AGARICUS: Advances Agriculture Science & Farming
Vol. 6 No. 2 August 2026, Page. 199 - 204
E-ISSN: 2797-0884

Inorganic Fertilization Substitution in Mustard Mustard Plant (Brassica juncea L.) Through the Application of Goat Manure Liquid Organic Fertilizer

Kholifatul Fuadah[*], Anggi Indah Yuliana[2], Mohamad Nasirudin[3]
[1*2,3] Agroecotechnologi, Universitas KH. A. Wahab Hasbullah
*Email: kholifatulfuadah584@gmail.com

ABSTRACT
This study examines the impact of the application of inorganic fertilizer and goat manure liquid organic fertilizer on the growth and yield of mustard greens (brassica juncea L). In this study using a factorial random group design (RAK), there are two factors used. The first factor is the application of chemical fertilizers which are divided into three categories; A0 (without chemical fertilizer), A1 with a dose of 4 grams per plot (100%), and A2 with a dose of 2 grams per plot (50%). The second factor is the provision of goat manure poc; K0 (without POC), K1 (50 ml/L), K2 (100 ml/L) and K3 (150 ml/L). The data collected was analyzed through ANOVA to understand the significant differences between treatments, then continued with testing to determine the Smallest Real Difference (BNT) at the level of 5%. The results of the study showed that the use of inorganic fertilizers had an impact on the number of leaves, leaf area, dry weight, and fresh weight of the plant, where the A2 treatment with a dose of 50% gave better results than other treatments. Meanwhile, the POC effect of goat manure plays a role in determining plant height, number of leaves, leaf area, dry weight, and fresh weight, where the K2 treatment shows better results than other treatments. The interaction between inorganic fertilizer and goat manure POC significantly affected the accumulation of plant biomass at 21 days postplanting (HST), with A2K2 treatment (50% inorganic fertilizer + 100 mL/l POC) resulting in the highest dry weight compared to other treatments. Treatments that applied entirely inorganic fertilizers (A1) combined with POC at doses of 100 ml/L (A1K2) or 150 ml/L (A1K3) showed dry weight that did not show a significant difference when compared to treatments using 100% inorganic fertilizers without POC (A2K0). Therefore, the use of POC provides an opportunity to reduce the dose of inorganic fertilizers by up to 50% in caisim plants.

***Keywords**: Caisim Mustard Greens, Goat Manure Liquid Organic Fertilizer, Inorganic Fertilizer*

INTRODUCTION
Caisim (*Brassica juncea* L.) is a vegetable that is widely grown in Indonesia because of its economic value and abundant nutrition. According to research (Azizah et al., 2016), there is significant public interest in CAISIM due to its ease of cultivation and promising market prospects. In addition, caisim is rich in essential nutrients such as protein, carbohydrates, calcium, phosphorus, iron, as well as vitamins A, B, and C that provide real health benefits (Nasution et al., 2014). Data from the Central Statistics Agency (BPS) in 2023 shows that domestic caisim production increased from 727,467 tons in 2021 to 760,608 tons in 2022, but then dropped to 686,876 tons in 2023. This decline confirms the need for efforts to increase caisim productivity in a sustainable manner.

In general, the increase in caisim mustard production is still highly dependent on the use of inorganic fertilizers, especially urea due to its ability to provide high amounts of nitrogen that can be absorbed quickly by plants. Based on research conducted by (Susanti et al., 2021), urea has a nitorgen content of about 46% which is important in supporting the vegetative development of plants. However, the continuous and excessive use of chemical fertilizers can damage soil quality and result in environmental pollution. In addition, the use of unbalanced chemical fertilizers can reduce soil organic matter content and gradually decrease soil fertility (Murnita & Taher, 2021).

One of the efforts to reduce the negative impact of the use of inorganic fertilizers is the application of the use of liquid organic fertilizers (POC). Liquid organic fertilizer derived from goat manure has great potential because of its macro and micronutrient content that is important for plant growth. According to (Octaviana, 2020), Goat manure processed into liquid organic fertilizer can increase nutrient availability and support plant growth. In addition, the use of organic-based liquid fertilizers can improve soil composition, increase microbial activity, and increase the soil's capacity to hold nutrient elements(Syamsiyah et al., 2023). Organic fertilizers in liquid form can be absorbed by plants more effectively compared to solid organic fertilizers because the nutrients in them are in a dissolved state (Tanti et al., 2020).

METHOD

This study was carried out in Banyuarang Village, which is located in Ngoro District, Jombang Regency, at an elevation of 44 meters above sea level, from October to December 2025. The materials used in this study include caisiim seeds of the tosanka variety, POC manure goat, soil, water and urea fertilizer. Tools used include; hoes, buckets, stationery, measuring cups, rulers, cameras, label paper, polybags, digital scales, and calipers.

This study applied a group random design method (RAK) designed in a factorial format, there were two variables tested, resulting in 12 treatments with three replications, resulting in a total of 36 experimental plots and 180 plants. Factor 1 consists of inorganic fertilizer dosage: A0 (without inorganic fertilizer), A1 (100% urea dose or 4 g per plot), and A2 (50% urea dose or 2 g per plot). Factor 2 consists of the POC dose of goat manure: K0 (without treatment), K1 (50 ml/L), K2 (100 ml/L), and K3 (150 ml/L). Both types of fertilizers are applied once a week on different days.

The observed parameters include; height of the plant, number of leaves, leaf area (calculated by the formula P x L x 0.6825), dry weight of the plant and also fresh weight of the plant. The data obtained was calculated by applying the variance analysis method (anova) at a rate of 5%. If there is a significant difference, it will be followed by the BNT test at the level of 5%. If the number F is calculated to exceed the F number of the table, then the next step is to test BNT (Smallest Real Difference) using a significance level of 5%. If the F count is less than the F table, then there is no need to proceed with the BNT (Smallest Real Difference) test at the level of 5% because there is no impact on the application between inorganic fertilizer and goat manure.

RESULT AND DISCUSSION

The results of this study show that there is an important relationship between the use of inorganic fertilizers (A) and liquid organic fertilizers derived from goat manure (K) on plant height growth, number of leaves, leaf area, and dry weight. However, no significant interaction was detected on the fresh weight of mustard greens plants.

Result

Plant height

Based on the analysis carried out, the height of the caisim mustard plant showed a significant interaction between the application of inorganic fertilizer and POC from goat manure to the height of the plant at the age of 7 hst. It shows that the A0K2 treatment produces the highest plant height, while the A0K0, A0K1, A0K3, A1K3 and A2K3 treatments produce better plant heights compared to the A1K1, A1K2, A2K0, A2K1 and A2K2 treatments which produce lower plant heights.

Treatment	Plant height 7 hst (cm)			
A+K interaction	K0	K1	K2	K3
A0	7.37 e	7.37 e	8.87 f	5.27 bc
A1	4.63 ab	4.37 A	4.2 A	6 cd
A2	4.13 A	3.73 A	3.73 A	6.53 of
BNT	0,86			

Remarks: Values listed in rows and columns ending with the same letter show no noticeable difference according to BNT's analysis (5%); TN (does not show a significant difference).

Number of leaves

Based on the observations made, the number of leaves from the caisim mustard plant showed a significant interaction between the application of inorganic fertilizer and the POC of goat kohe on the number of mustard leaves at the age of 14 and 28 days after planting. At 14 hst age, the A0K1 and A0K3 treatments yielded the highest number of leaves. Meanwhile, the A0K0, A0K2, and A2K0 treatments showed higher leaf count results when compared to the A1K0 and A2K1 treatments. At age 28 hst, the A1K2 treatment showed the highest leaf count, while the A2K0 treatment also gave a lot of leaves when compared to the A0K0, A0K1, A0K2, A0K3, A1K1, A1K3, A2K2, and A2K3 treatments, but did not show significant differences with the A2K1 treatment.

Treatment	Number of leaves 14 hst (strands)			
A+K Interaction	K0	K1	K2	K3
A0	5.33 c	6.67 p	5.33 c	6.67 p
A1	3.33 A	4.33 b	3.67 ab	4 ab
A2	5.67 c	3.33 A	5.33 c	4 ab
BNT	0,69			
Treatment	Number of leaves 28 hst (strands)			
A+K Interaction	K0	K1	K2	K3
A0	2.67 A	5.67 bcd	6 cd	5.67 bcd
A1	5.33 bc	5 b	8 g	6 cd
A2	7.67 f	7 Ef	6.33 of	6 cd
BNT	0,98			

Remarks: Values listed in rows and columns ending with the same letter show no noticeable difference according to BNT's analysis (5%); TN (does not show a significant difference).

Leaf area

Based on the analysis carried out, the size of the leaf area of the mustard caisim plant showed a significant interaction between the use of non-organic fertilizer and POC from goat manure on the leaf size at the age of 7 days after planting. This shows that the A0K2 treatment produces the largest leaf area, while the A0K0 treatment shows a higher leaf area compared to a number of other treatments. On the other hand, the A0K1 treatment showed a wider leaf area size compared to the A0K3 treatment.

Treatment	Leaf area (cm^2)			
A+K interaction	K0	K1	K2	K3
A0	23.29 (e)	13.64 (d)	38.73 (f)	6.96 (ABC)
A1	8.12 (bc)	7.74 (abc)	3.87 (a)	5.90 (ABC)
A2	6.75 (ABC)	9.22 (c)	5.10 (ab)	3.97 (a)
BNT	4,09			

Remarks: Values listed in rows and columns ending with the same letter show no noticeable difference according to BNT's analysis (5%); TN (does not show a significant difference).

Dry weight of the plant

Based on the observations made, the dry weight of caisim mustard plants showed a significant interaction between the use of inorganic fertilizer and goat kohe POC on the dry weight of caisim mustard at the age of 21 hst. This shows that the A2K2 treatment produces the greatest dry weight of the plant compared to some other treatments, while the A0K3 treatment also provides a higher dry weight, but there is no significant difference when compared to the A2K3 treatment. The A0K0, A0K1, A1K0, and A1K2 treatments showed the lowest dry weight when compared to the other treatments, although there was no significant difference when compared to the A2K1 treatment.

Treatment	Dry weight of the crop at 21 hst (g)			
A+K interaction	K0	K1	K2	K3
A0	0.82 A	0.76 A	1.86 cd	2.63 e
A1	0.88 A	0.66 A	1.51 bc	1.45 bc

A2	1.75 cd	1.17 ab	4.69 f	2.20 de
BNT	0,54			

Remarks: Values listed in rows and columns ending with the same letter show no noticeable difference according to BNT's analysis (5%); TN (does not show a significant difference).

Fresh weight of the plant

Based on the observations that have been made, the wet weight of mustard caisim plants shows that there is no significant interaction between the application of inorganic fertilizer and POC from goat manure related to the wet weight of mustard caisim at the age of 35 days after planting. This shows that the use of POC from goat manure in K1, K2, and K3 treatments results in higher crop fresh weight compared to K0 treatments. Meanwhile, for inorganic fertilizer factors, the A1 and A2 treatments showed a higher yield of fresh plant weight when compared to the A0 treatment.

POC GOAT KOHE	Fresh Weight (G)
K0	31.7 (a)
K1	52.4 (b)
K2	50.2 (b)
K3	53.8 (b)
BNT	5,83
Inorganic Fertilizer	
A0	39 (a)
A1	50.7 (b)
A2	51.4 (b)
BNT	5,045

Remarks: Values listed in rows and columns ending with the same letter show no noticeable difference according to BNT's analysis (5%); TN (does not show a significant difference).

Discussion

Plant height

The interaction between non-organic fertilizers and POC from goat manure had a clear impact on the height of caisim mustard plants after 7 hst. The A0K2 treatment produces the highest plant height compared to other treatments. This suggests that the appropriate use of POC from goat manure can meet the nutritional needs of plants in the early stages of their growth, potentially supporting cell extension as well as vegetative growth of plants. Based on (Wua et al., 2022), the application of organic fertilizer in liquid form has been proven to stimulate the high growth of mustard greens (*Brassica juncea* L.) when compared to plants that do not receive liquid organic fertilizer treatment. This is in line with the opinion (Sulistyawati et al., 2024), which states that combining inorganic fertilizers with goat kohe POC can help the growth of mustard greens plant better.

Number of leaves

The interaction between synthetic fertilizers and liquid organic fertilizers from goat manure has a significant effect on the number of leaves in mustard plants at the age of 14 and 28 days after planting. At 14 hst age, treatments of A0K1 (no inorganic fertilizer + POC 50 ml/L) and A0K3 (no inorganic fertilizer + POC 150ml/L) produced the highest number of leaves compared to other treatments. At 14 days of age after planting, treatments A0K1 (no inorganic fertilizer + POC 50 ml/L) and A0K3 (no inorganic fertilizer + POC 150 ml/L) produced the highest number of leaves compared to the other treatments. At age 28 HST, the A1K2 treatment produced the highest number of leaves compared to the other treatments. According to (Istiqomah & Serdani, 2018), that the use of organic fertilizers and chemical fertilizers provides different plant growth results when compared to using only one type of fertilizer. This corresponds to the view. This is in line with the opinion (Hidayati et al., 2021), which says that using organic fertilizers and non-organic fertilizers together can affect the growth of mustard greens in important ways, including the number of leaves produced.

Leaf area

The interaction between chemical fertilizers and liquid fertilizers derived from goat manure has a visible impact on leaf size when the plant is 7 hst old. This shows that the combination of the two fertilizers helps the leaf growth process from the beginning. The availability of nitrogen from artificial fertilizers, combined with large and small nutrients in POC, plays a role in the formation of chlorophyll and accelerates the process of photosynthesis. A larger leaf area allows the plant to absorb more sunlight, thus promoting better growth. This is in accordance with the opinion (Amalia et al., 2023), which states that the leaf area tends to increase as the dose or volume of fertilizer applied increases.

Dry weight of the plant

The interaction between chemical fertilizers and organic fertilizers in liquid form from goat manure has a significant impact on the dry weight of the plant at the age of 21 hst. The A2K2 treatment showed the highest dry weight. In addition, the administration of A1K2 and A1K3 treatment did not show a significant difference when compared to A2K0. This indicates that the use of organic liquid fertilizers can reduce the need for inorganic fertilizers by as much as 50%. This proves that the combination of these two types of fertilizers can increase the absorption of photosynthetic results stored in plant tissues. According to (Lazuardi et al., 2024), that the ability of plants to absorb nutrients is very helpful in their growth and metabolic processes, this can be seen from the size of their dry weight. This is in accordance with (Ganti et al., 2023), which says that organic matter can make nutrients in the soil more readily available and also help plant growth.

Fresh weight of the plant

The interaction between non-organic fertilizers and liquid-based organic fertilizers from goat manure did not show a significant impact on the fresh weight measures of the plants. This shows that the combination of the two treatments did not produce a significant difference in the fresh weight of the caisim mustard plant. This lack of interaction suggests that the plant's fresh weight response is more influenced by other factors, such as the plant's ability to absorb water and environmental conditions during the growth period. According to (Amalia et al., 2023), states that crop yields can be maximized if certain conditions are met, such as the availability of adequate nutrients and appropriate environmental factors. Nutrients are essential for plant growth, which can grow well if the required nutrients are in sufficient quantities and suitable for the plant to absorb. This supports to guarantee better growth and development of plants.

CONCLUSIONS

Reducing the dose of inorganic fertilizers has been proven to have a real influence on the growth and yield of caisim mustard. Observations that had an inconsistent impact were seen in the parameters of leaf count (7 and 35 hst), leaf size (14 and 35 hst), dry weight of plants (14 and 28 hst), as well as in the fresh weight parameters of 35 hst. The best reduction in A2 treatment with a 100% urea fertilizer concentration.

The addition of POC doses from goat manure was not sufficient to reduce the use of inorganic fertilizer in caisim mustard (*Brassica juncea* L.) plants, but the combination of 50% (A2) and 100 ml/L (K2) inorganic fertilizer yielded the highest dry weight results at the age of 21 days after planting.

Increasing the dose of POC from goat manure has not been successful in reducing the use of chemical fertilizers in mustard plants of caisim (*Brassica juncea* L.), but the combination of 50% (A2) and 100 ml/L (K2) chemical fertilizer administration yields the highest dry weight results at age 21 hst. The interaction between inorganic fertilizer and POC from goat manure was seen in the use of 100% inorganic fertilizer (A1) with POC 100 ml/L (A1K2) and POC 150 ml/L (A1K3) which showed no significant difference in dry weight compared to 100% inorganic fertilizer treatment without POC (A2K0). Thus, the use of POC is able to reduce the application of inorganic fertilizers in caisim plants by up to 50%.

REFERENCES

Amalia, N., Santoso, B. budi, & Farida, N. (2023). Pengaruh Pemberian Pupuk Anorganik dan Pupuk Organik Cair (POC) Limbah Air Cucian Beras Terhadap Pertumbuhan dan Hasil Tanaman Sawi (*Brassica juncea* L.). *Jurnal Ilmiah Mahasiswa Agrokomplek*, *2*(1), 45–53. https://doi.org/10.29303/jima.v2i1.2290

Azizah, N., Haryono, G., & Tujiyanta. (2016). Respon Macam Pupuk Organik Dan Macam Mulsa Terhadap Hasil Tanaman Sawi Caisim (*Brassica Juncea*, L.) Var. Tosakan. *Ilmu Pertanian Tropika Dan Subtropika 1 (1) : 44 - 51*, *1*(1), 44–51.

Ganti, nur wana sari la sira, Ginting, S., & Leomo, S. (2023). Pengaruh Pemberian Pupuk Organik Terhadap Sifat Kimia Tanah Masam dan Hasil Tanaman Jagung (*Zea mays* L.). *Berkala Penelitian Agronomi*, *11*(1), 24–34. https://doi.org/10.33772/bpa.v11i1.400

Hidayati, S., Nurlina, & Purwanti, S. (2021). Uji Pertumbuhan Dan Hasil Tanaman Sawi Dengan Pemberian Macam Pupuk Organik Dan Pupuk Nitrogen. *Cemara*, *18*(2).

Istiqomah, & Serdani, A. D. (2018). Pertumbuhan dan Hasil Tanaman Sawi (*Brassica juncea* L. Var. Tosakan) Pada Pemupukan Organik, Anorganik dan Kombinasinya. *Agroradix*, *1*(2), 1–8.

Lazuardi, M. S., Sunawan, & Basit, A. (2024). Pengaruh Konsentrasi Dan Interval Waktu Pemberian Pupuk Organik Cair Urine Kelinci Terhadap Pertumbuhan Dan Hasil Kualitas Tanaman Sawi Caisim (*Brassica Juncea* L.) Varietas Shinta. *L AGRONISMA*, *12*(1), 462–473.

Murnita, & Taher, Y. A. (2021). Dampak Pupuk Organik dan Anorganik terhadap Perubahan. *Jurnal Menara Ilmu*, *XV*(2), 67–76.

Nasution, F. J., Mawarni, L., & Meiriani, M. (2014). Aplikasi Pupuk Organik Padat Dan Cair Dari Kulit Pisang Kepok Untuk Pertumbuhan Dan Produksi Sawi (*Brassica Juncea* L.). *Agroekoteknologi*, *2*(3), 1029–1037.

Oktaviana, N. (2020). Pengaruh Pemberian Pupuk Organik Cair (Poc) Kotoran Kambing Terhadap Pertumbuhan Dan Hasil Tanaman Kedelai (*Glycine Max* (L.) Merril). Studi Agroekoteknologi Fakultas Pertanian Universitas Jambi.

Sulistyawati, Pratiwi, S. H., & Pranata, D. H. (2024). Pengaruh Kombinasi Pupuk Organik Cair (POC) Ubur-Ubur dan Pupuk Urea terhadap Tanaman Sawi Hijau (*Brassica juncea* L .). *Vegetalika*, *13*(3), 260–269. https://doi.org/https://doi.org/10.22146/veg.93479

Susanti, R., Widagdo, S., & Pangaribuan, D. H. (2021). Pengaruh Dosis Pupuk Urea Terhadap Pertumbuhan Dan Hasil Tanaman Kailan (*Brassica Oleracea* Var . Alboglabra). *Agrotek Tropika*, *9*(1), 137–144.

Syamsiyah, J., Herdiyansyah, G., Hartati, S., Widijanto, H., Larasati, I., & Aisyah, N. (2023). Pengaruh Substitusi Pupuk Kimia Dengan Pupuk Organik Terhadap Sifat Kimia Dan Produktivitas Jagung Di Alfisol Jumantono. *Jurnal Tanah Dan Sumberdaya Lahan*, *10*(1), 57–64. https://doi.org/10.21776/ub.jtsl.2023.010.1.6

Tanti, N., Nurjannah, N., & Kalla, R. (2020). Pembuatan Pupuk Organik Cair Dengan Cara Aerob. *ILTEK : Jurnal Teknologi*, *14*(2), 2053–2058. https://doi.org/10.47398/iltek.v14i2.415

Wua, E. C., Mambu, S. M., & Umboh, S. D. (2022). Pengaruh Aplikasi Berbagai Dosis Pupuk Organik Cair Terhadap Pertumbuhan Vegetatif Sawi Hijau (*Brassica juncea* L.). *JOURNAL of Biotechnology and Conservation in WALLACEA*, *02*(02), 99–106. https://doi.org/https://doi.org/10.35799/jbcw.v2i2.42868