



Comparative Analysis of Morphological and Biochemical Traits in *Fragaria × ananassa* (Cv. Chandler) under Varied Cultivation Systems

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present research was carried out at Khalsa college Amritsar during 2018-19 to investigate the effect of different cultivation systems on the morphological and biochemical attributes of strawberry cv. Chandler under subtropical conditions of Punjab. The experiment was laid out in Randomized Block design by using eight treatments, each comprising three replications. The different planting systems including flat beds, raised beds, ridges, soilless media, polythene bags, cement pots, plastic crates and low poly tunnels were employed during this research. The runners of strawberry collected from Dr Y S Parmar University of Horticulture and Forestry, were utilized for the experiment. The morphological parameters such as fruit size, weight, number of achenes and biochemical parameters like Total soluble solids, acidity, sugars and ascorbic acid content were analyzed. The results of this present study revealed that maximum fruit length, breath, number of achenes were observed under low poly tunnels. Similarly, the maximum TSS, total sugar content, ascorbic acid and minimum acidity level was recorded under low under poly tunnels. These

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outcomes strongly suggest the superiority of utilizing low poly tunnels for strawberry cultivation, emphasizing their potential to enhance both morphological traits and biochemical compositions compared to the other employed planting systems.

Keywords: Morphological; planting systems; quality; strawberry.

1. INTRODUCTION

The domesticated garden strawberry, *Fragaria xananassa* Duch., is an allo-octoploid ($2n=8x=56$), and it has a distinct natural and domestication history [1]. It is a perennial, low-climbing, stoloniferous herb that is a member of the family Rosaceae and sub family Rosoideae [2]. The strawberry, one of the tastiest fruits in the world, is a fantastic source of vitamins, minerals and antioxidants. It also has a great flavor and tantalizing aroma [3].

Strawberries are grown using a variety of techniques around the world, including glasshouses, polyethylene bags, low tunnels, soilless media, raised beds, cement pots, flat beds and ridges. Due to their ability to extend the harvest season and enhance fruit quality, high and low tunnels are highly popular in Asia and the Mediterranean region [4,5]. Low tunnels may provide a beneficial opportunity to grow crops early in the growing season while also protecting them from environmental extremes, premature ripening, and obtaining a greater marketable yield. The growing of strawberries in soilless substrate has been a solution adopted in several countries due to issues with soil-borne diseases and the prohibition of fumigant agents for disinfection. In a soilless system, the substrate has a significant impact on the productivity and fruit quality of strawberries [6]. Cocopeat, which has a high water retention and cation exchange capacity, is the most widely utilized organic substrate in India. The chemical composition of strawberry fruits can be greatly affected by cultivation methods [7]. Raised bed strawberry farming increases fruit productivity and enhances the quality of the crop [8].

Strawberries has been produced under open conditions from long period for commercial production which results in poor fruit quality and production. The different cultivation systems have a big influence on the morphological and chemical composition of strawberry. Therefore, there is need of developing new techniques to meet the optimum standards of produce

[9]. Keeping in view, the objective of this study was to investigate the effects of different planting systems on the morphological and biochemical attributes of strawberry cv. Chandler.

2. MATERIALS AND METHODS

The present investigation was carried out at Khalsa College Amritsar Department of Horticulture's experimental area, during the year 2018-19. This location is 774 feet above sea level and can be found in 31° -38' latitude and 75° -52' longitude. The experiment was done under subtropical conditions of Punjab. It has 735mm of annual rainfall, the most of which occurs from July to September. Winters are when frost most frequently occurs, while summers are when temperatures can reach up to 48° C. On the second fortnight of October, healthy and diseased free runners were planted at a 45 × 30 cm spacing. The soil was sandy loamy with a pH of 8.4 and 6.3 kg/ha of available phosphorous, 180 kg/ha available potash and 0.28% total nitrogen. A uniform dose of Farm Yard Manure (FYM) @ 50 q/ha was applied to all plots before the preparations of the field. The availability of the nitrogen, phosphorous and potash content in soil was studied by taking the sample before the sowing of the crop. The experiment was laid out in Randomized Block Design by using eight treatments, each comprising three replications. In three replications with eight treatments. Eight treatments viz. T₁, (Flat beds); T₂, (Raised beds); T₃, (Ridges); T₄, (Soilless media); T₅, (Polythene bags); T₆, (Cement pots); T₇, (Plastic crates); and T₈, (Low poly tunnels). The data were analyzed by using software SPSS, following the standard ANOVA techniques and difference between the treatment means was tested as for their statistical significance with critical difference value at 5 % level of significance.

Data collection included morphological and biochemical parameters: fruit length, breath, weight, number of achenes, organoleptic rating, fruit color and TSS, acidity, TSS:acid ratio, Total sugars, reducing sugars, non reducing sugars and ascorbic acid content were recorded.

3. RESULTS AND DISCUSSION

3.1 Morphological Parameters

The morphological parameters of strawberry cv. Chandler were significantly influenced by different cultivation systems (Fig.1). The maximum fruit length was recorded under low poly tunnels (4.83 cm) followed by plastic crates (4.57 cm). Similarly the maximum fruit breadth (3.87 cm) was noticed in T₈ which was significantly higher than T₇ and T₁. The fruit weight was found to be maximum (16.17g) under T₈ which was statistically at par with T₇ and T₁, while fruit weight was minimum (10.52g) recorded in T₄. Maximum number of achenes (317.77) was observed under T₇ followed by T₂ and T₃. The maximum organoleptic score (8.2) was awarded to fruits harvested from the plants of T₈ while minimum in case of T₄. Fruits were evaluated for their colour rating by panel of five judges on score card (maximum 10 points) based on the colour of the fruits and results on the investigations revealed that plants grown under T₈ produced excellent colour (9.23) followed by T₇, while minimum was recorded under T₄. It might be due to increased growth parameters of strawberry because the plants get more benefit from all the controlled climatic and soil conditions under low poly tunnels. This ultimately results in transfer of large amount of nutrients to regenerative organs, which in turn resulting in more fruit size, Rahman et al, [10] Kumar et al, [11] Qureshi et al, [12].

3.2 Biochemical Parameters

The biochemical parameters of strawberry cv. Chandler (Fig. 2) were significantly influenced by different cultivation systems. The present results of this research revealed that the maximum TSS (8.57°B) was observed in T₈, followed by T₇ and T₁ while minimum was observed in T₄. Hence it was found that maximum TSS might be occurred due to the creation of a better microclimate as well as weed free environment under low tunnels which led to increased the TSS of the fruits. The gradual increase in temperature under tunnels enabled favorable conditions and metabolite mobilization by breakdown of carbohydrates and energy for supply of moisture and nutrients by roots. A similar result in strawberry was reported by Kaitlyn et al. [4] Laugale et al. [13] and Voca et al, [14].

Acidity content was influenced by different cultivation systems. Minimum acidity (0.53 %) was found in fruits produced under T₈ which was significantly followed by T₇. TSS: acid ratio were observed maximum (16.17) in plants of T₈, while minimum 8.12 was observed under the T₄. The improvement of fruit quality under low tunnels might be responsible for the improvement of TSS: acid ratio. The present results are in accordance with the research findings of Quershi et al, [12] in strawberry cv. Chandler.



Fig. 1. Strawberry plants

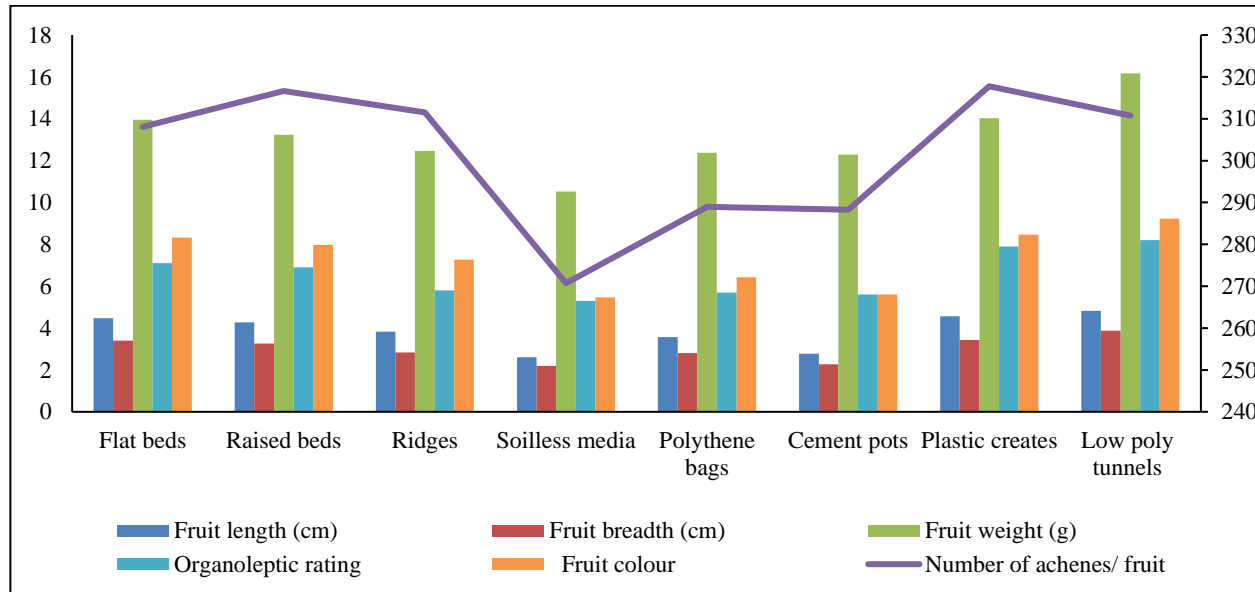


Fig. 2. Effect of different cultivation systems on the morphological attributes of strawberry cv. Chandler
 (T₁: Flate beds, T₂: Raised beds, T₃: Ridges, T₄: Soilless media, T₅: Polythene bags, T₆: Cement pots, T₇: Plastic crates, T₈: Low poly tunnels)

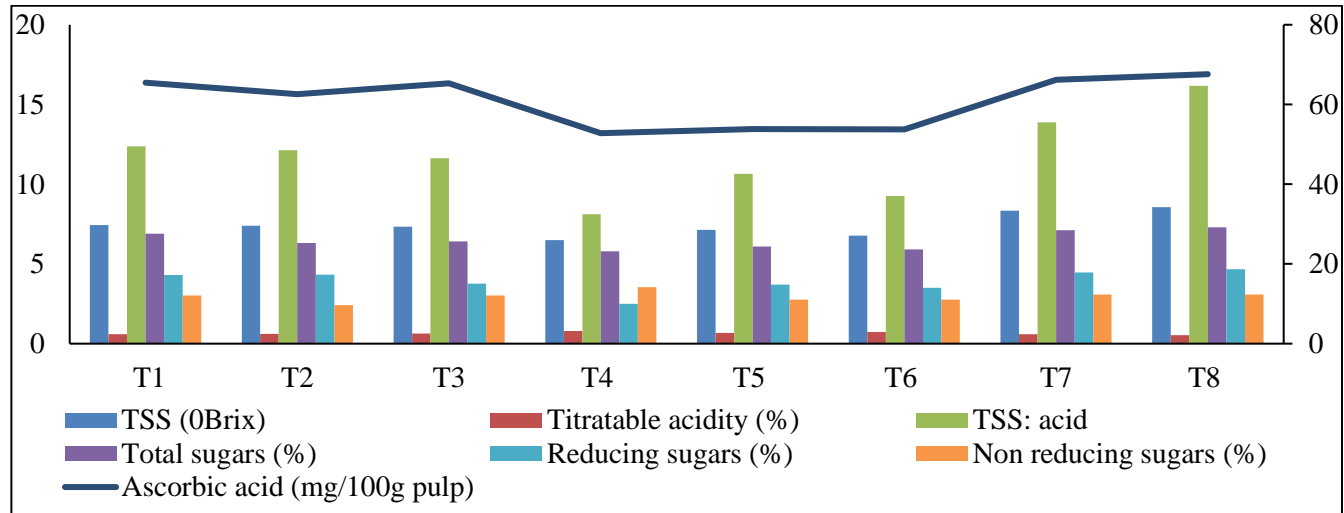


Fig. 3. Effect of different cultivation systems on the morphological attributes of strawberry cv. Chandler
 (T₁: Flate beds, T₂: Raised beds, T₃: Ridges, T₄: Soilless media, T₅: Polythene bags, T₆: Cement pots, T₇: Plastic crates, T₈: Low poly tunnels)

The plants under T₈ produced fruits with the highest total sugar content (7.30%), which was statistically comparable to the T₇. Lowest value of total sugars (5.8%) was recorded in T₄. The reducing sugars was found maximum (4.47%) in T₈, which was significantly higher than all other treatments, and minimum (2.49 %) were observed in T₄. This is because distinct soil regimes were created as a result of solar radiation absorption, heat transfer from the soil to the atmosphere, and heat loss through low tunnels. The rise in sugars may be related to altered soil temperature regime and higher reflection light. Under tunnels there was a reflection of less than five percent of incident radiation irrespective to growing environments. Thus it might be due to changes in substrate temperature more than to the reflected light resulting in increase of reducing sugars. The research findings of Laugale et al.[13] and Voca et al.[14] in strawberry fruits of cvs. Clery and Asia, Quershi et al,[12] in strawberry cv. Chandler.Kumar et al, [11] Singh et al, [15] Rahman et al, [10] also reported the same in strawberry.

The maximum ascorbic acid content (67.60mg) was observed in T₈, followed by T₇ (66.23mg), while minimum (52.8mg) ascorbic acid content was observed in T₄. An increased in the amount of ascorbic acid might be due to the role of elevated soil temperature as catalyst for root activities including uptake of water and nutrients which ultimately produce fruits with better quality [16] The present findings were similar with the research studies of Laugale et al.[13] and Voca et al, [14] in strawberry fruits of cvs. Clery and Asia, Quershi et al,[12] in strawberry cv. Chandler.

4. CONCLUSION

In order to assess the effects of various growing conditions on the morphological and biochemical characteristics of the Strawberry cv. Chandler, a field study was carried out at Khalsa College Amritsar during, 2018-2019. According to the study's findings, the plants grown under low poly tunnels (T₈) produced fruits having maximum fruit length, weight, organoleptic rating, colour, and TSS (8.57 Brix), TSS:acid ratio (16.17), total sugars (7.30%), reducing sugars (4.67%), and ascorbic acid content (67.60 mg). The amount of non-reducing sugars and acidity was highest in soilless media (T₄). The production of plants in low tunnels has also shown to be successful in reducing fruit acidity. In plastic crates, the highest

(317.77) number of achenes per fruit was found in plastic crates (T₇). Consequently, it was discovered that low polytunnel cultivation was effective.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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