BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE DEPARTMENT OF CROP SCIENCE

# EFFECT OF MEDIA AND VARIETY ON THE PERFORMANCE OF STRAWBERRY

NYAMUNDASOKA PRISCA RUTENDO

(B211799B)

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(CROP SCIENCE)

Date:

# DEDICATION

I dedicate this project to my parents Mr and Mrs Nyamundasoka.

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| PRISCA R NYAMUNDASOKA | ……………….……. | 17/09/25 |
| (CANDIDATE) | (SIGNATURE) | (DATE) |

CERTIFIED BY

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| MR. MUTSENGI | ………………………. | ………………….. |
| (SUPERVISOR) | (SIGNATURE) | (DATE) |

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| MR. MUTSENGI | ……..………………. | …………………….. |
| (CHAIR PERSON) | (SIGNATURE) | (DATE) |

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# ABSTRACT

This study investigated the effect of different growth media and strawberry varieties on the plant's vegetative growth, fruit quality, yield and disease incidence. The experiment followed a factorial arrangement within a randomized complete block design complete (RCBD) with two varieties monterey and cabrillo were grown in three different media sandy loam, pine bark and clay loam. The results showed that the growing media significantly affect plant growth, fruit quality, yield and disease prevalence ($p < 0,05$). Significant interactions between media and variety were observed. The clay loam and pine bark resulted in the highest yield and fruit quality while sandy loam performed poorly. The study showed that pine bark is most effective media for promoting vegetative growth and its importance as a substrate in disease management. The study highlights recommendations to farmers that sandy loam should be supplemented with organic matter as it showed lower performance in all parameters. In between the strawberry varieties monterey is recommended to farmers as it outperformed the cabrillo variety in most parameters including leaf number, yield and fruit weight. These results provide valuable insights for farmers and agricultural practitioners ways to enhance strawberry production through optimal medium variety pairing. Recommendation to farmers to use pine bark can serve as a preventative measure against soil-borne diseases due to its better drainage and aeration. This can reduce dependence on chemical fungicides promoting more sustainable farming.

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# CHAPTER 1

## 1.1 Introduction

Strawberry (Fragaria ananassa) cultivation plays a crucial role in global horticulture, contributing significantly to agricultural economies. As a high-value crop, strawberries require optimal growing conditions to achieve maximum yield and quality. One of the most critical factors influencing strawberry production is the choice of growing media, as soil composition directly affects plant growth, water retention, nutrient availability, and overall production efficiency. This study focuses on assessing the performance of two strawberry varieties, Cabrillo and Montero, in three different growing media—sandy loam, pine bark, and clay loam. The findings from this research will provide valuable insights into sustainable strawberry production methods, particularly for farmers seeking to optimize yield and quality through improved soil management practices.

Strawberry production varies across regions, with countries such as Morocco, Egypt and South Africa leading in African strawberry exports due to favourable climatic conditions and well-established production systems. According to the Global production statistics of year 2023 due to its country’ s favourite climate and advanced agricultural practices Morocco produces at approximately 180000 metric tons. Followed by Egypt which produced around 110000 metric tons in 2023. The country’s production is driven by both domestic consumption and export markets, particularly to Europe and the Middle East. South Africa’s strawberry production was about 40000 metric tonnes in 2023 and the industry benefits from a diverse climate, allowing for extended growing seasons. In Zimbabwe, strawberry farming is gaining traction, particularly in urban and peri-urban areas such as Harare and Marondera. However, despite its potential, large-scale strawberry production remains limited, with smallholder farmers often facing significant challenges in adopting the crop. The unpredictability of climate, limited access to capital, inadequate technical knowledge, and restricted market opportunities hinder the expansion of strawberry cultivation among small-scale farmers. Understanding how different soil compositions influence strawberry growth under local conditions could help address some of these challenges, making production more viable and sustainable.

## 1.2 Background of the study

Strawberries are among the most widely cultivated and economically valuable fruits worldwide, with global production exceeding 9 million metric tons in 2022 (FAO, 2023). The demand for strawberries has risen due to their rich nutritional profile including high vitamin C, antioxidants, and fibre which contribute to numerous health benefits such as improved heart health and blood sugar regulation (Singh et al., 2021). However, optimizing strawberry production requires selecting suitable growing media, as soil properties influence plant growth, fruit yield, and disease susceptibility.

Traditional field cultivation in sandy loam and clay loam soils remains common, while alternative substrates such as pine bark are increasingly explored in soilless and hydroponic systems (Daugaard & Callesen, 2020). Each soil type has unique physical and chemical characteristics that impact water retention, nutrient availability, and root aeration. Studies have demonstrated that sandy loam provides good drainage and aeration, clay loam retains moisture and nutrients effectively, and pine bark offers high organic content but may require additional fertilization (Zhang et al., 2022).

The raised beds with soil substrate, clay loam and sandy loam has been associated with higher frequency of diseases, low yields and extensive land usage. Strawberry yield, quality, and disease prevalence are strongly influenced by the media properties. Different media types affect moisture, aeration and microbial activity influencing disease susceptibility with some promoting root diseases like Phytophthora and Fusarium while others may reduce disease incidence. This study focused on evaluating the growth, yield, fruit quality, and disease prevalence of  cabrillo and montero strawberey.

## 1.3 Problem Statement

However comparative research on these substrates for strawberry cultivation particularly with the Cabrillo and Montero varieties is limited.

## 1.4 Justification of the Study

Strawberry cultivation is essential for food security, economic development, and sustainable agriculture. The findings of this study will benefit multiple stakeholders:

Farmers and agronomists will gain insights into the most suitable soil media for growing cabrillo and montero strawberries, helping them optimize yield and quality while reducing input costs. Policymakers and agricultural extension officers can use the findings to develop guidelines for sustainable strawberry farming, particularly in regions with varying soil conditions.

From an academic perspective, this study will contribute to existing literature on strawberry production systems, particularly in evaluating the influence of soil media on plant performance. By addressing a critical knowledge gap, it will provide a foundation for future research on improving strawberry cultivation practices in diverse agro ecological zones.

## 1.5 Study Objectives

### 1.5.1 Main Objective

To compare the performance of cabrillo and montero strawberry varieties in different media

### 1.5.2 Specific Objectives

1. To determine the effect of media type and variety on the vegetative growth parameters (leaf number and number of runners per plant) strawberries.
2. To determine the effect of variety and media of fruit yield of strawberry
3. To evaluate the effect of variety and media type on strawberry fruit quality attributes (size and degree of blemish)
4. To assess the effect of variety and media type on disease prevalence in strawberries

## 1.6 Hypotheses

i. Variety and media type have an effect on the vegetative growth of strawberry.

ii. There is no significant difference in the fruit yield of strawberry varieties grown in different media.
iii. Variety and media have an effect on the quality of strawberry fruits.
iv. There is no significant difference on disease prevalence of cabrillo and montero strawberries grown in different soil media

# CHAPTER 2

## LITERATURE REVIEW

### Introduction

Strawberry production status varies in different countries or regions. In Zimbabwe the production of strawberries is relatively small but is also growing steadily. The main production areas in Zimbabwe are Nyanga, Marondera and some parts of Manicaland Province. Due to high market demand the interest is increasing in urban centres like Harare and Bulawayo. Cultivation is mainly open field, with an increased adoption of greenhouse and drip irrigation technologies. In Zimbabwe problems encountered in strawberry production include the limited use of certified planting materials (Chikobvu etal 2020). Some of the challenges are pest and disease pressure, poor post-harvest handling, this is due to lack of knowledge and education for the farm workers. In countries like South Africa strawberry production is more commercialized and advanced. In South Africa the production is big since the farms are highly mechanized and irrigated production systems for example farms in Western Cape (DAFF 2020). The use of plasticulture and tunnel farming is common in South Africa. The product is consumed locally and exported to the European Union and the Middle East. Globally strawberry production is a multi-billion-dollar industry with Unites States, China, Mexico, Turkey and Egypt as the top Producers (FAO 2022).

The production consists the use of controlled environment agriculture that is green houses and vertical farming. These top producers are on breeding programs which focus on yield, disease resistance and the shelf life of strawberry plant. Strawberries has nutritional benefits that is why it is considered a super fruit due to its high nutrient content and health benefits. According to Giampieri (2012) strawberry contains 59 mg per 100g of vitamin C which boosts the immunity and antioxidant, 2g per 100g of fibre which aids in digestion, folate which is important for cell growth, potassium which regulates the blood pressure and antioxidants, which helps in anti- inflammatory and anti-cancer properties. The health benefits of strawberries are may help to regulate blood sugar levels, it improves heart health by reducing oxidative stress and aid in skin health and cognitive function. There are problems encountered in Strawberry production which include pest and diseases. Common pests include spider mites, aphids, thrips and whiteflies.

The diseases are Botrytis which is gray mold, powdery mildew, verticillium wilt and anthracnose. Strawberries are climate sensitive mostly to extreme temperatures and frost therefore they require well drained soil and consistent moisture (Hancock 2020). Post harvest losses in strawberry production because strawberries are highly perishable because their shelf life is short (2 to 5 days). In developing countries they lack cold storages and transportation that is poor roads.

The growing substrate used for the production of strawberry plays an essential role in determining the vegetative growth, fruit yield and fruit quality. Strawberry require a well-structured, aerated and nutrient rich medium to survive whether they are grown in open fields, greenhouses or soilless systems. The qualities of a suitable growing medium for strawberries include good drainage the media must allow excess water to drain freely because strawberry is highly susceptible to root rot (Maas 1998). Waterlogged mediums lead to diseases like Phytophthora root rot and Verticillium wilt. The medium must have high water holding capacity the media should be able to retain enough moisture for optimal growth between irrigations. A suitable medium maintains moisture without becoming saturated supporting steady plant development (FAO 2011). The medium should have adequate aeration because strawberry roots need oxygen to function effectively. Substrates like pine bark promote root respiration reducing fungal infections because they are well aerated. An optimal pH range is need for strawberry production to thrive they grow best in a slightly acidic medium with 5.5- 6.5. Acidic pH promotes nutrient availability and prevents iron and manganese deficiency. The media must be rich in organic matter because organic matter enhances microbial activity, soil structure enhancement and nutrient supply. Organic matter improves the fertility, water retention and microbial biodiversity of strawberry soils by Hancock 2020. The medium should be of low Salinity because strawberries do not grow well in saline soils. High salt levels can impair the water uptake and cause leaf burn.

Strawberries are adaptable to different agro ecological zones and cultivation systems because of their shallow root system, the short growing cycle and high diversity among cultivars. Strawberries has climatic adaptability, its optimal temperatures range between 15-25 degrees Celsius. They tolerate mild frost but are sensitive to extreme heat and prolonged cold. Cultivar like Montero flower under decreasing day length because they are short day varieties. Soil adaptability, strawberries prefer well drained sandy loam with pH between 5.5-6.5. They can be grown in soils like clay loams with varying textures provided there is drainage. In soilless systems, strawberries grow well in substrates like pine bark (Hartz etal 2000). Geographic adaptability, strawberry are effectively grown in temperate regions like USA and China and Tropical or subtropical regions like Zimbabwe, South Africa and Mexico. These regions requires locayion specific variety selection and season planning to avoid high rainfall or heat. The genetic adaptability where many cultivars were bred for specific traits for example disease resistance to Verticillium wilt, climate tolerance to heat or photoperiod and fruit size and yield. Genetic improvement has increased the adaptability of strawberries to both biotic and abiotic stresses (Maas 1998).

## Production Soil Types and Their Influence on Strawberry

### Sandy Loam

Sandy loam is a type of soil which consist of favourable properties of sand, silt and clay. Due to its balanced texture and composition that is 50-70% sand (large particles 0,005-2,0mm), 10-30% silt (medium particles 0,002-0,05mm) and 5-20% clay (fine particles <0,002mm) it gives its well-draining properties. There is high micro porosity because of the sand particles which creates large pore spaces enhancing the availability of oxygen for roots. The loose structure gives easy root penetration. On vegetative growth it promotes root expansion and may lead to water stress thereby reducing leaf number and runners. Studies indicate that sandy loam enhances root development and minimizes the risk of waterlogging a significant factor affecting strawberry yield and fruit quality (Smith etal, 2018). There is moderate cation exchange capacity (CEC) because the clay and silt fractions helps in retaining nutrients like $Ca^{2+}$, $K^{+}$ and $Mg^{2+}$, However, its low water-holding capacity requires frequent irrigation and proper fertilization strategies to maintain nutrient availability (Jones & Carter 2017).

### Pine Bark Substrate

Pine bark is commonly used in soilless and container-based systems. The physical properties offers high good aeration because of its coarse texture with high porosity reducing root diseases and promoting healthier plants (Hochmuth etal, 2019). It retains moisture while allowing excess water to drain which prevents waterlogging a common problem in strawberry production that can lead to root rot (Raviv etal 2002). Pine bark substrate has slow decomposition and nutrient release because it gradually breaks down realising small amounts of nutrients e.g potassium and calcium over time. Pine bark decomposes faster than hardwood bark because of its low C:N Ratio reducing nitrogen immobilisation. Research suggests that pine bark substrates improve fruit quality and uniformity but may require additional nutrient supplementation due to limited natural fertility (Fernandez & Williamson, 2016). Biologically pine bark encourages beneficial microbes, the organic matter supports mycorrhiza fungi which help in nutrient uptake. In strawberries pine bark can suppresse diseases for example soil borne pathogens can be suppressed by phenolic compounds found in pine bark substrate (Bonanomi etal 2010).

**Clay Loam**

Clay loam is a soil texture class which contains a significant proportion of clay along with balanced amount of sand and silt. It is known for its fertility, moisture retention and structural stability. The texture and composition of clay loam consists of clay 27-40% clat (very fine particles <0,002mm), sand 20-45% (coarse particles 0,05-2,0mm), silt 15-53% (medium particles 0,002-0,005mm). this composition and texture gives it a smooth yet slightly gritty feel when moist (Braydy and Weil 2016). The fine clay particles on clay loam characterized by higher water-holding capacity and nutrient retention, can support robust strawberry plant growth under controlled irrigation conditions. On aeration and porosity it gives low micro porosity because it is clay dominated and there are fewer larger pores thus restricting oxygen flow to roots. Excessive moisture retention can increase disease susceptibility, necessitating proper drainage management (Zhao etal, 2018). Comparisons between clay loam and sandy loam indicate that clay loam may enhance berry size and blemish. This enhancement is due to high cation exchange capacity (CEC) because of clay minerals that is montmorillonite kaolite holds nutrients like $K^+$, $Ca^{2+}$ and $NH_4^+$ effectively. Clay particles in clay loam are rich in macronutrients also that is iron, zinc and manganese (Hillel 2003). Clay loam can lower overall yield due to aeration limitations (Kumar etal, 2019). Requires organic amendments (compost and manure) to improve its structure and reducing compaction.

## Strawberry Varieties: Cabrillo and Montero

### Cabrillo Variety

Cabrillo is a relatively new day-neutral variety developed by the University of California breeding program in 2015. It is well known for its high yield potential, an early season cultivar with great fruit quality and is resistance to common strawberry pathogens. Studies show that Cabrillo performs well in sandy loam soils, producing consistently high yields with proper irrigation and fertilization management (Shaw etal, 2017). However, in clay loam conditions, excessive water retention may reduce fruit quality and increase disease incidence (Martínez etal, 2019). Cabrillo variety has shown that it has strong root development and yield in pine bark substrate. In sandy loam it promotes early fruit production because it warms up quickly in spring. Cabrillo can have a strong vegetative growth in clay loam if managed properly

### Montero Variety

Montero is a short-day variety which was also developed by the University of California. It is recognized for its firm fruit texture, high yields, extended harvest season and high sugar content. Montero variety has moderate to high vigour which results in runner production, The size of the berry is medium to large with a conical shape and the blemish is bright red to glossy exterior. Research indicates that Montero thrives in clay loam soils where nutrient availability is optimized, leading to improved fruit development and marketable yield (Lopez et al., 2018). However, in sandy loam, it requires frequent irrigation adjustments to prevent water stress (Gonzalez & Rivera, 2019). In pine bark substrate it reduces risks of root rot because of excellent drainage.

## Comparative Performance of Strawberry Production Systems

Studies comparing soil-based and soilless strawberry cultivation suggest that pine bark systems enhance early fruiting and disease resistance but may require more intensive nutrient management (Hochmuth et al., 2019). Additionally, sandy loam supports faster root development, while clay loam sustains long-term plant vigour with proper drainage. Comparisons between cabrillo and Montero indicate that while cabrillo excels in sandy loam, montero adapts better to clay loam conditions (Zhao etal, 2018).

# CHAPTER 3

## 3.1 Experimental site

Mushandi Home Farm is located 8.5 km from the Harare-Mutare highway in Macheke, within Mashonaland East Province, Zimbabwe. The Mushandi Home Farm coordinates are -18,13901 latitude and 31,84933 longitude. The farm falls under Natural Region IIb. Mushandi Home Farm receives an annual mean rainfall of approximately 750 mm to 1000 mm, which is adequate for dryland field crop production. Rainfall distribution is relatively even, although January occasionally experiences dry spells requiring supplementary irrigation. The mean annual temperature is 18°C, with a minimum of 4°C and a maximum of 19°C, indicating a cool climate. Frost occurrences are common during winter, necessitating escape planting and the selection of frost-tolerant crops.

### 3.2 Experimental Design

The study employed a randomized complete block design (RCBD) arranged in factorial manner. There were two factors; media type and variety. Variety had two levels Monterey and Cabrillo and media type had three levels sandy loam, pine bark and clay loam. The trial was replicated three times for statistical accuracy, that is (6 treatments by 3 replicates). The blocking factor was media type.

## **3.3** Agronomic practices

### 3.3.1Land preparation

A tractor drawn ripper was used first to break up compacted soil layers followed by chisel plough to further loose the soil and improve aeration and then a disc harrow to break big soil clods and obtaining fine tilth. Application of lime and gypsum at a rate of one tonne per hectare to correct acidity and improve soil structure and gypsum was applied to help break up clay and reduce sodicity. Compound fertilizers of 300 kg/ha Tobacco Fert (6:18:15); 750 SSP/ha and 200 kg K2SO4/ha were broadcasted using a tractor drawn fertilizer spreader and disced into the soil before planting. The field was irrigated to field capacity to fully saturate the root zone and ranged between 100-150mm. Raised beds were manually made which were measuring 40m (L) x 0.90m (W) x 0.4m (H) using hoes, shovels, measuring strings, wood pegs and tape measure. During the bed making process, gypsum, lime and compound fertilizers were thoroughly incorporated into the soil profile. Beds were as levelled as possible to ensure good water distribution when drip irrigation was installed. For the pine bark media table top structures were raised 1m above ground level of support trellises using wooden poles. Pine bark bags of 40m combined length were placed on top of the structures and pierced at the bottom for drainage.  Same amount of fertilizers applied to the sandy loam and clay loamy media were also applied to the pine bark media.

### 3.3.2Mulching

UV stabilised clear plastic was used in soil media plots only not in pine bark media so as to conserve moisture, hinder weed growth and to avoid strawberries direct contact with soil.

### 3.3.3Planting

Planting of strawberries was done in winter between June and July. Two varieties Cabrillo and Montero were used. Removed the plants from the cold room as required not allowing them to dry out and graded health and vigorous seedlings thoroughly under a shade and discarded undersized cuttings with poorly developed root systems and planted out top quality cuttings with strong rooting systems which are able to withstand planting stress. Trimmed roots to about 10 cm removing old leaves to minimize transpiration stress. Setting water was poured into the planting station to ensure an improved root to soil contact and eliminate air spaces around the roots. A spacing of 0.40x 0.25m was used.

### 3.3.4Fertigation and irrigation

Fertilizer application and irrigation was done through drip pipes systematically and was done for 16minutes with drip volume of 650ml and EC OF 1.6 for fertilizers. The amount of fertilizer application was based on soil analysis results. Plant nutrients and water were applied through drip irrigation. Plants were irrigated with pure water for 3 days so as to allow the media to be stabilised and reach a consistent state before introducing fertilizers. Fertilizers applied were calcium nitrate, SOP (vita k), Magnesium sulphate, omni boost and MKP.

*Table 3.1 Fertilizers applied.*

| **Growth Stage (Weeks After Planting** | **Product** |
|---|---|
| Pre flowering (5-7 WAP) | Magnesium sulphate |

| | |
|---|---|
| Post flowering and fruit development (8-10 WAP) | Calcium nitrate |
| Fruit stage (10-14 WAP) | Potassium sulphate |

### 3.3.5Removal of runners and old leaves

Runners and old leaves were removed using hands and it was done before flowering and fruiting. Runners are removed in order to prevent them from competing with the main plant for nutrients when they develop. Runners divert energy from fruit production to vegetative growth. Old leaves are also removed to avoid competing with the plant for food and they also can be used by pests as shelter or harbour plant pathogens like fungi and bacteria. Removing old leaves improves light penetration for developing fruits enhancing sugar accumulation and quality.

### 3.3.6Weed management

The UV plastic mulch played a pivotal role in controlling weeds. However, a few weeds emerged from the strawberry crown. Weeds were pulled by hand and used hoes to clear pathway to avoid competition for the uptake of nutrients and water with strawberries.

### 3.3.7Disease management

*Table 3.3 Diseases and their control*

| **Disease** | **Rate/ha** | **Chemical** | **Application detail** |
|---|---|---|---|
| Powdery mildew | 300ml | Amister top | Sprayed at first disease sighting |
| Botrytis | 450kg | Scala | Sprayed at first disease sighting |

### 3.3.8 Pest management

*Table 3.2 Crop pests and their control*

| Pest | Rate/ha | Chemical | Application method |
|---|---|---|---|
| Nematodes | 2L | Oxamyl | Drenching |
| White grubs | 400ml | Chlorpyrifos | Drenching |
| Aphids | 3×100m rolls | Optirol yellow traps | Spread along tunnel length |
| Red spider mites | 75ml | Dimethoate | Full cover spray |

### 3.3.9Harvesting

Harvesting was done from 90-120 days after planting. It was done by hands with minimum damage since the crop is very perishable. The strawberries were picked with the stalk attached and were arranged in crates with sleeves to avoid bruising. Strawberries were kept in the cold room for refrigeration at 3 – 5 degrees Celsius to remove field heat and also lengthen their shelf life. The harvesting indices were a full colour development that is 80% red surface, a firm texture with no soft spots and the stalk should be attached to prolong shell quality.

### 3.3.10Grading

Grading was done with minimal damage as the crop is very perishable. Strawberries were picked with the stalk attached to the fruit and placed in shallow punnets which were ranging from 250g to 400g. They were graded according to size, color and shape where Grade A was greater than 12g and Grade B was less than 12g.

## 3.4 Data Collection

### 3.4.1Vegetative Growth Parameters

Leaf number: Counting was done 5 times from week 2 to week 6.

Number of runners: Counting was done 5 times from week 2 to week 6.

Counting was done on 10 randomly selected plants from each plot from week 2 to week 6. The same plants were tagged and monitored till the end of the research to ensure consistency. I used random sampling technique where the plants were selected randomly. The average values of the selected 10 plants were recorded from each replicate. Growth rate was not directly calculated but the number of leaves and runners represented vegetative growth.

#### 3.4.2Fruit Yield

The yield was collected by weighing the mass of strawberries produced weekly. The average weight obtained from the six replications was recorded. All ripe fruits were collected and measured using a digital balance.

#### 3.4.3Fruit Quality

The quality of the fruits was determined when grading. The fruits were graded by their weight. There were 2 grades based on weight where the fruits with 12g and above were Grade A and those with less than 12g were Grade B. Weight was only used as a parameter for fruit quality but colour and firmness can be used also.

#### 3.4.4Disease prevalence

Disease prevalence was measured by checking once diseased plants just before the first harvest. A scoring system of scale 0-5 was used where 0 showed no symptoms, 1 represented 1-10% leaves affected, 2 represented 11-25% affected, 3 represented 26-50% affected,4 represented 51-75% affected and 5 represented 75% affected or plant death. The average disease score was obtained from the six replications and recorded.

### 3.2.4 Statistical Analysis

All collected data were analyzed using Analysis of Variance (ANOVA) in GenStat 17$^{th}$ Edition. Significant differences among treatments were determined using Fisher's Least Significant Difference (LSD) test at a 5% significance level ($p \leq 0.05$).

# CHAPTER 4

## 4.0 RESULTS

### 4.1 Leaf growth

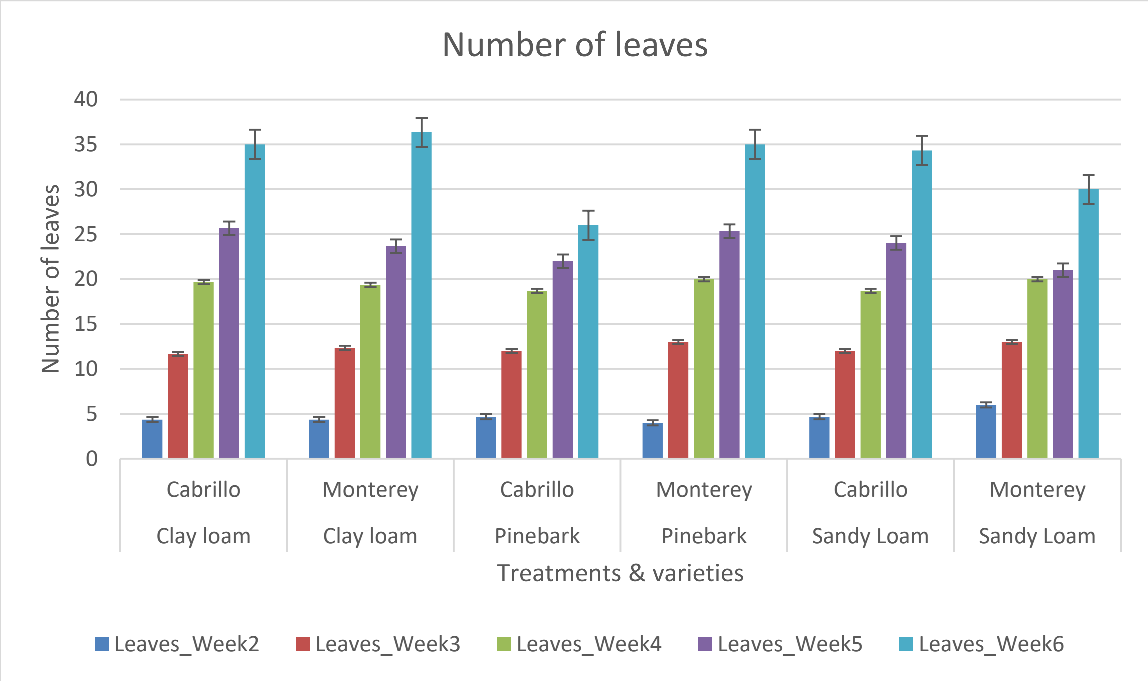


*Figure 1: Number of leaves*

Anova results for leaf growth revealed complex interactions across weeks. There were statistically significant interactions in week 2 between treatment and variety (p=0.007) and significant treatment effects (p=<0.008) showing that media type substantially affected leaf development differently for each variety. Sandy loam media had the highest average leaf count (5.365) whereas clay loam and pine bark had similar leaf counts (4.325 and 4.381 respectively).

Week 3 showed no significant interactions suggesting stabilized growth. Week 4 also showed no significant interactions. Week 5 showed an insignificant treatment x variety interaction (p=0.209) while week 6 showed marginally insignificant treatment effects (p=0.078).

They were consistently non-significant differences among the varieties with Monterey showing slightly higher leaf numbers in most weeks. The analysis suggests that media type more so in early growth stages played a more important role in leaf development than variety selection.

## 4.2 Runner analysis

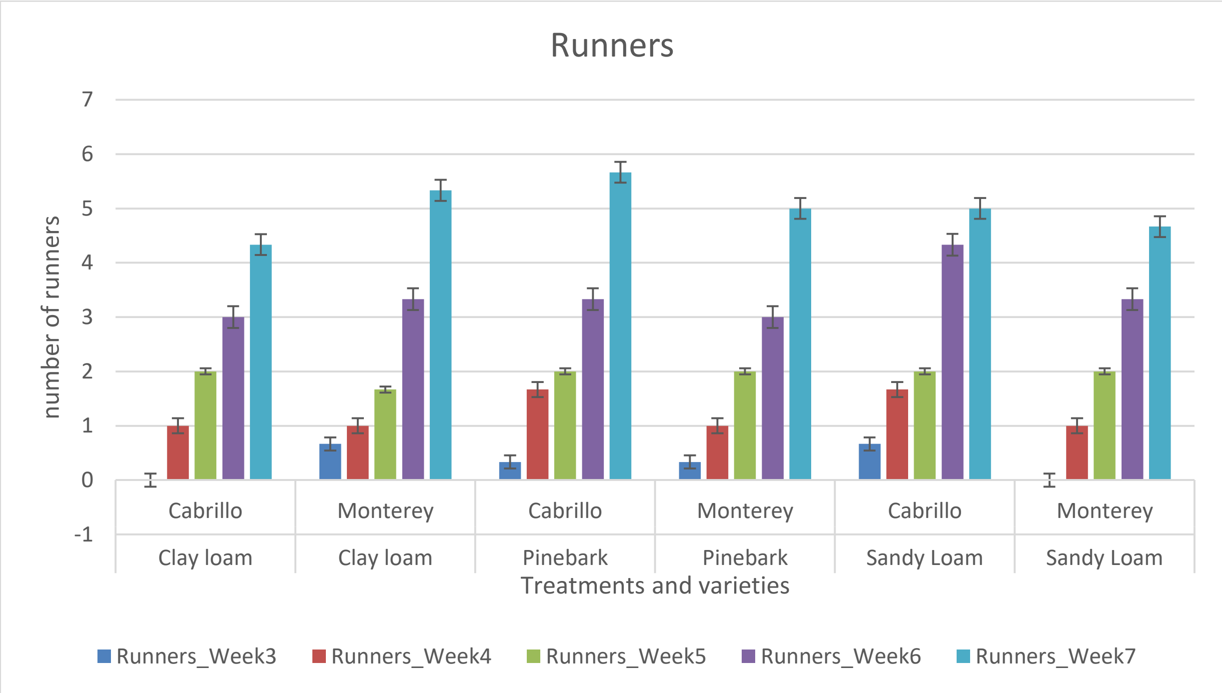


*Figure 2: Number of runners*

Varying interaction patterns were seen in runner development across weeks. In week 3 the treatment by variety interactions were not statistically significant (p=0.125) with lower runner numbers (0.32 – 0.4 runners per plant).

In week 4 there were significant interactions between treatment and variety (p=0.021). The variety effects were also significant (p=0.003) with Cabrillo producing more runners (1.482) compared to Monterey (0.996). Treatment also had a significant influence on runner production (p=0.05) with pine bark (1.383) and sandy loam (1.31) media producing significantly more runners than clay loam (0.996).

From week 5 to week 7, there was progressively less significant interactions. By week 6-7, neither variety nor treatment significantly influenced runner production indicating stabilization of runner development.

4.3 Fruit quality

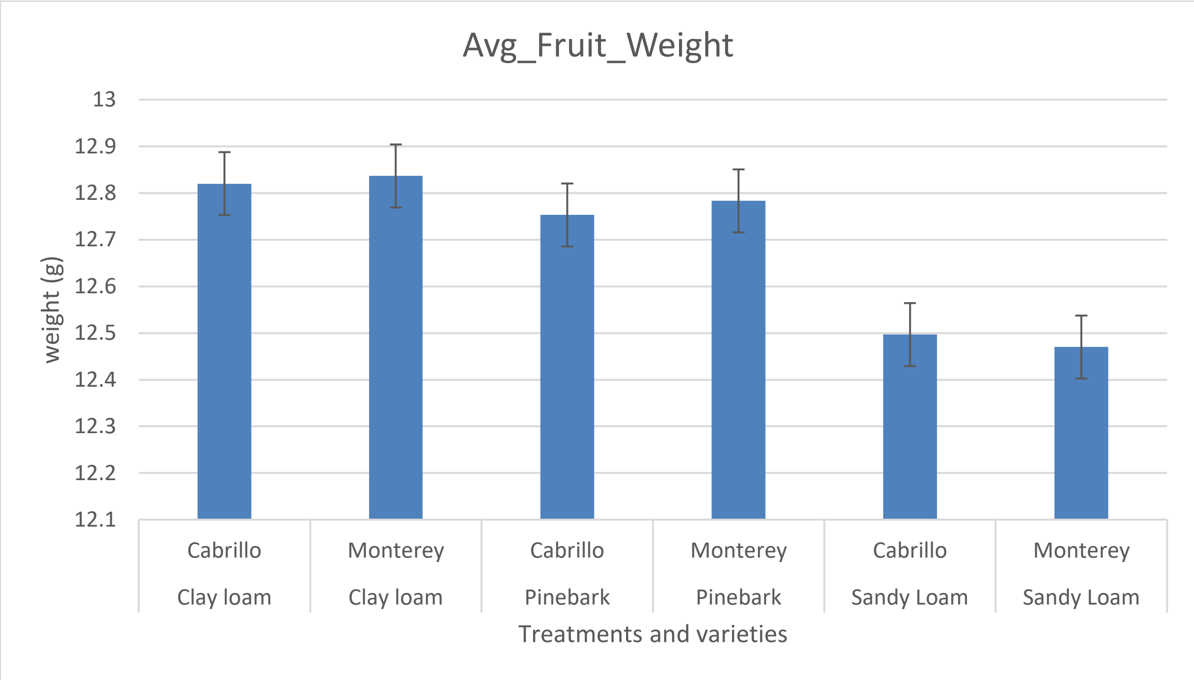


*Figure 3: Average fruit weight*

The analysis of variance revealed highly significant treatment x variety interactions ($p<0.001$) revealing complex interactions between media and variety in determining fruit weight. Treatment had an extremely significant effect ($p<0.001$) with average fruits weight varying for clay loam (12.80g), pine bark (12.63g) and sandy loam (12.66g). The effects of the different varieties was marginally non-significant ($p=0.091$) With Marginal difference between Cabrillo (12.73g) and Monterey (12.69g).

4.4 Yield

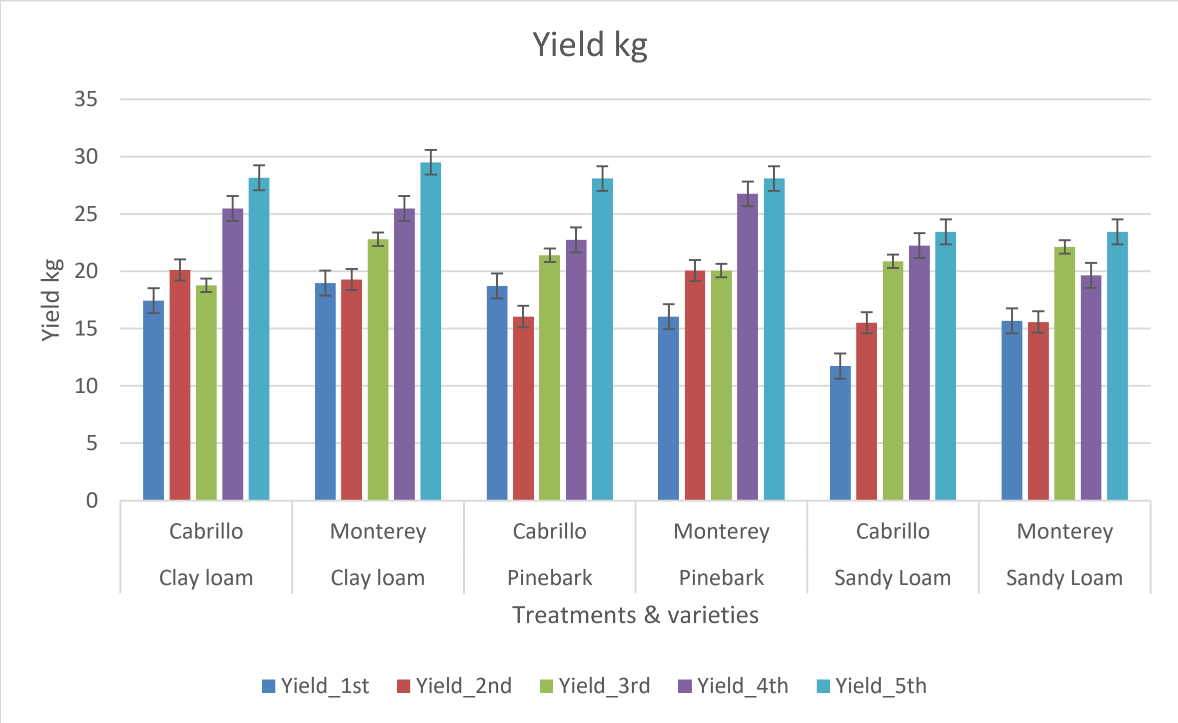


*Figure 4: Yield*

The analysis of variance for yield revealed significant treatment x variety interactions (p=0.027) showing complex interactions between media and variety. Treatment effects were highly significant (p=0.003) with mean yields for clay loam (18.21) pine bark (17.39) and sandy loam (13.70). Variety effects when insignificant with minimal differences. Cabrillo had 15.96kg and Monterey had 16.90kg. Clay loam and pine bark consistently outperformed sandy loam with Monterey showing more adaptability across different media types.

4.5 Diseased Plants

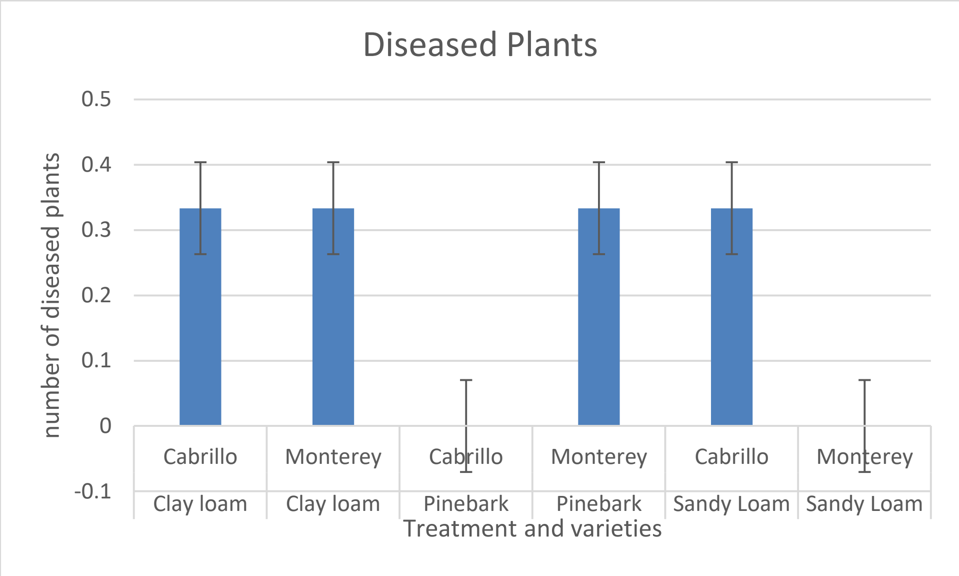


*Figure 5: Diseased plants*

The analysis of variance for disease incidence revealed no statistically significant interactions. The treatment x variety interactions were nearly zero (p=0.998) indicating no meaningful interaction between media and variety in disease development.

Treatment effects were also not significant (P=0.507) with mean disease incidents across media being Clay loam (0.3373), pine bark (0.0024) and sandy loam (0.3373).

# CHAPTER 5

## 5.0 DISCUSSION

### 5.1 Leaf development

Leave growth dynamics showed complex interactions between media and variety more so in the early stages of growth. The notable interactions in week 2 ($p=0.007$) indicate media type critically influenced initial leaf development. Sandy loam promoted more vigorous leaf expansion potentially as a result of microporocity and easy root penetration (Smith etal 2018). By week three to four leaf growth had stabilized showing adaptation to different media conditions.

The differences between varieties though statistically non-significant hint at nuanced growth response. Monterey consistently showed marginally higher leaf numbers possibly reflecting its moderate vigour. These findings are consistent With Zhao etal. (2018) who highlighted the importance of media specific management strategies and strawberry production.

### 5.2 Runner production

Runner development showed interesting patterns across media types. Week four showed the significant interaction between treatment and variety ($p=0.021$) showing the complex relationship between media and variety in vegetative propagation. Cabrillo produced more runners more so in pine bark and sandy loam media indicating variety specific responses to substrate characteristics.

The variation in runner production reflects differences in substrate properties. Pine bark's high porosity and aeration (Hochmuth etal 2019) likely made it possible for runner development whereas  clay loam's dense structure possibly restricted lateral growth. This emphasizes the importance of substrate selection in management of strawberry plant architecture.

### 5.3 Fruit weight

The highly significant treatment x variety interactions ($p< 0.001$) in fruit weight shows that media profoundly affected fruit development differently for each variety. Clay loam showed the most consistent fruit weights possibly as a result of its superior nutrient retention capabilities (Braydy and Weil, 2016).

Monterey showed more variability across media with significant weight reductions in sandy loam. This variety sensitivity shows that substrate selection must take into account specific variety characteristics. The minimal overall weight differences between varieties suggests that media management can overshadow genetic potential.

**5.4 Yield**

The variations in yield show substrate specific characteristics. Clay loam's superior nutrient retention (Braydy and Weil, 2016) likely contribute to consistent performance while sandy loam's limited water holding capacity (Smith et al., 2018) likely limited yield potential. Monterey's adaptability across the different media is consistent with previous research suggesting that variety specific responses to substrate conditions (Zhao etal, 2018) highlighting the significance of integrated variety and media selection in strawberry cultivation.

**5.5 Disease incidents**

In spite of the high variability no statistical significant interactions revealed themselves in disease occurrence. The low disease levels across treatments indicates robust plant health. Pine bark's potential disease suppressive properties (Bonanomi etal 2010) might contribute to the general law disease incidence. The absence of significant differences suggest that both varieties and media types maintained similar disease resistance. This finding contradicts some expectations about substrate specific disease susceptibility showing the potential of modern strawberry varieties and cultivation method.

**5.6 Overall performance**

The research reveals the intricate interactions between media types and strawberry varieties. Whilst statistical significance varied across parameters consistent patterns revealed themselves sandy loam and pine bark generally enabled more vigorous growth whereas clay loam provided stable nutrient environment.

Monterey and Cabrillo showed variety specific responses placing emphasis on the need for tailored cultivation methods. The study emphasizes the complexity of strawberry production were substrate selection and variety choice interact dynamically to influence plant performance.

# CHAPTER 6

## CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

This project was done so as to evaluate the effect of media and variety of strawberry. The media included sandy loam, pine bark and clay loam with varieties Monterey and Cabrillo. Main parameters which were assessed included number of leaves, number of runners for the vegetative growth and yield, average fruit weight and disease incidence. The results which were obtained shows evidence that both the choice of substrate and variety significantly influence the strawberry's vegetative growth, yield, average fruit weight and disease prevalence. Pine Bark emerged as the most effective medium for promoting vegetative growth, as evidenced by the highest number of leaves and runners. Its properties such as enhanced aeration and drainage may have likely contributed to healthier root systems and more vigorous plant development (Raviv etal, 2004). Sandy Loam underperformed in most objectives this was maybe possibly due to its properties of lower nutrient and moisture retention. Clay Loam showed that it is the best media for the average fruit quality and fruit yield. Its balanced physical and chemical properties appear to support optimal conditions for fruit development and size which are critical factors in determining market value (Strik & Buller, 2002). The media showed again favourable results when paired with the Monterey variety suggesting a synergistic interaction between the substrate and the plant's genetic potential. Monterey variety consistently outperformed the Cabrillo variety in most parameters including leaf number, yield, and fruit weight. These differences are attributed to inherent varietal characteristics that favour higher productivity and adaptability. Moreover, disease prevalence was lowest in Pine Bark enforcing its importance as a substrate in disease management. These results collectively emphasize that optimal strawberry production requires careful consideration of both the growing medium and variety selection. A one size fits all approach may not yield the best outcomes rather matching specific substrates with appropriate varieties can significantly enhance productivity, fruit quality and plant health.

## 6.2 Recommendations

Based on the experimental results of my study l recommended the following to growers and farmers to implement these recommendations

1. Optimal Medium Variety Pairing

Growers should consider using Clay Loam combined with the Monterey variety to achieve maximum yield and fruit weight. This combination demonstrated superior performance reflecting the interaction between environmental conditions and genetic traits.

2. Use of Pine Bark for vegetative propagation

For nurseries or growers focusing on vegetative propagation (runner production) Pine Bark is recommended due to its support for vegetative vigour and reduced disease incidence.

3. Avoidance of Sandy Loam in yield-oriented production

Sandy Loam should be avoided in high-yield commercial setups unless supplemented with organic amendments as it consistently showed lower performance across critical growth parameters.

4. Integrated Disease Management through media selection

Pine Bark can serve as a preventative measure against soil-borne diseases due to its better drainage and aeration. This can reduce dependence on chemical fungicides promoting more sustainable farming.

5. Selection of high performing varieties

Monterey is recommended as the superior variety under most conditions tested in this study. Its robust performance highlights its adaptability and high genetic yield.

## REFERENCES

Daugaard, H. & Callesen, K. (2020). Effects of growing media on strawberry yield and quality in a controlled environment. Horticultural Science Journal, 55(3), 145-157.

FAO (2023). Global strawberry production statistics 2022. Food and Agriculture Organization. Retrieved from www.fao.org

Singh, R., Sharma, R., & Kumar, A. (2021). Nutritional and health benefits of strawberries: review of recent research. Journal of Functional Foods, 76, 104345.

Zhang, L., Wang, Y., & Li, H. (2022). Comparative analysis of soil substrates for optimal strawberry production: A case study of sandy loam, clay loam, and organic media. Agricultural Sciences Review, 89(4), 212-230.

Fernandez, G., & Williamson, J. (2016). Effects of organic substrates on strawberry production. Horticultural Science Journal, 51(3), 245-259.

Gonzalez, L., & Rivera, M. (2019). Comparative performance of Montero strawberry in different soil conditions. Journal of Berry Research, 6(4), 312-328.

Hochmuth, G., Cantliffe, D., & Santos, B. (2019). Soilless strawberry production: A review. International Journal of Horticultural Science, 24(2), 121-139.

Jones, A., & Carter, T. (2017). Soil properties and their impact on strawberry yield. Agricultural Science Review, 42(1), 55-71.

Kumar, P., Patel, R., & Singh, M. (2019). Influence of soil type on strawberry fruit development. Soil and Crop Science Journal, 58(2), 178-195.

Lopez, R., Hernandez, D., & Morales, F. (2018). The adaptability of Montero strawberries in clay-rich soils. Fruit Science Journal, 9(3), 220-235.

Martínez, J., Pérez, C., & Rojas, B. (2019). Effects of soil moisture on Cabrillo strawberries. Journal of Agricultural Research, 15(1), 45-60.

Shaw, D., Larson, K., & Peterson, B. (2017). Genetic and environmental factors affecting Cabrillo strawberry yield. Plant Science Research, 31(4), 389-403.

Smith, R., Allen, G., & Davidson, T. (2018). The role of soil texture in strawberry root development. Soil and Plant Science, 33(2), 99-115.

Zhao, W., Liu, Y., & Feng, H. (2018). Comparative analysis of strawberry growth in different soil types. Journal of Horticultural Studies, 12(1),

Gomez, K.A., & Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. John Wiley & Sons.

Larson, K.D. (1994). Strawberry Management in Soilless Systems: Best Practices for Optimal Yield. California Strawberry Commission.

Smith, R., & Roberts, D. (2010). Soil Properties and Plant Growth: A Field Guide to Understanding Soil and Crops. Springer.

Zimbabwe Meteorological Services Department. (2023). Annual Climate Report 2023. Government of Zimbabwe.

Raviv, M., Wallach, R., Silber, A., & Bar-Tal, A. (2004). Substrates and their analysis. In M. Raviv & J. H. Lieth (Eds.), Soilless Culture: Theory and Practice (pp. 25–101). Elsevier.

Strik, B. C., & Buller, G. (2002). Reducing the cost of establishing strawberries in the Pacific Northwest using organic and conventional methods. HortTechnology, 12(4), 689–693.

Hancock, J. F. (2020). Strawberries. CABI Publishing.

Maas, J. L. (1998). Compendium of Strawberry

Global Production Statistics (2023)

Hartz etal (2000)

# Appendix

Appendix ANOVA 1: Number of leaves week 2

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 0.0627 | 0.0314 | 0.15 | 0.862 |
| Treatment ignoring Variety | 2 | 3.6205 | 1.8103 | 8.73 | 0.008 |
| Treatment eliminating Variety | 2 | 3.6772 | 1.8386 | 8.86 | 0.007 |
| Variety ignoring Treatment | 1 | 0.0857 | 0.0857 | 0.41 | 0.536 |
| Variety eliminating Treatment | 1 | 0.1425 | 0.1425 | 0.69 | 0.429 |
| Treatment.Variety | 2 | 3.837 | 1.9185 | 9.25 | 0.007 |
| Residual | 9 | 1.8667 | 0.2074 | | |
| Total | 16 | 9.5294 | 0.5956 | | |

Appendix ANOVA 2: Number of leaves week 3

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 2.984 | 1.492 | 0.65 | 0.547 |
| Treatment ignoring Variety | 2 | 1.428 | 0.714 | 0.31 | 0.742 |
| Treatment eliminating Variety | 2 | 1.163 | 0.582 | 0.25 | 0.783 |
| Variety ignoring Treatment | 1 | 3.086 | 3.086 | 1.34 | 0.278 |
| Variety eliminating Treatment | 1 | 2.821 | 2.821 | 1.22 | 0.298 |
| Treatment.Variety | 2 | 0.084 | 0.042 | 0.02 | 0.982 |
| Residual | 9 | 20.8 | 2.311 | | |
| Total | 16 | 28.118 | 1.757 | | |

Appendix ANOVA 3: Number of leaves week 4

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 3.935 | 1.968 | 0.25 | 0.783 |
| Treatment ignoring Variety | 2 | 1.018 | 0.509 | 0.07 | 0.937 |
| Treatment eliminating Variety | 2 | 0.848 | 0.424 | 0.05 | 0.948 |
| Variety ignoring Treatment | 1 | 0.86 | 0.86 | 0.11 | 0.748 |
| Variety eliminating Treatment | 1 | 0.689 | 0.689 | 0.09 | 0.773 |
| Treatment.Variety | 2 | 2.176 | 1.088 | 0.14 | 0.872 |
| Residual | 9 | 70.417 | 7.824 | | |
| Total | 16 | 78.235 | 4.89 | | |

Appendix ANOVA 4: Number of leaves week 5

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 1.425 | 0.713 | 0.11 | 0.893 |
| Treatment ignoring Variety | 2 | 15.838 | 7.919 | 1.28 | 0.325 |
| Treatment eliminating Variety | 2 | 16.464 | 8.232 | 1.33 | 0.313 |
| Variety ignoring Treatment | 1 | 4.002 | 4.002 | 0.64 | 0.443 |
| Variety eliminating Treatment | 1 | 4.628 | 4.628 | 0.75 | 0.41 |
| Treatment.Variety | 2 | 23.283 | 11.642 | 1.87 | 0.209 |
| Residual | 9 | 55.883 | 6.209 | | |
| Total | 16 | 101.059 | 6.316 | | |

Appendix ANOVA 5: Number of leaves week 6

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 6.769 | 3.384 | 0.46 | 0.644 |

| | | | | | |
|---|---|---|---|---|---|
| Treatment ignoring Variety | 2 | 50.351 | 25.176 | 3.43 | 0.078 |
| Treatment eliminating Variety | 2 | 53.052 | 26.526 | 3.62 | 0.07 |
| Variety ignoring Treatment | 1 | 9.752 | 9.752 | 1.33 | 0.279 |
| Variety eliminating Treatment | 1 | 12.453 | 12.453 | 1.7 | 0.225 |
| Treatment.Variety | 2 | 24.662 | 12.331 | 1.68 | 0.24 |
| Residual | 9 | 66 | 7.333 | | |
| Total | 16 | 160.235 | 10.015 | | |

Appendix ANOVA 6: Number of runners week 3

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 0.249 | 0.1245 | 0.49 | 0.628 |
| Treatment ignoring Variety | 2 | 0.0051 | 0.0026 | 0.01 | 0.99 |
| Treatment eliminating Variety | 2 | 0.006 | 0.003 | 0.01 | 0.988 |
| Variety ignoring Treatment | 1 | 0.0024 | 0.0024 | 0.01 | 0.925 |
| Variety eliminating Treatment | 1 | 0.0032 | 0.0032 | 0.01 | 0.913 |
| Treatment.Variety | 2 | 1.3417 | 0.6708 | 2.64 | 0.125 |
| Residual | 9 | 2.2833 | 0.2537 | | |
| Total | 16 | 3.8824 | 0.2426 | | |

Appendix ANOVA 7 Number of runners week 4

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 0.09216 | 0.04608 | 0.75 | 0.498 |
| Treatment ignoring Variety | 2 | 0.51795 | 0.25897 | 4.24 | 0.05 |
| Treatment eliminating Variety | 2 | 0.625 | 0.3125 | 5.11 | 0.033 |

| | | | | | |
|---|---|---|---|---|---|
| Variety ignoring Treatment | 1 | 1.05 | 1.05 | 17.18 | 0.003 |
| Variety eliminating Treatment | 1 | 1.15705 | 1.15705 | 18.93 | 0.002 |
| Treatment.Variety | 2 | 0.74167 | 0.37083 | 6.07 | 0.021 |
| Residual | 9 | 0.55 | 0.06111 | | |
| Total | 16 | 3.05882 | 0.19118 | | |

Appendix ANOVA 8: Number of runners week 5

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 2.4078 | 1.2039 | 1.75 | 0.228 |
| Treatment ignoring Variety | 2 | 0.0846 | 0.0423 | 0.06 | 0.941 |
| Treatment eliminating Variety | 2 | 0.084 | 0.042 | 0.06 | 0.941 |
| Variety ignoring Treatment | 1 | 0.0095 | 0.0095 | 0.01 | 0.909 |
| Variety eliminating Treatment | 1 | 0.0089 | 0.0089 | 0.01 | 0.912 |
| Treatment.Variety | 2 | 0.2398 | 0.1199 | 0.17 | 0.843 |
| Residual | 9 | 6.2 | 0.6889 | | |
| Total | 16 | 8.9412 | 0.5588 | | |

Appendix ANOVA 9: Number of runners week 6

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 5.5843 | 2.7922 | 2.83 | 0.111 |
| Treatment ignoring Variety | 2 | 1.5846 | 0.7923 | 0.8 | 0.477 |
| Treatment eliminating Variety | 2 | 1.5026 | 0.7513 | 0.76 | 0.494 |
| Variety ignoring Treatment | 1 | 0.7714 | 0.7714 | 0.78 | 0.399 |

| | | | | | |
|---|---|---|---|---|---|
| Variety eliminating Treatment | 1 | 0.6895 | 0.6895 | 0.7 | 0.424 |
| Treatment.Variety | 2 | 1.3926 | 0.6963 | 0.71 | 0.519 |
| Residual | 9 | 8.8667 | 0.9852 | | |
| Total | 16 | 18.1176 | 1.1324 | | |

Appendix ANOVA 10: Number of runners week 7

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 3.1412 | 1.5706 | 2.59 | 0.13 |
| Treatment ignoring Variety | 2 | 0.4154 | 0.2077 | 0.34 | 0.719 |
| Treatment eliminating Variety | 2 | 0.381 | 0.1905 | 0.31 | 0.738 |
| Variety ignoring Treatment | 1 | 0.0857 | 0.0857 | 0.14 | 0.716 |
| Variety eliminating Treatment | 1 | 0.0513 | 0.0513 | 0.08 | 0.778 |
| Treatment.Variety | 2 | 1.8667 | 0.9333 | 1.54 | 0.267 |
| Residual | 9 | 5.4667 | 0.6074 | | |
| Total | 16 | 10.9412 | 0.6838 | | |

Appendix ANOVA 11: Number of diseased plants

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 0.003406 | 0.001703 | 1.61 | 0.252 |
| Treatment ignoring Variety | 2 | 0.092476 | 0.046238 | 43.74 | < 0.001 |
| Treatment eliminating Variety | 2 | 0.090404 | 0.045202 | 42.76 | < 0.001 |
| Variety ignoring Treatment | 1 | 0.00378 | 0.00378 | 3.58 | 0.091 |
| Variety eliminating Treatment | 1 | 0.001708 | 0.001708 | 1.62 | 0.236 |
| Treatment.Variety | 2 | 0.292849 | 0.146425 | 138.52 | < 0.001 |
| Residual | 9 | 0.009513 | 0.001057 | | |

| | | | | | |
|---|---|---|---|---|---|
| Total | 16 | 0.399953 | 0.024997 | | |

Appendix ANOVA 12: Average fruit weight

| Source | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block | 2 | 0.003406 | 0.001703 | 1.61 | 0.252 |
| Treatment ignoring Variety | 2 | 0.092476 | 0.046238 | 43.74 | < 0.001 |
| Treatment eliminating Variety | 2 | 0.090404 | 0.045202 | 42.76 | < 0.001 |
| Variety ignoring Treatment | 1 | 0.00378 | 0.00378 | 3.58 | 0.091 |
| Variety eliminating Treatment | 1 | 0.001708 | 0.001708 | 1.62 | 0.236 |
| Treatment.Variety | 2 | 0.292849 | 0.146425 | 138.52 | < 0.001 |
| Residual | 9 | 0.009513 | 0.001057 | | |
| Total | 16 | 0.399953 | 0.024997 | | |

Appendix ANOVA 13: Fruit weight at 1st picking

| Source of variation | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block stratum | 2 | 2.216 | 1.108 | 0.35 | |
| Block.*Units* stratum | | | | | |
| Treatment | 2 | 69.148 | 34.574 | 10.82 | 0.003 |
| Variety | 1 | 3.976 | 3.976 | 1.24 | 0.291 |
| Treatment.Variety | 2 | 33.696 | 16.848 | 5.27 | 0.027 |
| Residual | 10 | 31.954 | 3.195 | | |
| Total | 17 | 140.991 | | | |

Appendix ANOVA 14: Fruit weight at 2nd picking

| Source of variation | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block stratum | 2 | 40.896 | 20.448 | 5.14 | |

| | | | | | |
|---|---|---|---|---|---|
| Block.*Units* stratum | | | | | |
| Treatment | 2 | 52.602 | 26.301 | 6.61 | 0.015 |
| Variety | 1 | 5.249 | 5.249 | 1.32 | 0.277 |
| Treatment.Variety | 2 | 19.977 | 9.988 | 2.51 | 0.131 |
| Residual | 10 | 39.784 | 3.978 | | |
| Total | 17 | 158.508 | | | |

Appendix ANOVA 15: Fruit weight at 3rd picking

| Source of variation | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block stratum | 2 | 27.9 | 13.95 | 1.16 | |
| Block.*Units* stratum | | | | | |
| Treatment | 2 | 2.21 | 1.1 | 0.09 | 0.913 |
| Variety | 1 | 7.8 | 7.8 | 0.65 | 0.44 |
| Treatment.Variety | 2 | 21.61 | 10.8 | 0.89 | 0.439 |
| Residual | 10 | 120.74 | 12.07 | | |
| Total | 17 | 180.25 | | | |

Appendix ANOVA 16: Fruit weight at 4th picking

| Source of variation | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block stratum | 2 | 21.768 | 10.884 | 1.13 | |
| Block.*Units* stratum | | | | | |
| Treatment | 2 | 71.169 | 35.584 | 3.69 | 0.063 |
| Variety | 1 | 0.999 | 0.999 | 0.1 | 0.754 |
| Treatment.Variety | 2 | 33.302 | 16.651 | 1.73 | 0.227 |
| Residual | 10 | 96.42 | 9.642 | | |
| Total | 17 | 223.658 | | | |

Appendix ANOVA 17: Fruit weight at 5th picking

| Source of variation | d.f. | s.s. | m.s. | v.r. | F pr. |
|---|---|---|---|---|---|
| Block stratum | 2 | 44.357 | 22.179 | 3.58 | |
| Block.*Units* stratum | | | | | |
| Treatment | 2 | 102.567 | 51.284 | 8.27 | 0.008 |
| Variety | 1 | 0.911 | 0.911 | 0.15 | 0.709 |
| Treatment.Variety | 2 | 1.796 | 0.898 | 0.14 | 0.867 |
| Residual | 10 | 61.982 | 6.198 | | |
| Total | 17 | 211.613 | | | |