Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

The Effect of Different Doses of Compost and Urea Fertilizer on the Growth of Pak Choi (*Brassica rapa* L.)

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Received: June 5, 2025. Accepted: October 17, 2025. Published: December 17, 2025

Abstract: Pak Choi is a widely cultivated plant species in Indonesia. To grow optimally, Pak Choi requires a growing medium containing sufficient nutrients. To ensure adequate nutrient levels in the growing medium, fertilization is necessary. Research on the effect of compost and urea fertilizer applications on Pak Choi growth was conducted from March to June 2025. This study aims to analyze the vegetative growth of Pak Choi after being given compost and urea fertilizer treatments. In this study, a completely randomized design with 2 factors was used. The compost application was 0 kg, 0.8 kg, 1.6 kg, and 2,4 kg for 8 kg of soil in a polybag. The urea fertilizer treatment was 0 grams, 0.5 grams, 1 gram, and 1.5 grams for each plant. Each treatment combination was performed with three replications. The results showed that the compost treatment had a significant effect on the fresh weight, number of leaves, plant height, and leaf length of Pok choy. The application of urea fertilizer can increase the fresh weight, number of leaves, plant height, and leaf length of Pak Choi. The interaction between compost and urea fertilizer had no significant effect on fresh weight, leaf number, plant height, or leaf length. The optimal dose of compost was 1.2 kg. The 1.5-gram urea fertilizer treatment resulted in better growth than the other doses.

Keywords: Compost; Pak Choi Growth; Urea Fertilizer.

Introduction

Pak Choi is a seasonal vegetable widely cultivated in Indonesia. Pak Choi is widely cultivated for its high nutritional value. Pak Choi contains vitamin A, which is essential for eye health, vitamin E, an antioxidant that protects cells, and vitamin K, which plays a role in blood clotting and the prevention of heart disease. Pak Choi also contains folate, which helps prevent brain and spinal abnormalities [1].

When cultivating Pak Choi, the availability of nutrients in agricultural land is crucial. Increasing nutrient availability can be achieved by applying fertilizers, both organic and inorganic. Currently, Indonesians tend to use inorganic fertilizers because they are readily available and their effects on plant growth can be observed quickly. Long-term application of chemical fertilizers has negative environmental impacts. The minerals contained in chemical fertilizers can kill microorganisms that play a role in the decomposition of organic matter in the soil, thus depriving the soil of nutrients to support plant growth [2]. Therefore, the use of chemical fertilizers should be limited by using them in conjunction with organic fertilizers.

Compost is an organic fertilizer that can be used to stimulate plant growth. Compost contains carbon = 25.13% - 32.74%, Nitrogen = 1.55% - 1.94%, Phosphorus = 0.27% - 0.40%, Potassium = 0.45% - 0.96% [3]. Furthermore, compost contains organic C = 22.05 - 22.51%, total Phosphorus = 0.81%, total Nitrogen = 0.73%, and total Potassium = 0.51% [4]. Thus, compost is one of the good organic fertilizers for use on agricultural land.

The use of compost can improve plant growth. Cow manure compost treatment can increase plant height, leaf length and fresh weight of green eggplant fruit. The combination of 0.5 grams of urea fertilizer and 1.5 kg of cow manure compost resulted in better green eggplant growth compared to other treatments [5]. The application of compost had a significant effect on the growth of *Setaria sphacelata*. S. The best dose that can affect the growth of *Setaria sphacelata*. S is 375 g for one plant which can be seen from the growth of plant height = 45.07 cm, number of tillers = 4.97 stems, number of leaves = 20.63 strands, fresh weight = 575.00 grams and dry weight = 31.00 grams [6].

Referring to the description above, research has been conducted on the effect of different doses of compost and urea fertilizer on the growth of Pak Choi. This study aimed to analyze the physiological effects of urea fertilizer, compost, and the interaction between urea and compost on the vegetative growth of Pak Choi. Furthermore, this study aimed to determine the optimal doses of urea and compost for bok choy cultivation.

Research methods

Research Stages

The stages of this research are: (1) making compost using cow dung, bran, and husks as the basic ingredients, (2) cleaning up trash and weeds in the experimental area, (3) adding 6 kg of paddy soil to each polybag, (4) adding compost to the planting medium in the polybag according to the treatment dosage, (5) planting Pak Choi in each polybag, (6) adding urea fertilizer to each polybag

How to Cite:
I. W. Merta and A. Raksun, "The Effect of Different Doses of Compost and Urea Fertilizer on the Growth of Pak Choi (Brassica rapa L.)", *J. Pijar.MIPA*, vol. 20, no. 7, pp. 1386–1390, Dec. 2025. https://doi.org/10.29303/jpm.v20i7.7543

according to the treatment dosage, (7) watering the Pak Choi regularly once every 2 days, (8) measuring plant growth parameters, (9) analyzing research data.

Tools and Materials

This research used various materials, including compost made from cow faeces, Pak Choi seeds, urea fertilizer, polybags, well water, label paper, sacks, and paddy soil. Furthermore, the equipment used included a sickle, a hoe, a measuring cup, an analytical balance, a hand scale, a knife, a tape measure, and scissors.

Research Design

This study used a completely randomized design with two factors. The first factor was the compost treatment, consisting of four levels: E0 (0 kg), E1 (0.8 kg), E2 (1.6 kg), and E3 (2.4 kg) per polybag. The second factor was the application of urea fertilizer, consisting of four levels: F0 = 0 g, F1 = 0.5 g, F2 = 1.0 g, and F3 = 1.5 g of urea fertilizer per plant. The compost and urea fertilizer applications were replicated three times, resulting in 48 experimental units. The compost treatment was applied 7 days before planting. The urea fertilizer treatment was applied 14 and 22 days after planting by dissolving it in 100 ml of water. Research data, including plant height, number of leaves, leaf length, and fresh weight, were analyzed using descriptive statistics [7].

Results and Discussion

Plant Height

Plant height was measured 30 days after the plants were planted. The average plant height data in Table 1 shows variation due to compost and urea fertilizer treatments. The maximum plant height of 26 cm was observed in the treatment of 1.6 kg of compost combined with 1.5 g of urea fertilizer. Furthermore, the minimum plant height of 18 cm was found in the treatment of 0 grams of urea fertilizer combined with 0 kg of compost.

Table 1. The average height of Pak Choi due to compost and urea fertilizer treatment.

Treatment Combination	Plant Height (cm)	Treatment Combination	Plant Height (cm)
E0F0	18	E2F0	20
E0F1	19	E2F1	20
E0F2	20	E2F2	21
E0F3	20	E2F3	20
E1F0	19	E3F0	23
E1F1	20	E3F1	24
E1F2	21	E3F2	26
E1F3	20	E3F3	25

Anova results show that the use of compost and urea fertilizer can increase the height of Pak Choi. The interaction between compost and urea fertilizer applications did not significantly affect the height of Pak Choi. The increase in Pak Choi height due to compost treatment occurs because compost is an organic fertilizer rich in nutrients needed by plants. The levels of N, P, and K in compost are N = 1.0%, P = 0.23%, and K = 0.52%. The nutrient content of compost meets the SNI 19-7030-2004 standard, namely N = 0.40%, P = 0.10%, and K = 0.20% [8].

The increase in plant height after urea fertilizer treatment is possible because nitrogen is a basic component of protein needed to build chlorophyll, which is essential for photosynthesis. Nitrogen, absorbed by plants from the soil, is necessary for the formation of nucleic acids in the nucleus. Nucleic acids play a crucial role in cell division, which is essential for plant growth, including leaf cell division, ultimately leading to leaf elongation [9].

In other plants, it has also been reported that urea fertilizer treatment can increase plant height. Urea fertilizer treatment can increase stem height and the number of rice tillers [10]. Urea fertilizer application has a significant effect on plant height. The optimal dose is 6 kg per bed, resulting in a plant height of 12.78 cm [11]. Urea fertilizer application has a significant effect on plant height, number of branches, fresh leaf weight per plant, dry leaf weight per plant, and root volume of Mint (Mentha piperita L.) [12].

Leaf Length

Pak Choi leaf length showed variation due to compost and urea fertilizer application. Table 2 shows that the maximum average leaf length measured was 22 cm, observed in the combination treatment of 1.6 kg compost and 1.5 g urea fertilizer. The lowest average leaf length, 14 cm, was observed in the treatment of 0 g urea fertilizer and 0 g compost.

Table 2. Average Leaf Length of Pak Choi due to compost and urea fertilizer treatment.

Treatment Combination	Leaf Length (cm)	Treatment Combination	Leaf Length (cm)
E0F0	14	E2F0	17
E0F1	15	E2F1	17
E0F2	15	E2F2	18
E0F3	15	E2F3	18
E1F0	16	E3F0	20
E1F1	16	E3F1	20
E1F2	17	E3F2	22
E1F3	16	E3F3	21

The results of data analysis showed that compost treatment caused an increase in the length of Pak Choi leaves. NPK fertilizer treatment had a significant effect on the length of Pak Choi leaves. The interaction of compost and urea fertilizer treatments did not have a significant effect on influencing the length of Pak Choi leaves. The increased length of Pak Choi leaves resulting from compost treatment was due to the presence of essential nutrients in the compost, which are required for plant physiological processes. Based on the results of chemical analysis of solid compost from four types of raw materials (rice straw, soybean stalks, peanut shells, and household waste) whose production was accelerated using EM4, the compost made from straw raw materials had a total N content of 2.17%, potassium oxide of 2.65%, and phosphorus pentoxide of 2.43% [13]. Compost with soybean stalk raw materials had

a total N content of 2.10%, potassium oxide of 2.29%, and phosphorus pentoxide of 1.93%. Compost made from peanut shells contains 2.42% total nitrogen, 1.69% potassium oxide, and 1.65% phosphorus pentoxide. Household waste compost contains 1.08% total nitrogen, 1.69% potassium oxide, and 1.65% phosphorus pentoxide.

The application of urea fertilizer has a significant effect on increasing the length of Pak Choi leaves. This occurs because urea fertilizer contains nitrogen. Nitrogen plays a crucial role in enhancing the proliferation of microorganisms in the soil and is involved in the formation of nucleic acids and proteins in plant tissue [14]. Nitrogen plays a role in the formation of amino acids, chlorophyll, and other compounds. Therefore, nitrogen is essential for vegetative plant growth, such as leaf growth [15].

Number of leaves

Leaf counts were conducted when the pakchoy was 31 days old. The results showed that the number of Pak Choi leaves varied depending on the dosage of compost and urea applied. The highest average number of leaves was 14, found in the experimental unit with 1.6 kg of compost and 1.5 g of urea. The lowest number of leaves was 10, observed in the experimental unit E0F0. The average leaf count data are presented in Table 3.

Anova results showed an increase in the number of Pak Choi leaves after compost treatment. In other plants, compost application was also found to increase leaf number. Compost treatment increased the number of leaves, fresh weight, and dry weight of Cananga odorata forma genuine seedlings [16]. Compost use increased the number of leaves, stem length, and leaf length of melon [17]. Vermicompost application significantly increased the number of leaves, leaf area, fresh weight, and dry weight of bok choy [18]. Compost treatment made from sago pulp significantly affected the number of leaves and the height of mung beans [19]. Compost treatment increased the number of leaves, leaf length, and stem height of spinach [20].

Table 3. Average Number of Pakchoy Leaves Due to Compost and Urea Fertilizer Treatments

Treatment Combination	Leaf Length (cm)	Treatment Combination	Leaf Length (cm)
E0F0	10	E2F0	12
E0F1	10	E2F1	12
E0F2	11	E2F2	13
E0F3	11	E2F3	13
E1F0	11	E3F0	12
E1F1	12	E3F1	12
E1F2	12	E3F2	14
E1F3	13	E3F3	13

Urea fertilizer application can also improve bok choy growth. Similar results have been obtained for other crops as well. Applying up to 200 kg of urea fertilizer per hectare of land can increase the growth and production of odot grass [21]. Different doses of urea significantly affected plant height, branching rate, flower number, fruit number, fruit weight, fruit length, fruit volume, and plant dry weight. Combinations of cow manure, goat manure, and chicken manure, each with a urea dose of 200 kg per hectare, resulted in higher chili growth and yield than combinations of these manures with other urea doses [22].

Pakchoy Wet Weight

The wet weight of Pak Choi measured 34 days after planting varied among experimental units. Table 4 shows that the combination of 0 grams of compost and 0 grams of urea fertilizer resulted in a wet weight of 112 grams. Furthermore, the combination of 1.5 grams of urea fertilizer and 1.6 kg of compost resulted in a wet weight of 132 g.

Table 4. Average Fresh Weight of Pak Choi Due to Compost and Urea Fertilizer Treatments

Treatment Combination	Fresh Weight (g)	Treatment Combination	Fresh Weight (g)
E0F0	112	E2F0	118
E0F1	114	E2F1	119
E0F2	114	E2F2	130
E0F3	115	E2F3	130
E1F0	115	E3F0	132
E1F1	116	E3F1	135
E1F2	118	E3F2	132
E1F3	118	E3F3	138

The results showed that compost application can increase the fresh weight of Pak Choi stems and leaves. The increase in fresh weight due to compost treatment was also found in other plants. Compost treatment significantly affected the fresh weight and number of shallot bulbs [23]. The combination of Trichoderma fungi, endomycorrhizae, and compost fertilizer showed a significant effect on the fresh weight of plants, plant height, number of leaf stalk branches, dry weight of plants, and dry weight of roots of sengon seedlings compared to the control [24]. The application of compost made from water hyacinth waste significantly affected the fresh weight, number of leaves, plant height, and dry weight of cayenne pepper [25].

Urea fertilizer treatment can increase the fresh weight of Pak Choi. Several studies have also found that urea fertilizer treatment significantly affects plant fresh weight. Urea and manure treatments can increase the fresh weight, dry weight, leaf area, and height of corn plants [26]. Urea fertilizer treatment can increase mustard greens production. The highest production was found at 200 ppm [27]. Urea and organic fertilizer treatments can increase fresh weight, flowering age, fruit number, and harvest time of cucumber plants [28].

Conclusion

In a study on the effect of compost and fertilizer dosage on bok choy growth, it was concluded: (1) Compost treatment can increase bok choy vegetative growth, (2) plant height, number of leaves, leaf length, and fresh weight of stems and leaves were significantly different due to differences in compost dosage, (3) The interaction between compost and urea fertilizer treatment had no significant effect on bok choy growth.

Author's Contribution

A. Raksun and I. W. Merta prepared the proposal in November 2024. From March to June 2025, the two authors

conducted the research. Furthermore, from July to August 2025, the two researchers jointly prepared the research article.

Acknowledgements
The research team would like to thank the Rector of Mataram University for facilitating the research. We also thank the community members who assisted with the research, from procuring equipment and materials to preparing the research report.

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