Managing Agricultural Practice and Community Engagement Journal
MAPACE

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Growth Response And Production Of Pakchoy Plants To Chicken Manure Application

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Submitted:
27/04/2026
Revision:
30/04/2026
Accepted:
09/05/2026
Published:
22/06/2026

DOI:
https://doi.org/10.29244/mapace.1.2.59-65

Keywords:
Brassica rapa L., farming feasibility, pakchoy, chicken manure

ABSTRACT

Pakchoy productivity in Indonesia remains low and has not balanced the steadily increasing market demand. This study aims to analyze the effect of chicken manure application on the growth and yield of pakchoy (*Brassica rapa* L.) and the feasibility of farming at Persada Farm, Bogor. The research method used a Randomized Complete Block Design (RCBD) with two treatments: control (P0) and chicken manure application of 10 kg/plot (P1). Results showed that chicken manure application significantly improved plant performance. At 5 weeks after planting (WAP), plants with P1 treatment reached an average height of 29.6 cm and 12.6 leaves, far surpassing P0 which only reached 21.6 cm and 8.6 leaves. Harvest weight per plant in P1 (250 g) reached double that of P0 (120 g). Farming analysis showed an R/C ratio of 1.71 with a total net profit of Rp828,000 from an 8 m² area over 35 days. In conclusion, the use of chicken manure is highly effective in increasing harvest quantity and quality (Grade A) and is economically feasible for development.

INTRODUCTION

Pakchoy (*Brassica rapa* L.) is an important vegetable commodity in Indonesia with high development potential to meet public nutritional needs. However, 2023 data from the Central Bureau of Statistics (BPS) shows an imbalance between production at 686,876 tons and increasing market demand, resulting in an import dependency of 15.62 tons. The low average national productivity of only 9.93 t/ha demands intensification efforts through more effective, efficient, and sustainable cultivation methods to support national food security.

Farmers have long been highly dependent on chemical fertilizers due to their ability to provide rapid plant responses. However, continuous use of chemical inputs has proven to negatively impact agricultural ecosystems, such as decreasing organic matter levels, soil acidification, and degrading soil microbial activity. As a solution, chicken manure offers advantages through complete macronutrient content and the ability to naturally improve the physical, chemical, and biological properties of the soil, while also reducing production costs by up to 40% compared to inorganic fertilizers (Sianipar et al., 2020).

Based on these issues, this research was conducted to evaluate the effectiveness of chicken manure application in increasing the vegetative growth and yield of pakchoy plants. In addition to agronomic aspects, this study focuses on farming feasibility analysis to compare cost efficiency and income between the use of organic fertilizer and the control. The results are expected to provide practical recommendations for farmers to implement environmentally friendly pakchoy cultivation systems that maintain high economic value.

RESEARCH METHODS

Time and Location

The research was conducted at Persada Farm, Bogor City, West Java, from June 15 to July 30, 2025.

Tools and Materials

The equipment used in this study included observation forms, hoes, hand weeders, seedling trays, stationery, measuring tapes, and water hoses. The materials consisted of soil, chicken manure, botanical pesticides, water, and pakchoy seeds (*Brassica rapa* L.) of the Nauli F1 variety.

Observation and Data Collection

Observations were made on *Brassica rapa* L. plant samples to evaluate the effectiveness of chicken manure application. Growth parameters observed included plant height (cm) and number of leaves (strands), recorded weekly starting from 2 weeks after planting (2 WAP). Additionally, environmental conditions such as pest attack intensity and weed presence were monitored to ensure optimal cultivation. At the end of the period, total plant fresh weight (g) was measured at harvest to assess total biomass accumulation and determine the technical feasibility of the organic cultivation method.

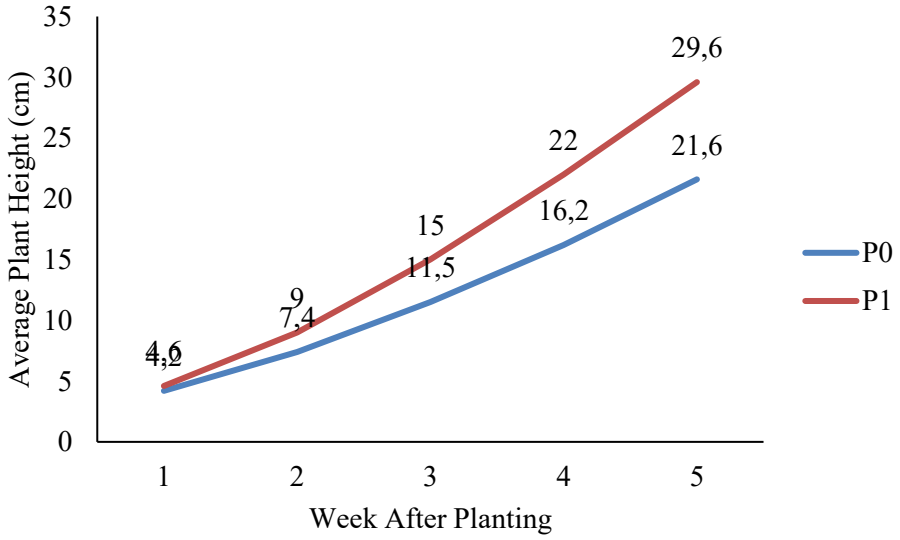
Data Analysis

Data and information analysis were performed using qualitative and quantitative methods. Quantitative analysis involved systematic numerical data processing using Microsoft Excel to calculate average, minimum, and maximum values. This study was conducted using a Completely Randomized Block Design (RBD) consisting of two treatments: control (P0) and application of chicken manure at a dose of 10 kg/bed (P1). The experiment was conducted on plots or beds measuring 1 meter wide and 8 meters long with a planting distance of 16.7 cm x 20 cm. With these specifications, the plant density in each experimental unit was 240 planting holes. For daily observation purposes, 23 sample plants were taken for each treatment, determined through purposive sampling using the Slovin method with a tolerance limit of 20%. All primary data collected were then processed quantitatively using Microsoft Excel software to calculate descriptive statistics, which included the average value, minimum value, maximum value, and data distribution (standard deviation) to objectively analyze the effect of treatments on bok choy growth and yield. Analyzed data is presented in tables and graphs to facilitate interpretation and comparison with relevant scientific literature.

RESULTS AND DISCUSSION

Plant Height

Observation results showed significant differences in plant height. P1 treatment showed much more progressive growth compared to P0. Vegetative growth parameters, including plant height, were monitored routinely once a week.



Schemes 1. Average Plant Height

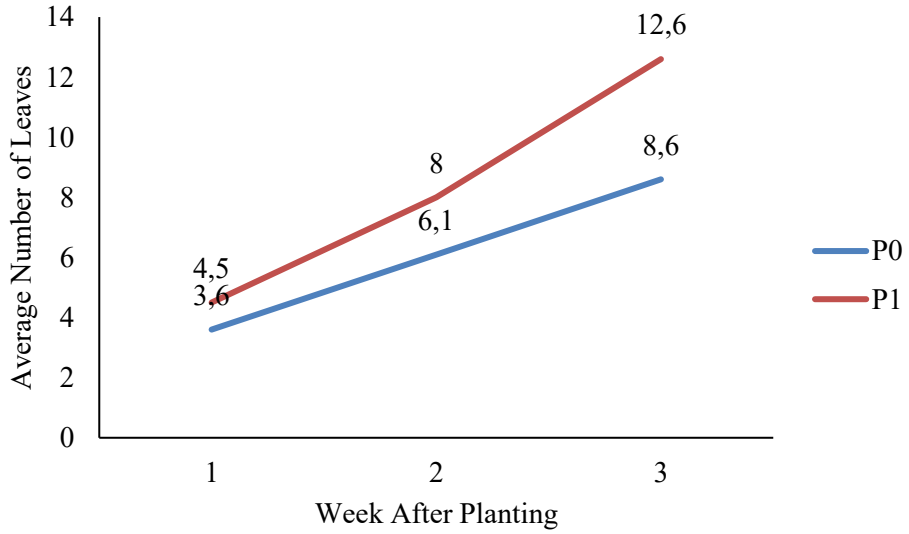
Plant height observations were conducted routinely once a week using a measuring ruler, with the measurement reference point starting from the base of the stem above the medium to the highest point of the leaf blade. The observation phase began at 2 WAP (Weeks After Planting), coinciding with the schedule for transplanting seedlings to the field. The average plant height data for the two treatments P0 (control without chicken manure) and P1 (with chicken manure) are presented in Schemes 1. Average Plant Height.

Based on the observation results, the average height of the pak choi plants showed an increasing pattern each week, though there was a significant performance disparity between the P0 and P1 treatments. In the control treatment (P0), growth tended to be slower as the plants relied solely on the limited natural nutrients available in the soil, resulting in a height of only 21.6 cm by the end of the observation at 5 WAP. Conversely, the P1 treatment showed a much more progressive upward trend in every phase, where the plant height surged to a peak average of 29.6 cm at 5 WAP.

A comparison of the performance between the two treatments shows a height gap that widened sharply as the plants aged, reaching a difference of 8 cm by the final observation (29.6 cm versus 21.6 cm). This phenomenon indicates that macro-nutrients, particularly Nitrogen from the chicken manure, were absorbed optimally to support cell elongation at the plant's apical growing points. The use of organic fertilizer is significantly capable of increasing plant biomass by improving the root environment compared to treatments without organic fertilization. These findings are supported by Sianipar et al. (2020), who confirmed that the addition of organic matter from manure can improve the physical structure of the soil and increase water retention capacity, allowing roots to absorb nutrients more efficiently for conversion into plant biomass. Consistent with this finding, Wedhu et al. (2021) also concluded that organic fertilizer intake is crucial for optimizing vegetative growth and leaf number, which directly increases photosynthetic capacity and final crop weight.

Number of Leaves

Observation results showed significant differences in leaf number parameters. P1 treatment showed much more progressive growth compared to P0. Vegetative growth parameters, including leaf number, were monitored routinely once a week.



Schemes 2. Average Number of Leaves

The observation of leaf count was conducted by examining all fully expanded leaf blades on sample plants. This data collection was carried out routinely once a week during the vegetative growth phase, starting at 2 weeks after planting (WAP). The recapitulation of the average leaf count development is presented in Schemes 2. Average Number of Leaves.

Based on the observation graph, the average leaf count in the control group (P0) exhibited a slow but stable growth rate, influenced by the minimal availability of natural macronutrients in the planting medium, resulting in an average of only 8.6 leaves by 3 WAP. In contrast, the P1 treatment showed a much more progressive performance, with leaf growth peaking at 3 WAP, where plants produced a maximum average of 12.6 leaves per individual.

The difference in leaf formation performance between P0 and P1 was highly conspicuous and continued to increase until the end of the observation period, with a margin reaching 4 leaves. This surge in vegetative growth in the P1 treatment proves that the high nitrogen content in chicken manure was responsively absorbed by the roots to stimulate massive new leaf shoots. Such an increase is crucial for optimizing photosynthetic capacity, which ultimately improves the final harvest weight. Increasing the number of leaves is crucial for plants to optimize photosynthetic capacity, ultimately increasing final harvest weight (Wedhu et al., 2021). This aligns with research by Mustaqim et al. (2023), which states that adequate nutrient availability, especially nitrogen, stimulates the growth of denser and wider vegetative organs, thereby increasing overall biomass accumulation. Furthermore, increasing leaf surface area through increasing the number of leaves increases the capture of sunlight necessary for carbohydrate formation through photosynthesis (Yama & Kartiko, 2020).

Production Yield and Quality

Observations on harvest weight parameters showed a significant influence from chicken manure application on pakchoy (Nauli F1) productivity.

Table 1. Harvest Weight of Each Treatment

Harvest Result Without Chicken Manure (P0)	
Harvest Weight (g)	Average Weight of Sample Plants (g)
15.000 g	120 g
Harvest Result With Chicken Manure (P1)	
Harvest Weight (g)	Average Weight of Sample Plants (g)
25.000 g	250 g

The observation of harvest weight parameters indicates a significant influence of chicken manure application on the productivity of Pak Choy (Nauli F1). Based on the data in Table Harvest Result Weight per Treatment, there is a substantial difference in weight between the control plants (P0) and those treated with chicken manure (P1). The total harvest weight for the P1 treatment reached 25,000 g, dominating the production yield with a total weight margin of 10,000 g over the P0 treatment, which produced 15,000 g. This difference in yield quality is even more evident in the average individual plant weight, where the P1 treatment achieved an average of 250 g per plant, more than double the weight of the P0 plants, which averaged only 120 g.

This data objectively proves that chicken manure application is significantly more effective at increasing biomass compared to cultivation methods without organic inputs. The significant increase in plant weight in the P1 group was driven by the ability of chicken manure to improve the physical structure of the soil and provide stable macronutrients, especially nitrogen (N), phosphorus (P), and potassium (K) (Sianipar et al., 2020). The

addition of this organic material has been shown to increase water retention capacity and improve soil structure, allowing the root system to absorb nutrients more efficiently for conversion into plant biomass (Sianipar et al., 2020). Nitrogen plays a crucial role in stimulating vegetative organ growth and cell expansion, resulting in wider, bushier, and thicker, fleshy bok choy leaves (Mustaqim et al., 2023). In terms of quality, this optimal nutrient intake ensures that the majority of the harvest has superior performance and meets premium or Grade A quality criteria (Wedhu et al., 2021).

Overall Harvest Weight

Table 2. Overall Harvest Weight

Overall Harvest Weight	
Harvest Weight (g)	Sample Harvest Weight (g)
40.000 g	11.500 g

Overall, the accumulated harvest weight from the entire observation area reached 40,000 g (40 kg). The P1 treatment dominated the production yield with a total weight difference of 10,000 g over P0. The disparity in quality was even more evident in the average individual plant weight, where P1 reached 250 g more than double the weight of P0 plants, which averaged only 120 g. This data objectively proves that the application of chicken manure is significantly more effective in increasing biomass compared to cultivation methods without additional organic inputs.

The significant weight increase in the P1 group was triggered by the ability of chicken manure to improve soil physical structure and provide stable macronutrients, particularly Nitrogen (N), Phosphorus (P), and Potassium (K). Nitrogen plays a crucial role in stimulating vegetative organ growth and cell enlargement, resulting in pak choi leaves in the P1 treatment growing wider, lusher, and thicker (Mustaqim et al., 2023). Conversely, in the P0 group, limited nutrient intake prevented the plants from reaching their maximum growth potential, causing them to remain stunted.

In terms of yield quality, plants in the P1 treatment showed superior performance, with the majority of the harvest meeting Grade A criteria. Prominent physical characteristics included fresh green leaf blades, wide oval shapes, a crunchy texture, and freedom from physical damage. This premium quality offers higher market value compared to the P0 yields, which fell mostly into the Grade B category. Grade B results were characterized by non-uniform crop sizes and evidence of Pest Attack (OPT), such as armyworms or aphids. Thus, the use of chicken manure is proven effective in increasing both the quantity and quality of the harvest at Persada Farm, thereby maximizing the percentage of Grade A qualifications which hold higher economic value.

Farming Analysis

Based on a total production cost of Rp1,172,000 and revenue of Rp2,000,000, the analysis is as follows:

$$\text{R/C} = \frac{\text{Rp. } 2.000.000}{\text{Rp. } 1.172.000} = 1{,}71$$

$$\text{BEP (Rp)} = \frac{\text{Rp. } 1.172.000}{40 \text{ kg}} = \text{Rp. } 29.300/\text{kg}$$

The total revenue from 40 kg of pakchoy sold at Rp50,000/kg (Rp10,000 per 200g) was Rp2,000,000. The R/C ratio of 1.71 indicates that every Rp1 invested yields a return of Rp1.71. A value of R/C > 1 shows the business is feasible and profitable. With an actual selling price of Rp50,000/kg against a BEP of Rp29,300/kg, there is a significant margin confirming the economic efficiency of chicken manure.

CONCLUSION

Chicken manure application significantly increases the fertility and productivity of pakchoy. Treated plants grew taller and fuller, reaching 250g compared to 120g for unfertilized plants. Economically, this organic cultivation is highly feasible, generating a net profit of Rp828,000 from an 8 m² plot in 35 days.

ACKNOWLEDGMENTS

The author would like to thank Mr. Tri Budiarto, S.KPm., M.Si and Mrs. Ririh Sekar Mardisiwi, S.P., M.Si as supervising lecturers, as well as Persada Farm for the facilities and guidance during the Field Work Practice.

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