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Growth and Production Response of Cowbean (*Vigna unguiculata* (L.) Walp) to Goat Dunge and Straw Mulch Fertilizer Application

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Abstract:
Cowpea (*Vigna unguiculata* (L.) Walp) is a legume with good adaptability to various soil types and drought conditions, offering potential as an alternative protein source to soybeans. This study aimed to investigate the effect of goat manure fertilizer and straw mulch on the growth and yield of cowpea. The research was conducted from August to November 2024 at the agricultural field of Politeknik Negeri Jember using a factorial randomized block design with two factors: goat manure dosage (0, 90, 110, 130, and 160 g/plant) and mulch type (silver mulch and straw mulch), with three replications. Growth parameters and yield components such as plant height, number of pods, pod weight, and seed weight were recorded. The results showed that the application of 160 g/plant goat manure significantly increased plant height at 35 days after planting, the number of pods per plant, wet and dry pod weights, and seed yield, while straw mulch had no significant effect on any variable. No interaction effect was observed between the two treatments. The findings suggest that goat manure application is an effective strategy to enhance cowpea productivity under field conditions without the need for straw mulching.

Keywords:
cowpea, goat manure, growth, straw mulch, yield

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INTRODUCTION

Indonesia is an agricultural country where the agricultural sector plays a significant role in supporting the national economy. Most Indonesian people also depend on agriculture as their main source of livelihood. Among the main food commodities, soybeans rank third after rice and maize. However, national soybean production is still insufficient to meet domestic consumption needs; Indonesia relies on imports (Buletin Konsumsi Pangan – Pusdatin, 2022).

Cowpea (Vigna unguiculata (L.) Walp) is a potential alternative food crop that deserves further development. According to the Directorate of Various Legumes and Tubers, cowpea production in Indonesia reached 290.78 thousand tons of dry beans in 2020, but this decreased to 212.86 thousand tons in 2021 (Buletin Konsumsi Pangan – Pusdatin, 2022). Domestic consumption of cowpeas in 2021 was around 13 thousand tons, whereas industrial needs reached 2.8 million tons. This significant gap between production and demand indicates the urgent need to increase cowpea productivity through effective cultivation practices.

Cowpea contains a high amount of plant-based protein and ranks second after soybean (Ismayanti et al., 2015). This crop is known for its drought tolerance and adaptability to various soil types, making it highly suitable for cultivation in many regions. Additionally, cowpea cultivation has

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lower production costs than soybean cultivation (Kementerian Pertanian, 2019). Despite its potential, cowpea productivity in Indonesia remains low at approximately 1 ton per hectare, far below other countries such as the United States and China, which can achieve up to 2 tons per hectare.

One factor contributing to low cowpea productivity is the lack of soil nutrients, which leads to declines in soil physical, chemical, and biological properties. Efforts to increase productivity can be made by applying organic fertilizers, such as goat manure, and by using mulch, both of which are known to improve soil fertility and plant growth. Goat manure contains essential nutrients, including nitrogen, phosphorus, potassium, calcium, magnesium, and organic carbon, all of which are important for improving soil fertility and plant productivity (Samekto, 2006). In addition, research by Sherin and Kharis (2023) showed that applying 150 g of goat manure per plant positively affected leaf development and pod formation in cowpea.

The application of straw mulch also plays an important role in increasing cowpea productivity. Mulch functions to maintain soil moisture, suppress weed growth, support beneficial microorganisms, improve organic matter content, and reduce water evaporation (Hayati et al., 2010). Organic mulch can stabilize soil temperature, reduce surface runoff, prevent erosion, and increase soil nutrient content (Barchia, 2009).

This study aims to analyze the effects of goat manure and straw mulch on cowpea (Vigna unguiculata (L.) Walp) growth and production. Specifically, this study seeks to evaluate the effects of goat manure dosage, straw mulch, and their interaction on cowpea growth and yield components. The results are expected to contribute to optimizing cowpea cultivation through sustainable agricultural practices and to help reduce dependence on soybean imports.

METHOD

This research was a field experiment conducted to examine the effect of goat manure and straw mulch on the growth and production of cowpeas (Vigna unguiculata (L.) Walp). The research design used was a factorial randomized block design (RBD) with two factors and three replications. The first factor was goat manure fertilizer at five dosage levels: 0 g/plant, 90 g/plant, 110 g/plant, 130 g/plant, and 160 g/plant. The second factor was mulch type, namely silver plastic mulch and straw mulch.

The population in this study was all cowpea plants cultivated on the experimental plots. The sample comprised cowpea plants grown under the goat manure and mulch treatment combinations in each experimental unit. The sampling technique used was purposive sampling, where plants from designated sample plots were observed and measured for each parameter.

No specific intervention outside the treatment combinations was applied in this study. The research was conducted from August to November 2024 on the agricultural experimental land of Politeknik Negeri Jember, in Sumbersari District, Jember Regency, East Java Province, Indonesia. The research site is located at an altitude of approximately 133 meters above sea level with an average temperature of 29°C, relative humidity of 70%, and rainfall of 100 mm during the study period.

The instruments and materials used in this research included planting tools (hoes, measuring tape, water cans, weighing scales), agronomic supplies (goat manure, cowpea seeds, EM-4 decomposer, fertilizers, pesticides), and observation tools (notebook, camera, sample bags). The data collected included plant height, number of pods per plant, fresh pod weight per plant, dry pod weight per plant, fresh pod weight per plot, dry pod weight per plot, dry seed weight per plant, dry seed weight per plot, and 100-seed weight.

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Data collection was performed by directly measuring and weighing plant parts at harvest. Statistical analysis was carried out using analysis of variance (ANOVA), and if significant differences were found, further tests were conducted using Duncan's Multiple Range Test (DMRT) at a significance level of 5% and 1%. Data interpretation was based on the significance of the treatments' effects on the observed parameters.

This study did not involve human or animal testing; therefore, ethical clearance was not required. However, the research was carried out responsibly by following good agricultural practice and environmental sustainability principles.

RESULT

The results of this study showed that applying goat manure significantly affected several observed variables of cowpea growth and production. The variables influenced included plant height at 35 days after planting (DAP), number of pods per plant, fresh pod weight per plant, fresh pod weight per plot, and dry pod weight per plant. Meanwhile, the application of straw mulch showed no significant effect on any observed parameters. Furthermore, no significant interaction between goat manure and straw mulch was found for any of the measured variables.

Effect of Goat Manure on Plant Height at 35 DAP

The application of goat manure significantly affected plant height at 35 days after planting. The highest plant height was observed in the treatment with 160 g/plant goat manure. The detailed data are presented in Table 1.

Table 1. Effect of Goat Manure on Plant Height of Cowpea at 35 DAP

Goat Manure Dose (g/plant)	Plant Height (cm)
0	40.95 a
90	41.78 a
110	43.80 a
130	46.00 ab
160	50.57 b

Note: Different letters indicate significant differences based on DMRT at 5% level.

Effect of Goat Manure on Number of Pods per Plant

The number of pods per plant was significantly affected by goat manure application. The highest number of pods was obtained with the 160 g/plant goat manure treatment. The data are presented in Table 2.

Table 2. Effect of Goat Manure on Number of Pods per Plant

Goat Manure Dose (g/plant)	Number of Pods (pods/plant)
0	20 a
90	21 ab
110	22 abc
130	23 bc
160	24 c

Note: Different letters indicate significant differences based on DMRT at 5% level.

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Effect of Goat Manure on Fresh Pod Weight per Plant

Fresh pod weight per plant increased significantly with higher doses of goat manure. The 160 g/plant treatment produced the highest pod weight. The data are presented in Table 3.

Table 3. Effect of Goat Manure on Fresh Pod Weight per Plant

Goat Manure Dose (g/plant)	Fresh Pod Weight (g)
0	75 a
90	74 ab
110	79 abc
130	82 bc
160	87 c

Note: Different letters indicate significant differences based on DMRT at 1% level.

Effect of Goat Manure on Fresh Pod Weight per Plot

The application of goat manure significantly influenced fresh pod weight per plot. The highest value was obtained at the 160 g/plant dose. The detailed data are shown in Table 4.

Table 4. Effect of Goat Manure on Fresh Pod Weight per Plot

Goat Manure Dose (g/plant)	Fresh Pod Weight (kg)
0	0.690 a
90	0.900 b
110	0.912 b
130	0.987 b
160	1.004 b

Note: Different letters indicate significant differences based on DMRT at 1% level.

Effect of Goat Manure on Dry Pod Weight per Plant

Goat manure application also significantly affected dry pod weight per plant. The highest dry pod weight was achieved with 160 g/plant goat manure. The data are presented in Table 5.

Table 5. Effect of Goat Manure on Dry Pod Weight per Plant

Goat Manure Dose (g/plant)	Dry Pod Weight (g)
0	52 a
90	53 a
110	61 ab
130	63 ab
160	68 b

Note: Different letters indicate significant differences based on DMRT at 1% level.

DISCUSSION

The results showed that applying goat manure significantly affected cowpea growth and production. The treatment with 160 g/plant goat manure produced the highest plant height, number of pods per plant, fresh pod weight per plant, fresh pod weight per plot, and dry pod weight per plant. This shows that an adequate supply of nutrients is important for supporting the growth and production of legumes. Goat manure contains essential nutrients, such as nitrogen, phosphorus, potassium, calcium, magnesium, and organic carbon, which improve soil fertility and support plant productivity (Samekto, 2006).

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The increase in plant height observed in this study is consistent with the findings of Sherin and Kharis (2023), who reported that applying 150 g of goat manure per plant increased vegetative growth of cowpeas, particularly leaf area. The nitrogen content of goat manure plays a key role in stimulating cell division and elongation, thereby directly affecting plant height. This supports the statement that organic fertilizers not only provide macro-nutrients but also improve soil structure and aeration, which are important for root development and nutrient absorption (Rahayu et al., 2014).

The increased number of pods per plant was also influenced by the application of goat manure. Sufficient nutrient availability, especially nitrogen and phosphorus, has been shown to affect flowering, pod formation, and seed filling in legumes (Sherin and Kharis, 2023). Goat manure provides a continuous nutrient supply during the generative phase, resulting in increased pod numbers and seed weight. Furthermore, goat manure enhances soil microbial activity, thereby increasing nutrient availability to plants (Rahayu et al., 2014).

The increase in fresh pod weight per plant and per plot is also consistent with previous studies. Goat manure improves soil water retention and nutrient availability, supporting pod filling and ultimately increasing fresh pod weight. This aligns with previous findings that using organic fertilizers, such as goat manure, can increase the productivity of legume crops (Nugraha and Islami, 2015; Anita Kholivia, 2018). This confirms that the application of organic fertilizers is an effective alternative to chemical fertilizers for increasing crop yields.

However, the application of straw mulch in this study did not significantly affect any of the observed parameters. These results contradict research findingsenhan that mulch can improve soil moisture, suppress weed growth, and improve soil fertility, thereby positively impacting crop growth and yield (Hayati et al., 2010; Barchia, 2009). The absence of mulch effects in this study may be due to adequate rainfall during the planting period, which reduced the role of mulch in maintaining soil moisture.

Another possible reason for the absence of mulch effects is the relatively short observation period, which was limited to one growing season. The long-term benefits of mulch are usually more visible in dry climates or on land with high temperature fluctuations. In addition, the type and thickness of mulch also influence its effectiveness, which may not have been optimal in this study (Barchia, 2009). The novelty of this study lies in providing scientific evidence, under Jember's agro-climatic conditions, that goat manure alone, without the addition of straw mulch, is sufficient to improve cowpea growth and production. This finding is important because it shows that simple organic fertilization techniques can be an effective solution for smallholder farmers to optimize yields using locally available resources.

The results of this study contribute significantly to the practice of sustainable agriculture. The use of goat manure improves soil health, reduces dependence on chemical fertilizers, and supports environmentally friendly farming systems. Furthermore, the utilization of goat manure, which is cheap and easy to obtain, can reduce production costs while increasing productivity, which is relevant to small-scale farming in developing countries.

The significance of these findings for agriculture and agroindustry lies in the practical recommendations for cowpea cultivation using local resources. This research supports efforts to optimize production systems through sustainable farming methods that promote soil conservation, crop health, and higher yields. These findings also support food diversification programs by encouraging the production of alternative vegetable protein sources such as cowpeas. A limitation of this study is that it was only conducted in a single planting season and under specific environmental conditions. The results may differ if the research is conducted in different regions or over several planting seasons. Therefore, further studies are needed to investigate the long-term

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effects of combining organic fertilizers and mulch in various environmental settings and to evaluate the economic feasibility for broader adoption by farmers.

CONCLUSION

The results of this study concluded that the application of goat manure significantly influenced the growth and production of cowpeas (Vigna unguiculata (L.) Walp). The dose of 160 g/plant goat manure produced the highest plant height, number of pods per plant, fresh pod weight per plant, fresh pod weight per plot, and dry pod weight per plant. In contrast, straw mulch did not significantly affect any of the observed variables. There was also no significant interaction between goat manure and mulch on all parameters measured.

The answer to the research question is that goat manure application, especially at 160 g/plant, is effective in increasing cowpea growth and yield, whereas straw mulch provides no significant additional benefits under the agro-climatic conditions during the study period. This indicates that goat manure alone can serve as an appropriate and practical organic fertilizer for cowpea cultivation, improving crop productivity.

This study suggests that farmers can improve cowpea yields by using organic fertilizers, such as goat manure, without the need for additional mulch application. This practice is more economical and supports sustainable agriculture by utilizing locally available organic materials. Further research is recommended to examine the long-term effects of organic fertilizer and mulch application across different growing seasons and environmental conditions to strengthen recommendations for broader agricultural practices.

REFERENCES

Barchia, M. F. (2009). Pengaruh penggunaan mulsa terhadap pertumbuhan dan hasil tanaman hortikultura. *Jurnal Ilmu-Ilmu Pertanian Indonesia, 11*(2), 147–153.

Buletin Konsumsi Pangan – Pusdatin. (2022). *Statistik konsumsi pangan nasional 2022*. Pusat Data dan Sistem Informasi Pertanian, Kementerian Pertanian RI.

Choudhary, M., Datta, A., Jat, H. S., Yadav, A. K., Sapkota, T. B., Mondal, S., & Sharma, P. C. (2018). Sustainable intensification influences soil quality, biota, and productivity in cereal-based systems of North-West India. *Applied Soil Ecology, 126*, 189–198. https://doi.org/10.1016/j.apsoil.2018.02.016

Daryanto, S., Wang, L., & Jacinthe, P. A. (2017). Impacts of no-tillage management on nitrate loss from corn, soybean, and wheat cultivation: A meta-analysis. *Scientific Reports, 7*, 12117. https://doi.org/10.1038/s41598-017-12383-7

Hayati, E., Tjokrokusumo, S., & Rauf, A. (2010). Pengaruh pemberian pupuk kandang dan mulsa terhadap pertumbuhan dan hasil kacang panjang (*Vigna sinensis* L.). *Jurnal Agronomi Indonesia, 38*(2), 108–114.

Fan, X., Li, Y., Zheng, J., Li, X., & Zhang, F. (2025). Organic fertilizer improves crop yield through regulating soil microbial community and enhancing nutrient cycling. *International Journal of Agriculture, 17*(2), 55–67. https://doi.org/10.1007/s42139-025-00345-0

Ismayanti, D., Supriyanto, B., & Suwarto. (2015). Pengaruh komposisi pupuk organik dan anorganik terhadap pertumbuhan dan hasil kacang tunggak (*Vigna unguiculata* (L.) Walp.). *Jurnal Produksi Tanaman, 3*(5), 396–403.

Volume 02 Number 01
May 2026
e-ISSN: 3124-8179
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Kementerian Pertanian. (2019). *Statistik kedelai Indonesia 2019*. Pusat Data dan Sistem Informasi Pertanian, Kementerian Pertanian RI.

Li, S., Li, J., Zheng, H., Wang, J., & Zhao, B. (2023). Responses of crop yield and soil properties to long-term organic and inorganic fertilization in China: A meta-analysis. *Geoderma, 426*, 116174. https://doi.org/10.1016/j.geoderma.2022.116174

Nugraha, M. H., & Islami, T. (2015). Pengaruh pemberian pupuk kandang kambing dan pupuk organik cair terhadap pertumbuhan dan hasil tanaman kacang tunggak (*Vigna unguiculata* (L.) Walp.). *Jurnal Produksi Tanaman, 3*(9), 753–760.

Rahayu, W., Rachmawati, F., & Sundari, T. S. (2014). Pengaruh pupuk kandang kambing terhadap karakteristik tanah, pertumbuhan, dan hasil kedelai (*Glycine max* L.). *Jurnal Produksi Tanaman, 2*(5), 368–376.

Sherin, & Kharis, I. (2023). Respons pertumbuhan dan hasil kacang tunggak (*Vigna unguiculata* (L.) Walp.) terhadap dosis pupuk kandang kambing dan frekuensi penyiraman. *Jurnal Agronomi Indonesia, 51*(1), 75–82.

Singh, J., & Biswas, H. (2022). Role of organic farming in sustainable agriculture: A review. *Sustainability, 14*(13), 7999. https://doi.org/10.3390/su14137999

Tadesse, G., Astatkie, T., Yitbarek, T., & Molla, D. (2022). Soil organic amendments and their effects on crop yield and soil quality: A review. *Agronomy, 12*(8), 1840. https://doi.org/10.3390/agronomy12081840

Zhang, Y., Wang, J., & Liu, X. (2020). Effects of organic and inorganic fertilizers on soil properties and crop yield: A meta-analysis. *Soil & Tillage Research, 200*, 104611. https://doi.org/10.1016/j.still.2020.104611