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Effect of Branch Pruning and NPK Fertilizer Dosage on Plant Growth and Yield of Baby Cucumber (*Cucumis sativus* L.)

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ABSTRACT

Cucumber (Cucumis sativus L.) is rich in nutrients and vitamins, an is popular for fresh salads and various processed foods. The objective of this work is to study the effects of branch pruning and NPK fertilizer dose on the growth and yield of baby cucumber in order to solve the decrease in cucumber production. The research was executed in Dander Village, Bojonegoro Regency, East Java. The experiment was performed according to a Randomized Block Design with two factors. The first factor is branch pruning, and the second factor is the dose of NPK fertilizer. Branch pruning was carried out in four ways: no pruning, pruning branches at nodes 1–3, nodes 1–4, and nodes 1–5. The NPK fertilizer dose was also applied at four levels: 800, 900, 1,000, and 1,100 kg/ha. The observed parameters included plant length, number of leaves, time to female flower appearance, fruit length, number of fruits per plant, total fruit weight per plant, and fruit weight per hectare. The data were analyzed using analysis of variance (ANOVA) and tested with HSD at 5%. The results showed that the combination of no pruning and the application of 1,100 kg/ha NPK fertilizer produced the best results in terms of fruit weight per hectare.

1. INTRODUCTION

Cucumber (*Cucumis sativus* L.) has high nutritional and vitamin content and is popular for Indonesian people as fresh or processed vegetable. Cucumbers can also be processed into skin care ingredients and herbal drinks with medicinal properties for humans. Nutritional value of cucumbers is quite good with high mineral and vitamin content and good to be consumed as a daily vegetable (Ishak *et al.*, 2019). Every 100 g cucumbers, the nutritional content involves energy 15 cal, protein (0.8 g), starch (0.1 g), carbohydrates (3 g), phosphorus (30 mg), iron (0.5 mg), thiamine (0.02 mg), riboflavin (0.01 mg), malonic acid (14 mg), vitamin A (0.45 IU), vitamin B1 (0.3 IU), and vitamin B2 (0.2 IU).

Cucumber production in Indonesia decreased slightly from 441,286 ton in 2020 to 415.874 ton in 2023 (BPS, 2024). The decrease is resulted from the decline of harvested from 41,016 ha to 40.530 ha during the same period. Another factor contributing to the decrease in cucumber production is that cucumber farming is still considered as side business with less effective cultivation techniques. Several efforts have been made to increase cucumber production, one of which is by pruning branches on cucumber plants. Pruning branches or commonly called pruning is the cutting and removal of branches that grow unwantedly. Pruning on baby cucumber plants is also useful for reducing competition for photosynthate. This stage aims to stimulate the formation of female flowers so that they quickly undergo a fertilization process which can ultimately increase production and often the fruit produced has good quality. Amsar *et al.* (2018) explain that pruning aims to control vegetative growth which can stimulate growth in certain parts and ultimately accelerate generative growth in a plant.

In addition to pruning, there is a fertilization technique that increase the production of baby cucumbers. According to Sabbaha *et al.* (2023), NPK compound fertilizer is one of the inorganic fertilizers that efficiently increases the

availability of macronutrients (N, P, and K) which can replace single fertilizers such as Urea, SP-36, and KCI. Research of Noviana *et al.* (2019) proved that application of NPK fertilizer in cucumber plants improve plant growth (numbers of leaves, female flowers, and plant length), and production (number of fruits, fruit yield, fruit size (length, weight, diameter), as well as hasten the growth process from flowering, fruiting, to the first harvest.

Pruning and fertilization in the cultivation of baby cucumbers are important to increase the amount of production produced. These two techniques can be effective in overcoming problems related to the decrease of cucumber production. This study aims to appraise and prove that the two cultivation techniques (NPK application combined with branch pruning) can increase the growth and yield of baby cucumber in order to determine the best treatment.

2. MATERIALS AND METHODS

This research was executed from January to March 2024 in agricultural land in Dander Village, Bojonegoro Regency, East Java Province. The agricultural land used by the researcher has a temperature of 22-32 °C with an altitude of 250-500 m above sea level with an average rainfall of around 1,500 mm/year. Baby cucumber seeds of the Metavy F1 variety were used in this research. Fertilizer and chemicals included Mutiara NPK fertilizer (16:16:16), manure, Curacron insecticide, and Orondis Opti fungicide.

2.1. Design of Experiment

The experiment was performed using plot trial under factorial Randomized Block Design (RBD). Branch pruning (P) was the first factor involving of four ranks: no pruning (P0), branch pruning at internodes 1-3 (P1), branch pruning at internodes 1-4 (P2), branch pruning at internodes 1-5 (P3). NPK fertilizer (N) was the second factor comprising of four doses: 800 kg/ha = 30 g/plant (N1), 900 kg/ha = 33.7 g/plant (N2), 1,000 kg/ha = 37.5 g/plant (N3), and 1,100 kg/ha = 41.2 g/plant (N4). All treatment combinations were assembled into three groups resulted in 48 experimental plots.

2.2. Cucumber Planting

This research was conducted on soil beds with a plot size of 150 cm length and 100 cm width. The plots were piled with a height of 30 cm and were separated with a space of 100 cm. Basic fertilization was applied 7 days before sowing by providing manure with a dose of 1.5 kg/m^2. This fertilizer was sprinkled on all beds. The seeds were first soaked in water for about 30 min to select the good quality seeds. Good seeds (sunken in the water) were sowed in the soil bed at 3 cm depth. Each hole was filled with two seeds. The planting distance was 40 cm × 70 cm.

The application of NPK fertilizer was applied to the plants six times at the beginning of planting, 14, 21, 28, 35 and 42 DAS (days after sowing). Watering was done daily in the morning or evening depending on field conditions. Weeding is done by pulling weeds using hands. After that, stakes are installed using bamboo or wood with a height of 2 meters as a place for the baby cucumber plants to spread. When the plants have grown and there are branches, pruning is carried out by taking newly grown shoots according to each treatment level, namely without pruning, pruning branches at internodes 1-3, pruning branches at internodes 1-4 and pruning on branches at internodes 1-5. The control of plant pests and diseases (OPT) is carried out mechanically and chemically. Mechanical control involves removing parts of the plant affected by pests or diseases. Chemical control is implemented by applying the insecticide Curacron at the recommended dosage of 1.5 ml/L and the fungicide Orondis Opti at the recommended dosage of 3 ml/L. Baby cucumber harvesting is conducted when the fruit is 8–10 days old after pollination, using a hand-picking method by detaching the fruit stem manually.

In this study, observation variables were divided into vegetative and generative parameters. Vegetative parameters included measuring plant length and number of leaves. Meanwhile, generative parameters include the emergence age of female flowers, fruit length, number of fruits, fruit weight, and total fruit yield per hectare. Data analysis from the results of the experiment was carried out using analysis of variance (ANOVA) according to the experiment design two-factorial RBD, then further evaluation using the Tukey or HSD (Honestly Significant Difference) test was carried out with α level of 5%.

3. RESULTS AND DISCUSSION

3.1. Plant Length (cm)

The results of the ANOVA revealed that interaction treatment of branch pruning combined with the dose of NPK fertilizer are significant to the length of baby cucumber plants at the age of 28, and 42–70 DAP as detailed in Table 1. The interaction is not significant at plant age of 14 and 21 DAP as presented in Table 2. Meanwhile, the single effect of

Table 1. Effect of treatment on the average plant length of baby cucumber at 28, 42–70 DAP (days after planting)

Age (DAP)	NPK Fertilizer Dosage (kg/ha)	Branch Pruning			
		No Pruning	Nodes 1 – 3	Nodes 1 – 4	Nodes 1 – 5
28	800	63.08 a	77.38 ab	75.04 ab	75.21 ab
	900	79.17 ab	88.75 bc	75.13 ab	78.71 ab
	1000	71.38 ab	82.38 bc	89.80 bc	90.04 bc
	1100	75.96 ab	80.21 b	99.09 c	97.88 c
	HSD 5%		16.48		
42	800	220.94 a	228.83 ab	227.39 ab	233.11 ab
	900	240.28 ab	254.78 ab	267.00 bc	269.94 bc
	1000	256.33 ab	242.95 ab	268.61 bc	259.72 b
	1100	249.44 b	249.06 b	288.78 c	292.83 c
	HSD 5%		22.61		
49	800	263.83 a	278.11 ab	269.71 ab	271.00 ab
	900	267.22 a	291.83 b	303.50 b	300.28 ab
	1000	300.28 b	298.78 b	307.33 bc	306.33 bc
	1100	284.89 ab	296.00 b	329.05 c	332.55 c
	HSD 5%		22.83		
56	800	282.83 a	297.67 ab	292.00 ab	294.61 ab
	900	304.17 ab	310.55 b	322.39 b	319.28 b
	1000	319.28 b	317.22 b	326.33 bc	321.22 b
	1100	311.17 b	311.55 b	349.22 c	352.39 c
	HSD 5%		23.41		
63	800	289.83 a	307.50 ab	301.61 ab	304.22 ab
	900	310.33 ab	321.56 b	334.23 b	328.11 b
	1000	327.33 b	313.56 ab	337.00 bc	331.78 b
	1100	327.61 b	330.72 b	358.13 c	358.83 c
	HSD 5%		23.67		
70	800	298.67 a	314.33 ab	308.78 ab	314.67 ab
	900	320.44 ab	330.72 b	339.06 b	336.95 b
	1000	336.05 b	319.22 ab	345.00 bc	339.67 b
	1100	337.00 b	331.78 b	366.78 c	368.00 c
	HSD 5%		23.57		

Note: same letters following mean values in the same DAP and column indicate not significantly different in the HSD 5% test.

Table 2. Effect of treatment on the average plant length of baby cucumber at 14, 21, and 35 DAP

Branch Pruning	Average Plant Length (cm)		
	14 DAP	21 DAP	35 DAP
No Pruning	6.38	16.93	139.79
Nodes 1-3	6.83	19.64	140.18
Nodes 1-4	6.74	22.46	147.91
Nodes 1-5	6.10	19.74	151.48
HSD 5%	ns	ns	ns
NPK Fertilizer Dosage (kg/ha)			
800	6.71	18.65	132.17 a
900	6.59	20.43	147.85 b
1000	6.40	19.42	145.69 b
1100	6.34	20.28	153.66 b
HSD 5%	ns	ns	11.87

Note: same letters following mean values in the same DAP and column indicate not significantly different in the HSD 5% test. ns: not significant.

NPK fertilizer dose treatment was significantly different on the length of baby cucumber plants at the age of 35 DAP. The longest average results were obtained in the combination of pruning treatments of internodes 1-5 with NPK dose of 1,100 kg/ha at the age of 42–70 DAP, namely 292.83 cm, 332.55 cm, 352.39 cm, 358.39 cm, and 368.00 cm, respectively. At the age of 28 DAP the longest average was obtained in the combination of pruning treatments of internodes 1-4 with a dose of fertilizer of 1,100 kg/ha, namely 99.09 cm.

These results can occur because pruning of branches on internodes 1-4 at the age of 28 DAP produces more remaining branches that remain active to support plant metabolism and accelerate plant length growth at the beginning of growth, while pruning of internodes 1-5 reduces the number of active branches so that the growth of the main stem becomes more focused at a later age and makes the plant grow with a different pattern. Meanwhile, the shortest average results at the age of 28, 42-70 DAP were obtained in the combination of treatments without branch pruning and the lowest dose of NPK fertilizer (800 kg/ha), namely 63.08 cm, 220.94 cm, 263.83 cm, 282.83 cm, 289.83 cm, and 298.67 cm, respectively.

From the results above, it shows that the combination of pruning treatments of internodes 1-5 with a dose of NPK fertilizer of 1,100 kg/ha produced the highest results in plant length parameters and could focus the photosynthesis products (photosynthates) and the respiration process on plant growth. This is also influenced by the provision of a high fertilizer dose because the higher the dose of NPK fertilizer, the higher the plant growth. These results are in accordance with Anisuzzaman *et al*. (2021), who explain that the nitrogen element plays a role in compiling chlorophyll in cell division and enlargement in the apical meristem, so that the shoots in the plant will grow taller.

Table 2 shows the single effect of branch pruning treatment and NPK fertilizer dosage on the length of baby cucumber plants at the ages of 14, 21 and 35 DAP. At those ages, branch pruning treatment alone did not significantly affect the plant length of baby cucumber. Meanwhile, the NPK dose was also not significant on the length of baby cucumber. At 35 DAP, however, NPK dose was significant with the highest plant length reached average 153.66 cm with the NPK dose of 1,100 kg/ha, and at 800 kg/ha produced an average plant length of around 132.17 cm. The content of macronutrients, especially N in NPK fertilizers given at high doses, can fully support plant growth. This N element plays a major role in the vegetative growth of plants in baby cucumber plants. This is n accordance with Nugroho (2015) that the N element has an important role in increasing the growth of stems and leaves in plants. It is also strengthened by the statement of Marlina *et al*. (2015), that the element N can facilitate the process of photosynthesis so that it can affect the acceleration of plant length because photosynthesis is used as a source of energy in plants. Not only can it maintain plant life such as roots, stems, and leaves of plants but also accumulated in the growth of seeds and fruits in plants.

3.2. Number of Leaves

The interaction of pruning and NPK dose was significant on the average number of leaves of baby cucumber plants at aged 49 DAP only as detailed in Table 3. Statistical inferences reveals a tendency of decreasing the number of leaves due to number of pruning nodes with the best are recorded at no pruning. This is simply because no pruning plants will have more branch contributing to the total number of leaves. Table 3 also reveals that increasing NPK dose in general improved the number of plant leaves for all pruning methods with highest results recorded at the dose of 1100 kg/ha and the lowest at 800 kg/ha. At NPK dose 1100 kg/ha, the highest number of leaves (110,78) was produced from no pruning treatment which is not statistically different to those of branch pruning of 1–3 and 1–5 nodes. Branch pruning of 1–4 nodes resulted the lower leaves (103.0), but still the highest in the group as compared to those of other doses.

Table 3. Effect of treatment on the average number of leaves of baby cucumber at 49 DAP

Age (DAP)	NPK Fertilizer Dosage (kg/ha)	Branch Pruning			
		No Pruning	Nodes 1–3	Nodes 1–4	Nodes 1–5
49	800	97.00 bc	91.00 ab	90.00 ab	85.45 a
	900	99.11 bc	92.45 b	93.00 b	88.11 ab
	1000	97.33 bc	92.00 ab	92.89 b	91.89 ab
	1100	110.78 d	105.33 cd	103.00 c	106.11 cd
	HSD 5%	6.74			

Note: same letters following mean values in the same pruning method indicate not significantly different in the HSD 5% test.

On the other hand, the single treatment of NPK fertilizer significantly influence the number of leaves of the plants at the age of 35 to 70 DAP, but not significant at 21 and 28 DAP. Meanwhile, the average number of leaves of baby cucumber plants aged 21–70 DAP due to branch pruning treatment and NPK fertilizer dose alone is presented in Table 4. Based on the results above, the combination of treatment without branch pruning and giving an NPK fertilizer dose of 1,100 kg/ha showed the highest results for the number of leaves parameter because these two factors support each other in the vegetative growth of plants. This is because plants have more branches for the production of new leaves, thereby increasing the overall number of leaves. In addition, at high NPK dose, the source of macro nutrients N, P, K, are more available especially the N element which is very important for leaf formation because it plays a role in the synthesis of protein and chlorophyll which supports photosynthesis. In line with the statement of Wijaya *et al*. (2015), that plant growth is not inhibited in plants that are not pruned, thus increasing the number of leaves produced compared to pruned plants. This is in line with Suhastyo & Raditya (2019), that essential macro nutrient especially nitrogen is indeed needed by plants in forming their vegetative organs, namely plant roots, stems, and plant leaves. So if the dose of nitrogen is added, it will affect the increase in plant growth and the number of leaves.

Table 4 shows the effect of single treatment of branch pruning and NPK dose on the average number of leaves of baby cucumber at the age of 21–70 DAP. As a single factor, branch pruning had a significant impact on the number of leaves at the age of 28–63 DAP. No pruning treatment resulted the highest number of leaves all times starting at age of 28 DAP with 17.17 leaves, consistently increases to 133.56 leaves at the age of 70 DAP. The lowest number of leaves was obtained in the treatment of branch pruning of internodes 1–5, namely 13.77 leaves at the age of 28 DAP, 131.33 leaves at the age of 70 DAP. These results show that the treatment without pruning has a significant impact on the number of leaves. This happens because without branch pruning, the number of leaves on the plant is greater because the plant is allowed to grow naturally to gain more branches and leaves.

The single treatment NPK dose also has a significant impact on the number of leaves of baby cucumber plants at the age of 35 - 70 DAP. At the age of 35 DAP, the NPK fertilizer dose of 1,000 kg/ha produces the largest number of leaves, with an average of 48.50 leaves. However, at the age of 42 - 70 DAP, the NPK fertilizer dose of 1,100 kg/ha gives the highest results with an average number of leaves of 77.28 strands at age 42 DAP, 121.00 strands at 56 DAP, 132.68 strands at 63 DAP, and 145.29 strands at 70 DAP. On the other hand, the lowest dose of NPK (800 kg/ha) produced the lowest average number of leaves, namely 46.36 leaves at 35 DAP, 70.29 leaves at 42 DAP, 103.94 leaves at 56 DAP, 114.53 leaves at 63 DAP, and 125.33 leaves at 70 DAP. The results above prove that fertilizing with a dose of 1,100 kg/ha of NPK can improve the amount of leaves of baby cucumber plants compared to other doses. This is due to the increase in the N element contained in NPK fertilizer. The N component shows an essential role in the growth of leaves in baby cucumber, so that when given a dose of 1,100 kg/ha of NPK, baby cucumber plants have the most leaves. This is in accordance with the work of Fiolita *et al.* (2017), that rapid stimulation of plant growth requires a lot of nitrogen nutrients so that stems, branches, and leaves can grow quickly, so that they can help the photosynthesis process which requires the formation of green leaves first and also the formation of proteins, fats, and various organic compounds.

Table 4. Effect of treatment on the average number of leaves of baby cucumber at 21–70 DAP

Treatment	Average Number of Leaves of Baby Cucumber Plants (leaves)						
	21 DAP	28 DAP	35 DAP	42 DAP	56 DAP	63 DAP	70 DAP
Branch Pruning							
No Pruning	3.67	17.17 b	49.22 b	77.44 b	112.31 b	123.03 b	133.56
Nodes 1–3	4.08	14.62 ab	47.08 a	71.88 a	107.92 a	119.31 a	132.31
Nodes 1–4	4.17	16.55 ab	46.94 a	70.56 a	109.22 ab	120.50 a	131.14
Nodes 1–5	3.83	13.77 a	46.53 a	69.72 a	109.25 ab	120.37 a	131.33
HSD 5%	ns	3.04	2.07	2.46	3.12	2.31	ns
NPK Fertilizer Dosage (kg/ha)							
800	3.92	16.35	46.36 a	70.29 a	103.94 a	114.53 a	125.33 a
900	4.00	14.89	46.75 ab	70.45 a	106.03 ab	116.91 b	128.03 b
1000	3.83	14.13	48.50 b	71.57 a	107.72 b	119.11 b	129.58 b
1100	4.00	16.75	48.17 ab	77.28 b	121.00 c	132.68 c	145.39 c
HSD 5%	ns	ns	2.07	2.46	3.12	2.31	2.41

Note: same letters following mean values in the same treatment and same plant age indicate not significant in the HSD 5% test. ns: not significant.

3.3. Female Flower Emergence

The results of the analysis of variance conducted by this researcher showed that the combination of branch pruning treatment accompanied by the administration of NPK fertilizer according to the dosage explained above did not provide a significant interaction on the age of female flower emergence on baby cucumber plants. The single treatment of branch pruning and NPK fertilizer dosage did not significantly affect the age of female flower emergence. The average age of female flower emergence on baby cucumber plants based on the single treatment of branch pruning and NPK fertilizer dosage is portrayed in Table 5. The effect of single treatment of branch pruning and NPK fertilizer dose on the age of female flower emergence in baby cucumber plants. In single treatment, branch pruning did not show a significant effect on the age of female flower emergence. Likewise, single dose of NPK fertilizer also did not have a significant effect on this parameter. This is thought to be caused by factors other than branch pruning and NPK fertilizer that can affect the age of female flower emergence, such as genetic factors, environmental factors (temperature, light, and humidity), and physiological aspects of the plant itself. If these factors are not supportive, then even if branch pruning is carried out, the plant may take longer to flower. In accordance with the statement of Annisa & Gustia (2017), that internal factors and factors outside the plant can affect the flowering phase in plants. Internal factors that affect flowering in plants include phytohormones and genes, while factors outside the plant that can affect flowering in plants include light, humidity, light intensity, temperature and nutrients.

Table 5. Effect of treatment on the female flower emergence (FFE) of baby cucumber

Branch Pruning	FFE (days)
No Pruning	35.82
Nodes 1–3	36.10
Nodes 1–4	34.72
Nodes 1–5	36.39
HSD 5%	not significant

NPK Fertilizer Dose (kg/ha)	FFE (days)
800	34.89
900	35.42
1,000	36.58
1,100	36.24
HSD 5%	not significant

3.4. Fruit Length (cm)

The results of the analysis of variance conducted by this researcher showed that the combination of branch pruning treatment accompanied by the provision of NPK fertilizer at different dosages did not result a significant interaction on the length of the baby cucumber fruit. However, the single treatment of branch pruning had a significant effect on the length of the baby cucumber fruit at harvest weeks 3–5. Meanwhile, the single dose of NPK fertilizer showed a significant impact on the length of the baby cucumber fruit at harvest week 2. The average length of the baby cucumber fruit from week 1 to week 5 based on the single treatment of branch pruning and NPK fertilizer dosage can be seen in Table 6. The effect of a single treatment of branch pruning and the dose of NPK fertilizer on the average fruit length of baby cucumber plants in the 1st–5th week of harvest. In a single treatment, branch pruning shows a real influence on fruit length in the 3rd to 5th week of harvest. As a single treatment, branch pruning showed a significant effect on fruit length at harvest week 3 to week 5. The longest average fruit length was obtained in the treatment of branch pruning of internodes 1–4, which was 19.29 cm at harvest week 3 and in the treatment of branch pruning of internodes 1–5 with a fruit length of 18.38 cm at week 4 and 18.54 cm at week 5. Conversely, the shortest average fruit length at harvest week 3 to week 5 was obtained in the treatment without branch pruning with fruit lengths of 17.42 cm, 17.17 cm, and 17.29 cm, respectively.

Branch pruning treatment had a significant effect on the fruit length parameter, namely by pruning branches of internodes 1-5 it was proven to be able to increase fruit length compared to pruning other branches. This is because the reduction of unwanted branches can reduce competition for photosynthate translocation, so that the development of fruit size in terms of length can increase. Similar to the statement by Rasilatu *et al*. (2016), that assimilates can concentrate in the formation of fruit which begins with pruning the plant first. On the other hand, the single treatment of NPK fertilizer doses had a significant effect on the length of baby cucumber fruit only in the 2nd week of harvest. The average length of the longest fruit was 18.83 cm which was obtained in the treatment of NPK fertilizer doses of 1,100 kg/ha. Meanwhile, the average length of the shortest fruit was obtained in the treatment of the lowest NPK fertilizer dose (800 kg/ha), which was 17.92 cm.

Table 6. Effect of treatment on the average fruit length (cm) of baby cucumber during harvest week 1–5

Treatment	Week of Harvest				
	1	2	3	4	5
Branch Pruning					
No Pruning	17.28	18.33	17.42 a	17.17 a	17.29 a
Nodes 1-3	18.08	18.71	18.42 b	17.50 ab	17.54 ab
Nodes 1-4	18.17	18.50	19.29 b	18.00 ab	17.79 ab
Nodes 1-5	17.50	18.54	19.08 b	18.38 b	18.54 b
HSD 5%	not significant	not significant	0.92	1.20	1.07
NPK Fertilizer Dosage (kg/ha)					
800	18.00	17.92 a	18.42	17.46	17.50
900	17.75	18.75 ab	18.42	17.92	17.88
1000	17.79	18.58 ab	18.67	17.83	17.79
1100	17.58	18.83 b	18.71	17.83	18.00
HSD 5%	not significant	0.88	not significant	not significant	not significant

Note: in the same treatment and column, mean values tracked by different letters are significant in the HSD 5% test.

The treatment of NPK fertilizer doses of 1,100 kg/ha had a significant effect on fruit length. This is due to the P and K elements contained in NPK fertilizer which function to maximize fruit formation which ultimately increases the length of the fruit. This is in accordance with Fitriani *et al*. (2018), who stated that the influence of P nutrients is very essential in forming fruit so that its size is maximized. In addition, its existence as an ATP former ensures the availability of energy during the plant growth stage. This encourages the smooth formation of assimilates and their transportation to storage. The element K has an essential role in physiological processes, carbohydrate and starch metabolism. Adequate potassium content encourages the creation of a normal fruit formation and enlargement process.

3.5. Number of Fruits per Plant

The average number of fruits per baby cucumber plant based on the single treatment of branch pruning and NPK fertilizer dose can be seen in Table 7. The results of the analysis of variance carried out by this researcher showed that the combination of branch pruning treatment accompanied by the application of NPK fertilizer according to the dosage described above did not provide a significant interaction with the number of fruit per plant of baby cucumber plants. The single treatment of branch pruning had a significant effect on the number of fruits per baby cucumber plant at the 2nd week of harvest. In addition, the single treatment of NPK fertilizer dose showed a significant effect on the number of fruits per baby cucumber plant at the 4th and 5th week of harvest. The effect of single branch pruning treatment and NPK fertilizer dose on the average number of fruits per baby cucumber plant during harvest week 1-5. Single branch pruning had a significant effect on the number of fruits per plant only in harvest week 2. During that period, the treatment without branch pruning produced the highest average number of fruits per plant, which was 5.08 fruits. In contrast, the treatment of pruning branches at internodes 1-5 produced the lowest average number of fruits

Table 7. Effect of treatment on the average number of fruits per plant of baby cucumber during harvest week 1–5

Treatment	Week of Harvest				
	1	2	3	4	5
Branch Pruning					
No Pruning	1.92	5.08 b	4.58	2.50	2.58
Nodes 1-3	2.83	4.08 ab	4.42	2.25	2.00
Nodes 1-4	3.25	4.33 ab	3.58	2.25	2.00
Nodes 1-5	2.58	3.50 a	4.08	2.00	2.08
HSD 5%	not significant	1.29	not significant	not significant	not significant
NPK Fertilizer Dosage (kg/ha)					
800	3.17	3.67	4.67	1.75 a	1.75 a
900	2.33	4.67	4.08	2.00 a	2.00 a
1000	3.08	3.92	3.67	1.92 a	1.92 a
1100	2.00	4.75	4.25	3.33 b	3.00 b
HSD 5%	not significant	not significant	not significant	0.96	0.85

Note: in the same treatment and column, mean values tracked by different letters are significant in the HSD 5% test.

per plant, which was 3.50 fruits. The treatment without branch pruning showed a significant effect on the number of fruits per plant. The treatment without branch pruning gave the best results compared to branch pruning. This happened because without branch pruning, plants tended to produce more branches and leaves which allowed the photosynthesis process to run more optimally. With more leaves, plants can absorb more sunlight and produce photosynthate needed for fruit formation and development. This is the same as the explanation of Yudianto *et al*. (2015), that the number of leaves on a plant will affect the growth and development of the plant, where plants that have more leaves will have more energy available for photosynthesis compared to those with few leaves.

The single treatment of NPK fertilizer doses also had a significant effect on the number of fruits per plant at harvests in the 4th and 5th weeks. The average number of fruits per plant was the highest, namely 3.33 fruits and 3.00 fruits obtained in the treatment of NPK fertilizer doses of 1,100 kg/ha. Meanwhile, the average number of fruits per plant was the lowest obtained in the treatment of the lowest NPK fertilizer dose (800 kg/ha), namely 1.75 fruits at harvests in the 4th and 5th weeks. The provision of NPK fertilizer with a dose of 1,100 kg/ha was able to provide the best results for the parameter of the number of fruits per plant. This is suspected that by providing a high dose of NPK fertilizer, it provides the elements P and K which are very necessary for fruit growth and development, so that it can increase the number of fruits per plant. According to Satria *et al*. (2015), that nutrients when given in increasing amounts will cause the formation of new higher proteins. This makes the physiological processes of plants such as photosynthesis and respiration work optimally. While the K element will optimize the distribution of nutrients and assimilates in the leaves of the plant to all plant tissues, ultimately facilitating the photosynthesis process and increasing the fruit produced by the plant.

3.6. Total Fruit Weight per Plant (g)

The results of the analysis of variance conducted by this researcher showed that the combination of branch pruning treatment accompanied by the use of NPK fertilizer according to the dosage explained above did not have a significant effect on the total fruit weight per baby cucumber plant. Meanwhile, the single effect of branch pruning treatment and NPK fertilizer dosage significantly affected the total fruit weight per plant. The average total fruit weight per baby cucumber plant affected by branch pruning treatment and NPK fertilizer dosage individually is presented in Table 8. The effect of single branch pruning treatment and NPK fertilizer dose on total fruit weight per plant. Single branch pruning has a significant effect on total fruit weight per plant with the highest average total fruit weight per plant of 2311.04 g obtained in the treatment without branch pruning. Meanwhile, the lowest average total fruit weight per plant was obtained in the treatment of pruning branches of internodes 1-5, namely 1843.04 g.

Table 8. Effect of treatment on the total fruit weight (g) per plant of baby cucumber

Branch Pruning	FFE (days)
No Pruning	2311.04 b
Nodes 1–3	1975.18 ab
Nodes 1–4	1949.63 a
Nodes 1–5	1843.04 a
HSD 5%	355.07

NPK Fertilizer Dose (kg/ha)	FFE (days)
800	1774.75 a
900	1942.66 a
1,000	2007.32 ab
1,100	2354.16 b
HSD 5%	355.07

Note: Numbers followed by the same letter in the same treatment are not significant in the HSD 5% test.

The results above show that without branch pruning, plants can maintain more leaves and branches that function as the main photosynthetic organs in plants. By having more leaves, plants can capture more sunlight which ultimately produces more photosynthates to be directed at fruit production. In addition, with more branches, plants can produce more flowers that have the potential to develop into baby cucumbers. In accordance with the statement of Ihsan (2022), that the number of leaves in plants has a major influence on the photosynthesis process which can ultimately increase food reserves to be stored by the plant.

On the other hand, the administration of a single dose of NPK fertilizer also had a significant effect on the total fruit weight per baby cucumber plant. The largest average total fruit weight per plant, which was 2354.16 g, was obtained in the NPK fertilizer dose treatment of 1,100 kg/ha. Conversely, the lowest average total fruit weight per plant was obtained in the lowest NPK fertilizer dose treatment (800 kg/ha), which was 1774.75 g. Based on the results

above, the NPK fertilizer dose treatment of 1,100 kg/ha showed the best results in the total fruit weight parameter per plant. This is thought to occur because NPK fertilizer provides nutrients that are very much needed for fruit growth and development, especially P and K elements which are very important in the fruit filling process and improving the quality and size of the fruit. Senbayram *et al*. (2015) explained that nutrients given to plants must be balanced so that plant growth and production are also good because if there is a lack of nutrients, the plants cannot work according to their physiological needs.

3.7. Fruit Yield

Results of the ANOVA indicate that the combination of branch pruning treatment accompanied by the use of NPK fertilizer at variation doses produced a significant effect on the fruit yield (t/ha) of baby cucumber. A single treatment of branch pruning has a significant impact on the fruit yield. Meanwhile, a single treatment of NPK fertilizer dose has no significant impact on the fruit yield. Table 9 details the average fruit yield of baby cucumber as affected by the combination treatment of branch pruning and NPK dose. The combination treatment of no pruning with NPK dose of 1100 kg/ha produced the highest fruit yield, namely 76.67 t/ha. Conversely, the combination of branch pruning treatment of internodes 1-3 and the lowest NPK dose (800 kg/ha) resulted the lowest average fruit yield of 43.05 t/ha.

Table 9. Effect of treatment on the average fruit weight per hectare of baby cucumber

NPK Fertilizer Dosage (kg/ha)	Average Fruit Weight (ton/ha)			
	Branch Pruning			
	No Pruning	Pruning of nodes 1-3	Pruning of nodes 1-4	Pruning of nodes 1-5
800	55.81 ab	43.05 a	43.64 a	46.81 a
900	52.32 ab	58.84 ab	47.91 a	48.14 a
1000	61.72 ab	43.63 a	54.83 ab	53.94 ab
1100	76.67 b	65.17 ab	61.58 ab	47.70 a
HSD 5%	25.92			

Note: Mean values followed by the same letter in the same pruning method are not significant in the HSD 5% test.

The results above show that the combination of treatment without branch pruning and an NPK dose of 1,100 kg/ha resulted the highest results in increasing fruit weight per hectare. This is because the treatment without branch pruning, plants can maintain more leaves that function as the main photosynthetic organs. With more leaves, the photosynthetic ability of plants increases, which ultimately provides more photosynthates for fruit production. Meanwhile, the higher the NPK dose, the more sources of macro nutrients N, P, K are available in the soil so that it can increase plant growth and yield. This is the same as what was conveyed by Zamzami *et al*. (2015), that the number of leaves maintained will affect the photosynthesis results in plants so that the nutrients needed for plant growth can be met sufficiently. The same is explained by Bachtiar *et al*. (2016), that nutrients greatly affect the formation of fruit in plants in the process of photosynthesis. Macro nutrients (N, P, and K) form carbohydrates, fats, proteins, minerals, and vitamins which are then transferred to the fruit storage part of the plant. The P element is an element that has a role in the process of photosynthesis, developing plant roots, forming flowers, seeds, and fruit. This element has the second most important order after nitrogen in plants.

4. CONCLUSION

The interaction of branch pruning and NPK dose significantly influence the growth and yield parameters of baby cucumber. NPK dose of 1,100 kg/ha resulted in the increase of plant length, number of leaves, and fruit weight per hectare. As a single treatment, branch pruning at internodes 1-5 gave the best results for the fruit length parameter. On the other hand, the treatment without branch pruning resulted in an increase of the amount of leaves, number of fruits, and fruit weight. The NPK fertilizer dose of 1,100 kg/ha alone gave the best plant growth in term of length, number of leaves, fruit length, number of fruits, and fruit weight.

Based on the findings of this study, it is recommended to use a combination of treatment without branch pruning with an NPK dose of 1,100 kg/ha to maximize the production of baby cucumber plants. In addition, for future research, it is important to further explore parameters such as the average leaf area of baby cucumber plants (*Cucumis sativus* L.) in order to obtain more in-depth information about the factors that affect plant yields.

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