

Effect of Various NPK Fertilizer Doses On the Growth of Two Cucumber (*Cucumis Sativus* L.) Varieties

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ABSTRACT: Cucumber (*Cucumis sativus* L.) is a horticultural commodity with high economic value whose demand continues to increase, yet national production has actually shown a declining trend in recent years due to a reduced harvested area and low land productivity. Efforts to increase production through agricultural intensification, particularly the use of superior varieties and appropriate fertilization, represent a strategy that warrants further study to optimize the growth and yield of cucumber on dryland. This study aimed to determine the effect of NPK Phonska Plus fertilizer applied at various doses on the growth of two superior cucumber varieties, namely Baresta F1 and Semi F1, cultivated on dryland in Central Lombok, West Nusa Tenggara. The study used a nested Randomized Block Design (RBD) consisting of two factors: NPK Phonska Plus fertilizer dose (P) and variety (V). The parameters observed were plant height, number of leaves, and number of branches. The response shown by the fertilizer dose treatments nested within each variety varied with respect to cucumber growth. A fertilizer dose of 400 kg/ha in the Baresta F1 variety produced optimal growth. A fertilizer dose of 600 kg/ha in the Semi F1 variety produced optimal growth.

KEYWORDS: Growth, Cucumber, NPK Phonska Plus, Variety

I. INTRODUCTION

Cucumis sativus L. is one of the vegetable commodities that has long been known and widely favored by the Indonesian public. This plant is widely distributed throughout Indonesia because it grows well in lowland areas and is known for its relatively short production cycle with fairly productive yields. Economically, cucumber is classified as a high-value commodity because of its diverse uses, ranging from fresh consumption as a side dish (lalapan), pickles, and salads, to its use as a raw material in the food, cosmetic, and pharmaceutical industries (Azis *et al.*, 2020). In addition to its economic value, cucumber is also known to contain bioactive compounds beneficial to health, including flavonoids and vitamin C, which act as antioxidants that neutralize free radicals while also supporting the body's defense system. This is reinforced by the findings of Agustin and Gunawan (2019), who identified various active compounds in cucumber extract, including steroids, terpenoids, alkaloids, phenolics, flavonoids, and saponins, which collectively contribute to the plant's pharmacological activity, including antioxidant and antimicrobial effects.

Nevertheless, the considerable economic potential and health benefits of the cucumber plant have not been fully reflected in national production figures, which, according to data from the Central Statistics Agency (BPS), have actually shown a declining trend in recent years. As shown by BPS data, cucumber production has recorded consecutive declines over the past several years. Based on BPS data (2024), national cucumber production declined consistently over the last three years, from 471,941 tons in 2021 to 444,057 tons in 2022 and further declined to 416,728 tons in 2023. This decline in production is thought to be closely related to the reduced harvested area and the low productivity of land used for cucumber cultivation in various regions of Indonesia. This condition indicates that efforts to increase national cucumber production still require serious attention, particularly through the application of appropriate cultivation technology, such as the use of high-yielding superior varieties and fertilization tailored to plant needs.

One approach that can be taken to increase national cucumber production is agricultural intensification, namely by optimizing plant growth through the application of appropriate cultivation technology. Optimal plant growth is a key foundation for achieving high yields, because vegetative growth processes such as leaf, stem, and branch formation directly determine the plant's photosynthetic capacity, which ultimately affects fruit formation and development (Dendi *et al.*, 2019).

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One key factor determining the quality of cucumber plant growth is the availability of sufficient and balanced nutrients in the soil, in which nitrogen (N), phosphorus (P), and potassium (K) play the most crucial roles in supporting metabolic processes and the formation of vegetative organs (Setyorini *et al.*, 2013). In this context, fertilization with compound NPK fertilizer is a practical solution that can be applied to meet the needs of these three macronutrients simultaneously in a single application, making it more efficient and effective than single-nutrient fertilization.

In addition to fertilization, the use of superior varieties with high growth potential and good adaptability to local environmental conditions is also a determining factor for successful cucumber cultivation, because genetic differences between varieties produce different growth responses to the cultivation inputs applied (Balitbangtan, 2015).

Baresta F1 and Semi F1 are two superior hybrid cucumber varieties with high growth and yield potential as well as good adaptability to dryland conditions. The Baresta F1 variety, developed by PT East West Seed Indonesia, has a yield potential of up to 47 tons/ha with a harvest age of around 31–32 days after planting, is resistant to Gemini Virus, and is able to adapt to lowland and mid-altitude areas as well as drought conditions (PT East West Seed Indonesia, 2018).

Meanwhile, the Semi F1 variety, developed by PT Benih Citra Asia, has a yield potential of up to 45 tons/ha, can be harvested around 34 days after planting, is resistant to viral attack, and produces uniformly shaped fruit of good quality (PT Benih Citra Asia, 2025). Although both varieties possess high genetic potential, optimizing their growth and yield still requires appropriate fertilization support, given that soil nutrient availability is often the main limiting factor in dryland cultivation systems. In this regard, NPK Phonska Plus fertilizer, which contains five essential nutrients simultaneously—nitrogen (N), phosphorus (P), potassium (K), sulfur (S), and zinc (Zn)—is considered to have good potential to optimally support the vegetative growth of both cucumber varieties (Pupuk Indonesia, 2020). Based on the foregoing, this study was conducted to examine the effect of NPK Phonska Plus fertilizer applied at various dose levels on the growth of two cucumber varieties, namely Baresta F1 and Semi F1, cultivated on dryland in Central Lombok Regency, West Nusa Tenggara.

II. MATERIALS AND METHODS

A. Research Design and Location

The method used in this study was an experimental method involving field research. The study was conducted using a nested Randomized Block Design (RBD) consisting of two factors: the Phonska Plus fertilizer dose factor (P), consisting of 4 levels—Phonska Plus 0 kg/ha (p0), Phonska Plus 200 kg/ha (p1), Phonska Plus 400 kg/ha (p2), and Phonska Plus 600 kg/ha (p3)—and the variety factor (V), consisting of 2 varieties—Baresta F1 (v1) and Semi F1 (v2). Each treatment combination was replicated 3 times, resulting in 24 experimental units. This study was carried out in Sepakek Village, Pringgarata District, Central Lombok Regency, from May to July 2025.

B. Research Implementation

Land preparation began by clearing the research plots of weeds and crop residues using a sickle and hoe. The soil was loosened with a hoe, and the land was leveled and divided into three blocks with a 100 cm spacing between blocks. A total of 24 experimental plots, each measuring 120 cm × 300 cm, were prepared, so that each block consisted of 8 plots with a 50 cm spacing between plots within a block. After land preparation was completed, composite soil samples were taken from the research site and analyzed to determine total N, available P, available K, and soil pH at the Soil Laboratory of Udayana University.

Cucumber seeds were planted in planting holes 3–4 cm deep made using a dibble stick, with a planting spacing of 50 cm × 80 cm. Each plot consisted of two rows of plants with five plants per row, giving a total of ten plants per plot. Each planting hole was planted with a single seed.

Replanting (gap-filling) was carried out at 7 days after planting (DAP) to replace damaged or non-germinating seeds using reserve seedlings prepared in advance. Watering was carried out once a day in the afternoon, adjusted to soil moisture conditions at the research site, and was discontinued on rainy days.

Fertilization was carried out twice: basal fertilization and treatment fertilization (Phonska Plus). Basal fertilization consisted of organic fertilizer at a dose of 500 kg/ha, applied together with land preparation. Treatment fertilization (Phonska Plus) was applied twice, at 7 and 21 DAP. Fertilizer was applied by dibbling to a depth of 3–4 cm at a distance of 10–15 cm from the plant, after which the dibble hole was covered again with sufficient soil. Harvesting began when the plants were 35 DAP old and was carried out gradually at intervals of 3–4 days, for a total of 10 harvest rounds.

C. Observations

Observations were made according to the established parameters. Sample plants were selected from each experimental unit by taking three plants that grew normally and were located in the middle of the plot. Sample plants were determined from the

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start of observation and did not include border plants, in order to avoid the border effect (Hanafiah, 2014). The observed parameters were as follows:

Plant Height (cm)

Plant height was measured at 7, 14, and 21 days after planting (DAP) using a ruler. Measurements were taken from the base of the stem at the soil surface to the tip of the tallest leaf blade.

Number of Leaves (leaves)

The number of leaves was counted at 7, 14, and 21 days after planting (DAP) by counting all fully opened leaves using a hand counter (manual counting device).

Number of Branches (branches)

The number of branches was counted at plant ages of 7, 14, and 21 DAP; the branches counted were those originating from the main stem of the plant.

III. RESULTS AND DISCUSSION

A. Plant Height (cm)

Table 3.1 Mean Plant Height of 2 Varieties at 4 NPK Fertilizer Doses across Various Observation Ages

Treatment		Plant Height (cm) at Observation Age (DAP)		
		7	14	21
P ₀	V ₁ (Baresta F1)	4.33 a	9.11 a	18.22 a
	V ₂ (Semi F1)	3.22 a	9.67 a	17.22 a
P ₁	V ₁ (Baresta F1)	3.56 a	7.89 a	16.22 a
	V ₂ (Semi F1)	3.89 a	7.78 a	18.67 a
P ₂	V ₁ (Baresta F1)	4.56 a	12.11 a	24.22 a
	V ₂ (Semi F1)	4.22 a	10.45 a	21.44 a
P ₃	V ₁ (Baresta F1)	3.56 a	8.33 a	19.11 a
	V ₂ (Semi F1)	4.11 a	10.33 a	26.33 a

The mean plant height of both cucumber varieties under the various NPK fertilizer dose treatments is presented in Table 3.1. Based on Table 3.1, it can be seen that mean plant height at 7, 14, and 21 DAP did not differ significantly between NPK fertilizer dose treatments (P₀, P₁, P₂, and P₃) or between the tested varieties (Baresta F1 and Semi F1), as indicated by the identical letter notation across all treatment combinations based on the LSD test at the 5% level. Although not statistically significant, the mean values show that the P₂ and P₃ treatments produced relatively greater plant height than P₀ and P₁ at 21 DAP, in both the Baresta F1 and Semi F1 varieties.

In the V₂ (Semi F1) variety, the highest mean plant height was obtained at a fertilizer dose of 600 kg/ha, reaching 26.33 cm. Meanwhile, in the V₁ (Baresta F1) variety, the highest mean plant height was obtained at a dose of 400 kg/ha, reaching 24.22 cm. This difference in growth response is thought to be related to each variety's ability to utilize available nutrients as well as differences in nutrient requirements during the vegetative growth phase.

NPK fertilizer application contributed to increasing the availability of macronutrients, particularly nitrogen (N), phosphorus (P), and potassium (K), which play important roles in supporting plant growth. Among these three nutrients, nitrogen is the most required during the vegetative phase because it serves as the main constituent of amino acids, proteins, enzymes, and chlorophyll. Adequate nitrogen availability increases chlorophyll formation, allowing photosynthesis to proceed more optimally and plant growth to improve. Conversely, nitrogen deficiency can inhibit chlorophyll formation, reduce photosynthetic efficiency, slow plant growth, and potentially reduce yield (Dendi *et al.*, 2019).

B. Number of Leaves (leaves)

Table 3.2 Mean Number of Leaves of 2 Varieties at 4 NPK Fertilizer Doses across Various Observation Ages

Treatment		Number of Leaves (leaves) at Observation Age (DAP)		
		7	14	21
P ₀	V ₁ (Baresta F1)	3.00 a	4.67 a	7.22 a
	V ₂ (Semi F1)	3.00 a	5.11 a	6.78 a

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P ₁	V ₁ (Baresta F1)	3.00 a	4.89 a	6.89 a
	V ₂ (Semi F1)	3.00 a	4.44 a	7.11 a
P ₂	V ₁ (Baresta F1)	3.00 a	5.45 a	7.89 a
	V ₂ (Semi F1)	3.22 a	5.11 a	7.44 a
P ₃	V ₁ (Baresta F1)	3.00 a	4.78 a	6.89 a
	V ₂ (Semi F1)	3.00 a	5.45 a	8.56 a

Table 3.2 shows that the mean number of leaves at 7, 14, and 21 DAP did not differ significantly between NPK fertilizer dose treatments (P₀, P₁, P₂, and P₃) or between the tested varieties (Baresta F1 and Semi F1), as indicated by the identical letter notation across all treatment combinations based on the LSD test at the 5% level.

In the V₂ (Semi F1) variety, the highest mean number of leaves at 21 DAP was obtained at a fertilizer dose of 600 kg/ha, with 8.56 leaves. Meanwhile, in the V₁ (Baresta F1) variety, the highest mean number of leaves was obtained at a fertilizer dose of 400 kg/ha, with 7.89 leaves. These results indicate that higher fertilizer doses do not always produce a greater number of leaves in every variety, since the plant's response to fertilization is influenced by genetic characteristics and each variety's ability to utilize available nutrients.

The increase in the number of leaves observed under these treatments is thought to be related to the availability of macronutrients, especially nitrogen (N), phosphorus (P), and potassium (K), in amounts sufficient to support vegetative plant growth. Nitrogen plays an important role in chlorophyll and tissue formation, thereby increasing photosynthetic activity that supports new leaf formation. Phosphorus functions in the energy transfer process through the ATP and ADP compounds required for cell growth and development, while potassium plays a role in regulating various physiological processes in plants. In addition, increasing plant age allows the continuous formation and development of leaves, so that the number of leaves tends to increase along with plant growth (Dendi *et al.*, 2019).

C. Number of Branches (branches)

Table 3.3 Mean Number of Branches of 2 Varieties at 4 NPK Fertilizer Doses across Various Observation Ages

Treatment		Number of Branches (branches) at Observation Age (DAP)		
		7	14	21
P ₀	V ₁ (Baresta F1)	1.00 a	1.33 a	2.33 a
	V ₂ (Semi F1)	1.00 a	1.56 a	2.00 a
P ₁	V ₁ (Baresta F1)	1.00 a	1.56 a	2.33 a
	V ₂ (Semi F1)	1.00 a	1.56 a	2.45 a
P ₂	V ₁ (Baresta F1)	1.00 a	1.78 a	2.67 a
	V ₂ (Semi F1)	1.11 a	1.56 a	2.45 a
P ₃	V ₁ (Baresta F1)	1.00 a	1.56 a	2.45 a
	V ₂ (Semi F1)	1.00 a	1.67 a	2.45 a

Based on Table 3.3, it can be seen that the mean number of branches at 7, 14, and 21 DAP did not differ significantly between NPK fertilizer dose treatments (P₀, P₁, P₂, and P₃) or between the tested varieties (Baresta F1 and Semi F1) based on the LSD test at the 5% level.

In the V₂ (Semi F1) variety, the highest mean number of branches was obtained at a fertilizer dose of 600 kg/ha, with 2.45 branches per plant. Meanwhile, in the V₁ (Baresta F1) variety, the highest mean number of branches was obtained at a fertilizer dose of 400 kg/ha, with 2.67 branches per plant. The absence of a significant difference in the number of branches across fertilizer doses is thought to be because the plants were still in the early growth phase, so that nutrient requirements could still be met by the nutrients available in the soil. At this stage, the plant's response to additional fertilizer had not yet become fully apparent, as branch growth generally becomes more active as plant age increases and nutrient requirements grow.

In addition, branch formation is also influenced by the genetic factors of the variety and by environmental conditions that support plant growth. These results are consistent with the findings of Pirhat (2025), who reported that the effect of fertilization on plant growth tends to become more evident at 42 DAP, or when the plant approaches the transition from the vegetative to the reproductive growth phase.

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IV. CONCLUSIONS

Based on the results of this study, the following conclusions can be drawn regarding the response of the observed growth variables to the treatments applied:

Fertilizer dose. Within the range of doses tested (0, 200, 400, and 600 kg/ha), NPK Phonska Plus fertilization did not produce a statistically significant effect on plant height, number of leaves, or number of branches at 7, 14, or 21 DAP, in either cucumber variety, based on the LSD test at the 5% level. This indicates that during the early vegetative phase (up to 21 DAP), the naturally high initial soil fertility—particularly the very high available-P status and the high available-K status (Table 1)—was likely still sufficient to support growth, so that additional NPK fertilizer had not yet shown a measurable advantage over the unfertilized control.

Variety × dose interaction (nested response). Although not statistically significantly different, the mean values showed a consistent pattern in which both varieties achieved their highest vegetative performance at different doses. The Baresta F1 (V1) variety achieved the greatest plant height (24.22 cm), the highest number of leaves (7.89 leaves), and the highest number of branches (2.67 branches) at 21 DAP under a dose of 400 kg/ha (P2). Conversely, the Semi F1 (V2) variety achieved the greatest plant height (26.33 cm), the highest number of leaves (8.56 leaves), and the highest number of branches (2.45 branches) at 21 DAP under a dose of 600 kg/ha (P3).

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