Akta Agrosia

The Effects of Vermicompost Dosage Applied at Different Times on the Growth and Yield of Sweet Corn

Mutia Mayasari, Sigit Sudjatmiko* and Hesti Pujiwati
Agroecotechnology Study Program, Department of Crop Production. Faculty of Agriculture, University of Bengkulu, Bengkulu, Indonesia

Doi: 10.31186/aa.27.2.95-102

ARTICLE INFO

Keywords:
application times,
environmental safety,
organic farming,
sweet corn,
vermicompost

Article history:
Received: Nov 7, 2024
Accepted: Dec 24, 2024

*Corresponding author:
E-mail:
sigitsudjatmiko@unib.ac.id

ABSTRACT

The cultivation of sweet corn currently relies on inorganic nutrient inputs, which often lead to excessive use of fertilizers and subsequent land degradation. To address this issue while maintaining land productivity, researchers have explored the application of vermicompost fertilizer, known for its positive impact on soil physical, chemical, and biological properties. The aims of this study were to determine the vermicompost fertilizer doses applied at different times to enhance sweet corn growth and yield. The research was arranged in a completely randomized block design with a single factor by combining the doses of vermicompost (50% to 100%) and variations of application times (one to two weeks before planting). Each treatment was replicated three times. The results revealed that the 100% vermicompost applied two weeks before planting showed the highest increased on the plant height, leaf numbers, and the husk cob weight. The application of vermicompost as organic fertilizer enhanced the productivity of sweet corn.

INTRODUCTION

Sweet corn (*Zea mays saccharata* Sturt L.) is a widely consumed agricultural product known for its delicious, sweet taste and rich nutritional content. Beyond its flavor, sweet corn offers significant health benefits. Notably, it contains carbohydrates, protein, and vitamins. Additionally, corn plays a crucial role in overall health due to its high dietary fiber content (Swapna et al., 2020), and starch is the dominant hydrocarbon component (Szymanek, 2012). For individuals with diabetes, sweet corn is beneficial due to its composition of sucrose, starch, carbohydrates, and low-fat content (Putri, 2011). Moreover, sweet corn has a short production period, making it a popular crop among farmers (Anggraini and Sugiarti, 2018).

The current yield of sweet corn in Indonesia stands at 8.31 tons per hectare, falling short of its potential range of 14-18 tons per hectare. To address this gap, concerted efforts are necessary to boost sweet corn production. One effective approach is the utilization of organic fertilizer (Pasaribu et al., 2011). Organic fertilizer offers several advantages for plant growth. Vermicompost not only provides

ISSN: 1410-3354 / e-ISSN:2615-7136

Cited this as: Mayasari, M., S. Sudjatmiko and H. Pujiwati. 2024. The effects of vermicompost dosage applied at different times on the growth and yield of sweet corn. Akta Agrosia 27(2):95-102 Doi: 10.31186/aa.27.2.95-102

essential nutrients but also improves soil structure and enhances drought resistance (Shah et al., 2023) and engages in competition with pathogens and stimulates systemic resistance in plants, thereby preventing pathogenic infestations (Wei et al., 2024) and lowers the acidity in Entisols and Inceptisols (Muktamar et al., 2021). Consistent use of organic fertilizers can lead to improvements in the physical, chemical, and biological properties of the soil, contributing to environmental safety (Voltr et al., 2021).

Vermicompost, an organic fertilizer, is produced by mixing waste materials with an earthworm stimulator (*Lumbricus rubellus*). Derived from worm droppings, vermicompost serves as an excellent organic fertilizer for plants due to its easy absorption and comprehensive nutrient content and as an efficient alternative for enhancing soil and plant health (Gajalakshmi and Abbasi, 2004; Marvelia et al., 2006; Rehman et al., 2023). This nutrient-rich fertilizer contains essential elements such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), and iron (Fe), all vital for plant growth (Muktamar et al, 2017; Maisura et al., 2019; Adhikary, 2012). Laboratory tests conducted by the Directorate of Horticultural Protection, Ministry of Agriculture (2020), revealed specific percentages in vermicompost: 1.79% nitrogen, 1.79% potassium, 0.85% phosphorus, 30.52% calcium, and 27.13% carbon. Additionally, vermicompost contains organic compounds like auxin, gibberellin, and cytokinin (Ravindran et al., 2016). Importantly, unlike some fertilizers, vermicompost does not harm the soil (Krisnawati et al., 2018). Research conducted by Miftahillah et al. (2022) demonstrated that applying vermicompost organic fertilizer to sweet corn plants at a rate of 7.5 tons per hectare resulted in the highest yield potential. This positive effect is attributed to the nutrient-rich composition of vermicompost, which serves as a valuable source of nutrients for the soil (Rehman et al, 2023). Other studies have corroborated these findings, reporting that applying vermicompost organic fertilizer significantly influenced plant height and corn ear weight (Prasetyo and Suriadikarta, 2019; Prihatiningsih, 2008). This impact is linked to an increase in cation exchange capacity, enhancing nutrient availability for absorption and utilization by the sweet corn plants.

Crop production depends on various factors, with fertilizer application playing a crucial role (Liliane and Charles, 2020). For sweet corn plants, essential elements like nitrogen (N) and phosphorus (P) are necessary to stimulate growth (Szymanek et al., 2006). While inorganic fertilizers typically meet most of these N and P requirements, their unregulated and continuous use can lead to soil damage and reduced fertility. Improper nitrogen (N) utilization causes greenhouse gas emissions (GHG), while insufficiency prevents high production and quality (Majumdar, 2018). To enhance sweet corn production sustainably, organic fertilizers such as vermicompost offer a viable alternative. However, determining the optimal dosage and timing for vermicompost application remains an open question. This study aims to investigate the impact of different vermicompost doses and application timings on sweet corn growth and yield.

MATERIALS AND METHOD

The study was carried out in Air Manjuto District, Mukomuko Regency, Bengkulu, located at an elevation of approximately 8.5 meters above sea level, from June to August 2022. The materials used were sweet corn seeds var. Paragon, vermicompost, urea, TSP, KCl, fungicides, and insecticides. The research was designed in a randomized completely block design with a single factor, as follows:

K_0: Application of 300 $kg.ha^{-1}$urea, 100 $kg.ha^{-1}$ TSP, and 100 $kg.ha^{-1}$ KCl without adding vermicompost;
K_1: 100% vermicompost fertilizer (6 $ton.ha^{-1}$) applied 2 weeks before planting;
K_2: 75% vermicompost (4 $ton.ha^{-1}$) applied 2 weeks before planting;
K_3: 50% vermicompost (2 $ton.ha^{-1}$) applied 2 weeks before planting;
K_4: 100% vermicompost (6 $ton.ha^{-1}$) applied 1 week before planting;
K_5: 75% vermicompost (4 $ton.ha^{-1}$) applied 1 week before planting; and

K_6: 50% vermicompost (2 ton.ha^{-1}) applied 1 week before planting.

Each treatment was replicated 3 times, resulting in a total of 21 experimental units. Data were collected from 5 sample plants from each experimental unit.

All treatments received supplementary inorganic fertilizer at a baseline rate of 50% of the recommended dosage. The urea was applied twice, with a rate of 75 kg.ha^{-1} during planting and an additional 25 kg.ha^{-1} at 2 weeks after planting (WAP). In addition, 50 kg.ha^{-1} of triple superphosphate (TSP) and 50 kg.ha^{-1} of potassium chloride (KCl) fertilizers were applied at planting time. The control treatment (K_0) followed a separate procedure. The application of urea for K_0 involved a total quantity of 300 kg.ha^{-1} , applied twice, i.e., 150 kg.ha^{-1} at the time of planting and another 150 kg.ha^{-1} at 2 WAP. Meanwhile, both TSP and KCl were given at a rate of 100 kg.ha^{-1} at planting. Before cultivating the soil, soil analysis was conducted by collecting soil samples at a depth of 20 cm. These samples were subsequently examined for nitrogen (N), phosphorus (P), potassium (K), pH, and organic carbon content.

Two seeds were planted in a spacing of 75 cm × 20 cm. The plants were irrigated to keep the soil moisture at field capacity. Thinning was conducted two weeks after planting, leaving one vigorously growing plant. Weeding and hilling were performed simultaneously, 4 weeks after the initial planting.

The growth and yield parameters measured were plant height, leaf number, leaf area, leaf chlorophyll content, cob diameter (without husks), cob weight (without husks), cob length (without husks), tip back, the weight of husked cob per plot, fresh weight of cob, and plant fresh weight. Data were analyzed statistically with ANOVA at a 5% level, followed by Duncan's Multiple Range Test (DMRT) at 5%.

RESULTS AND DISCUSSION

Data of soil analysis included total nitrogen of 0.32% (medium), phosphorus of 5.83 ppm (very low), potassium of 0.34 me/100 g^{-1} (medium), organic carbon of 4.96% (high), and a pH of 5.90 (slightly acidic). During the research (June, July, and August), the averages of air temperatures were 26.1°C, 26.7°C, and 26.6°C, respectively. The average of air humidity ranged from 83.9% to 84.9%, and the average of monthly rainfall was 293 mm, 83 mm, and 224 mm, respectively. Corn plants thrive in temperatures of 21°C to 34°C and require monthly rainfall of 250-500 mm, aligning with optimal growing conditions (BPTP, 2009; Riwandi et al., 2014; Hatfield & Prueger., 2015; Vogel et al., 2019; Ruminta et al., 2024).

Plant Height and the Number of Leaves

The growth of plant height reveals that vermicompost fertilizer dosage and application timing contribute to weekly uniform growth (Figure 1). Among the treatments, K_1 resulted in the tallest plants, reaching 231.4 cm, while treatment K_4 had the shortest plants at 196.8 cm. In the K_1 treatment, vermicompost adequately breaks down two weeks before planting, ensuring nutrient availability for the plants. Notably, studies by Nasution (2019) emphasize that maize plants during weeks 5-7 are particularly critical and require sufficient nutrients and water to thrive.

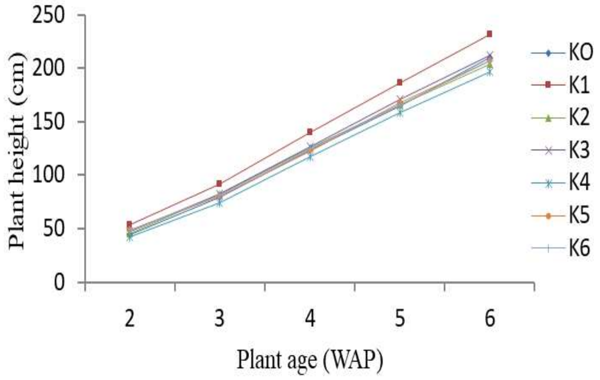

Figure 1. The growth of plant height up to 6 weeks after panting (WAP)

Figure 2 illustrates the weekly increase in the number of leaves. Among the treatments, K_1 produced the greatest number of leaves, with an average of 11.46, while the K_4 treatment resulted in the fewest leaves, averaging 10.26. However, leaf number is influenced not only by appropriate timing and dosage of vermicompost but also by internal

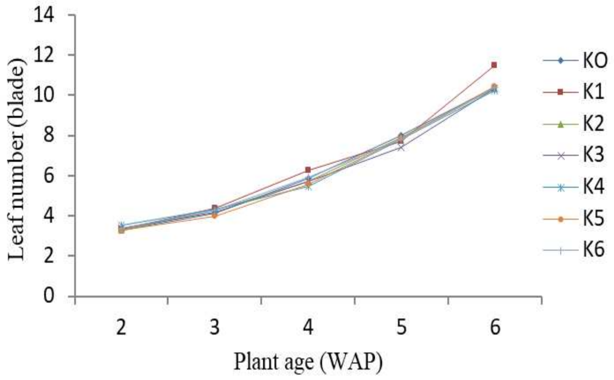

Figure 2. The number of leaf up to 6 weeks after planting (WAP

and external factors. Genes and hormones constitute the internal factors originating from the plant itself, whereas temperature, weather, and humidity are the external factors.

Recapitulation of Analysis of Variance

The combination of dose and timing of vermicompost significantly affected growth and yield variables on plant height and the number of leaves, the weight of husked cob per plot and the weight of husked cob (Table 1). However, the dose and timing of vermicompost fertilizer did not significantly affect other growth characteristics, such as leaf area and leaf chlorophyll, and yield variables such as ear diameter with husk, ear diameter without husk, ear weight without husk, and ear length without husk, and tip back.

Growth Components of Corn

Figure 3 and Table 2 present the results of further analysis of the data of plant height and

Table 1. The summary of analysis of variance on sweet corn

Parameters observed	F-cal		CV (%)
Plant height at 6th week	7.14	*	3.31
Leaf number at 6th week	7.02	*	2.61
Leaf area	0.49	ns	9.11
Chlorophyll content	0.40	ns	13.00
Cob diameter with husk	0.68	ns	4.28
Cob diameter without husk	1.04	ns	3.80
Cob weight without husk	1.49	ns	11.37
Cob length without husk	1.46	ns	3.02
Tip back	0.63	ns	18.67
Cob weight/plot	4.32	*	11.50
Fresh cob weight	4.57	*	8.26
Plant fresh weight	1.45	ns	14.43

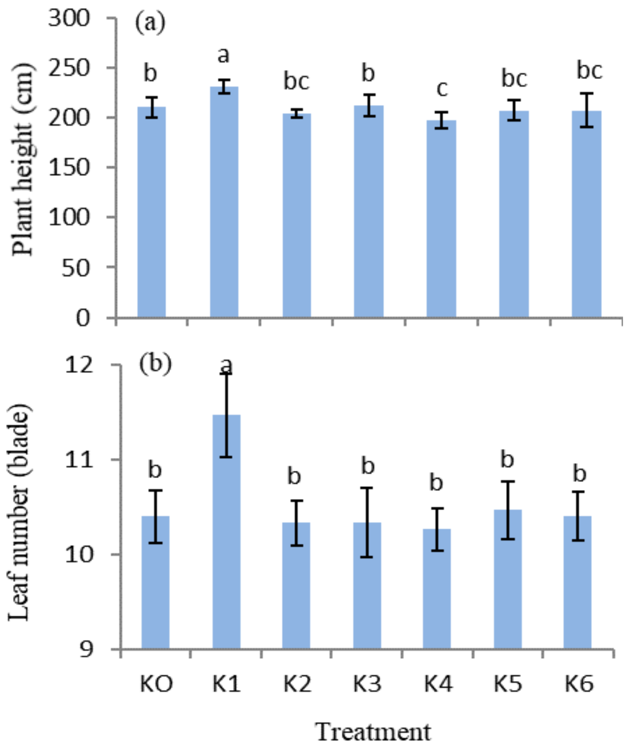

Figure 3. Effect of vermicompost fertilizer dosage and application timing on (a) plant height, and (b) leaf number at the 6th week

which likely contributed to the observed improvements in plant height and leaf number. Rosniawaty et al. (2022) emphasized that higher doses of vermicompost enrich the soil with nutrients that can be readily absorbed by plants. Furthermore, Leo et al. (2022) confirmed that vermicompost fertilizer contains a comprehensive range of nutrients.

The results also highlight that the average plant height meets the prescribed criteria for the variety. Vermicompost has the potential to enhance both macro- and micronutrient availability. It also contributes to an increase in the Cation Exchange Capacity (CEC) within the root zone. This improved CEC facilitates better nutrient absorption, ultimately leading to optimal plant height growth (Prihatiningsih, 2008) and raised nitrogen (N), phosphorus (P) and potassium (K) uptakes and linearly enhanced growth and yield of sweet corn (Muktamar et al., 2017).

The vermicompost with various doses and application times did not significantly affect the variables of leaf area ($P > 0.05$) and leaf chlorophyll ($P > 0.05$), as indicated in Table 2. This insignificance can be ascribed to the circumstances of the first soil analysis, which indicated a nitrogen (N) level of 0.32%.

Table 2. Average of sweet corn leaf area and chlorophyll contents

Treatment	Leaf area (cm^2)	Chlorophyll content ($\mu g.g^{-1}$)
K_0: Application of 300 $kg.ha^{-1}$ urea, 100 $kg.ha^{-1}$ TSP, and 100 $kg.ha^{-1}$ KCl	9235,99 a	642,30 a
K_1: 100% vermicompost (6 $ton.ha^{-1}$), applied 2 weeks before planting	9533,21 a	720,52 a
K_2: 75% vermicompost (4 $ton.ha^{-1}$), applied 2 weeks before planting	8700,52 a	662,32 a
K_3: 50% vermicompost (2 $ton.ha^{-1}$), applied 2 weeks before planting	8856,18 a	666,32 a
K_4: 100% vermicompost (6 $ton.ha^{-1}$), applied 1 week before planting	9485,15 a	617,99 a
K_5: 75% vermicompost (4 $ton.ha^{-1}$), applied 1 week before planting	8972,66 a	657,14 a
K_6: 50% vermicompost (2 $ton.ha^{-1}$), applied 1 week before planting	8807,10 a	645,84 a

Although it came within the medium category, it was still sufficient for plant chlorophyll synthesis. Other factors, such as the genetic cha-racteristics of plant varieties and the amount of sunshine they received, contribute to the plant growth. According to Sitompul and Guritno (1995), an abundance of sunlight is essential for the efficient process of photosynthesis and the subsequent growth of leaves. Moreover, differences in plant species and cultivation sites have a substantial effect on leaf surface area measurements. It is crucial to take into account any mistakes, particularly when differentiating between the leaf blade and petiole (Haryadi, 2013).

Yield Components of Sweet Corn

Figure 4 and Table 3 present the results of further analysis on the effect of dosage and timing of vermicompost fertilizer application on yield variables.

In Treatment K_1, which involved applying 100% vermicompost two weeks before planting, the weight of cobs per plot was 13.80 kg, with the maximum individual cob weight at 404.93 g. These results did not significantly differ from treatment K_4, where 100% vermicompost was applied one week before planting. According to Wirawan et al. (2021), vermicompost fertilizer's sand-like texture facilitates rapid decomposition. Applying vermicompost one week before planting may help equalize the decomposition process compared to applying it two weeks prior, ensuring that nutrients remain accessible and can be efficiently assimilated by plants. In addition, the average cob weight of 341.69 g closely aligns with the potential variety yield range of 371.31 to 431.49 g. These findings suggest that the cob weight corresponds well with the ideal description for this cultivar.

Table 3 shows that vermicompost fertilizer dosage and timing did not significantly affect cob diameters and lengths, cob weight without husks, and fresh plant weight ($p>0,05$). Protein synthesis requires nitrogen (N), which determines cob size. Irianti et al. (2022) found that maize cob diameters improve protein synthesis. Due to its low nitrogen content of 1.79% (Wahyudin and Irwan, 2019),

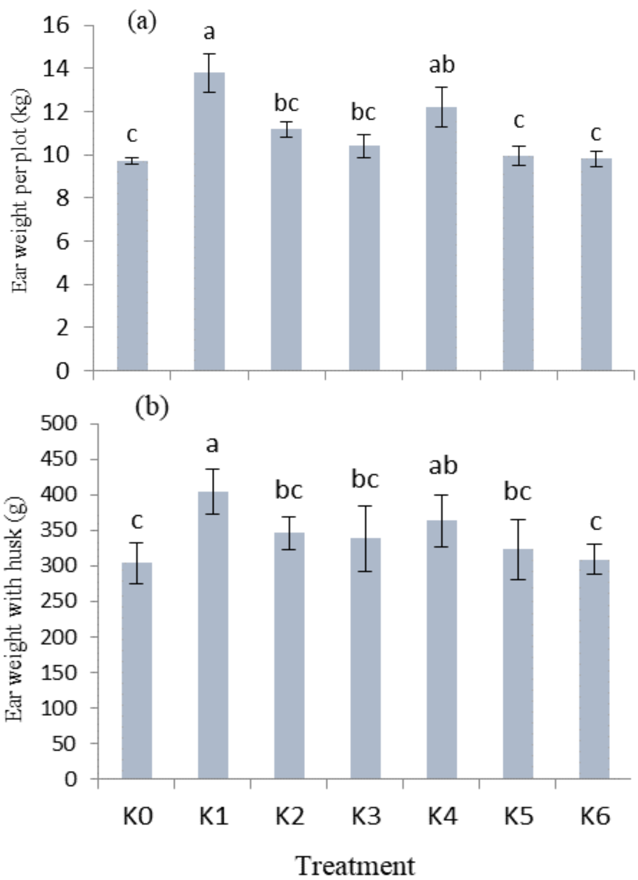

Figure 4. Effect of vermicompost fertilizer dosage and application timing on (a) Ear weight per plot, and (b) Ear weight with husk.

vermicompost fertilizer has little effect on maize cob diameter. Sweet corn cob length depends on phosphorus (P) for seed formation and growth. Unfortunately, soil phosphorus is only 5.83%. Vermicompost contains 0.73% phosphorus, but not enough to suit plants' demands (Admira et al., 2014). Since vermicompost has little nitrogen and phosphorus, it has little effect on growth factors and yield components. This discussion emphasizes the importance of matching fertilizer nutrient mix to crop needs. Vermicompost improves soil structure and microbial activity, but its low nitrogen and phosphorus content may require additional fertilizers for plant growth and output. Effective fertilization solutions need understanding how fertilizer types interact with crop nutrition needs.

According to Haitami and Wahyudi (2019), the dosage and timing of vermicompost fertilizer application do not significantly impact cob weight without husks and fresh plant weight. They suggest that the size of plant leaves is crucial for solar energy absorption, which directly affects photosynthate production. Photosynthate allocation influences seed yield, as it is stored within the seeds. During the seed filling period, dry matter accumulation, essential for seed development, increases. However, vermicompost application timing and dosage might affect seed development potential. Despite these benefits, the low nitrogen and phosphorus content in vermicompost (Wahyudin and Irwan, 2019) limits its impact on growth parameters like cob diameter and length. Leaf size and health are critical for maximizing photosynthetic efficiency and seed yield. Larger, healthier leaves capture more sunlight, leading to increased photosynthate production, which is essential during the seed-filling stage. Therefore, vermicompost may need supplementation with nitrogen- and phosphorus-rich fertilizers to meet high nutrient demands during critical growth stages.

The interaction between vermicompost and other fertilizers should be explored to develop a balanced fertilization strategy. Combining vermicompost with inorganic fertilizers could optimize nutrient availability, enhancing overall plant growth and yield. Future research should identify the optimal combination of organic and inorganic fertilizers to leverage vermicompost's benefits while addressing its nutrient limitations, leading to sustainable and efficient agricultural practices and better crop yields and soil health.

CONCLUSION

In conclusion, the study demonstrated that 100% vermicompost applied two weeks before planting produced the most favorable results for sweet corn. This treatment significantly improved plant height, increased leaf number, and resulted in higher husk cob weight per plot. Therefore, integrating vermicompost into sweet corn cultivation can substantially boost crop productivity.

ACKNOWLEDGMENT

We would like to express our gratitude to the Laboratory of Agronomy, Faculty of Agriculture University of Bengkulu for providing facility support toward this research.

REFERENCES

Admiral, A. Wardati dan Armaini. 2014. Aplikasi kascing dan N, P, K terhadap tanaman jagung manis (*Zea mays saccharata Sturt*). Jurnal Online Mahasiswa Bidang Pertanian, 2(1):1-13.

Adhikary, S. 2012. Vermicompost, the story of organic gold: A review. Agric. Sci. 3, 905–917.

Anggraini, R., dan T. Sugiarti. 2018. Analisis pengemasan jagung manis (*Zea mays saccharata* Sturt) berkelobot dengan berbagai bahan pengemas. Foodtech: Jurnal Teknologi Pangan, 1(1) : 25-31.

BPTP. 2009. Budidaya Tanaman Jagung. Badan Ketahanan Pangan dan Penyuluh Pertanian Aceh, Aceh.

Direktorat Perlindungan Hortikultura Kementerian Pertanian 2020. Pupuk kascing. http://ditlin.hortikultura.pertanian.go.id/index.php/artikel/detail/Pupuk Kascing. Diakses 21 Februari 2022.

Gajalakshmi, S dan S. A. Abbasi. 2004. Earthworms and vermicomposting. International Journal Biotechnology, (3):486-494.DOI:https://doi.org/10.24198/jnttip.v2i2.27568

Haitami, A dan W. Wahyudi. 2019. Pemanfaatan pupuk kompos jagung manis dalam meningkatkan produksi tanaman jagung (*Zea mays* L) pada tanah ultisol. Jurnal Agronomi Tanaman Tropika,1(1):42-48.

Hatfield, J. L., and J. H. Prueger. 2015. Temperature extremes: Effect on plant growth and development. Weather and Climate Extremes, 10:4–10.

Haryadi, H. 2013. Pengukuran luas daun dengan metode simpson. Anterior Jurnal, 12 (2):1 -5

Irianti, A.T.P., A. Suyanto dan Johansyah. 2022. Pengaruh pupuk kandang burung puyuh dan Trichoderma sp. Terhadap Pertumbuhan dan hasil tanaman jagung manis (*Zea mays* L.) pada tanah aluvial di polybag.Jurnal Agrosains, 15(2):42-46.

Krisnawati, S., M.T. Darini dan D. Darnawi. 2018. Pengaruh komposisi media tanam dan dosis pupuk kascing terhadap pertumbuhan dan hasil tanaman tomat varietas intan (*Solanum lycopersicum* L.). Jurnal Ilmiah Agroust, 2(1): 43-55.

Leo, I.P., B.P. Udiyana dan I.M. Suryana. 2022. Respon tanaman sawi hijau (*Brassica juncea* l.) terhadap perlakuan pupuk kascing pada tanah lempung liat berpasir. Agrofarm Jurnal Agroteknologi, 1(01):18–23.

Liliane, T. N., and M.S. Charles. 2020. Factors affecting yield of crops. Agronomy-Climate Change & Food Security. Edited by Amanullah. https://www.intechopen.com/chapters/70658

Maisura, M., A. Mardhiah dan N. Hafni. 2019. Pemberdayaan masyarakat kelompok tani melalui teknologi pembuatan pupuk kascing. Baktimas Jurnal Pengabdian pada Masyarakat, 1(2): 114–119.

Majumdar, K. 2018. Does improved plant nutrition provide a credible entry point for climate and weather adaptive crop production? Journal of the Indian Society of Soil Science, 66: S84–S103.

Marvelia, A., S. Darmanti dan S. Parman. 2006. Produksi tanaman jagung manis (*Zea mays saccharata* Sturt) yang diperlakukan dengan kompos kascing dengan dosis yang berbeda. Buletin Anatomi dan Fisiologi, 14 (2): 7–18.

Miftahillah, A. Marliah, dan Halimursyada. 2022. Pengaruh dosis pupuk vermikompos dan konsentrasi pupuk organik cair agrobost terhadap pertumbuhan dan hasil jagung manis (*Zea mays saccharata* Sturt). Jurnal Ilmiah Mahasiswa Pertanian, 7(2):128-137.

Muktamar, Z., S. Sudjatmiko, M. Chozin, N. Setyowati, and Fahrurrozi. 2017. Sweet corn performance and its major nutrient uptake following application of vermicompost supplemented with liquid organic fertilizer . International Journal on Advanced Science Engineering Information Technology. 7 (2): 602-608.

Muktamar, Z., B. Hermawan, Wulandari, P. Prawito, S. Sudjatmiko, N. Setyowati, F. Fahrurrozi. and M. Chozin. 2021. Vermicompost Buffering Capacity to Reduce Acidification of Pb and Cd Contaminated Inceptisols and Entisols. J Trop Soils,26(1): 1-9.

Pasaribu, M. S., W. A. Barus, dan H. Kurnianto. 2011. Pengaruh konsentrasi dan interval waktu pemberian pupuk organik cair (poc) nasa terhadap pertumbuhan dan produksi jagung manis (*Zea mays saccharata* Sturt). Agrium, 17(1): 46-52.

Prasetyo, B.H dan D A. Suriadikarta. 2006. Karakteristik, potensi, dan teknologi pengelolaan tanah ultisol untuk pengembangan pertanian lahan kering di Indonesia. Jurnal Litbang Pertanian, 25(2): 39–46.

Prihatiningsih, N.L. 2008. Pengaruh kascing dan pupuk anorganik terhadap serapan K dan hasil tanaman jagung manis (*Zea mays saccharata* Sturt) pada tanah alfisol jumantono. Skripsi, Program Studi Ilmu Tanah, Jurusan Ilmu Tanah, Fakultas Pertanian. Universitas Sebelas Maret Surakarta.

Putri, H. A. 2011. Pengaruh pemberian beberapa konsentrasi pupuk organic cair lengkap (POCL) Bio Sugih terhadap pertumbuhan dan hasil tanaman jagung manis (*Zea mays saccharata* Sturt L.). Skripsi. Fakultas Pertanian.Universitas Andalas Padang.

Rahmatika, W dan M. Anggraini. 2021. Pengaruh jenis dan waktu aplikasi pupuk organik terhadap pertumbuhan dan hasil tanaman jagung manis (*Zea mays saccharata* Sturt). Jurnal Agroekoteknologi, 14(2): 91-94.

Ravindran, B.; J. W. Wong, A. Selvam, G. Sekaran. 2016. Influence of microbial diversity and plant growth hormones in compost and vermicompost from fermented tannery waste. Bioresour. Technol. 217, 200–204.

Rehman, S ur, F. De Castro, A. Aprile, M. Benedetti, and F. P. Fanizzi. 2023. Vermicompost: Enhancing Plant Growth and Combating Abiotic and Biotic Stress. Agronomy 2023, 13, 1134:1-25

Riwandi, R., H. Merakati dan H. Hasanudin. 2014. Teknik Budidaya Jagung dengan Sistem Organik di Lahan Marjinal. UNIB Press. Bengkulu.

Rosniawaty, S., M. Ariyanti dan C. Suherman. 2022. Respons pertumbuhan tanaman kelapa (*Cocos nucifera* L.) belum menghasilkan terhadap aplikasi berbagai dosis kascing. Jurnal Agroteknologi dan Sains Fakultas Pertanian, Universitas Garut, 6(2):78-85.

Ruminta, L. Maysix, dan F.Y. Wicaksono. 2024. Identification of climate change and its impact on maize (Zea mays L.) production in Majalengka Regency. Jurnal Kultivasi 23 (1): 43-51.

Shah, M. N., D. L. Wright, S. Hussain et. al. 2023. Organic fertilizer sources improve the yield and quality attributes of maize (*Zea mays* L.) hybrids by improving soil properties and nutrient uptake under drought stress. Journal of King Saud University – Science, 35(4) 102570.

Sitompul, S.M dan B. Guritno. 1995. Analisis Pertumbuhan Tanaman. Gadjah Mada University Press, Yogyakarta.

Swapna, G., G. Jadesha and P. Mahadev. 2020. Sweet corn – A future healthy human nutrition Food. Int. J. Curr. Microbiol. App. Sci. 9(7): 3859-3865.

Szymanek, M. 2012. Processing of sweet corn. Trends in Vital Food and Control Engineering. pp:85-98. DOI: 10.5772/35867. https://www.intechopen.com/chapters/35127

Szymanek, M., B. Dobrzañski jr., I. Niedzióka, and R. Rybczyñski. 2006. Sweet corn harvest and technology. Physical Properties and Quality. Centre of Excellence Agrophysics .for Applied Physics in Sustainable Agriculture. Published by: B. Dobrzański Institute of Agrophysics of Polish Academy of Sciences.

Thite, M. D., S. R. Ingle, and A. S. Gaikwad. 2022. Effect of incubation duration of incorporated organic manures on chemical properties of inceptisol. The Pharma Innovation, 11(10):162-166. DOI: https://doi.org/10.22271/tpi.2022.v11.i1c.9950

Vogel, E., M.G. Donat, L.V., Alexander, M. Meinshausen, D.K. Ray, D. Karoly, N. Meinshausen and K. Frieler. 2019. The effects of climate extremes on global agricultural yields. Environmental Research Letters, 14(5). https://doi.org/10.1088/1748-9326/ab154b

Voltr, V., V. Voltr, L. Menšík, L. Hlisnikovský, M. Hruška, E. Pokorný, and L. Pospíšilová. 2021. The soil organic matter in connection with soil properties and soil inputs. Agronomy 11(4): 779.

Wahyudin, A dan A. W. Irwan. 2019. Pengaruh dosis kascing dan bioaktivator terhadap pertumbuhan dan hasil tanaman sawi (*Brassica juncea* L.) yang dibudidayakan secara organik. Jurnal Kultivasi, 18(2): 899-902.

Wei, X., B. Xie,C. Wan,R. Song, W. Zhong, S. Xin. and K. Song. 2024. Enhancing soil health and plant growth through microbial fertilizers: mechanisms, benefits, and sustainable agricultural practices. Agronomy 2024, 14, 609: 1-16. https://www.mdpi.com/2073-4395/14/3/609

Wirawan, I.K.J.A., I.M. Suryana dan I.M. Sukerta. 2021. Pertumbuhan dan hasil tanaman kangkung darat (*Ipomoea reptans* Poir) akibat pemberian pupuk kascing. Agrimeta Jurnal. Pertanian Berbasis Keseimbangan Ekosistem, 11(21): 56–60.