Original Research Article

Comparative analysis of Morphological and Biochemical traits in *Fragaria* × *ananassa* (Cv. Chandler) under varied cultivation systems

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Abstract

The present research was carried out at Khalsa College Amritsar during 2018-19 to ~~investigated~~investigate~~the effect~~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 includingflat 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 maximum fruit length, breath, number of achenes were observed underlow poly tunnels. Similarly, the maximum TSS, total sugar content, ascorbic acid and minimum acidity level was recorded under low under poly tunnels. These 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~~Strawberry

Introduction

The domesticated garden strawberry, *Fragaria×ananassa*Duch., is an allo-octoploid ($2n_{=}$ $8x_{=}$ 56), and it has a distinct natural and domestication history (Edger *et al*, 2019). It is a perennial, low-climbing, stoloniferous herb that is a member of the family Rosaceae and sub family Rosoideae (Sadiq and Kaur, 2017). The strawberry, one of the tastiest fruits in the world, is a fantastic source of vitamins, minerals and antioxidants. It also has a great ~~flavour~~flavor and tantalizingaroma (Kher *et al*, 2010).

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 (Espi*et al*, 2006). 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 (Albaho*et al*, 2008). Cocopeat, which has a high water retention and cation exchange capacity, is the most widely ~~utilised~~utilized organic substrate in India. The chemical composition of strawberry fruits can be greatly affected by cultivation methods (Voca*et al*, 2006). Raised bed strawberry farming increases fruit productivity and enhances the quality of the crop (Kamangar *et al*, 2014).

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 (Claire *et al*, 2018). 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.

Materials and Methods

The present investigation was carried out at Khalsa College Amritsar Department of Horticulture's experiment 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. T_1, (Flat beds); T_2, (Raised beds); T_3, (Ridges); T_4, (Soilless media); T_5, (Polythene bags); T_6, (Cement pots); T_7 (Plastic crates); and T_8 (Low poly tunnels).The data were analyzed by 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.

Comment [H1]: Is this not high enough for growing strawberry rhizomes? Because the range of absorption of many elements in its pH is close to 7. Isn't this pH very alkaline? Were the elements easily absorbed by the plants and were you lacking in the elements when growing the rhizomes?

Comment [H2]: What software did you use to analyze the data?

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.

Fig 1: Strawberry plants

Results and Discussion

Morphological parameters:

The morphological parameters of strawberry *cv.* Chandler were significantly influenced by different cultivation systems (Figure 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 ~~The~~the maximum fruit breathwas noticed in T_8 which was significantly higher than T_7 and T_1. The fruit weight was found to be maximum (16.17g) under T_8 which was statistically at par with T_7 and T_1, while fruit weight was minimum (10.52g) recorded in T_4. Maximum number of achenes (317.77) was observed under T_7 followed by T_2 and T_3. The maximum organoleptic score (8.2) was awarded to fruits harvested from the plants of T_8while

minimum in case of T_4. 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 T_8 produced excellent colour (9.23) followed by T_7, while minimum was recorded under T_4. It might be due to increased growth parameters of strawberry because the plants gets more benefit from all the controlled climatic and soil conditions under low poly tunnels. Thisultimately results in transfer of large amount of nutrients to regenerative organs, which in turn resulting in more fruit size**,(**Rahman *et al*, 2014; Kumar *et al*, 2011; Qureshi *et al*, 2012).

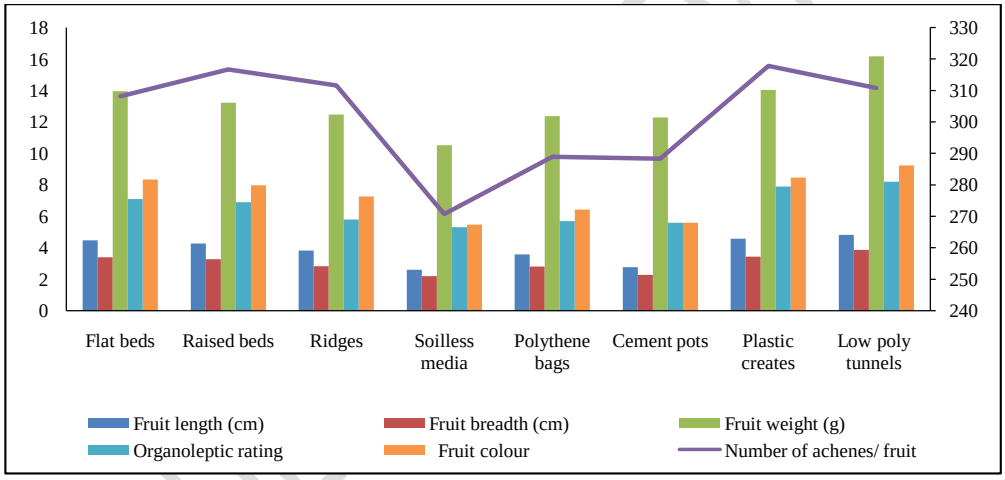

Figure 2: Effect of different cultivation systems on the morphological attributes of strawberry cv. Chandler

Comment [H3]: Place the letters on each column and under each table explain the significance or not of each treatment

Biochemical parameters: The biochemical parameters of strawberry *cv.* Chandler (Figure 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 T_8, followed by T_7 and T_1 while minimum was observed in T_4. 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 ~~favourable~~favorable conditions and metabolite mobilization by breakdown of carbohydrates and energy for supply of moisture and nutrients by roots. A Similar ~~results~~result in strawberry was reported by Voca*et al*, (2009).

Acidity content was influenced by different cultivation systems. Minimum acidity (0.53 %) was found in fruits produced under T_8 which was significantly followed by T_7.TSS: acid ratio were observed maximum (16.17) in plants of T_8, while minimum 8.12 was observed under the T_4.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*,(2012) in strawberry *cv.* Chandler**.**

The plants under T_8 produced fruits with the highest total sugar content (7.30%), which was statistically comparable to the T_7. Lowest value of total sugars (5.8%) was recorded in T_4. The reducing sugars was found maximum (4.47%) in T_8, which was significantly higher than all other treatments, and minimum (2.49 %) were observed in T_4. 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 Voca*et al* (2009) in strawberry fruits of cvs. Clery and Asia, (Quershi*et al*,(2012) in strawberry cv. Chandler.Kumar *et al*, 2011; Singh *et al*, 2012; Rahman *et al*, 2014) also reported the same in strawberry.

The maximum ascorbic acid content (67.60mg) was observed in T_8, followed by T_7 (66.23mg), while minimum (52.8mg) ascorbic acid content was observed in T_4. 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 (Reiss *et al.*, 2004). The present ~~findings was~~findings were similar with the research studies of Voca*et al*, (2009) in strawberry fruits of cvs. Clery and Asia, Quershi*et al*,(2012) in strawberry cv. Chandler.

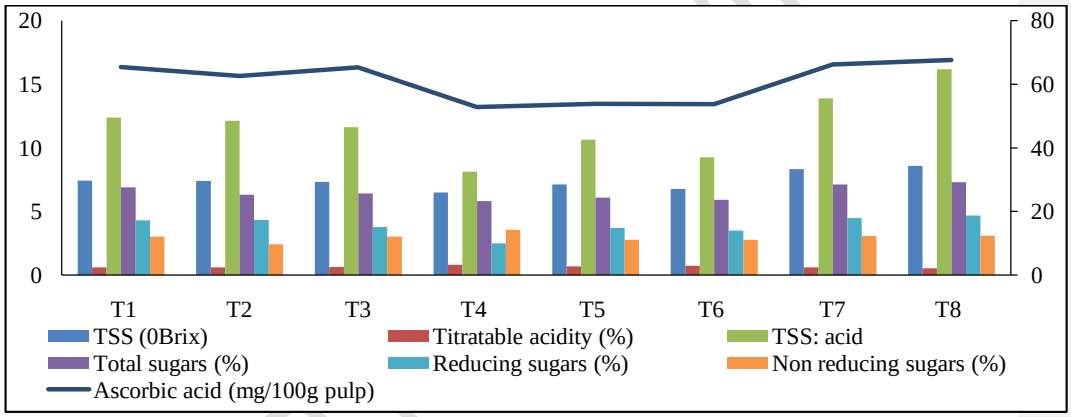

Figure 3: Effect of different cultivation systems on the morphological attributes of strawberry cv. Chandler

Comment [H4]: Place the letters on each column and under each table explain the significance or not of each treatment

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 (T_8) produced fruitshaving 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 T_4. 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 (T_7). Consequently, it was discovered that low polytunnel cultivation was effective.**REFERENCES**

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