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# Effect of Fruit Pruning and Potassium Application on Growth and Production of Strawberry (*Fragaria chiloensis*)

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**Abstract:** This study aims to determine the effect of fruit pruning and application of Potassium on the growth and production of strawberry plants (*Fragaria chiolensis*). This study used a randomized block design (RBD) with 2 factors. The first factor was fruit pruning consisting of 4 levels: P0 = No pruning, P1 = 1 pruning, P2 = 2 pruning, P3 = 3 pruning. The second factor is Potassium fertilizer consisting of 4 levels: K0 = 0 g/plant, K1 = 2 g/plant, K2 = 4 g/plant, K3 = 6 g/plant. The observed variables were plant height (cm), flowering age (days), Fruit Weight (g), Fruit Volume (cm3), Sugar Content (%), Plant Wet Weight (g), and Plant Dry Weight (g). The results showed that pruning three fruits/plant increased plant height, fruit weight, fruit volume, sugar content, fresh weight and dry weight. Applying potassium fertilizer up to a dose of 6 g/plant can increase plant height, flowering time, fruit weight, fruit volume, sugar content, and wet and dry weight. Meanwhile, the interaction between fruit pruning and potassium application had no significant effect on all observed parameters.

**Keywords:** Fruit pruning; Potassium; Strawberries

## Introduction

One of the most essential fruit commodities in the world is the Strawberry, scientifically known as *Fragaria chiloensis*. This is especially true for countries with a subtropical climate. Agricultural science and technology that continues to develop lately facilitate the cultivation of strawberries in tropical climates (Oğuz et al., 2022; Sengodan, 2022). Even though they are not native to Indonesia, strawberries are able to thrive and generate significant profits if cultivated with agribusiness and agro-industry patterns. The climatic conditions in Indonesia, as stated by (Prabowo & Sitawati, 2019; Sukasih & Setyadjit, 2019) support the growth and productivity of strawberries.

Strawberries are a precious commodity with many benefits. Strawberries are 96% edible. It is not only consumed fresh but can also be processed into several other food products such as jam, syrup, sweets, dodol, juice, yogurt, cakes, and ice cream raw materials (Alves et al., 2020; Holmes et al., 2020; Suanda, 2023). Strawberries have a high nutritional content with a complete nutritional composition. For every 100 g of fresh strawberries, there are 37 calories of energy, 0.8 g of protein, 0.5 g of fat, 8.0 g of carbohydrates, 28 mg of calcium, 27 mg of phosphate, 0.8 mg of iron, 60 SI of vitamin A, B 0.03 mg, vitamin C 60 mg, and water 89.9 g. Besides containing various vitamins and minerals, strawberries also have other benefits (Ganhão et al., 2019; Kowalska et al., 2018; Megasari, 2019; Surbakti, 2020; Winardi & Harefa, 2018).

There are many varieties of strawberries suitable for planting in Indonesia. These include Oso Grande, Tenira, Shantung, Sweet Charlie, Robunda, Tristar, Earlibrite, Nyoho, Elvira, Bogota, Michiko, and Hokowaze. In Lembang Bandung, farmers tend to use the Shantung variety when growing sweet charlie, Tristar, and Oso Grande for fresh fruit. However, for processed foods such as jams and jellies, they prefer to use the Shantung variety. In the Takengon region of Central Aceh, the varieties most widely planted are Michiko, Tristar, and Earlibrite. This information is based on research (Kurnia & Mulyono, 2006).

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Strawberry production is a rapidly growing industry in the Karo Regency, North Sumatra. In particular, the area is known for the cultivation of this berry. The table below provides information on land for growing Strawberry plants and their corresponding yields in Karo District, North Sumatra (Kurnia & Mulyono, 2006). They reported that an area of 0.14 Ha with 8,000 seedlings produced a total production of 4,000 kg/year. Considering the two-year growing season, the total production reaches 8,000 kg with a productivity level of 57,142.85 kg/Ha. Until now, strawberry production has not been able to meet market demand. This can be seen from the various fruit suppliers from North Sumatra and Tongkoh, who can only provide 15-30 kg of strawberries, even though the daily requirement reaches 60 kg. Likewise, harvesters in Berastagi must receive their harvest from several farmers located around Tongkoh and Pangalengan to meet a minimum requirement of 500 kg every three days for a jam factory located in Jakarta.

Many alternative methods of cultivating strawberries have been developed to meet the increasing market demand. This method has been designed to achieve the highest possible strawberry yield while maintaining optimal quality. Some techniques that have been applied include innovative cropping systems, high-yielding varieties, and appropriate cultivation methods (Silaban & Trimo, 2021; Tulak et al., 2020; Wihardjaka, 2018).

One of the ways that farmers do to increase the yield of strawberry plants is the use of potassium fertilizer. This fertilizer affects the ability of plants to transfer carbohydrates from leaves to other organs, thus improving fruit quality, increasing plant resistance, and helping to absorb water and nutrients (Artyszak, 2018; Nakro et al., 2023; Rosyidah & Nurhidayati, 2022; Sholihah & Nurhidayati, 2022).

In 2012, the high demand for strawberries exceeded domestic production capacity. As a result, there was an increase in imports of strawberries by 24.7%, from 452 tons to 564 tons (Karo, 2013). This trend is projected to continue in both the domestic and international markets. This provides an opportunity for strawberry farmers to improve the quality, quantity, and consistency of their production to meet the increasing demand and take advantage of the market. Along with market demand and strawberry agro-industry, which continues to increase, the need for extensification and intensification of strawberry plants is becoming increasingly necessary. Extensification expands agricultural areas to increase yields, while intensification aims to optimize agricultural land to achieve higher yields (Lika et al., 2018; Sinaga et al., 2022).

The act of pruning plants is an effort to optimize environmental factors that directly affect photosynthesis, including temperature, humidity, light, and wind circulation. Pruning can also help stabilize branch growth and the fruit it produces. The number of branches on a strawberry plant dramatically affects the quality of the fruit and seeds it produces, as stated by (Neneng, 2021; Wibowo, 2021).

Two critical factors are fruit thinning and nutrient additions to determine yield and quality. One of the essential nutrients for plants is Potassium which has various roles, such as helping the production of proteins and carbohydrates and activating enzymes. Potassium is vital in photosynthate translocation through the phloem vessels (Rika, 2022; Zen, 2022). Fertilizers such as KCl and KNO3 contain Potassium. Applying KNO3 fertilizer to strawberry plants is believed to reduce plant vegetative growth and produce amino acids that stimulate the formation of flowers and fruit (Swadaya & Sutiyoso, 2018; Mas'ud et al., 2020; Sihombing, 2021) conducted research that revealed the ability of KNO3 to enhance growth, flower and fruit production, and ultimately yield. Research to examine the effect of potassium application and fruit pruning on the development and yield of strawberry plants is related to the description above.

This research is important because market demand and the strawberry agro-industry continue to increase, so the need for extensification and intensification of strawberry plants is becoming increasingly necessary. Regarding health, strawberries have very good benefits on the body, namely increasing immunity, preventing cancer and improving brain function. In this research actionPruning plants is an effort to optimize environmental factors that directly affect photosynthesis, including temperature, humidity, light, and wind circulation. Pruning can also help stabilize branch growth and the fruit it produces. As well as the function of Potassium, which reveals the ability of KNO3 to increase growth, flower and fruit production, and yield.

## Method

This research was conducted in Barusjahe Village, Barusjahe District, Karo District, North Sumatra, at an altitude of ±1,500 meters above sea level. This study used a randomized block design (RBD) with two factors, namely: Factor I. Fruit pruning (P) consisted of 4 levels, namely: P0 = fruit without pruning (control); P1 = 3 fruit left/plant; P2 = 2 fruit left/plant; P3 = 1 fruit left/plant-factor II. Potassium Fertilizer (KCL) consists of 4 levels: K0 = 0 g/plant (control); K1 = 2 g/plant; K2 = 4 g/plant; K3 = 6 g/plant. Analysis of the data used is a fingerprint of variance. The observed variables were plant height (cm), flowering age (days), Fruit Weight (g), Fruit Volume ($cm^3$), Sugar Content (%), Plant Wet Weight (g), and Plant Dry Weight (g).

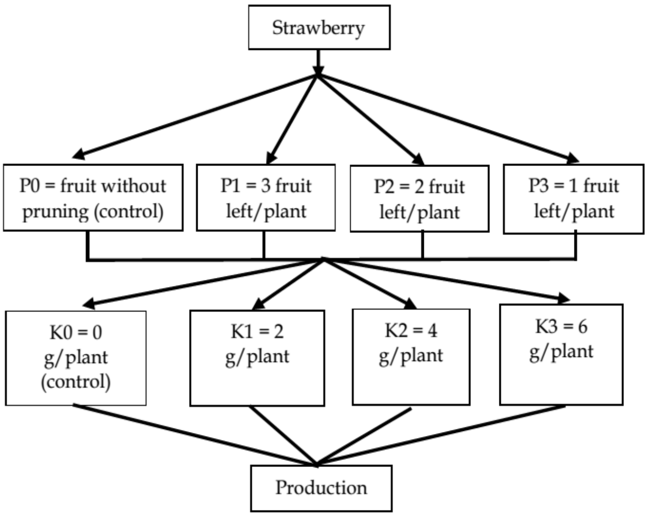


**Figure 1.** Research flow the effect of fruit pruning and application of Potassium on the growth and production of strawberry plants (*Fragaria chiolensis*)

## Results and Discussion

*Research Results*

*Plant Height*

Data on strawberry plant height at 2, 3, 4, and 5 weeks after transplanting (HSPT) due to pruning and doses of potassium fertilizer, while the variance list showed that pruning had no significant effect on all ages of observation. Potassium fertilizer dose treatment significantly affected the ages of 4 and 5 HSPT but had no significant effect on the ages of 2 and 3 HSPT. The interaction between the two treatments had no significant effect. The average height of strawberry plants at 2, 3, 4, and 5 HSPT is due to pruning fruit and different doses of potassium fertilizer. Table 1 shows the average strawberry plant height at 2, 3, 4, and 5 HSPT due to fruit pruning and different doses of potassium fertilizer.

Table 1 shows that in the pruning treatment, the highest plants were at P3, followed by P2, P1, and the lowest plants were at P0. Table 1 shows that in the treatment of potassium fertilizer doses at the age of 5 HSPT, the highest plants were in the K3 treatment, which was significantly different from K0 but not significantly different from K1 and K2. The lowest mean plant height was found in treatment K0, significantly different from K3 but not from K1 and K2. Based on the variance, the effect of potassium fertilizer application on plant height is known to be linear. The effect of potassium fertilizer dose on strawberry plant height at 5 HSPT can be seen in Figure 2. Figure 2 shows that the higher the dose of potassium fertilizer, the higher the plant height.

**Table 1.** Average Strawberry Plant Height Due to Fruit Pruning and Dosage of Potassium Fertilizer at 2, 3, 4, and 5 Days After Transplanting

| Treatment | Plant Height (cm) | | | |
|---|---|---|---|---|
| | 2 HSPT | 3 HSPT | 4 HSPT | 5 HSPT |
| P0 | 6.00 | 6.50 | 6.91 | 10.91 |
| P1 | 5.94 | 6.44 | 6.94 | 10.97 |
| P2 | 6.40 | 6.90 | 7.40 | 11.40 |
| P3 | 6.70 | 7.20 | 7.70 | 11.70 |
| BNJ | - | - | - | 0.51 |
| K0 | 5.66 | 6.16 | 6.58 b | 10.58 b |
| K1 | 6.33 | 6.83 | 7.3 ab | 11.33 ab |
| K2 | 6.38 | 6.88 | 7.38 ab | 11.38 ab |
| K3 | 6.67 | 7.17 | 7.67 a | 11.69 a |

*Note: Numbers followed by the same letter in the same column are significant, not significantly different at the 5% test level*

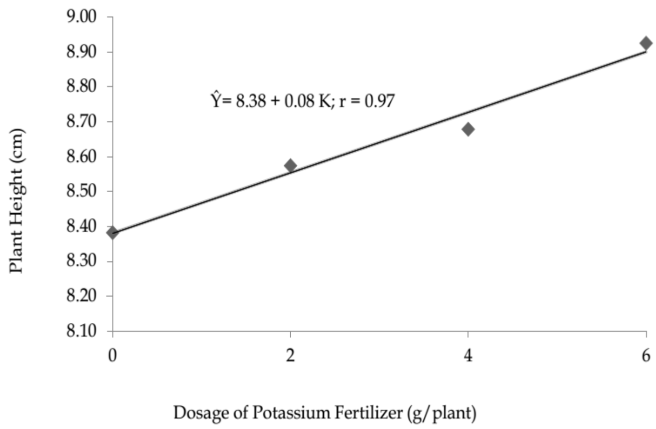


**Figure 2.** Effect of potassium fertilizer dosage on strawberry plant height 5 days after transplanting

*Flowering Age (Days)*

Data on the flowering age of strawberry plants due to pruning and doses of potassium fertilizer. The list of variances showed that the dose of potassium fertilizer had a significant effect on flowering time, while fruit pruning and the interaction between the two treatments had no significant effect on flowering time.

Table 2 presents a different test of the average flowering age of strawberry plants due to pruning and different doses of potassium fertilizer. Table 2 shows that in the treatment of potassium fertilizer doses, the fastest flowering age was found in the K3 treatment, which was significantly different from K0, K1, and K2. The variance results show that the effect of potassium fertilizer on flowering time is linear. The effect of giving doses of potassium fertilizer on flowering age can be seen in Figure 3.

**Table 2.** Average Age of Flowering of Strawberry Plants due to Pruning and Dosage of Potassium Fertilizer (Days)

| Treatment | K0 | K1 | K2 | K3 | Average |
|---|---|---|---|---|---|
| P0 | 33.17 | 32.23 | 31.13 | 30.53 | 31.77 |
| P1 | 33.70 | 32.07 | 32.50 | 31.23 | 32.38 |
| P2 | 32.97 | 32.77 | 32.60 | 30.33 | 32.17 |
| P3 | 32.73 | 32.73 | 32.40 | 30.51 | 32.09 |
| Average | 33.14c | 32.45 bc | 32.16 b | 30.65a | |

*Note: Numbers followed by the same letter in the same column are significant, not significantly different at the 5% test level*

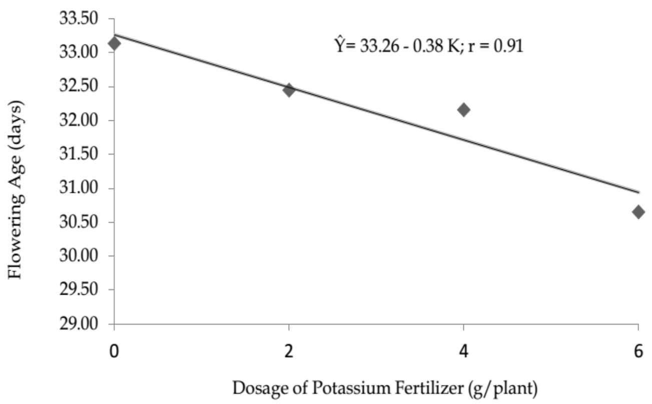


**Figure 3.** Effect of potassium fertilizer dosage on strawberry plant flowering age

Figure 3 shows that the higher the dose of potassium fertilizer, the faster the flowering time of the strawberry plants.

*Fruit Weight (g)*

Data on strawberry plant fruit weight at harvest 1, 2, 3, 4, and 5 due to fruit pruning and doses of potassium fertilizer. The list of variances shows that fruit pruning significantly affects harvests 1, 2, 3, 4, and 5. Potassium fertilizer dose treatment significantly affects harvests 1, 2, 3, and 4 but has no significant effect on harvest 5. The interaction between the two treatment effects is not significant. The average strawberry fruit weight in harvests 1, 2, 3, 4, and 5 is due to fruit pruning and different doses of potassium fertilizer.

Table 3 presents the average strawberry fruit weight in harvests 1, 2, 3, 4, and 5 due to fruit pruning and different doses of potassium fertilizer. Table 3 shows that the treatment of fruit pruning from harvest 1 to harvest 3 was the highest average fruit weight in P3, which was significantly different from P0, P1, and P2. The lowest average fruit weight was found at P0, significantly different from P1, P2, and P3.

**Table 3.** Average Strawberry Fruit Weight due to Pruning and Dosage of Potassium Fertilizer at Harvests 1, 2, 3, 4, and 5

| Treatment | Fruit Weight (g) | | | | |
|---|---|---|---|---|---|
| | Harvest 1 | Harvest 2 | Harvest 3 | Harvest 4 | Harvest 5 |
| P0 | 7.49 d | 8.31 d | 8.63 d | 7.66 b | 8.10 b |
| P1 | 11.27 c | 13.26 c | 11.93 c | 8.43 ab | 8.24 ab |
| P2 | 13.05 b | 15.11 b | 13.42 b | 8.73 ab | 8.72 ab |
| P3 | 17.89 a | 18.17 a | 18.47 a | 9.74 a | 9.49 a |
| K0 | 11.90 b | 12.54 b | 12.17 b | 7.85 b | 8.43 |
| K1 | 12.41 ab | 12.89 b | 12.71 b | 8.6 ab | 8.32 |
| K2 | 12.60 ab | 13.45 b | 13.61 b | 8.71 ab | 8.75 |
| K3 | 12.80 a | 15.97 a | 13.94 a | 9.40 a | 9.06 |

*Note: Numbers followed by the same letter in the same column are significant, not significantly different at the 5% test level*

In harvests 4 to 5, the highest average fruit weight was found in P3, significantly different from P0 but not significantly different in P1 and P2. The lowest average fruit weight was found at P0, significantly different from P3 but not significantly different from P1 and P2. Potassium fertilizer dose treatment in harvest 1, the highest average fruit weight was found in K3, which was significantly different from K0 but not significantly different from K1 and K2. In harvests 2 and 3, the highest average fruit weight was found in K3, which was significantly different from K0, K1, and K2. The lowest mean is found in K0, significantly different from K3 but not from K1 and K2. In harvest 4, the highest average fruit weight was found in K3, significantly different from K0 and K1 but not significantly different from K2. The lowest mean is found in K0, significantly different from K3 but not from K1 and K2.

The effect of fruit pruning on strawberry fruit weight in harvest 5 can be seen in Figure 4. Figure 4 shows that the highest fruit weight was found in P3, which was 9.49 g, followed by P2, P1, and P0. Based on the analysis of variance, the effect of fruit pruning on fruit weight is linear. The effect of giving doses of potassium fertilizer on strawberry fruit weight in harvest four can be seen in Figure 5.

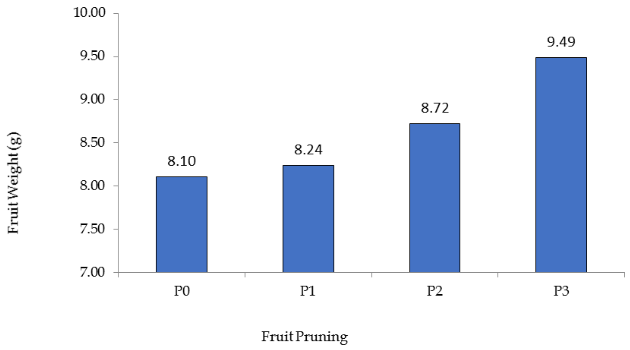


**Figure 4.** The effect of pruning on fruit weight at harvest 5

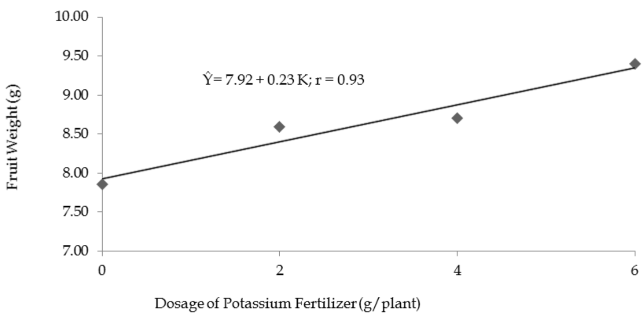


**Figure 5.** Effect of potassium fertilizer dosage on strawberry fruit weight at harvest 4

From Figure 5, it can be seen that the higher the dose of potassium fertilizer, the weight of the strawberry fruit increases.

*Fruit Volume (cm³)*

Data on strawberry plant fruit volume in harvests 1, 2, 3, 4, and 5 due to fruit pruning and doses of potassium fertilizer. The list of variances shows that fruit pruning significantly affects harvests 1, 2, 3, 4, and 5. Potassium fertilizer dose treatment significantly affects harvest 4 but has no significant effect on harvests 1, 2, 3, and 5. Interaction between the two treatments unreal effect. The average volume of strawberries in harvests 1, 2, 3, 4, and 5 is due to fruit pruning and different doses of potassium fertilizer. Table 4 shows the average volume of strawberries in harvests 1, 2, 3, 4, and 5 due to fruit pruning and different doses of potassium fertilizer.

Table 4 shows that in the treatment of pruning fruit in harvest 1, the highest average fruit volume was found in treatment P3, which was significantly different from P0 and P1 but not significantly different from P2. The lowest mean is at P0, significantly different from P2 and P3 but not significantly different from P1. In harvests 2 and 3, the highest average fruit volume was at P3, significantly different from P0, P1, and P2. The lowest mean is at P0, significantly different from P1, P2, and P3.

**Table 4.** Average Strawberry Fruit Volume due to Pruning and Dosage of Potassium Fertilizer at Harvests 1, 2, 3, 4, and 5

| Treatment | Fruit Volume ($cm^3$) | | | | |
|---|---|---|---|---|---|
| | Harvest 1 | Harvest 2 | Harvest 3 | Harvest 4 | Harvest 5 |
| P0 | 9.28 c | 9.14 d | 9.02 d | 9.27 d | 8.60 d |
| P1 | 9.84 bc | 10.40 c | 10.45 c | 10.28 bc | 9.49 bc |
| P2 | 10.75 ab | 11.07 b | 11.18 b | 10.77 ab | 9.70 b |
| P3 | 11.83 a | 13.28 a | 13.45 a | 12.91 a | 12.44 a |
| K0 | 10.50 | 10.79 | 10.70 | 10.39 b | 9.76 |
| K1 | 10.22 | 10.87 | 10.95 | 10.60 b | 10.06 |
| K2 | 10.43 | 10.98 | 11.10 | 10.93 ab | 10.08 |
| K3 | 10.54 | 11.26 | 11.34 | 11.30 a | 10.34 |

*Note: Numbers followed by the same letter in the same column are significant, not significantly different at the 5% test level*

At harvest 5, the highest average was found at P3, significantly different from P0, P1, and P2. The lowest mean is at P0, which is significantly different from P1, P2, and P3. Potassium fertilizer dose treatment at harvest 4, the highest average fruit volume was found in K3, which was significantly different from K0 and K1 but not significantly different from K2. The lowest mean fruit volume was found in K0, significantly different from K3 but not from K1 and K2. The effect of fruit pruning on strawberry fruit volume in harvest five can be seen in Figure 5.

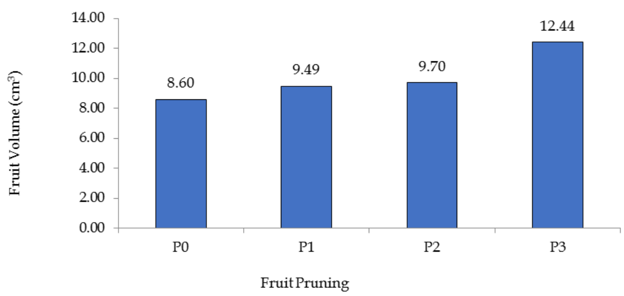


**Figure 6.** Effect of Pruning on Fruit Volume at Harvest 5

Figure 6 shows that the highest fruit volume was at P3, followed by P2 and P1, and the lowest fruit volume was at P0. From the analysis of variance, it is known that the effect of potassium fertilizer on fruit volume is linear.

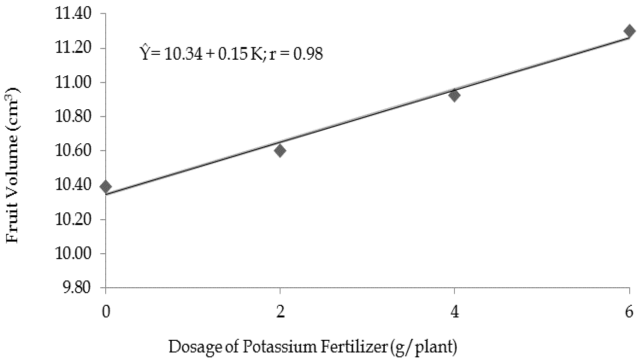


**Figure 7.** Effect of potassium fertilizer dosage on strawberry fruit weight at harvest 4

The effect of giving doses of potassium fertilizer on the volume of strawberry fruit in harvest 4 can be seen in Figure 7. Figure 7 shows that the higher the dose of potassium fertilizer, the more fruit volume will increase.

*Sugar Content (%)*

Data on the sugar content of strawberry plants at harvest 1, 2, 3, 4, and 5 due to fruit pruning and doses of potassium fertilizer. The list of variances shows that fruit pruning significantly affects harvests 1, 2, 3, 4, and 5. Potassium fertilizer dose treatment significantly affects harvest 4 but has no significant effect on harvests 1, 2, 3, and 5. Interaction between the two treatments unreal effect. The average sugar content of strawberries in harvests 1, 2, 3, 4, and 5 is due to fruit pruning and different doses of potassium fertilizer.

Table 5 shows the average sugar content of strawberries in harvests 1, 2, 3, 4, and 5 due to fruit pruning and different doses of potassium fertilizer.

**Table 5.** Average Strawberry Sugar Levels Due to Pruning and Dosage of Potassium Fertilizer in Harvests 1, 2, 3, 4, and 5

| Treatment | Sugar level (%) | | | | |
|---|---|---|---|---|---|
| | Harvest 1 | Harvest 2 | Harvest 3 | Harvest 4 | Harvest 5 |
| P0 | 8.23 b | 8.65 c | 8.64 b | 9.33 b | 8.18 c |
| P1 | 8.53 b | 9.12 abc | 9.28 ab | 9.90 ab | 9.60 bc |
| P2 | 9.17 ab | 10.50 ab | 9.96 ab | 10.14 ab | 11.04 ab |
| P3 | 10.41a | 10.57 a | 10.82 a | 11.16 a | 12.09 a |
| K0 | 8.53 b | 7.97 c | 7.20 d | 8.61 c | 7.80 d |
| K1 | 8.88 ab | 9.48 abc | 9.41 bc | 9.71 bc | 10.18 bc |
| K2 | 9.04 ab | 10.21 ab | 10.19 ab | 10.51 ab | 10.49 b |
| K3 | 9.98 a | 11.17 a | 11.89 a | 11.71 a | 12.44 a |

*Note: Numbers followed by the same letter in the same column are significant, not significantly different at the 5% test level*

Table 5 shows that the treatment of fruit pruning in harvest 1 had the highest average sugar content in P3, which was significantly different from P0, P1, and P2. The lowest mean is at P0, significantly different from P3 but not significantly different from P1 and P2. At harvest 2, the highest mean was found in P3, significantly different from P0 but not significantly different from P1 and P2. The lowest mean is at P0, significantly different from P2 and P3 but not significantly different from P1. In harvests 3 and 4, the highest mean was found in P3, which was significantly different from P0 but not significantly different from P1 and P2. At harvest 5, the highest mean was at P3, significantly different from P0 and P1 but not significantly different from P2. In the potassium fertilizer dose treatment at harvest 5, the highest average was found in the K3 treatment, significantly different from K0, K1, and K2.

The effect of fruit pruning on strawberry sugar content in harvest 5 can be seen in Figure 8. Figure 8 shows that the highest sugar content is at P3, followed by P2, P1, and the lowest sugar content is at P0. From the analysis of variance, it is known that the effect of potassium fertilizer on sugar content is linear. The effect of giving potassium fertilizer on sugar levels in harvest 5 can be seen in Figure 9. From Figure 9, it can be seen that the higher the dose of potassium fertilizer, the more sugar content will increase.

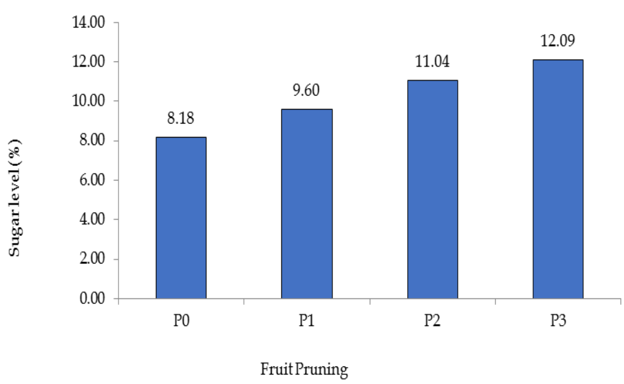


**Figure 8.** Effect of pruning on sugar content in harvest 5

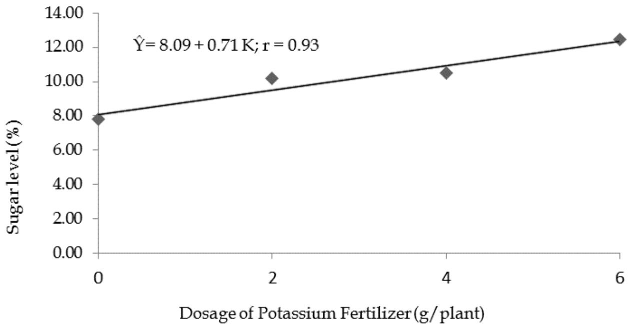


**Figure 9.** The effect of giving doses of potassium fertilizer on sugar levels at harvest 5

*Plant Wet Weight (g)*

Data on fresh weight of strawberry plants due to pruning and doses of potassium fertilizer. The list of variances showed that fruit pruning and potassium fertilizer dose had a significant effect on wet weight. In contrast, the interaction between the two treatments had no significant effect.

Table 6 presents a different test of the average fresh weight of strawberry plants due to pruning and the application of different doses of potassium fertilizer.

**Table 6.** Average Wet Weight of Strawberry Plants due to Pruning and Dosage of Potassium Fertilizer (g)

| Treatment | K0 | K1 | K2 | K3 | Average |
|---|---|---|---|---|---|
| P0 | 20.97 | 24.73 | 25.57 | 25.25 | 24.13 b |
| P1 | 23.13 | 24.16 | 25.85 | 25.78 | 24.73 ab |
| P2 | 25.65 | 26.00 | 25.27 | 25.67 | 25.65 ab |
| P3 | 25.63 | 25.72 | 26.00 | 26.97 | 26.00 8a |
| Average | 23.85 c | 25.15 abc | 25.67 ab | 25.92 a | |

*Note: Numbers followed by the same letter in the same column and row are not significantly different at the 5% test level*

Table 6 shows that in the pruning treatment, the highest average fresh weight was found at P3, which was significantly different from P0 but not significantly different from P1 and P2. The lowest mean is at P0, significantly different from P3 but not significantly different from P1 and P2. Potassium fertilizer dose treatment with the highest average fruit weight in K3 differed significantly from K0 but not significantly from K1 and K2. The lowest mean is found in K0, significantly different from K2 and K3 but not significantly different from K1. The effect of fruit pruning on the fresh weight of the strawberry plants can be seen in Figure 10.

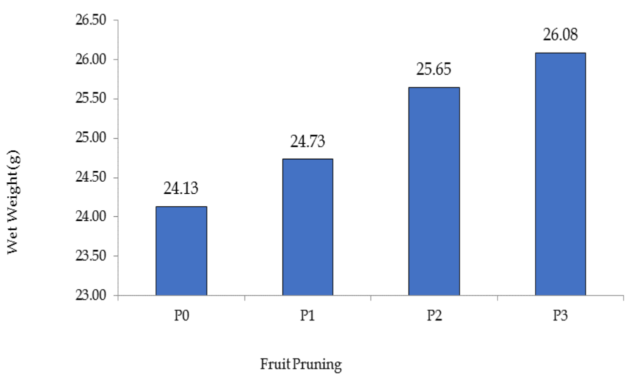


**Figure 10.** Effect of pruning on wet weight of strawberry plants

Figure 10 shows that the highest wet weight is at P3, P2, and P1, and the lowest is at P0. The variance results show that the effect of potassium fertilizer application on the fresh weight of strawberry plants is linear. The effect of potassium fertilizer on strawberry plants' wet weight can be seen in Figure 11.

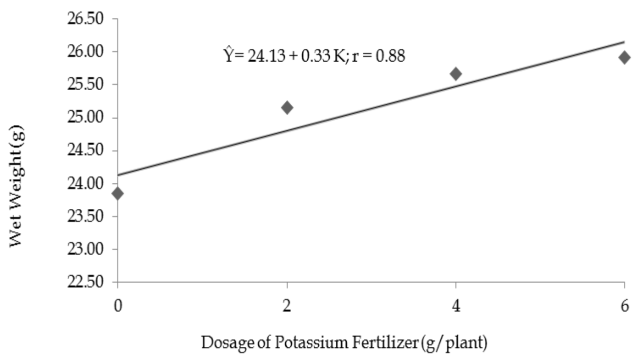


**Figure 11.** Effect of Dosing of potassium fertilizer on wet weight of strawberry plants

From Figure 10 It can be seen that the higher the dose of potassium fertilizer, the wet weight of the strawberry plants increases.

*Plant Dry Weight (g)*

Data on the dry weight of strawberry plants due to pruning and doses of potassium fertilizer. The list of variances showed that fruit pruning and potassium fertilizer dose had a significant effect on wet weight. In contrast, the interaction between the two treatments had no significant effect. Table 7 presents a different test of the average dry weight of strawberry plants due to pruning and the application of different doses of potassium fertilizer.

**Table 7.** Average Dry Weight of Strawberry Plants due to Pruning and Dosing of Potassium Fertilizer (g)

| Treatment | K0 | K1 | K2 | K3 | Average |
|---|---|---|---|---|---|
| P0 | 4.19 | 4.89 | 5.11 | 5.05 | 4.81 c |
| P1 | 4.63 | 4.83 | 5.17 | 5.16 | 4.95 abc |
| P2 | 5.13 | 5.20 | 5.05 | 5.13 | 5.13 ab |
| P3 | 5.13 | 5.14 | 5.20 | 5.39 | 5.22 a |
| Average | 4.77 c | 5.02 abc | 5.13 ab | 5.18 a | |

*Note: Numbers followed by the same letter in the same column and row are not significantly different at the 5% test level*

Table 7 shows that in the pruning treatment, the highest average dry weight was found in P3, which was significantly different from P0 but not significantly different from P1 and P2. The lowest mean is at P0, significantly different from P2 and P3 but not significantly different from P1. Potassium fertilizer dose treatment with the highest average fruit weight in K3 differed significantly from K0 but not significantly from K1 and K2. The lowest mean is found in K0, significantly different from K2 and K3 but not significantly different from K1.

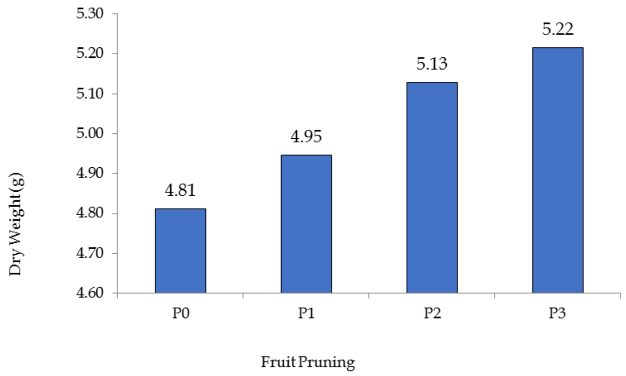


**Figure 12.** Effect of pruning on dry weight of strawberry plants

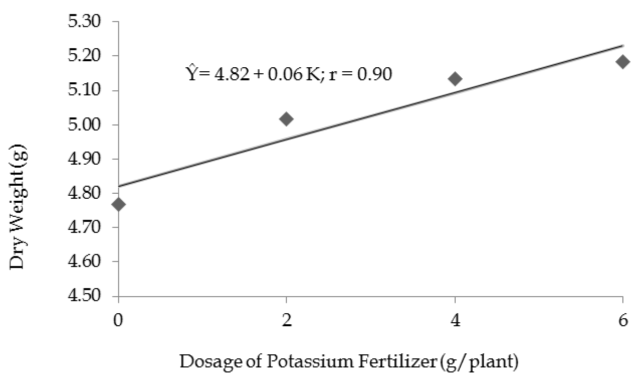


**Figure 13.** Effect of potassium fertilizer dosage on strawberry plant dry weight

The effect of fruit pruning on the fresh weight of the strawberry plants can be seen in Figure 12. Figure 12 shows that the highest dry weight is found in P3, followed by P2 and P1, and the lowest is in P0. From the analysis of variance, it is known that the effect of potassium fertilizer application on dry weight is linear. The effect of potassium fertilizer on strawberry plants' dry weight can be seen in Figure 13. From Figure 13, it can be seen that the higher the potassium fertilizer dose, the plant's dry weight increases.

*Discussion*

*Effect of Fruit Pruning on the Growth and Production of Strawberry Plants*

Tests of variance revealed that pruning had an essential impact on various factors, including fruit weight, fruit volume, sugar content, fresh weight, and dry weight. Pruning or thinning fruit is believed to cause photosynthetic results to only concentrate on certain parts of the plant's growing point. Pruning or thinning the fruit aims to produce relatively large strawberries. In addition, fruit thinning helps reduce competition between fruits for assimilation used for fruit growth, according to (Rahni et al., 2019; Riesky & Isnaini, 2022). Increasing fruit size, such as fruit diameter and weight, which are closely related to fruit volume, can be done through fruit thinning. This is in line with the statement (Ikhza, 2018; Mahmud & Chong, 2021; Zhang et al., 2023) that pruning (thinning) of fruit helps direct plant food extracts from photosynthesis, specifically toward the formation and growth of fruit to produce fast and considerable fruit growth. This supports this view, stating that fruit thinning allows more effective assimilation to storage organs, resulting in better early-stage fruit development (Masrie & Girma, 2022; Rutkowski & Łysiak, 2022).

Ayunda et al. (2021) and Marini et al. (2020), stated that fruit size is certain to increase as the number of fruit decreases due to fruit pruning. This occurs because the reduced number of fruits allows better space for the development of individual fruits. This opinion is supported by statements Pratama (2022) and Sukewijaya et al. (2022), that fruit thinning increased fruit size and quality. This is because most of the photosynthetic results are allocated for fruit growth.

Research results from Sofyadi et al. (2021) showed that Pruning significantly affected the number of leaves, number of fruits per plant, fruit length, fruit diameter, fruit weight per grain, and fruit weight per plant.

Herlina et al. (2017) it was reported that pruning treatment of 50% lower leaves and male flowers increased cob weight compared to treatment without Pruning. This shows that there is competition between the cobs and the lower leaves.

The process of pruning the fruit directly affects the plant's wet and dry weight. Figures 10 and 12 show that higher pruning levels increase wet and dry weights. The whole plant wet weight from the pruning treatment was 8.08%, and the total potassium treatment was 8.67%. Judging from the dry weight of the pruning plants, it was 8.52%, while the total potassium treatment was 8.59%. This phenomenon is suspected because the results of plant photosynthesis are partially utilized for plant growth, thereby increasing plant biomass. The growth of plant biomass is influenced by the amount of water absorption and the accumulation of photosynthetic products, represented by dry weight. When less fruit is left on the plant.

*Effect of Potassium Fertilizer on Growth and Production Strawberry Plant*

The variance test showed that the use of potassium fertilizer significantly impacted various aspects of the plant, such as plant height, flowering age, fruit weight, fruit volume, sugar content, plant fresh weight, and plant dry weight. When plants are given Potassium, their height tends to increase. This is because Potassium helps absorb water and nutrients from the soil. It also aids in the transport of assimilation from leaves to plant tissues and aids in the formation of carbohydrates and proteins in plants. In addition, Potassium stimulates the growth of new roots, which is very important for absorbing nutrients and minerals from the soil. The nutrients and minerals are then transported through the xylem tissue to the plant leaves for photosynthesis, and the plant utilizes the results for growth. To support plant growth, flowering, and fruit formation, K (potassium) fertilizer is added (Atsna, 2022; Rifimaro, 2021).

The process of growing strawberry flowers requires Potassium multiplied by Potassium fertilizer. This is because Potassium is an essential element that facilitates the synthesis and transportation of carbohydrates in plants, which in turn accelerates the thickening of cell walls and the stiffness of flower stalks, fruits, and branches (Karthika et al., 2018; Wu et al., 2018). The flowering age of strawberry plants is directly related to the dose of Potassium given: the higher the dose, the faster the flowering period. Potassium also plays an essential role in enzyme activity and contributes to fruit development in size and taste. In addition, it strengthens the plant body and prevents leaves, flowers, and fruit from falling off quickly. Potassium is a source of vital energy for plants, as it enables the metabolism of proteins, enzymes, hormones, and carbohydrates, accelerating the elongation of cell enlargement. Higher doses of potassium fertilizer produced strawberry plants with the highest fruit weight and volume (Hasanuzzaman et al., 2018). This can be seen in the pruning treatment, where the total fruit weight was 17.16%, and in the potassium treatment, the total fruit weight was 7.47%. Regarding fruit volume, the pruning treatment yielded 44.65%, while the potassium treatment yielded 5.94%.

Research results from Rhamadan (2022) showed that the production of strawberries significantly affected the POC interaction and the concentration of KNO3. Uliyah (2016) states that potassium absorbed by plants functions in the formation of proteins and carbohydrates and maintains plant turgor. The results of his research showed that the treatment of plant spacing and potassium fertilization had a significant effect on all observed components, including growth and yield, which included the number of leaves, leaf area, total plant fresh weight, total plant dry weight, cob weight with husks, cob weight without husks, cob diameter, and Brix.

Potassium has been shown to impact sugar levels in plants significantly. It is believed that the nutrition provided by Potassium is essential in increasing sugar levels in strawberries. During the ripening process, a natural increase in fruit sugar content is represented as a brix percentage. Research has shown that the total pruning treatment increased sugar content by 47.7%, while the total potassium treatment increased by 59.48%. This is due to the ability of Potassium to neutralize nitrite content, which in turn increases starch, sucrose, and poly fructose in plants. By providing sufficient Potassium, fruit sugar levels can increase significantly. Aprilia et al. (2023), Dewi et al. (2022), Novia et al. (2022), Saputra et al. (2022), and Sipayung et al. (2018), found that potassium administration also increased the mass percentage of sucrose. Sucrose synthase, the enzyme responsible for synthesizing sucrose, plays an essential role in the formation of sucrose. With the high availability of sucrose-forming nutrients and the sucrose synthase enzyme's activity, synthesizing amino acids into sucrose becomes easier. In addition, strawberries contain two other major sugar components, glucose, and fructose, which also increase during fruit development.

Functions of elemental K include increasing the production and movement of carbohydrates, which ultimately results in the thickening of the cell walls and further causes an increase in plant wet and dry weights.

*Interaction between Fruit Pruning and Potassium Fertilizer on the Growth and Production of Strawberry Plants*

After analysis of variance, it was found that the experimental parameters remained unaffected by the interaction between pruning and doses of potassium fertilizer. The reason behind this occurrence can be attributed to the application of two special techniques. The first involves applying Potassium during two growth stages: two weeks and four weeks after planting. The second technique is fruit pruning, which is done during the fruiting phase of the strawberry plant. By applying these two techniques separately, each treatment's effects are unrelated, and the two factors can be considered independent of each other.

## Conclusion

The results of this study indicated that the pruning treatment of strawberries had a significant effect on increasing fruit weight, fruit volume, sugar content, plant fresh weight, and plant dry weight. Potassium fertilizer application significantly increases plant height, fruit weight, fruit volume, sugar content, plant fresh weight, and plant dry weight, as well as accelerates the flowering age of strawberry plants. Meanwhile, the interaction between fruit pruning and potassium fertilizer had no significant effect on the growth and production of strawberry plants in all observed parameters.

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### Author Contributions
The main autor Efbertias Sitorus: designing research, conducting research, collecting data, and writing research articles. The second author Lince Romauli Panataria, helped design the research; the third author Meylin Kristina Saragih, helped prepare the report and research instruments; and the fourth author R. Lubis, conducted data analysis.

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### Conflicts of Interest
The author declares that all authors have no conflict of interest.

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