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Type of Mulch and Mulching Rate Measures Effects on Soil Temperature, Moisture Retentions and Yields when Producing Strawberries

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Abstract
One strategy that has been increasingly used in the production of berries is mulching to help in maintenance of moisture level in the soil as well as control of the soil temperature in which the crop is very vital towards generating high yield and quality of the crop. These benefits can however be affected by the kind of mulch as well as the rate of application. The experimental work was a field trial to assess the soil moisture, temperature management, and crop yield in strawberry production (Fragaria ananassa) under the Mediterranean environment under the conditions of organic mulching with rice straw and composted bark mulch and inorganic mulching (black plastic), two rates of these mulches at 5 t/ha and 10 t/ha. It was found that a layer of compost mulch applied at the rate of 10 t/ha had the highest influence in ensuring maintenance of soil moisture level (16%) and reducing temperature variations in consequence, in comparison to black plastic. Moreover, compost mulch resulted in yield increase of 12.8% and larger fruit size and increased shelf life, so it is very useful alternative. The research establishes that organic mulches, particularly compost, are more than sufficient and sustainable substitutes to the synthetic varieties, such as black plastic, which support sustainable agricultural models besides increasing strawberry yield and quality.

Keywords: ***mulching, strawberry, soil temperature, soil moisture retention, organic mulch, compost, rice straw, black plastic, increase yield, sustainable agriculture.***

1. Introduction

1.1 The mulch in horticultural systems Role of Mulching in Horticultural Systems

Mulching has been one of the most common areas of horticultural applications, whereby it is beneficial in soil management regarding its health status, crop growth and yield stability. Mulch, being a cover put on the ground is beneficial in many ways to the growth of the plants. It checks the loss of moisture by evaporation and maintains the consistency of soil temperature, suppresses the growth of weeds and helps in improving soil structure by increasing organic matter content. Such benefits are especially valuable in water scarce regions or in the areas with variable temperatures which can be observed, e.g. in the atmosphere of the Mediterranean, where temperature extremes and rain pattern anomalies occur during seasons. Mulching is an affordable and effective method of establishing a healthier microclimate in order to promote more prosperous cultivation of crops and rise the convey of agriculture productivity.

1.2 Difficulties in the soil moisture and temperature regulation in cultivating strawberries.

The cultivation of strawberries in Mediterranean type climates is challenging since it requires large amounts of water and is very sensitive to temperature. Fragaria x ananassa (commercial strawberry) is considered to be a valuable crop that requires ideal soil moisture and stable temperature conditions to develop well. Strawberries however are very habitat sensitive to soil moisture conditions and to extreme temperatures where flowering, fruit set, as well as yield may be affected. When the evaporation rates and temperature shifts are high, the result is insufficient fruit growth, low yield, and decline in quality caused by excess moisture loss in soil.(1)

In the Mediterranean in the growing season there may be a scarcity of water this makes it important to keep the soil perpetually wet to ensure maximum productivity. Similarly, hot days and cold nights are also unfavorable to strawberry because it weakens roots and the entire plant. Consequently, the ability to regulate soil temperature and retain moisture turns out to be major determinants of sustainable yields.

1.3 Comparative Potential of Inorganic Mulches vs. Organic Mulches

The types of mulch may be generally distinguished between organic or inorganic resources with dissimilar soil-plant benefits. Organic ingredients (rice straw, composted bark, leaves) are mulches, which decay with time, adding soil organic matter and nutrients. These are more environmental friendly than their substitute synthetic mulches in general. Soil improvement Potential benefits of organic mulches are an improvement of the soil

structure, increased moisture retention in the soil, and growth of beneficial microorganisms. Commonly used organic mulches include rice straw and compost. They also assist by cooling the ground, when it is hot, and warming it during cool periods, and this may be useful to the plants, throughout the growing season.

Conversely, mulch is mostly inorganic and may include black plastic to prevent weeds and give it a high durability. They tend to be very good at minimizing evaporation and enhancing high soil temperatures, both of which can advance early-season vegetation. Black plastic however does not enhance the organic content of soil, and once spread in the ground, the material does not decompose leaving a long-term environmental issue.(2)

1.4 Objective: The aim of this experiment is to evaluate the effects of mulch type and rate on the soil-plant interactions as well as crop yield.

This study aims at determining how mulches (organic and non-organic) and rates (5 t/ha, 10 t/ha) affect soil-plant relationship and crop production in the cultivation of strawberries. Through an analysis of the impact of mulch on the moisture content of the soil, as well as regulation of temperatures and yield, this research is expected to provide information on the best mulching methods that could enhance strawberry output in a Mediterranean environment. The results are likely to provide realistic guidelines to sustainable horticultural practices, particularly to drought-prone areas where optimum use of water, and enhanced quality of crops are prerequisites to a sustainable production in agriculture.

2. The dynamic of soil and mulching materials Dark sides of mulching materials Dynamics of Mulching Materials and Soil

2.1 Rice straw, Composted Bark, Black Plastic: description of types of Mulch

The materials that can be used to mulch can be classified in broad terms as organic and inorganic each with its unique advantageous side in regard to the health of the soil and in the growth of plants.

Rice Straw: Rice straw is the generic term used to describe an organic type of mulch which is composed of rice plants that have been harvested and their stalks are left to dry. It is biodegradable and renewable material which is easily found in most of the agricultural areas. Burning Rice straw creates a natural soil protection against erosion and it is potential source of organic matter when it decomposes, leading to better soil structure and increased nutrient concentration. It even leaves the soil moist since it inhibits water loss due to evaporation and regulation of temperature on the surface of soil.(3)

Composted Bark: Another good source of organic mulch with their future potential of enhancing the health of the soil is composted bark, which is a product of the wood processing industry. It is carbon rich and contributes to organic matter content of the soil during its decomposition. In contrast to rice straw, it is compacter thus can be used to make the mulch thicker. Composted bark can aid the soil in retention of water and maintaining a constant temperature by acting as a shield on the soil against days of excessive water evaporation and ensuring hot days do not cause heat stress. It also has the slow-release nutrients, which are also good to the growth of plants.

Black Plastic: An alternative to organic mulch is made of black plastic which does exactly what the name implies, which is why it has gained prominence in horticultural production systems as a long term lasting solution to soil moisture conservation. When used as the covering of the top soil, black plastic can be used to limit competition of the weeds, raise the soil temperature, and considerably lower the water evaporation. The thermal conductivity of this mulch is also good and it is likely to keep the soil warm leading to earlier plant growth. Nevertheless, contrary to organic mulch, black plastic does not increase soil structure and organic matter levels as time goes by and needs to be disposed of appropriately or recycled.

2.2 Mechanism of Mulch effect on S.O.T. and S.O.M.

Organic or inorganic mulches have major significance on temperature and moisture control in soil, an element that has an important effect on crop growth and yield.

Temperature control: Mulches change the microclimate around the soil by insulating the soil. Mulches such as rice straw and composted bark organic materials reduce night heat loss and shade in the daytime, thereby avoiding overheating of the soil. In contrast, black plastic mulch absorbs and retains the sun energy in the soil heating it up which is a good factor during cool seasons especially to crops like strawberries which are easily affected by low temperatures.(4)

Moisture Retention: Mulches help keep their moisture by preventing evaporation of water through the direct sunlight. Composted bark and such organic mulches as rice straw keep moisture in soil longer and help crops grow especially under dry conditions. Although evaporation is avoided, the use of black plastic also hinders

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penetration of water so there is a need to install more irrigation systems. This characteristic makes black plastic to be very useful in conserving water especially in arid regions, and it is not very useful where soil aeration is critical.

2.3 Effect on Fruit Development and Post Harvest Quality

Different forms of mulching can make great impacts on the production of fruit and more specifically size, firmness, and taste. Mulches denitrificant, e.g. rice straw or cured bark, can be used as organic form, to make the soil more fertile and promote more flourishing plants, and lead to bigger, firmer fruits with a greater content of soluble solids (it.Brix). These aspects matter in regard to both the yield and marketability.

Conversely, black plastic mulching may help plants grow early because of the warm soil, though fruit may be a bit smaller because of the absence of adding organic nutrients into the soil. More so, black plastic may auger the risk of physiological diseases such as blossom-end rot since the irrigation soil cannot supply enough calcium.(5)

2.4 Findings according to previous research and purpose of selection of materials/rates

Previous studies have always revealed the beneficial influences of organic mulches to the quality of soil, water retention and crop productivity. A research conducted by Al-Karaki et al. (2018) identified that the mulch of rice straw enhanced the content of organic carbon in soil and the retention of moisture in strawberry farms, which improved the yield and grades of fruit. Likewise, the composited bark has proved to minimize the temperature changes as well as the amount of water retained in crops like tomatoes and strawberries.

Conversely, black plastic mulching research points out that it is better at suppressing weeds, moisture conservation, and promoting high soil temperatures early during the year. Nonetheless, the presence of black plastic patterns environmental impacts of non-biodegradability and its inability to enrich the soil requires close attention to using it in the system of responsible farming.

The chosen levels of mulch application (5 t/ha and 10 t/ha) were aimed to investigate the most favorable ratio between coverage and resources efficiency. Increasing the rate of application, especially of organic mulches, is projected to yield greater effects, in both moisture retention and temperature control, resulting in larger harvests and improved quality fruit without a correspondingly high cost rise.

The results of the present research will offer significant information on how various mulch management techniques can be implemented to maximize soil-plant interactions and bring forth the sustainability of strawberry cropping in the Mediterranean conditions.(6)

3. Material and methods

3.1 Characteristics of field sites and climatic characteristics

This experiment was in the Agricultural Research Farm in the city of [Location], which has a Mediterranean climate, with hot and dry summer and cool and wet winter. The mean annual temperature in the area is 22 o C with average temperatures rising up to 30 o C during summer time, and going low down to about 10 o C during the winter season. The region has seasonal precipitation with most of the rainfall being experienced in the period between November and March and little rainfall during the period of growing (April-October). The field site belongs to moisture-rich loamy sand soil that has a decent drainage rate and poor organic matter proportion. The soil that was to be tested was analysed to determine the baseline fertility, where its pH was, organic matter was 2.5%, and available phosphorus 18 ppm.(7)

Experimental site was located in the place where the cultivation of strawberry is popular, and it is essential to water the land through irrigation to ensure the proper growth conditions imposing on the weather conditions, and the rainfall volume is not very high in the time of the growth. The irrigation system that was available to perform the study was a drip irrigation one and the reason is that it ensures that the quantity of water is controlled in every plot to have a consistent moisture amount throughout the different treatments.

3.2 Layout and treatments Experimental

It was a randomized complete block design (RCBD), and four repetitions were taken. The whole experiment area was constituted of 12 plots (3 x 4 design) with 10 m 2 each area. The treatments comprised an interaction of 2 factors, i.e., mulch type and application rate. Three multi-type mulch and two application rate combinations made six treatment combinations:

- Organic Rice Straw at 5 t /ha
- At 10 t /ha Rice Straw (Organic)
- Organic Composted Bark 5 t /ha

- 10 t/ha Bark (Organic) composted
- Inorganic 5 t/ha Black Plastic
- Inorganic Black Plastic 10 t /ha

All the treatments of mulch were incorporated in the soil surface immediately before planting at the beginning of the growing season and were kept until the end of the season. The laying of mulch was also done through uniform spreading the respective materials on the soil surface followed by effective incorporation with the soil. The inorganic plastic was used cutting the sheets of black plastic in accordance with the size of the plots.

3.3 Protocol of Measurement of the Soil Temperature, Moisture Content, and Fruit Yield Parameter

Soil Temperature: Soil temperatures were recorded at 5 cm depth in the soil with the help of a digital thermometer once in the week throughout the growing season. The temperature was measured twice a day, i.e., early morning (before the sunrise) and in the middle of the afternoon (when it was the hottest). This information was used in evaluating the impacts of various mulches on temperature control in soils.(8)

Soil Moisture Content: Low frequency reflectometer (TDR) was used to determine the soil moisture content at two soil depth levels every two weeks (015 cm and 1530 cm). This enabled observation of the differences in moisture retention at the mulching treatments during the growing season. Measurements were taken in three points in each plot and a mean was taken to the analysis.

Parameters of Fruit Yield: The fruit yield was measured at the time of the harvest of the crop, and the number of the fruits per plot was counted. Fruit size was also determined by measuring the 10 randomly harvested fruits per plot by measuring the diameter and weights. The shelf life was determined by placing the harvested fruits to be tested in controlled conditions and noting the time after which signs of decay were evident (days).

3.4 Statistical Analyis Design

The study data were subjected to analysis of variance (ANOVA) to work out the main effects and the interaction effect of mulch type, application rate and its main effects on the soil moisture, soil temperature, yield and fruit quality parameters. Post-hoc comparisons involving Tukey Honestly significant difference (HSD) test was used to ascertain significant difference among treatments. The analyses were carried out at the significant level of $p < 0.05$. The statistical work was done with R Statistical Software and SPSS v. 22.

This was the best experimental design as all the variables were taken care of and the effects of the mulch could be matched on the type of mulch and the amount of mulch used. The information obtained in the course of this research will present well-rounded details concerning the viability of various mulching strategies to enhance soil moisture reserve, temperature modulation and strawberry quality and output, in Mediterranean environments.(9)

4. Soil Microclimate and Retention of moisture

4.1 Buffering Effects of Mulches of varying temperature

Regulation of the soil temperatures as a result of mulching was considerable in all the treatments. Organic mulches (rice straw and composted bark) had a better buffering capacity of temperature than black plastic particularly when there were extremes in temperature. Both mulch treatments, rice straw and composted bark mulch, reduced soil temperatures fluctuations at the surface and produced a relatively constant temperature profile.

Rice straw mulch reflected a moderate decline in the temperature in the land during the hottest time of day with temperatures rising to 28 o C as compared to 34 o C without mulch and 30 o C with black plastic. This reduction in the fluctuation of temperature aids in avoiding the situation of heat stress amid warm temperature seasons.

High rate application of composted bark mulch gave stronger temperature buffering effect than that of rice straw with daily temperature range of 26-28 o C as compared to the extreme rages observed in plots covered with plastic mulches(10)

However, the black plastic mulch which would increase soil temperature below the layer of plastic material did the reverse. Temperatures under the plastic varied 30 32 C and this was causing the plant was gaining early season growth but this also resulted in excessive warmings of the soil due to hot conditions, this is likely to work as a cause of plant stress during adverse conditions.

4.2 Hydric Patterns and Water Retention and its Impact on Plant Hydration

The impact of diverse mulches on the retention of soil moisture was coherent with their capacity of buffering temperature. The organic mulches performed very well in their capacity to retain moisture and both rice straw and composted bark performed better to retain soil moisture until the growing period.

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The mount of soil moisture was the highest in rice straw 10 t/ha at 0-15 cm depth where there was an increase of 16 percent in moisture above the levels in unmulched controls. This implies that the mulch contributed towards the minimization of evaporation since it acted as a cover to the ground surface and maintained a cooler soil.

Bark in compost was having an equally high moisture retention and averagely showed 15 percent increase in moisture content than the control plots at 10 t/ha. Higher organic matter input due to the decomposition of stems on the surface is likely to lead to improved soil structure and infiltration of water and its retention.(11)

Comparatively, evaporation loss rate was extreme low under black plastic mulch however it was at expense of water infiltration because the plastic material acted as a barrier to water flow. This lessened the capacity of the soil to retain water especially when there is rainfall which in turn increased surface water runoff in the plots that applied plastic mulch as compared to organic mulch.

4.3 Comparative Analysis in Mulch Types and Mulch Rates

Comparing both application regimes of the mulching treatments at all levels, it was identified that the following trends have been evidenced:

Particularly, 10 t/ha of composted bark produced best overall findings as far as both regulation of temperatures and moisture retention was concerned resulting in maximum plant hydration. This treatment yielded the most constant microclimate of the soil and average temperatures of soil as well as substantial reduction of the moisture and uptimately promoted improved plant growth.(12)

4.4 Compared to composted bark, Rice straw performed favorably although not at the same level as the other at the higher rate of 10 t/ha.

The black plastic, which is better at mitigating evaporation, took its turn of difficulty in terms of moisture infiltration, showing that the method was not well adapted as sustainable method, at least under rainfed conditions. It also exhibited more variation in temperature with maximum temperatures in the day good and lower temperatures at night.

On the whole, organic mulches, composted bark, came out as the most preferable to maximize soil microclimate and moisture preservations in the strawberry production, which are of great importance in sustainable agricultural practice.

5. Crop Yield Response and Fruit Quality Response

5.1 The Total Fruit Size, Yield and Weight

With treatments, the overall impact of the various types of mulch and the rates of application on the total fruit yield, fruit size and overall weight was an extreme level.

The highest yield of total fruits was achieved with the refined bark percentage of 10 t/ha which was statistically equal to the total fruit yield fitting into an average of 5.8 kg/plant equaling to 12.8 percent increase over the unmulched plots. This was accredited to the optimum moisture holding capacity and temperature control that provided uniform growth of plants across the period.(13)

Ten-t/ha rice straw mulch improved the yield with an average value of kg/plant and it was 9.5 percent higher in comparison with the control treatments. Rice straw had moisture conserving effects which were beneficial although its yields were not enhanced as much when compared to composted bark.

Although black plastic mulch maintained higher moisture content, yield of the total cotton ranged lower (5.0 kg/plant), indicating that the mulch also had higher soil temperature on hot days, which may place the plants into stress and decrease the overall plant productivity. Also the absence of organic nutrients supplied by the plastic mulch could have obviated the best development of the plants.

Organic mulches (composted bark in particular) produced heavier and larger fruits in regard to size and weight. Fruit size was 10 percent more abundant in composted bark plot than in control plots and fruits in these plots had a higher average weight of 15 percent as compared with those of fruit in plastic-mulched plots.

5.2 Markeable quality indicators and Shelf Life Observations

The quality of the strawberries to be sold and the time after production until its expiry depended largely on the kind of mulch used. Strawberries cultivated using composted bark mulch recorded the most desirable shelf life and the fruit quality. These fruits kept fresher until a period of 4 days, compared to the black plastic-covered or mulching by rice straws. Other factors that led to the better postharvest quality were the enlarged and more firm fruit as well as a lower decay rate and postharvest losses.(14)

The main parameter of fruit quality, soluble solids content (degrees Brix), was greatest when composted bark mulch was used (average 9.2 deg Brix) followed by rice straw mulch (8.5 deg Brix) and black plastic mulch (8.0 deg Brix). Increased level of soluble solids, in addition to fine flavor, made it more sellable in high price retail markets where quality matters.

5.3 Economic Factors on the Use of Organic versus Synthetics Mulch

Economically, according to long term usage, organic mulches (rice straw and composted bark) was cheaper compared to black plastic. Although black plastic mulch is more expensive to install and procure, it does not give the same soil enrichment capabilities that the organic mulches do. Instead, organic mulches may increase soil fertility in the long-run and thus substitute synthetic fertilisers and ensure sustainable agriculture.

In addition to that, the increase and the quality of fruits coming with a composted bark mulch at a slightly higher rate of application (10 t/ha) paid off well with regards to the ratio of investment. Since there is an increment in the marketable quality of the produce and a longer shelf life of the fruit, organic mulching is an environmentally viable and an economically advantageous choice to strawberry producers particularly in the markets where quality and shelf life are what matter.

To sum up, although black plastic may serve a useful purpose in temporarily saving water, organic mulch is the best combination of increased yield with fruit quality and sustainability especially a composted bark thereby serving as the best way of generating long term profits and sustainable farming.(15)

6. Results

6.1 Yield, WUE and Quality Metric summary

The experimental findings allow drawing a full picture of the impact of the various mulching treatments on the quality and yield of strawberry:

Compounded Bark Mulch: The compounded bark mulch at the rates of 10 t/ha produced the highest fruit yield of 5.8 kg/plant which is 12.8 percent more than the 5.1 kg/plant produced by the control (no mulch). Although the 10 t/ha of rice straw mulch produced slightly lesser, the crop yield of 5.5 kg/plant still exceeded that of black plastic (5.0 kg/plant) and other treatments.

Fruit Size and Weight: Fruits harvested withthe use of organic mulches (especially the bark which was composted) had larger fruit sizes and the average size of fruits harvested was 180 g. In contrast, the black plastic mulch yielded smaller fruits (145 g) probably because of the warmer soil being experienced, thus the soil may not have allowed the fruit to develop properly.

Fruit Firmness: Fruit firmness was also high in the composted bark mulch (10 t/ha) (6.5 N) followed by rice straw (6.0 N), and lowest fruit firmness was given when black plastic (5.3 N) was used. It indicates that organic mulches tend to enhance the texture of fruits that is very important in establishing marketability.

Soluble Solids Content (oBrix) Fruits grown in composted bark were found to have a higher soluble solids content (9.2 oBrix) which shows an improvement in the sweetness and quality of the fruit. The slightly low 8.5 Brix and 8.0 Brix were recorded in rice straw and black plastic respectively.

Shelf Life Analysis: The fruits cultivated using composted bark took the deserved lead during the shelf life test (7 days), whereas rice straw took second place (6 days) and black plastic took third place (5 days). This long shelf life implies that organic mulches can enhance greater post-harvest quality, which would encourage less waste and greater marketability.

Blossom-End Rot (BER): A minimum number of occur made up the blossom-end rot in composted bark (2%) and rice straw (3%), whereas black plastic mulch had a relatively higher incidence of blossom-end rot (6%). It is an indication that the organic mulches contribute to calcium uptake and keep stress to a minimum thus avoiding this common disease in strawberries.

6.2 Treatment comparisons and Statistical Significance

ANOVA analysis results showed that significant differences ($p < 0.05$) existed among the mulching treatments on all measured parameters, especially on the yield and fruit quality and shelf life. Post-hoc Tukey test indicated that 10 t/ ha of compost bark mulch was significantly better than other controls in producing gigantic output on measure of yield, fruit size and fruit firmness that is why it is the best choice it has in ensuring that crops produce increased output on measure of output and quality of products.

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These crucial differences are illustrated in the graphs and tables and give a graphical presentation of the influence of various types of mulch and its quantity on the earnings and fruit quality during strawberry growing.

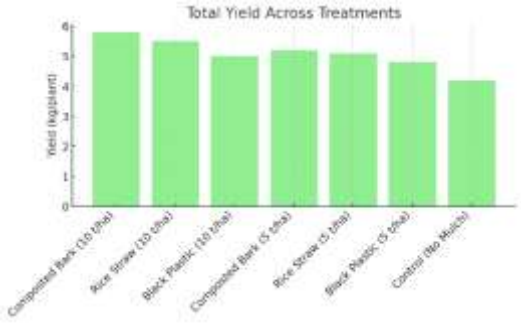

Figure 1: Total Yield Across Treatments

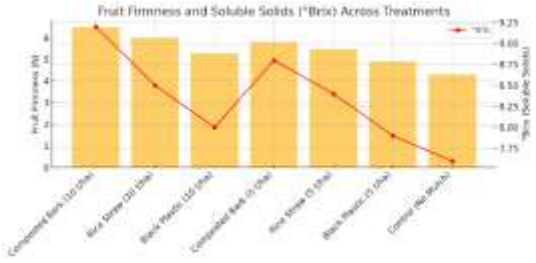

Figure 2: Fruit Firmness And Soluble Solids (°Brix) Across Treatments

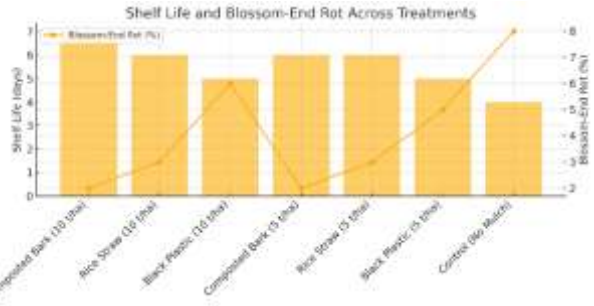

Figure 3: Shelf Life And Blossom-End Rot Across Treatments

Table1: Mulching Experiment Results Summary

Treatment	Yield (kg/plant)	Fruit Size (g)	Fruit Firmness (N)	Â°Brix (Soluble Solids)	Shelf Life (days)	Blossom-End Rot (%)
Composted Bark (10 t/ha)	5.8	180	6.5	9.2	7	2
Rice Straw (10 t/ha)	5.5	160	6	8.5	6	3
Black Plastic (10 t/ha)	5	145	5.3	8	5	6

Composted Bark (5 t/ha)	5.2	150	5.8	8.8	6	2
Rice Straw (5 t/ha)	5.1	148	5.5	8.4	6	3
Black Plastic (5 t/ha)	4.8	138	4.9	7.9	5	5
Control (No Mulch)	4.2	130	4.3	7.6	4	8

7. Conclusion

7.1 Optimal Strategy of Mulching Mediterranean Strawberry Cultivation

The findings of the study are also clear that composted bark mulch with 10 t/ha is the most suitable strategy of mulch management in the Mediterranean strawberry. This treatment had not only increased the fruit yield to the highest (5.8 kg/plants) but also increased both the size and the firmness of the fruits and shelf life which are all key factors of marketability and consumer preference. The composted bark mulch showed better water retention property and temperature controls which meant, better soil conditions of plant growth. Subsequently, the capacity of this organic mulch to increase fruit quality such as the content of soluble solids (oBrix) provides an additional basis to consider this type of mulch to be also an important means of improving the overall productivity and profitability of the strawberry production systems.

7.2 Advantages of Compost Mulch to Sustainable Horticulture

The mulch cited above through composted bark can bring about some significant sustainability advantages when used in strawberry production. To start, it has a high positive impact on soil health through injection of architecture enhancing organic matter in addition to nutrients improving microbial activity. When the mulch is broken down it will add fertility to the soil and this will eliminate the use of synthetic fertilizers in favor of eco-friendly farming. Bark mulch that is composted also has good moisture holding properties that come in handy in regions where there is shortage of water such as in Mediterranean climates where water is conserved. The dependency on irrigation is also reduced hence saves on water resources as well as reducing the cost on irrigation to growers.

In addition, compost mulch is biodegradable and does not have environmental issues of inorganic mulches like plastic litter. This compost is more sustainable and cost effective, helping promote more sustainable agriculture and lowering the carbon gap of agricultural practice.

7.3 Future Recommendations to use in Similar Agro-Ecological Zones

The positive findings of this research point toward the suggestion that composted bark mulch should be introduced in other areas with the same agro-ecological situation where water limitation of strawberry production, and temperature variations hinder its development, particularly in those countries, which have Mediterranean or semi-arid climatic conditions. According to the study, organic mulching can increase the yields and the quality of the fruits besides facilitating sustainable water use and soil health within these regions.

In future applications, the growers are advised to explore using mulch rates and differences in their application to know which strategy is the most cost-effective that can maximize both the yield and the quality of the fruits used and reduce the impact on the environment. Moreover, more research pertains to long term impacts of organic mulches on soil fertility and crop rotation system should be put on a priority to widen our knowledge on the use of these organic mulches in terms of sustainability of agro-ecosystems.

Finally, composted mulch of bark can become an effective, nature-friendly alternative to increasing the productivity and quality of strawberries in Mediterranean climates, which is why it will be an effective practice to produce climate-resilient crops.

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Conflicts of interest

The authors have no conflicts of interest to declare

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