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The Effect Plant Media Composition on the Growth and Production Some Varieties Strawberry

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Abstract
This research was conducted in Barus Jahe Village, Barus Jahe District, Karo Regency, North Sumatra, with an altitude of 1,367 meters above sea level. This study aims to determine the effect of the composition of the planting medium and several varieties on the production and growth of strawberry plants. The design used in this research is a Factorial Split Plot Design (RPT), which consists of two factors. The first factor is the main plot, Variety (V), with 3 levels: V1 = California, V2 = Local Bandung, and V3 = Local Brastagi. The second factor is the subplot, namely Planting Media Composition (M), which consists of Soil: Charcoal Husk: Chicken Manure, namely: M1= 1:1:1, M2= 2:1:1, M3= 1:2:1, and M4= 2:1:2.The variables observed were plant height, plant wet weight and plant dry weight, fruit weight and sugar content (Brix). Analysis of variance was used to test the effect of treatment and mean differences between treatments; honest significant difference tests, regression, and correlation were carried out at a test level of 5%. The research results showed that the composition of the planting media had no significant effect on the observed parameters. However, in some varieties, V1 (California) has a substantial impact on fruit weight and sugar content (Brix), and V2 (Local Bandung) has a significant effect on plant height, wet weight, and dry weight.

Keywords— Planting Media, Varieties, Strawberries.

Introduction

Strawberries (Fragaria sp.) are an important fruit crop worldwide, especially in countries with subtropical climates. Strawberry plants can live several years, but sometimes they are grown only as an annual. They have shallow roots, trifoliate compound leaves, white flowers, and red fruit (Jabat, 2023; A. M. Oktaviani et al., 2023; Wibowo & Alawiyah, 2019).

Strawberries can be consumed fresh or processed, such as syrup, jam, dodol, sweets, and additional ingredients in cakes or ice (Areni et al., 2019; Busthanul et al., 2023). Strawberries for fresh consumption have fresh red skin with a uniform fruit shape and size, while strawberries for processed fruit have the characteristics of a redder skin color and a high solid content. Every 100 g of strawberries contains 37 calories of energy, 0.7 g of protein, 60 IU of provitamin A, 59 mg of provitamin C, 0.03 g of thiamin, 0.07 g of riboflavin, 0.6 g of niacin, 21 mg of calcium, 21 mg of phosphorus, 8.4 g carbohydrates, 0.4 g fat, 1 mg iron, 1 mg sodium, 164 mg potassium, 12 mg

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magnesium and 89.9 g water (Kurnia & Mulyono, 2006; Pata'dungan et al., 2021).

Provitamin C in strawberries can reduce the risk of digestive tract cancer. Apart from provitamin C, strawberries contain several phytochemical compounds: anthocyanin, ellagic acid, catechin, quaerferrin, and kaemferol. Anthocyanins can lower blood pressure and prevent diabetes. Elagic acid is a phenolic compound that acts as an antitoxin, anti-free radical, anti-carcinogenic, and anti-mutagen, potentially inhibiting cancer (Pata'dungan et al., 2021; Renfiyeni et al., 2020).

Other benefits of strawberries include preventing cataracts, preventing constipation, reducing preventing cataracts, preventing constipation, reducing the risk of cancer, improving brain function, and fading teeth' yellow color. Consuming 8 strawberries or 50 calories every day can increase blood phosphate levels, reduce systolic blood pressure, help improve memory function, and overcome joint inflammation or rheumatism (P. N. Oktaviani, 2022). This strawberry plant will grow well in highland and cold areas with temperatures around 22 – 28^0C (Parehwa, 2020). According to (Afriani, 2021), the planting material generally used by farmers is stolen. Several widely developed strawberry varieties are the Santung, Sweet Charlie, and Local Brastagi varieties. Selection of plant varieties is highly recommended because using appropriate varieties or a high level of adaptation can increase yields and quality.

The Tanah Karo area of North Sumatra is suitable for strawberry cultivation. Strawberry cultivation in Tanah Karo only exists in Tongkoh Village, Tiga Panah District, and Korpri Village, Brastagi District. Farmers in North Sumatra (Tanah Karo) grow sweet Charli and oso grande varieties, which are very good for consumption as fresh fruit (Sinaga et al., 2022). To meet increasing market demand, several alternative cultivation techniques can be used for strawberry plants, with the hope that the resulting production will be optimal in quality and quantity. The methods used include planting systems, appropriate cultivation techniques, and the use of superior-characteristic varieties (Megasari, 2019).

Planting media is the main component of farming. The media functions to grow plants as a place for roots to establish plants, providing space, nutrients, water, and air for plant growth and development. Planting strawberries from stolon seeds using a planting medium mixed with charcoal husk and manure (2:1) can increase the growth percentage (Faisal et al., 2022; Mas'udah, 2022; Ramadhan et al., 2020). The media's physical, chemical, and biological properties primarily determine plant growth in polybags, including adequate nutrients, water, and soil air (Widyastuti et al., 2021). The planting medium, a mixture of soil, manure, and husk charcoal, has good water retention capacity, good enough porosity for root movement and respiration, and provides a source of nutrition for plants (Widyastuti et al., 2021).

A good planting medium must have good physical properties, be moist and porous, and have good drainage. Organic material that can be used as a source of nutrition for cultivation in polybags is compost and humus derived from cow dung, chicken dung, goat dung, rabbit dung, and other animal dung, straw, bamboo leaves, and other organic materials (Solichin & Badrudin, 2020).

Apart from the availability of nutrients, water, and air, plant growth in polybags is also influenced by the volume of media used. The media volume determines the amount of space available for growth and root strength to support planting and the availability of nutrients and water for plant growth and development. The larger the container or polybag size used (amount of media or weight of media used), the more freedom the roots have to grow. If the polybag size is smaller, the roots will not move freely

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Literature Review

The strawberry is a herbaceous fruit plant first discovered in Chile, America. One species of strawberry plant, Fragaria choiloensis L., has spread to various countries in America, Europe, and Asia. Furthermore, another species, namely Fragaria vesca L., is more widespread than the other species. This type of strawberry was also the first to enter Indonesia. The strawberries we find in supermarkets are hybrids from crossing Fragaria virgiana L. var Duchesne from North America with Fragaria chiloensis L. var Duchesne from Chile. The cross produced a hybrid, the modern (commercial) strawberry Fragaria x annanassa var Duchesne(Sonata, 2020).

Strawberries are subtropical plants that, in tropical areas, can adapt well to areas with rainfall of 600-700 mm/year with light hours of 8-10 hours per day. Adapts well to areas with temperatures between 17-20 ºC with air humidity between 80-90%(Surbakti, 2020). The altitude is around 1,000-1,300 meters above sea level. The height above sea level determines the air temperature and intensity of sunlight plants receive. The higher a place, the lower the temperature of that place, so the intensity of the sun decreases. This temperature and lighting will later classify which plants are suitable for the highlands or lowlands(Aryani, 2021).

Strawberries are a subtropical fruit; therefore, the strawberries cultivated in Indonesia result from introductions. California, this variety is now used widely in the world. The size of the fruit is enormous, the fruit is dense, the middle has a texture like foam, and the yield is high(Kurniawan, 2021).

Local Brastagi, the local variety of Brastagi, has a short shelf life at room temperature, meaning it can only last for one day. Meanwhile, this variety has an intense fruit aroma and bright red color, so this variety has the potential to be used as a processed ingredient(Ali et al., 2022). According to research(Ni'matillah et al., 2013), Using the local Brastagi variety tends to produce a higher fruit length of 2.76 cm. The use of planting materials and varieties does not affect the yield of strawberry plants. However, it does affect the number of fruit and fruit weight; namely, Saplings and Stolons' planting material produces several fruits of 3.87 - 4.07 fruit/plant and fruit weight of 23.47 - 28 .07 g/plant. The local Brastagi variety produced several fruits of 4.78 fruit/plant, a fruit weight of 31.13 g/plant, and a fruit sweetness level of 13.1obrix. These varieties have been widely cultivated, especially in highland areas such as Lembang, Cianjur, Cipanas, and Sukabumi (West Java), Batu and Situbondo (East Java), Magelang and Purbalingga (Central Java), Bedugul (Bali), and Berastagi (North Sumatra).

Local to Bandung, this variety has high yields, has many tendrils, flowers more than other varieties, grows at an altitude of 1300-1500 Mbps, with an optimum temperature of 17-18 ^{0}C, has a very sharp aroma, has a slightly soft texture, has a large size. Small fruit, very sour taste compared to other strawberry plants, susceptible to attacks by Verticillium (fungus) and anthracnose (spots on leaves and nodules on roots), and resistant to attacks by powdery mildew. This variety has a planting season in the middle of the season or in the middle of the month, where the condition of the fruit is quite soft, making it difficult for this pineapple variety to grow during the rainy season. The shelf life of this variety is around 3-4 days at a temperature of 22-27 ºC.

Research Method

This research was conducted in Barus Jahe Village, Barus Jahe District, Karo Regency, North Sumatra, with an altitude of 1,367 meters above sea level. The aim of this study is to determine the effect of the composition of the planting medium and several varieties on the production and growth of strawberry plants. The design used in this research is a Factorial Split Plot Design (RPT), which consists of two factors. The first factor is the main plot, Variety (V), with 3 levels: V1 = California, V2 = Local Bandung, and V3 = Local Brastagi. The second factor

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is the subplot, namely Planting Media Composition (M), which consists of Soil: Charcoal Husk: Chicken Manure, namely: M1= 1:1:1, M2= 2:1:1, M3= 1:2:1, and M4= 2:1:2.The variables observed were plant height, plant wet weight and plant dry weight, fruit weight and sugar content (Brix). An analysis of variance was used to test the effect of treatment. To test mean differences between treatments, honest significant difference tests, regression, and correlation were carried out at a test level of 5%.

Results and Discussion

Research result

Plant Height (cm)

The variance list showed that the treatments for several varieties had significant differences in plant height, but the planting medium and the interaction between the two treatments had no significant effect on strawberry plant height at all ages of observation. Figure 1 shows the differences in average plant height in the treatment of planting media composition and several varieties.

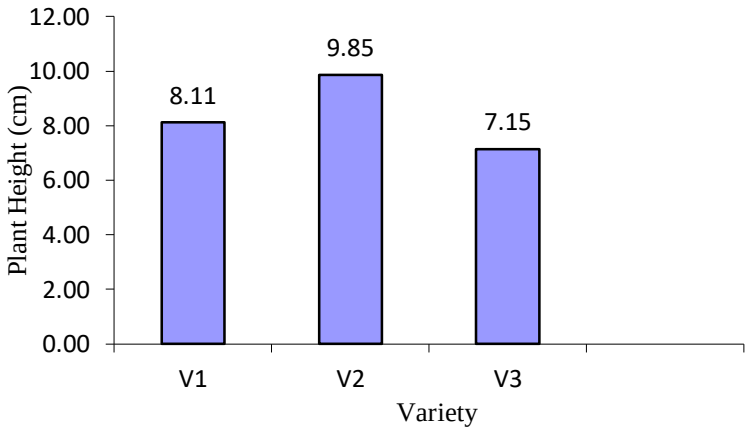


Figure 1. Relationship between plant height per sample and variety

Figure 1 shows that several varieties have the highest plant height in treatment V2 (Local Bandung), which is significantly different from V1 (California) and V3 (Local Brastagi). The relationship between plant height and several strawberry varieties (Figure 1). Plant height growth in the V2 variety increases according to the diagram curve.

2. Fruit Weight (g)

ListThe analysis of variance showed that the treatment of several varieties had a significant effect. However, the planting medium and the interaction of the two treatments had no significant effect on all strawberry fruit weights.

The results of the differences in average fruit weight per plant in the treatments of several varieties can be seen in the picture:

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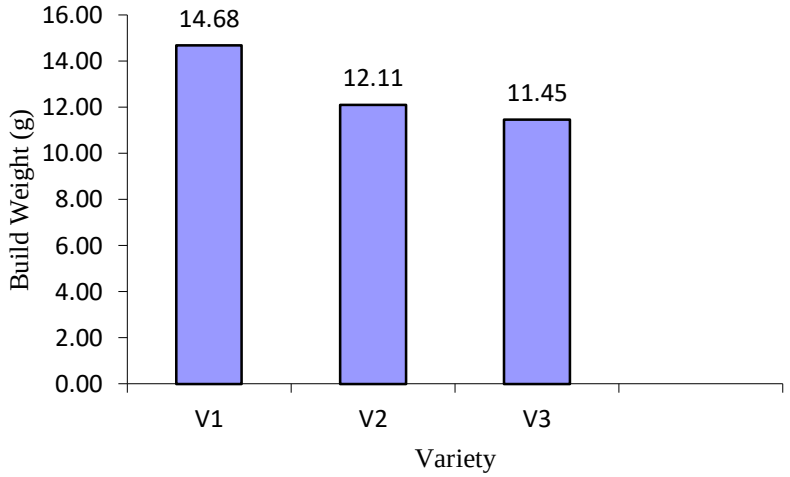


Figure 2. Relationship between fruit weight per sample with several varieties

Figure 2 shows several varieties. The heaviest fruit weight per plant was obtained in treatment V1 (California), significantly different from treatment V2 (local Bandung) but not significantly different from V3 (Local Brastagi). The relationship between fruit weight and several strawberry plant varieties (Figure 2) is shown. The use of the V1 variety in fruit weight increases according to the diagram curve.

3. Sugar Level (Brix)

ListThe variance test showed that the treatments of several varieties had a significant effect on the sugar content (Brix), but the planting medium and the interaction of the two treatments had no significant effect on the sugar content of the strawberry plants. The results of the difference in average sugar content (Brix) in the treatment of several varieties can be seen in Figure 3:

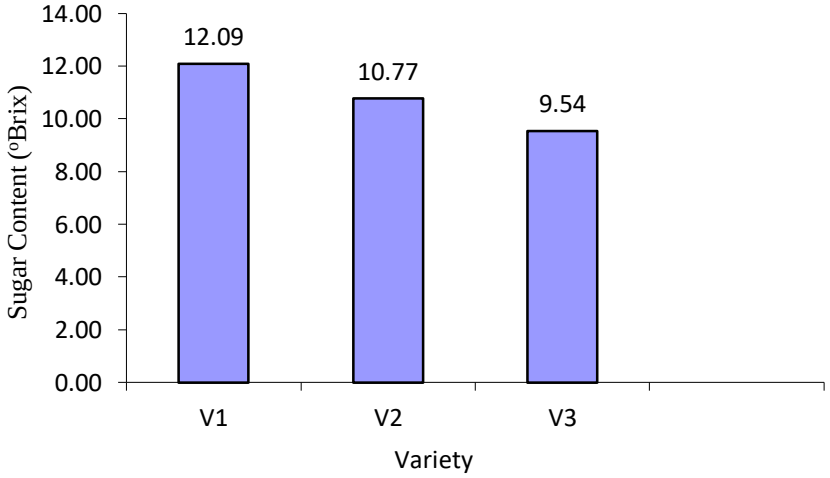


Figure 3. Relationship between sugar content (Brix) per sample with several varieties

Figure 3 shows the treatment of several varieties; the sweetest sugar content (Brix) was obtained in treatment V1 (California), significantly different from treatment V2 (Local Bandung) and significantly different from treatment V3 (Local Brastagi). The relationship between sugar content (Brix) and several varieties of strawberry plants. According to the diagram curve, the V1

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variety (California) has an increased sugar content (Brix).

4. Plant Wet Weight (g)

List The analysis of variance showed that the treatments of several varieties significantly affected the wet weight of the plants, but the planting medium and the interaction between the two treatments had no significant effect on the wet weight of the plants per sample. The results of differences in the average wet weight of plants per sample for several varieties can be seen in Figure 4.

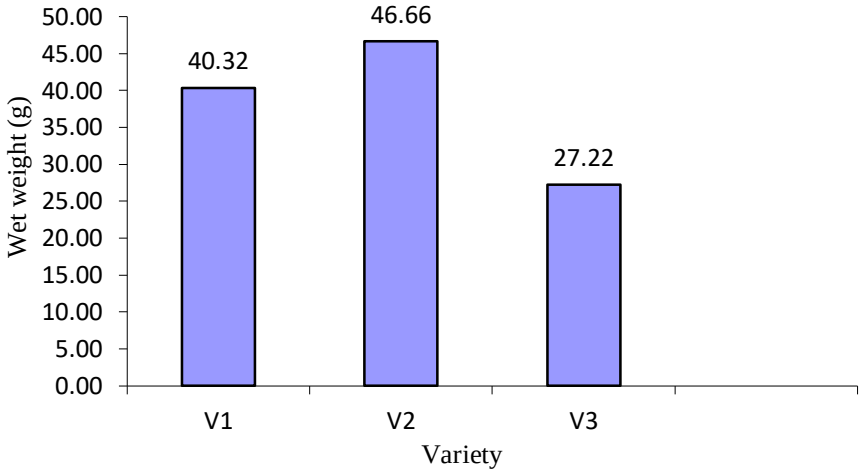
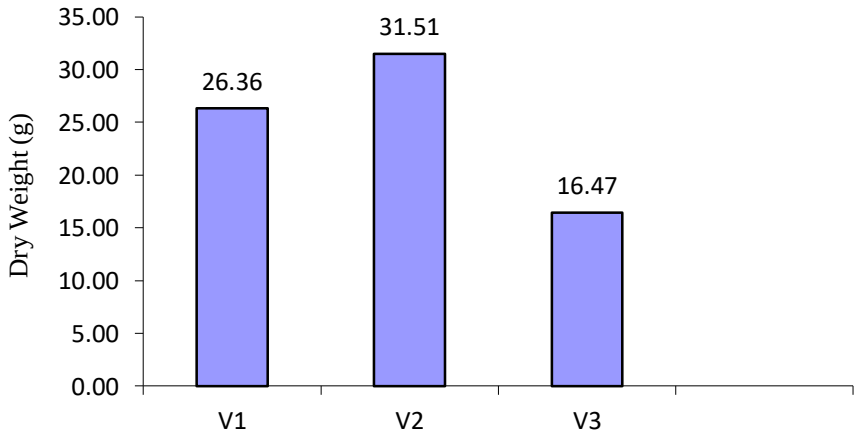


Figure 4. Relationship between plant wet weight per sample and several varieties

Figure 4 shows the treatment of several varieties. The heaviest wet plant weight was obtained in variety V2 (Local Bandung), significantly different from variety V3 (Local Brastagi) but not significantly different from V1 (California). Relationship between plant wet weight and several varieties (Figure 4). The use of the V2 variety has a wet plant weight that increases according to the diagram curve.

5. Plant Dry Weight (g)

ListThe analysis of variance showed that the treatments of several varieties had a significant effect on dry weight. However, the planting medium and the interaction of the two treatments had no significant effect on the dry weight of strawberry plants. Results of differences in average dry weight of plants for several varieties in Figure 5



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Figure 5. Relationship of Plant Dry Weight per sample with Several Varieties

Figure 5 shows the treatment of several varieties. The heaviest plant dry weight was obtained in variety V2 (Local Bandung), significantly different from treatment V3 (Local Brastagi) but not significantly different from V1 (California). Relationship between plant dry weight and several varieties. According to the diagram curve, the use of the V2 variety increases plant dry weight.

Discussion

The Effect of Several Plant Varieties on the Growth and Production of Strawberry Plants

The research results showed that the V2 variety had the highest rate of increase in plant height (9.85 cm) because its growth was more directed towards the growth and propagation of tendrils. For fruit weight, V1 (California) had heavy fruit weight and was followed by V2 (Local Bandung) and V2 (Local Brastagi).

In the treatment of several varieties, it was found that V1 (California) had a high level of fruit sweetness. The results obtained showed that the fourth harvest in the V1 (California) treatment had the highest average level of sweetness, followed by V2 (Local Bandung) and V3 (Local Brastagi). California, this variety is now used widely in the world. The size of the fruit is enormous, the fruit is dense, the middle has a foam-like texture, and the yield is high.

The process of ripening or fruit ripening is related to respiration and photosynthesis activities in plants, so the ripening process usually increases the amount of simple sugars that give the fruit a sweet taste. The three main sugars are sucrose, fruit juice, glucose, and fructose (Zumairy, 2018).

(Astuti et al., 2015) states that strawberries that ripen in the rainy season have lower sugar content than in the summer. Strawberry varieties with the best growth tend to be found in the local Bandung variety in terms of average plant height, plant wet weight, and dry weight of samples per plant, and the best production tends to be found in the California variety in terms of average fruit weight and sugar content, compared to the local Brastagi variety.

According to (Surbakti, 2020), the quantity and quality of a plant's yield are influenced by the variety used. Besides that, superior varieties usually have a higher level of resistance to pest attacks and better quality, such as fruit appearance (color, size, and shape), fruit hardness, aroma, taste, and nutritional content. Superior varieties are essential in increasing strawberry productivity because they have good characteristics and are genetically uniform, so they are expected to produce higher yields than other varieties.

Effect of Planting Media Composition on Growth and Production of Strawberry Plants

The results of the variance test showed that the composition of the planting media had no significant effect on plant height, fruit weight, sugar content (Brix), wet weight, and dry weight of plants per sample. There is no real influence of the composition of the planting medium on the parameters thought to be the case in making the husk charcoal planting medium. Not all of the husks burned completely; some turned to ash, and some did not burn.

(Susanto et al., 2010) stated that the temperature is high during flower blooming, and the receptivity of the stigma becomes short, thereby inhibiting fertilization. This can reduce the number and weight of harvested fruit. Many flowers fall and rot, which can decrease the number of fruits and fruit weight due to the bad climate. (Setiawan, 2012) stated that plant wet weight is influenced by water uptake. The more water uptake by plant tissue, the higher the plant's wet

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weight.

According to (Singgih, 2023), the larger the container or size of the polybag used (amount of media or weight of media used), the more freely the roots will grow. Plant growth and development are influenced by using the correct container size and the condition of the media, which can hold water and absorb water and minerals.

Husk charcoal is porous, light, and not dirty but can absorb low water and good porosity. This property is beneficial as a planting medium because it supports improving soil structure (Yanti, 2022). The comparison of the composition of the planting medium with husk charcoal and chicken manure improves soil porosity and water permeability; however, strawberry plants for this planting medium easily experience drought because the research location is in a mountainous area, so during the day, the temperature is high, evapotranspiration increases.

The light factor plays an important role in strawberry growth. In general, strawberries like direct sunlight but relatively low air temperatures. The problem in strawberry cultivation is the high air temperature, which causes the strawberry plants to dry out (Dienilah, 2022).

Interaction Effect of Planting Media Composition and Several Strawberry Plant Varieties

The interaction effect of the composition of the planting medium and several varieties of strawberry plants, as determined by the results of variance analysis, had no significant effect on plant height, flowering age, fruit weight per sample, sugar content per sample, wet weight per sample, and dry weight per sample. This is because varieties play a greater role in growth and production than the composition of the planting medium used.

The planting variety, the number of flowers, and the growing environment determine plant productivity. If the lighting is suitable and sufficient light is available at the time of fruit formation, the weight of the fruit and its quality are also influenced (Suparno et al., 2022).

Conclusion

The treatment of several strawberry varieties significantly affected plant height, sugar content, fruit weight, plant dry weight, and plant wet weight. The interaction between the planting medium and several strawberry varieties had no significant effect on the growth and production of strawberry plants, on plant height, fruit weight, sugar content, fruit weight, and plant dry weight.

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