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Research Article

Effect of organic and NPK fertilizers on flowering, pod formation, and seed production of cowpea (*Vigna unguiculata* L. Walp)

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ABSTRACT

Cowpea (Vigna unguiculata L. Walp), known as tolo beans in Indonesia, is a nutrient-dense legume consumed as young pods, dry seeds, or livestock feed. Despite its nutritional value and agronomic potential, cowpea productivity in Indonesia remains low. This study aimed to evaluate the effect of poultry manure and NPK fertilizers on flowering, pod formation, and seed filling of cowpea. The experiment was conducted from July to October 2024 at the Sawah Baru Experimental Field, IPB, using a randomized complete block design. Treatments included poultry manure at 0, 10, 20, and 30 tons ha^{-1} and NPK (16-16-16) at 0, 100, 200, and 300 kg ha^{-1}. Results showed that poultry manure at 10-30 tons ha^{-1} and NPK above 100 kg ha^{-1} significantly increased the productive nodes at the ninth week after planting. Both fertilizers enhanced plant growth and yield. The highest average seed yield was obtained at 30 tons ha^{-1} poultry manure (3.64 tons grain ha^{-1}) and 300 kg ha^{-1} NPK (3.38 tons grain ha^{-1}), highlighting the benefit of integrating organic and inorganic fertilization to boost cowpea productivity.

Keywords: cowpea; chicken manure; NPK fertilizer; kacang tolo

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INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) is a food crop rich in nutrients originating from African countries and is known in Indonesia as *kacang tolo* (Trustinah, 1998). Cowpeas can be eaten in two forms: as young pods or dry seeds. In addition, it can be used as animal feed. The nutritional content of cowpea is close to that of soybean plants. In 100 g of tolo bean seeds, there are 61.6 g of carbohydrates, 22.9 g of protein, 1.4 g of fat, and 342 calories. The nutritional composition of this product is similar to that of soybeans, comprising 34.8 g of carbohydrates, 34.9 g of protein, 18.1 g of fat, and 331 calories (Rabani et al., 2022).

The area of cowpea plantations in Indonesia is 702,163 hectares, with a production of 826,351 tons and a productivity of 1.17 tons ha^{-1} (Ministry of Agriculture, 2019). Indonesia's productivity remains low, at 1 tons ha^{-1}, compared to the United States and China, which can reach 2 tons ha^{-1} (Tukidi & Erwandri, 2023). The production of cowpeas in Indonesia has not been able to meet the consumer demand. This is due to a lack of knowledge about good agricultural practices and the use of low-yielding cowpea varieties, coupled with low soil fertility (Adigun et al., 2014).

The growth and production of cowpeas can be enhanced by improving cultivation techniques, including the application of both organic and synthetic fertilizers. The application of organic fertilizer can maintain and enhance soil fertility through physical, chemical, and biological processes. Ultimately, this will result in increased plant productivity. Chicken manure serves as a valuable nutrient for plants, providing a long-lasting benefit that helps maintain a balanced nutrient level in the soil (Dermiyati, 2015). Using organic fertilizers takes a considerable amount of time and requires relatively large quantities to have a positive impact on the soil and plants (Kuntyastuti et al., 2020). Fertilizer Chicken Coop is an organic fertilizer with a higher nutrient content than other types of livestock. Chicken manure contains 1.5% N, 1.3% P_2O_5, 0.8% K_2O, 4.0% CaO, and a 9-11% C/N ratio (Dermiyati, 2015). Cow manure contains 0.4% N, 0.2% P, and 0.1% K, while goat manure contains 0.6% N, 0.3% P, and 0.17% K (Prasetyo, 2014).

Inorganic fertilizers are generally considered the mighties suitable solution to the problem of declining soil nutrients and the sustainability of food production (Tadesse et al., 2022). One of the inorganic fertilizers is compound NPK fertilizer, which contains 1.6 % N, 1.6 % P, and 1.6 % K elements (Pratama et al., 2016). The nitrogen element (N) is a nutrient that plays a crucial role in forming plant vegetative organs and is the primary element in the synthesis of amino acids and proteins (Arista et al., 2015). The phosphorus (P) nutrient plays a crucial role in accelerating root growth, promoting mature plant growth, enhancing flowering, promoting seed ripening, and increasing grain production (Sahwaldi et al., 2023). Nutrient K is also essential in the seed formation process, along with nutrient P (Arista et al., 2015).

Based on Shofi's (2017) research results, the provision of 30 tons ha^{-1} of goat manure increased the growth and yield of soybean plants. Fadillah's research (2020) also found that the provision of 5 tons ha^{-1} goat manure and 45 kg ha^{-1} urea fertilizer (N) increases the growth of cowpea plants. The merger of goat manure with an application rate of 2.5 tons per hectare and 45 kg per hectare urea fertilizer (N) increased the growth and production of cowpeas better than without fertilizer.

Cowpea productivity in Indonesia remains low. As a result, improving yields through fertilization is limited. Most studies have focused on goat manure and inorganic fertilizers, but chicken manure, which has higher nutrient content, and its combined effect with inorganic fertilizers on flowering, pod formation, and seed production have not been thoroughly explored. Therefore, this research aimed to evaluate the effect of poultry manure and NPK fertilizers on flowering, pod formation, and seed filling of cowpea.

MATERIALS AND METHODS

This study was performed in July–October 2024 at the Sawah Baru Experimental Station, Postharvest and Biomass Laboratory, and soil and fertilizer analysis at the Testing Laboratory of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University. The tools used were SPAD, digital scales, and the LI-6800 Portable Photosynthesis System. The materials used were cowpea seeds of the Albina IPB variety, chicken manure, NPK 16-16-16 fertilizer, and plastic mulch. A randomized complete block design was followed, which involves two factors. The first factor was chicken manure, consisting of four levels: 0, 10, 20, and 30 tons per hectare. The second factor was NPK levels: 0, 100, 200, and 300 kg ha^{-1}. Every treatment included three replicates, leading to 48 experimental units. Every experimental unit consisted of 44 plants, with 10 sample plants selected within the unit.

Soil samples were collected compositely at 5 points with a depth of 15-20 cm. They were taken diagonally and then combined into one plastic bag, after which they were analyzed for pH, C-organic content, P, K, N-total content, and CEC. Analysis was also conducted on chicken manure, including pH, water content, C-organic, N, P, and K.

The soil was plowed and leveled. A bed measuring 8 m x 1 m was created. Chicken manure was applied at dosages of 0, 10, 20, and 30 tons ha^{-1}. Afterward, plastic mulch was installed, and planting holes were made. Seed planting was done at 2 weeks after plastic mulch installation. Planting distance was 50 cm x 35 cm using 2 seeds per hole. NPK 16-

16-16 fertilizer was applied in the quantities of 0, 100, 200, and 300 kg ha^{-1} at 2 weeks after planting (WAP).

Observations included plant height, number of leaves, leaf area, SPAD value, and the photosynthesis rate. During the generative phase, observations were made on flowering age, the quantity of productive nodes, seed set, and the shoot dry weight (g). The production evaluation included the pod number on each plant, weight of pods per plant (g), seed count per plant, 100 seed weight (g), count of wrinkled seeds per plant, count of damaged seeds per plant, total seed weight per plant (g), and seed yield (tons ha^{-1}).

The data were statistically evaluated through analysis of variance using R Studio software and Microsoft Excel 2010. Further testing using the Duncan multiple range test (DMRT) method at α = 5 %.

RESULTS AND DISCUSSION

Growth components

The generative phase, starting from the R1 phase 5 WAP, was marked by the appearance of the first flower. Plants entered the R2-R3 phase at 6 WAP, when the pods began to form. At 7 WAP, the plants entered the R4-R5 phase, marked by the start of pod development and filling. The R6-R8 phase occurred at 9 WAP, during which the seed-filling process occurs until the seeds reach full maturity.

The result indicated that chicken manure had a notable impact on the foliage area per plant, SPAD value, and photosynthesis rate. The dose of 30 tons ha^{-1} chicken manure demonstrated a leaf area per plant and SPAD value. Chicken manure at 20 tons ha^{-1} demonstrated an elevated average value compared to the control in terms of photosynthesis rate (Table 1). The availability of sufficient N and P nutrients in chicken manure enables plants to form larger and healthier leaves, thereby expanding the area for photosynthesis. Higher chlorophyll content and increased leaf area also increase photosynthesis rate, which supports higher growth and yield (Kanu et al., 2022; Subedi et al., 2022; Christina et al., 2024). Research by Utami et al. (2020) showed that applying chicken manure at a rate of 30 tons per hectare significantly increases plant height, leaf number, leaf area, and leaf chlorophyll content in soybean.

Table 1. The impact of chicken manure and NPK on leaf area per plant (LDPT), SPAD value, and photosynthesis rate (LF).

Treatment	LDPT (cm^2) 5 WAP	SPAD value 5 WAP	LF (µmol CO_2 m^{-2} s^{-1}) 6 WAP
Chicken manure (tons ha^{-1})			
0	30.97b	60.59b	21.72c
10	34.04a	70.28a	26.08b
20	37.68a	67.28a	32.24a
30	38.00a	71.35a	32.04a
Pr>F	0.00**	0.00**	1.36**
NPK 16-16-16 (kg ha^{-1})			
0	30.33b	59.75b	24.1b
100	35.64a	70.45a	30.04a
200	37.51a	67.64a	28.69a
300	37.22a	71.62a	29.21a
Pr>F	0.00**	0.00**	0.00**
Interaction	ns	ns	ns

Note: Numbers followed by the same letter in the same column are not significantly different at 5% level based on the DMRT test. * = significant at 5% level; ** = significant at 1% level; ns = not significant.

The application of NPK fertilizer significantly influenced leaf area per plant, the SPAD value, and the photosynthesis rate. The application rate of 300 kg ha^{-1} NPK fertilizer showed a higher average value than the control in terms of the SPAD value and photosynthesis rate; and 200 kg per hectare of NPK showed a higher average than the

control in leaf area per plant (Table 1). This occurs because nitrogen supports the formation of chlorophyll and leaf growth, phosphorus plays a part in the creation of energy and root development, and potassium is vital for maintaining water regulation and enzyme activity, so together they accelerate growth and increase the efficiency of plant photosynthesis (Nwokwu, 2020; Afifi et al., 2016). Research by Murdaningsih and Kramat (2014) demonstrated that using NPK fertilizer at a rate of 500 kg ha^{-1} significantly affected the height of mung bean plants. Additionally, the nitrogen level in NPK fertilizer is crucial in stimulating organs related to photosynthesis, specifically leaves, thereby increasing leaf area and SPAD value.

Application of chicken manure resulted in an increase in plant height as the dose increased (Figure 1). At 7 weeks after planting (WAP), plant height increased from 48.54 cm (control) to 53.28 cm at a dose of 30 tons ha^{-1} of chicken manure. Similarly, at 9 weeks after planting, the height increased from 99.49 cm to 106.31 cm at the highest dose. This increase indicates that chicken manure can provide macronutrients (N, P, K) gradually and continuously, which supports vegetative plant growth. In addition to macronutrients, chicken manure also contains micronutrients and organic matter that are important for the soil. Organic matter content plays a role in improving soil structure, enhancing air retention, and providing a favorable environment for the growth of roots and soil microorganisms (Anwar et al., 2023). Increased organic matter content also contributes to increased cation exchange capacity and water availability in the soil (Mazeika et al., 2020; Du et al., 2020; Liu et al., 2025).

NPK fertilizer application increases plant height. At 7 WAP, plant height increased from 48.13 cm (control) to 53.09 cm with a dose of 300 kg ha^{-1}. At 9 WAP, plant height also increased from 98.98 cm (control) to 103.5 cm with a dose of 300 kg ha^{-1} NPK (Figure 1). NPK provides macronutrients that are quickly available to plants, making it very effective in supporting growth during critical vegetative phases. Nitrogen promotes leaf and stem growth, increases chlorophyll formation, thereby accelerating vegetative growth and photosynthetic efficiency. Phosphorus supports root development, cell division, and energy transfer, which is crucial in the early growth phase for the formation of a strong root system. It assists physiological processes such as photosynthesis, stomatal regulation, and water and nutrient transport, thereby increasing plant resistance to stress and supporting optimal growth (Susanto & Amirta, 2020; Owain, 2024).

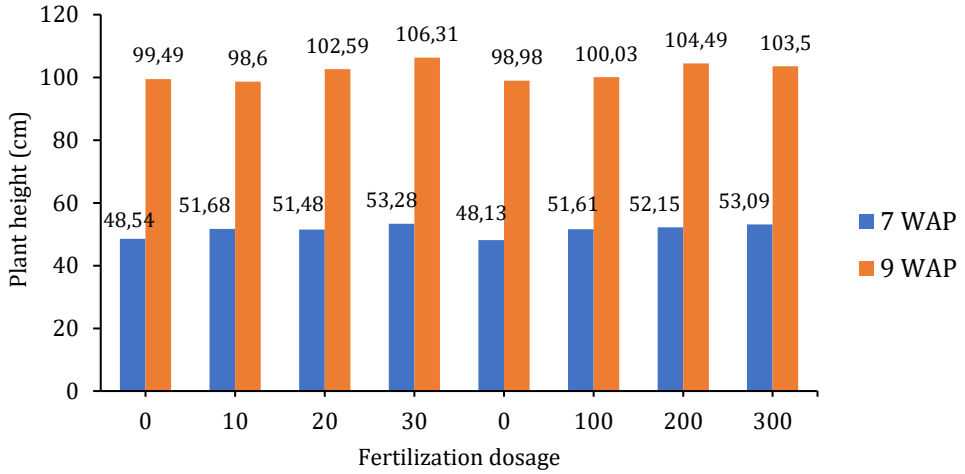

Figure 1. Plant height at 7 and 9 weeks after planting (WAP) with various dosages of chicken manure (0 – 30 tons ha^{-1}) and NPK fertilizer (0 – 300 kg ha^{-1}).

Observations revealed that the application of chicken manure and NPK fertilizer resulted in a higher number of leaves compared to the control (Figure 2). At 7 weeks after planting (WAP), the highest number of plant leaves was obtained from the chicken manure treatment with a dose of 20 tons ha^{-1} (43.2 leaves). Meanwhile, at 9 weeks after planting, the chicken manure treatment with a dose of 30 tons ha^{-1} produced the highest number of leaves (117.8 leaves) (Figure 2). This indicates that chicken manure contains complete nutrients, such as nitrogen, phosphorus, potassium, calcium, and magnesium, as well as a high level of organic matter. The use of chicken manure has been shown to increase soil and plant nutrient content, improve soil structure, and increase the activity of soil microorganisms that play a role in organic matter decomposition and nutrient cycling (Alomari et al., 2024; Azmi et al., 2021).

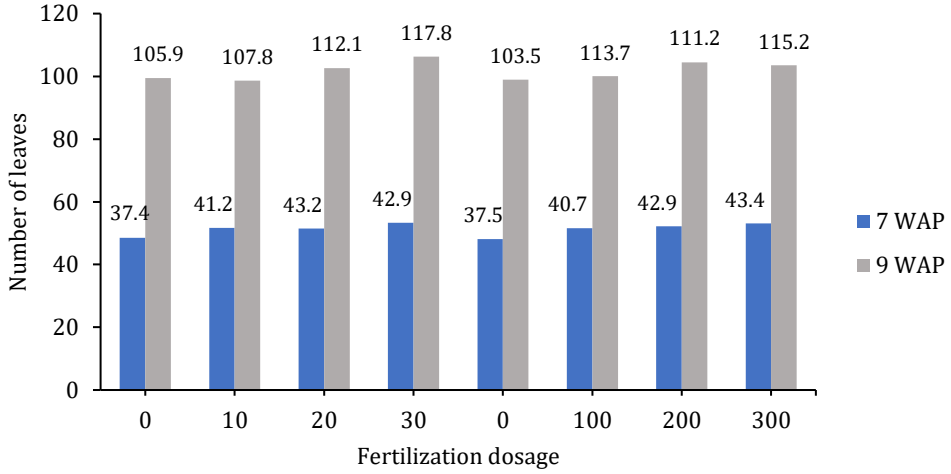

Figure 2. Number of leaves at 7 and 9 weeks after planting with various dosages of chicken manure (0 – 30 tons ha^{-1}) and NPK fertilizer (0 – 300 kg ha^{-1}).

NPK fertilizer application showed a positive effect on leaf number at 7 and 9 WAP (Figure 2). The number of leaves increased with increasing NPK dosage. At 7 WAP, the highest number of leaves (43.4 leaves) was achieved at a dosage of 300 kg ha^{-1}. Then, at 9 WAP, the number of leaves increased from 103.5 leaves to 115.2 leaves. Nitrogen is a primary macronutrient that is essential for plant vegetative growth, including leaf formation. Nitrogen plays a role in the synthesis of protein, chlorophyll, and nucleic acids, which are necessary for optimal leaf growth and development. Application of NPK fertilizer, especially those containing nitrogen, has been shown to increase chlorophyll, soluble sugar, and protein content in leaves, all of which contribute to better leaf growth during the vegetative phase (Liu et al., 2021; Menegatti et al., 2021).

Chicken manure had a considerable impact on the dry weight of the crown, but did not affect the flowering age and the quantity of productive nodes at the age of 6-8 WAP. The use of chicken manure at a rate of 30 tons per hectare resulted in a greater average shoot dry weight than the control (Table 2). This is because the high and balanced nutrient content of chicken manure, especially nitrogen, phosphorus, and potassium, which are very crucial for vegetative expansion and the formation of vegetation biomass. Chicken manure also enhances soil composition, boosts nutrient availability, and stimulates root growth and nutrient absorption, allowing plants to grow more optimally and produce a higher shoot dry weight (Christina et al., 2024; Kanu et al., 2022; Atugwu et al., 2023). Research results (Atugwu et al., 2023; Kanu et al., 2022; Soliman, 2023) showed that administering 30-40 tons per hectare of poultry waste consistently increased the dry weight of the canopy by about the control or lower dose.

NPK application at a rate of 300 kg ha^{-1} expedited the flowering age and increased the shoot's dry weight, but it did not have a significant impact on the quantity of

productive nodes at the age of 6-8 WAP (Table 2). Applying NPK fertilizer at medium to high doses consistently reduced the number of days until the blooming stage in cowpea, allowing the plants to flower earlier than those in the control or low-dose treatments. NPK provides essential nutrients (N, P, and K) that accelerate growth during the vegetative stage and facilitate the transition to the reproductive phase. The increase in the shoot dry weight given NPK fertilizer is due to the availability of sufficient elements like nitrogen (N), phosphorus (P), and potassium (K), which support optimal vegetative development of plants, and the plants form larger crowns and higher dry weight compared to the control (Priyadarsini & Anitha, 2023; Nwokwu, 2020).

Table 2. The impact of chicken manure and NPK on flowering age, productive node, and shoot dry weight.

Treatment	Flowering age (DAP)	Productive node number			Shoot dry weight (g)
		6 WAP	7 WAP	8 WAP	
Chicken manure (tons ha^{-1})					
0	42.17	3.7	4.7	5.7	97.94b
10	42.50	3.8	4.8	5.8	132.08a
20	42.17	4.0	5.0	6.0	150.24a
30	42.25	3.9	4.9	5.9	159.67a
Pr>F	ns	ns	ns	ns	0.00**
NPK 16-16-16 (kg ha^{-1})					
0	43.16a	3.8	4.8	5.7	99.97b
100	43.00a	3.8	4.8	5.8	144.56a
200	41.83b	3.9	4.9	5.9	139.10a
300	41.08c	3.9	4.9	5.9	156.29a
Pr>F	0.08**	ns	ns	ns	0.00**
Interaction	ns	ns	ns	ns	ns

Note: Numbers followed by the same letter in the same column are not significantly different at 5% level based on the DMRT test. * = significant at 5% level; ** = significant at 1% level; ns = not significant; DAP = days after planting

The mixture of chicken manure and NPK fertilizer significantly affects the quantity of productive nodes at the age of 9 WAP. The mixture that excludes chicken manure and NPK fertilizer, along with the combination without chicken fertilizer and NPK at 100 kg ha^{-1}, yielded an average number of productive nodes at 9 MST, which was lower than the other treatment combinations (Table 3). This occurs because neither provides enough essential nutrients for plants. Without chicken manure, the soil lacks organic matter and macro- and micro-nutrients necessary for vegetative and generative plant growth. Meanwhile, the provision of 100 kg ha^{-1} NPK alone, without additional organic fertilizer, is also not optimal enough to increase productivity, because inorganic fertilizers alone cannot improve soil structure and nutrient availability sustainably (Aldal'in & Alhrout, 2016). Soliman's (2023) study found that the combination of chicken manure, biofertilizer, and NPK on two varieties of cowpea significantly increased vegetative characteristics, including the leaf quantity, plant height, stalk number, root nodule quantity, and plant weight, compared to the control. The interaction between fertilizer made of organic materials and NPK provided the best growth results.

Table 3. The interaction between chicken manure and NPK fertilizer on the productive node at 9 WAP.

Chicken manure (tons ha^{-1})	NPK fertilizer 16:16:16 (kg ha^{-1})			
	0	100	200	300
0	6.7c	7.5b	8.4a	8.3ab
10	8.3ab	8.2ab	8.1ab	8.3ab
20	8.6a	8.1ab	8.5a	8.4a
30	8.5a	8.4a	8.7a	8.5a

Note: Numbers followed by the same letter are not significantly different at 5% level based on the DMRT test. * = significant at 5% level; ** = significant at 1% level; ns = not significant.

Yield components

Observations were conducted over three harvests, when the plants had entered the R8 phase, characterized by almost all the pods having dried and turned brown, and the seeds having hardened and being ready for harvest. Chicken manure had a notable impact on the quantity of pods per plant, as well as the weight of pods per plant, and the number of seeds for each plant, although it did not influence the weight of 100 seeds, nor did it change the quantity of wrinkled seeds per plant, and the number of damaged seeds per plant. The application of 30 tons ha^{-1} of chicken manure resulted in a greater average value compared to the lower control in terms of the pod number per plant, pod weight per plant, and the number of seeds per plant (Table 4). This indicates that the more chicken manure is applied, the looser the soil will be, the higher the nutrient levels will be, and the greater the absorption of plant roots will be; as a result, it will also increase the presence of N, P, and K elements in plants, leading to improved plant growth. The quantity of pods will rise, as will the weight of pods for each plant (Fathu et al., 2020). The study by Kanu et al. (2022) indicated that the supply of 8 tons ha^{-1} chicken manure enhanced the development and yield of cowpea vegetation compared to no fertilizer application. Oktavianti et al. (2017) also showed that the 10 and 30 tons ha^{-1} chicken manure applications resulted in an increased quantity of seeds per plant compared to the 20 tons ha^{-1} dose and control.

Table 4. The impact of chicken manure and NPK on the quantity of pods per plant (JPPT), weight of pods per plant (BPPT), number of seeds per plant (JBPT), and the weight of 100 seeds.

Treatment	JPPT	BPPT (g)	JBPT	Weight of 100 seeds (g)
Chicken manure (tons ha^{-1})				
0	53.2c	102.73c	375.6c	11.55
10	62.6b	130.44b	426.5ab	12.38
20	64.9b	132.57ab	419.6b	12.42
30	75.4a	144.81a	457.7a	13.02
Pr>F	7.94**	6.21**	0.00**	ns
NPK 16-16-16 (kg ha^{-1})				
0	51.1c	105.98b	381.5b	11.90
100	64.7b	132.97a	428.6a	12.37
200	67.0b	130.11a	430.4a	12.29
300	73.3a	141.48a	438.9a	12.80
Pr>F	4.83**	7.44**	0.00**	ns
Interaction	ns	ns	ns	ns

Note: Numbers followed by the same letter in the same column are not significantly different at 5% level based on the DMRT test. * = significant at 5% level; ** = significant at 1% level; ns = not significant.

Applying NPK fertilizer increased the pod number per plant, the weight of each pod per plant, and the number of seeds per plant. The NPK dose of 300 kg ha^{-1} yielded a higher average value than the control in terms of the quantity of pods per plant, the weight of pods per plant, and the count of seeds per plant (Table 4). These micronutrients are crucial for the vegetative and reproductive growth of plants. Nitrogen plays a vital role in promoting optimal tissue and leaf growth, thereby supporting photosynthesis and the development of flowers and pods. Phosphorus plays a vital role in the development of roots and the formation of flowers, whereas potassium contributes to seed filling and the formation of healthy pods. Combining these three elements in a balanced way increases growth and yield factors, including the quantity of pods, pod mass, and the number of seeds per plant (Pushpa et al., 2022; Afifi et al., 2016). The research results by Rabani et al. (2022) demonstrated that the use of NPK fertilizer enhanced both the pod number per plant and the weight of pods in cowpea plants. The percentage of whole seeds in the control chicken manure treatment was 56.74%, 10 tons ha^{-1} (57.56%), 20 tons ha^{-1} (55.72%), and 30 tons ha^{-1} (59.58%). In the control NPK treatment (54.36), 100 kg ha^{-1} (57.0), 200 kg ha^{-1} (59.77), and 300 kg ha^{-1} (58.4) (Table 4).

Chicken manure treatment significantly affected seed weight for each plant, as well as the yield of seed tons per hectare (Table 5). This chicken manure is rich in essential nutrients, including nitrogen (N), phosphorus (P), and potassium (K), which are essential for plant growth and yield formation. Chicken manure also enhances the soil's structure, boosts its capacity to retain water, and improves soil microorganism activity, enabling plants to utilize nutrients in a more efficient manner. This increases vegetative growth, such as height of the plant, leaf count, and branch quantity, total pod number, weight of seeds, and overall yield of the harvest), increased (Magalhaes et al., 2020; Bhargavi et al., 2022; Kanu et al., 2022). The use of chicken manure enhances the growth and productivity of long bean plants (Bulan et al., 2020). The application of chicken manure at a rate of 30 tons per hectare produced the best outcomes for bean plants (Yuniati & Purnama, 2023).

NPK fertilizer increased seed weight per plant and seed production tons per hectare compared to the control (Table 5). This is because NPK provides essential nutrients that plants need for optimal vegetative and generative growth. Nitrogen is essential for the synthesis of chlorophyll and vegetative growth, enabling plants to be healthier and produce more pods and seeds. Phosphorus supports root development and flower and seed formation, increasing the pod number and seeds and their weight. Potassium helps in the seed-filling process and increases the efficiency of water use and plant resistance to stress, so that seed yields per plant and plot increase (Nwokwu, 2020; Emmanuel et al., 2022; Afifi et al., 2016). Nwokwu's study (2020) showed that a 150 kg ha^{-1} NPK fertilizer treatment increased the development and productivity of cowpeas.

The findings showed that treating chicken manure 30 tons ha^{-1} produced seed production of 3.64±0.07 tons ha^{-1}, while NPK fertilizer produced 3.38±0.07 tons ha^{-1} (Table 5). These results have not fully reached the productivity range of the Albina IPB variety of 3.88-4.69 tons ha^{-1}. Still, the value is quite close to the lower limit of the variety's potential yield (Gustiningsih et al., 2023).

Table 5. The impact of chicken manure and NPK on wrinkled seed numbers per plant (JBKPT), damaged seed numbers per plant (JBRPT), seed weight per plant, and seed yield tons ha^{-1}.

Treatment	JBKPT	JBRPT	Seed weight per plant (g)	Seed yield (tons ha^{-1})
Chicken manure (tons ha^{-1})				
0	40.2	122.3	73.43c	2.50c
10	49.5	131.5	88.06b	3.02b
20	42.9	142.9	92.97b	3.18b
30	39.5	145.5	101.67a	3.64a
Pr>F	ns	ns	1.01**	0.06**
NPK 16-16-16 (kg ha^{-1})				
0	40.2	134.0	72.56c	2.47b
100	43.9	140.4	91.23b	3.13a
200	42.0	131.2	101.71a	3.36a
300	46.0	136.6	95.63ab	3.38a
Pr>F	ns	ns	4.90**	0.06**
Interaction	ns	ns	ns	ns

Note: Numbers followed by the same letter in the same column are not significantly different at 5% level based on the DMRT test. * = significant at 5% level; ** = significant at 1% level; ns = not significant.

CONCLUSIONS

The productive node number increased at 9 WAP when chicken manure was applied at 10-30 tons ha^{-1} and NPK was applied more than 100 kg ha^{-1}. Chicken manure treatment increased the development and productivity of cowpea plants on the Albina IPB variety. A quantity of 30 tons per hectare of chicken manure led to a higher average seed yield of 3.64 tons ha^{-1}. The application of NPK fertilizer enhanced the growth and yield of cowpea plants. A dosage of 300 kg ha^{-1} of NPK demonstrated a higher average seed yield of 3.38 tons ha^{-1}. Farmers are advised to adopt integrated fertilization for optimal yields. These

results can form the basis for policies promoting the balanced use of organic and inorganic fertilizers in legume cultivation.

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