tools and materials used in the research include agricultural equipment such as hoes, sickles, watering cans, buckets, trowels, sprayers, measuring tapes, digital scales, as well as supporting equipment like stationery, packaging plastic, worksheets, brix meters, banners, stakes, and blenders. The main materials used include glutinous corn seeds, liquid banana pseudostem fertilizer, compound NPK fertilizer, pesticides, herbicides, EM4, and molasses.

RESULT

Recapitulation

Through a series of studies, several results were obtained on various parameters analyzed using ANOVA, as follows.

Table 1. Recapitulation of Interaction Variance Analysis of Banana Pseudostem POC and NPK on Sticky Corn

Variable Observation	POC Banana Pseudostem	NPK	Interaction
Plant Height	ns	*	ns
Number of leaves	ns	**	ns
Stem diameter	ns	ns	**
Dry weight of cob	ns	ns	ns
Cob diameter	ns	*	ns
Cob length	ns	ns	ns
Brix level	ns	ns	ns
1000-Seed Weight	ns	ns	ns

Note: not significantly different (ns), significantly different (*), very significantly different (**)

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Based on Table 1, plant height and cob diameter showed significant differences (). The number of leaves also showed a significant difference ($p < 0.001$) under the NPK treatment, while stem diameter exhibited a highly significant interaction ($p < 0.001$). Parameters with significant differences were further analyzed using DMRT at a 5% significance level, while those with highly significant differences were tested at a 1% significance level.

Plant Height

Table 1 shows that plant height differed significantly (*) under the fertilizer treatment. Therefore, a follow-up test was conducted based on the results, as presented below.

Table 2. Plant Height of Glutinous Corn at Various NPK Fertilizer Dosage Levels

NPK	Plant Height (cm)	1% DMRT Score
P3 (175 kg/ha)	156,12 a	-
P2 (200 kg/ha)	148,29 b	3,70
P1 (225 kg/ha)	145,70 b	3,89

Note: Means followed by the same letter are not significantly different based on DMRT at the 5% significance level.

Treatment P3 (175 kg/ha) was the most effective, resulting in a plant height of 156.12 cm, while the lowest fertilizer dose increased the average plant height compared to other treatments. However, Treatment P1 (145.70 cm) was not significantly different from Treatment P2 (148.29 cm), as they shared the same statistical notation.

Amount of leaves

The number of leaves showed a highly significant difference under the NPK treatment, so a follow-up test using DMRT at the 1% significance level was conducted. The results are as follows.

Table 3. Number of Leaves of Glutinous Corn at Various NPK Fertilizer Levels

NPK	Number of leaves (sheet)	1% DMRT Score
P3 (175 kg/ha)	10,29 a	-
P1 (225 kg.ha)	9,76 b	0,136
P2 (200 kg/ha)	9,24 c	0,142

Note: Means followed by the same letter are not significantly different based on DMRT at the 1% significance level.

Based on leaf count, the best treatment was P3 (175 kg/ha), which produced the most leaves, totaling 10.29. The results for P3 in producing leaves were significantly different from those of treatments P1 and P2, which produced 9.76 and 9.24 leaves, respectively.

Stem diameter

Table 1. Shows that the interaction between treatments resulted in a highly significant difference. Therefore, a follow-up test using DMRT at the 1% significance level was conducted, as presented below.

Table 4. Follow-up Test Results for Stem Diameter

Treatment	Stem diameter (cm)	5% DMRT score
P3T3 (175 kg/ha + 300 ml/l)	2,18 a	-
P3T2 (175 kg/ha + 250 ml/l)	2,08 ab	0,46
P2T3 (200 kg/ha + 300 ml/l)	2,05 abc	0,48
P3T0 (175 kg/ha + control)	1,96 abc	0,49
P1T2 (225 kg/ha + 250 ml/l)	1,90 abc	0,50
P2T1 (200 kg/ha + 200 ml/l)	1,87 abc	0,51
P1T1 (225 kg/ha + 200 ml/l)	1,84 abc	0,51
P2T0 (200 kg/ha + Control)	1,84 abc	0,52
P3T1 (175 kg/ha + 200 ml/l)	1,80 abc	0,52
P1T0 (225 kg/ha + control)	1,72 abc	0,52
P1T3 (225 kg/ha + 300 ml/l)	1,66 bc	0,53
P2T2 (200 kg/ha + 250 ml/l)	1,53 c	0,53

Note: Means followed by the same letter are not significantly different based on DMRT at the 1% significance level.

The P3T3 treatment produced the highest result of 2.18 cm; however, it was not significantly different from P3T2, P2T3, P3T0, P1T2, P2T1, P1T1, P2T0, P3T1, and P1T0. Economically, the most optimal interaction was found in the P3T0 treatment (175 kg/ha + control), with a result of 1.96 cm, as it used the lowest fertilizer dosage and POC concentration.

Cob diameter

The cob diameter observed in Table 4.1 showed significant differences under the NPK treatment. Therefore, further testing using DMRT 1% is necessary, with the following results.

Table 4.5 Cob Diameter of Glutinous Corn at Various NPK Fertilizer Dosage Levels

NPK	Cob diameter (mm)	1% DMRT score
P3 (175 kg/ha)	52,7 a	-
P2 (200 kg.ha)	51,4 b	0,136
P1 (225 kg/ha)	41,0 c	0,142

Note: Values followed by the same letter are not significantly different according to DMRT at the 1% significance level.

The highest result was obtained from treatment P3, which produced a cob diameter of 52.7 mm. Treatment P3 was significantly different from all P2 and P1 treatments, which produced cob diameters of 51.4 mm and 41.0 mm, respectively. Therefore, the optimal treatment was P3 with a fertilizer dose of 175 kg/ha.

DISCUSSION

At the early growth stage, plants require an optimal nutrient supply to support the development of their vegetative parts. Simorangkir (2018) stated that plants will grow well if nutrients are available and properly absorbed. In this study, the lowest NPK dosage (175 kg/ha) outperformed higher dosages. An adequate dosage (in this case, 175 kg/ha) can support vegetative growth, including plant height, leaf number, and stem diameter (Table 1). Ramadhani et al. (2016) argued that the use of relatively low doses of fertilizer, particularly inorganic fertilizers, can help restore soil physical properties, allowing more nutrients to be absorbed by plants and optimizing plant growth and development (Anwar et al., 2020). According to Kriswantoro et al. (2016), enough nitrogen (N) can facilitate photosynthesis and metabolic processes in plants. In addition to nitrogen, other elements, such as phosphorus (P) and potassium (K), play important roles.

Phosphorus plays a role in cell division and the development of meristematic tissues, such as roots, thereby enhancing nutrient absorption (Munawar, 2018). Phosphorus fertilizer (P) is applied to support the flowering process and kernel filling in corn. During the vegetative phase, plants generally require a small amount of phosphorus, around 10%, while in the generative phase, the requirement increases to about 90% (Zamrodah, 2016). The addition of phosphorus is intended to improve vegetative growth, increase dry weight, and accelerate corn maturity (Supanji, 2019). In stimulating cob development, phosphorus is one of the key elements involved (Rasyad, 2022; Puspadewi et al., 2016). Phosphorus contributes to cob initiation and energy allocation during its formation. Adequate phosphorus availability ensures timely cob emergence and optimal cob filling. In this study, the phosphorus supplied through the 175 kg/ha NPK dosage was considered sufficient. In cases of phosphorus deficiency or toxicity, cob development is often suboptimal. Excess phosphorus can disturb the plant's nutrient balance, leading to overdose symptoms (Prakoso et al., 2022). Conversely, phosphorus deficiency may inhibit flower formation and negatively affect cob formation and size, as the cob develops from the female flower (Ernita et al., 2017).

In addition to nitrogen (N) and phosphorus (P), potassium (K) is essential for sugar and starch formation, sugar translocation, and enzyme activity. Moreover, potassium is required by plants to regulate intracellular water balance and facilitate cation transport across membranes (Widodo et al., 2021). Potassium deficiency in corn can lead to small, tapered cobs and poor kernel filling. Lingga and Marsono (2007) stated that fertilizer application must be accurate and at recommended concentrations, as excessive fertilization can lead to plant toxicity. Rohmaniya et al. (2023) also reported that using fertilizers at suboptimal rates can reduce corn productivity and cause toxicity. If the fertilization process is not properly managed and the concentrations are incorrect, the resulting yields will not be optimal.

It can be observed that the interaction affecting stem diameter occurred in the 175 kg/ha + control treatment, which resulted in a stem diameter of 1.96 cm. This interaction indicates that only the inorganic fertilizer played a role, without the addition of banana corm POC. This is in line with the study by Kartana et al. (2021), which found that with an optimal NPK ratio, plants utilize nutrients more efficiently without excessive vegetative growth, allowing energy to be directed toward strengthening stem structure. This occurred because the 175 kg/ha dosage was sufficient to support stem thickening. According to Paerah et al. (2022), an excess of nitrogen can lead to weak stems, increased risk of lodging, and greater susceptibility to pests and diseases. Furthermore, excessive fertilizer application can lead to unnecessary costs, rendering it inefficient and uneconomical (Tengah et al., 2016).

Specifically for the sweetness level parameter, the results showed no significant difference among the treatments, whether using lamtoro leaf POC or corn root PGPR. This is because glutinous corn is a type of corn with a unique characteristic—its endosperm contains a very high amount of amylopectin, around 72%, with the remaining 28% composed of amylose (Safrina et al., 2023). Amylopectin and amylose are components of starch, which is originally formed from sugars—the product of photosynthesis. If the sugar is not used immediately, it will be converted into starch to serve as a long-term energy and food reserve (Handoko and Riski, 2020). It is known that starch itself does not taste sweet to the human palate, but its sugar content can still be measured using a

Brix refractometer. However, sugars can remain in their original form without being converted into starch, depending on the plant's genetic factors. For example, sweet corn contains genes such as sugary (su-1), brittle (bt-2), and shrunken (sh-2), which prevent sugars from being converted into starch, whereas glutinous corn lacks these genes (Wachid and Alamsyah, 2018). Although the application of lamtoro leaf POC and corn root PGPR can enhance the sweetness of corn, in glutinous corn, without those specific genes, the sugars formed are still converted into starch. Therefore, neither the lamtoro leaf POC nor the corn root PGPR treatments increased the sweetness of glutinous corn.

CONCLUSION

Based on the research results, reducing the NPK fertilizer dosage and applying banana corm liquid organic fertilizer (POC) significantly affected several parameters. The use of NPK fertilizer had a significant effect on plant height (156.12 cm) and cob diameter (52.7 mm). For the number of leaves, the NPK treatment showed a highly significant difference, with an average of 10.29 leaves. Meanwhile, stem diameter showed a highly significant interaction effect between NPK fertilizer and banana corm POC, with a value of 1.96 cm. However, no significant effects were observed on dry cob weight, cob length, thousand-grain weight, or sweetness level. The best NPK dosage was 175 kg/ha, which had the greatest effect on plant height, leaf number, and cob diameter. For stem diameter, the most influential treatment was the combination of 175 kg/ha NPK with the POC control.

REFERENCES

Ainiya, M., Fadil, M., & Rika, D. (2019). Improvement of sweet corn growth and yield with the utilization of trichocompost and POC of lamtoro leaves. *Agrotech Research Journal, 3*(2), 69–74. https://doi.org/10.20961/agrotechresj.v3i2.31910

Amin, F., Adiwirman, & Yosefa, S. (2015). Study of the timing of applying leguminous compost fertilizer with the bioactivator *Trichoderma* sp. on the growth and production of red chili plants (*Capsicum annuum* L.). *Jurnal JOM Faperta, 2*(1), 1–15.

Anwar, S., Zamroni, Z., & Darnawi, D. (2020). The influence of NPK Mutiara fertilizer doses and goat manure on the growth and yield of sweet corn plants (*Zea mays saccharata* Sturt).

Badan Pusat Statistik. (2017). Data from the Central Statistics Agency on corn. http://www.bps.go.id/tnmn_pgn.php

Balitsereal. (2019). Sticky corn for food diversification.

Ernita, E. J., Yetti, H., & Ardian, A. (2017). The effect of corn husk waste application on the growth and production of sweet corn plants (*Zea mays saccharata* Sturt). *JOM Faperta, 4*(2), 1–15.

Erselia, I., Respatie, D. W., & Rogomulyo, R. (2017). The influence of NPK fertilizer and microbially enriched organic fertilizer combination on corn growth and yield. *Jurnal Vegetalika, 6*(4), 28–40.

Handoko, A., & Riski, A. M. (2020). *Textbook of plant physiology*. UIN Raden Intan Lampung.

Jati, B. M. A. M., Santoso, S. K., & Siswadi. (2023). Study of goat manure and NPK fertilizer on the growth and yield of sticky corn (*Zea mays* L.). *Jurnal Inovasi Pertanian, 25*(2), 134–139.

Jeksen, J., & Mutiara, C. (2018). The influence of different sources of organic materials on the quality of local microorganism production (MOL). *Agrica, 11*(1), 60–72.

Juhrian, Azrai, M., Tambaru, E., & Rahayu, J. E. (2019). Phenotypic characteristics and grouping of hybrid sweet corn (*Zea mays* L.) from peak crossbreeding. *Jurnal Ilmu Alam dan Lingkungan, 10*(1), 51–60. https://doi.org/10.20956/jal.v10i1.6624

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May 2026
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Kartana, S. N., Fatmawati, E., & Wawan. (2021). The role of liquid organic fertilizer (POC) from banana pseudostems in enhancing the growth and yield of sweet corn (*Zea mays* L. saccharata Sturt). *Jurnal PIPER, 17*(2), 85–91.

Kementerian Pertanian. (2018). *Komoditas pertanian sub sektor tanaman pangan*. Center for Agricultural Data and Information Systems.

Kriswantoro, H., Safriyani, E., & Bahri, S. (2016). Application of organic fertilizer and NPK fertilizer on sweet corn plants (*Zea mays saccharata* Sturt). *Jurnal Ilmu-Ilmu Agroteknologi, 11*(1), 1–6.

Lingga, P., & Marsono. (2007). *Fertilizer usage instructions*. Penebar Swadaya.

Lubis, R. (2019). The influence of leaf pruning around the cob on kernel filling in corn plants (*Zea mays* L.). *Agrium, 22*(1), 70–75.

Muhsanati, I. D., & Hasibuan, M. R. (2022). Response of corn plants (*Zea mays*) to various planting distances and fertilizer compositions.

Munawar, A. (2018). *Soil fertility and plant nutrition*. IPB Press.

Nasrun, N., Jalaluddin, J., & Herawati, H. (2017). Utilization of banana peel waste as a raw material for liquid fertilizer production. *Jurnal Teknologi Kimia Unimal, 5*(2), 19. https://doi.org/10.29103/jtku.v5i2.86

Paerah, J. A., Kadekoh, I., & Jeki, J. (2022). Growth and yield of local Sigi corn plants (*Zea mays* L.) due to the application of NPK fertilizer and tofu liquid waste. *J. Agrotekbis, 10*(6), 1025–1034.

Pandito, I. P. (2020). The effect of urea and SP-36 fertilizer doses on the growth and yield of hybrid glutinous corn plants (*Zea mays ceratina* L.) (Undergraduate thesis). Universitas Pembangunan Nasional Veteran.

Pasaribu, M. S., Barus, W. A., & Kurnianto, H. (2015). The effect of concentration and time interval of NASA liquid organic fertilizer on the growth and production of sweet corn (*Zea mays saccharata* Sturt). *Agrium, 17*(1).

Prakoso, T., Alpandari, H., & Sridjono, H. H. H. (2022). Response of essential macro nutrient application on corn plant growth (*Zea mays*). *Muria Jurnal Agroteknologi, 1*(1), 8–13.

Puspadewi, S., Sutari, W., & Kusumiyati, K. (2016). The effect of liquid organic fertilizer concentration and N, P, K fertilizer doses on the growth and yield of sweet corn (*Zea mays* L. var. rugosa Bonaf) cultivar Talenta. *Jurnal Kultivasi, 15*(3), 208–216.

Ramadhani, R. H., Roviq, M., & D. (2016). The influence of nitrogen fertilizer sources and timing of urea application on the growth and yield of sweet corn (*Zea mays* Sturt var. saccharata). *Jurnal Produksi Tanaman, 4*(1), 8–15.

Rasyad, M. R. (2022). The influence of vermicompost and eco-enzyme fertilizers on the growth and production of sweet corn (*Zea mays saccharata* Sturt) (Undergraduate thesis). Universitas Negeri Lampung.

Riwandi, R., Merakati, H., & Hasanudin, H. (2014). *Corn cultivation techniques with organic systems on marginal lands*. UNIB Press.

Rohmaniya, F., Jumadi, R., & Redjeki, E. S. (2023). Response of growth and yield of sweet corn (*Zea mays saccharata* Sturt) to the application of goat manure and NPK fertilizer. *Jurnal Tropicrops, 6*(1), 37–51.

Safitri, & Mareta. (2015). The effect of liquid organic fertilizer from kepok banana peels on the growth and production of bird's eye chili plants. *Jurnal Biopendix, 1*(1).

Sarif, P., Hadid, A., & Wahyudi, I. (2015). Growth and yield of mustard plants (*Brassica juncea* L.) due to the application of various doses of urea fertilizer. *J. Agrotekbis, 3*(5), 585–591.

Simorangkir, J. A. (2018). Response of Mutiara NPK fertilizer (16:16:16) on the growth and production of several sweet corn varieties (*Zea mays* L. saccharata Sturt). *Jurnal Ilmiah Mahasiswa Pertanian, 3*(1), 1–16.

Supandji, S., & Saptorini, S. (2019). Treatment of urea and SP-36 fertilizer doses on the growth and production of Arjuna variety corn plants (*Zea mays* L.). *Jurnal Agrinika, 3*(1). https://doi.org/10.30737/agrinika.v3i1.633

Syahrial, M. (2019). *Complete and practical guide to the most profitable corn cultivation*. Garuda Pustaka.

Syamsia, & Idham, A. (2019). *Production of hybrid corn seeds*. Nas Media Pustaka.

Tengah, J., Tumbeleka, S., & Toding, M. M. (2016). Growth and production of local glutinous corn (*Zea mays ceratina* Kulesh) at different NPK fertilizer levels.

Utami, S. (2014). Response of growth and yield of corn plants to the application of various doses of compost fertilizer and low-dose NPK input on mineral soil (Undergraduate thesis). Universitas Bengkulu.

Wachid, A., & Alamsyah, J. (2018). Response of growth and production of several sweet corn varieties (*Zea mays saccharata* Sturt) to NPK fertilizer application. *Nabatia, 6*(2), 75–85.

Widodo, W., Marlin, M., & Sitio, N. B. (2021). Response of shallots of Batu Ijo variety on doses of N and K fertilizers. *Akta Agrosia, 24*(1), 19–24. https://doi.org/10.31186/aa.24.1.19-24

Zamrodah, Y. (2016). Application of SP-36 fertilizer and chicken manure on phosphorus availability and uptake as well as corn plant growth on Ultisol. *Berkala, 15*(2), 1–23.