



Impact of Various Cultivation Systems on the Growth and Yield of Strawberry cv. Chandler

Komalpreet Kaur; Amarjeet Kaur*

Department of Horticulture, Khalsa College, Amritsar143001, India

*Corresponding author Email: dr.amarjitkaur30@gmail.com

ABSTRACT

To study the impact of various cultivation systems on performance of strawberry the proposed research study was conducted in the experimental plot of nursery of Department of Horticulture, Khalsa College, Amritsar during 2018-2019. The experiment was carried out following Randomised Block Design (RBD) replicated thrice. The runners of the strawberry cv. Chandler were collected from the Department of Pomology, Dr. YS Parmar University of Horticulture, Nauni, Solan Himachal Pradesh as bases of plant material. Different cultivation systems were adapted i.e. Flat beds(T₁), raised beds(T₂), ridges (T₃), soil less media(T₄), polythene bags(T₅), Cement pots (T₆), plastic crates (T₇) and low tunnels (T₈) to find out the best cultivation system for better vegetative growth, yield and fruit quality of strawberry. The results of the study revealed that the vegetative growth in terms of plant height, number of shoots, leaves, flowers and fruits were found significantly higher in the plants grown in plastic crates while fruit yield was increased under low poly tunnels.

Keywords: Cultivation, Growth, Himachal Pradesh, Qualitative traits, Quality, Sugars, Yield

INTRODUCTION

The cultivated garden strawberry (*Fragaria x ananassa* Duch.) an allo-octoploid ($2n = 8x = 56$), has a unique natural and domestication history (Edger *et al* 2019). It is one of the most popular fruit in the world (Rehman *et al* 2014). It is a perennial, low creeping, stoloniferous herb belonging to the family Rosaceae and sub family Rosoideae (Sadiq and Kaur 2017). The modern cultivated strawberry is a hybrid of two largely dioecious octaploid species (*Fragaria chiloensis* x *Fragaria virginiana* Duch). Strawberry plants has crowns from which all leaves, roots, flowers and runners grow (Bowling 2000). The name strawberry may derived from the practice of using straw mulch for cultivation and it may have come from the Anglo-Saxon word strew meaning to spread (Kaur and Kaur 2014). It is one of the delicious fruit of the world which has attained a premium position in the world fruit market as well as in the processing industries (Sharma and Sharma 2003). It is a rich source of vitamins A, B, C and niacin, minerals like phosphorous, potassium, calcium and iron (Karkara and Dwivedi 2002). Strawberry is used in making various



products such as preserves, purees, jams, juice, fruit crushes, red rose wine, ice-creams, milk shakes, toffees and jelly (Jadhav and Gurav 2018). They are rich in total antioxidants and thus important for human health (Halyorsen *et al* 2002). For many years, strawberry is being grown commercially under open conditions which can cause poor quality and production. Therefore, developing new methods to increase its yield and quality are important (Claire *et al* 2018). Different methods are being used for cultivation of strawberry like glasshouse, polyethylene bags, low tunnels, soil less media, raised beds, cement pots, flat beds, plastic creates, ridges all over the world. High and low tunnels are very common in the Mediterranean regions and Asia (Faspi *et al* 2006) as they prolong the harvesting period and improve the fruit quality. Significant effects of tunnels on vegetative growth, flowering traits, yield and fruit quality of strawberry were reported by Quershi *et al* (2012). Due to problems with soil diseases and ban of fumigant compounds for disinfection, the cultivation of strawberries in soilless substrate has been a solution adopted by many countries. Cultivation systems can have a big influence on chemical composition of strawberry fruits (Voca *et al* 2006, Cantliffe *et al* 2001). Strawberry cultivation on raised beds aids in an increase in fruit yield and improvement in quality traits (Kamangar *et al* 2014). Keeping in view, the above facts the present study was investigated to study the influence of various cultivation systems on the vegetative and reproductive growth, quality and yield of strawberry cv. Chandler.

MATERIALS AND METHODS

The present study entitled **Impact of various cultivation systems on the growth and yield of strawberry cv. Chandler** was conducted in the nursery of Department of Horticulture, Khalsa College Amritsar during 2018-2019. The runners of strawberry cv. Chandler were procured from Department of Pomology, Dr. Y.S. Parmar University of Horticulture, Nauni, Solan Himachal Pradesh as a bases of plant material. The experiment was laid out following RBD statistical design with 8 treatments (T₁ -Flat beds, T₂- Raised beds, T₃. Ridges, T₄- Soilless media, T₅- Polythene bags, T₆-Cement pots, T₇- Plastic crates, T₈- Low poly tunnels) replicated thrice. The runners were transplanted in well-prepared beds of each measuring 2m x 1m in size. The transplanting was done during second fortnight of October at a planting distance of 45x30 cm. Uniform dose of farm yard manure (FYM) @ 50 t/ha was applied to all plots before field preparations. The observations were recorded on growth and yield characters.

RESULTS AND DISCUSSION

Plant height (cm)

The data regarding plant height as influenced by various cultivation treatments depicted that maximum plant height (21.53cm) was recorded under treatment T₇ (Plastic crates) while the plant height (15.57 cm) in the plants grown in soilless media (T₄) was recorded to be the minimum. The increase in plant height might be due to the reason that the substrate material did not dry at a faster rate not reaching the point of incipient wilting between the irrigations in



various cultivation systems. There existed no water stress which resulted in good vegetative growth in plastic crates. The differences in water availability due to the differences in drying rates in various cultivation systems had a greater effect on plant growth in strawberry plants (Evan and Hensley 2004). Also, the efficient water use did not allow the physical conditions of the soil to deteriorate quickly leading to good vegetative growth in terms of plant height. The present results are in agreement with the research findings of Qureshi *et al* (2012), Paroussi *et al* (1995), Hassan *et al* (2011), Miralles *et al* (2012) in strawberry cv. Chandler and Sharma and Godhara (2012) and Kaur and Kaur (2017) also reported an increase in height on raised beds in plants of strawberry cv. Sweet Charlie.

Number of shoots per plant

The data regarding number of shoots per plant showed that the maximum number of shoots 13.30 were observed under the treatment T₇. The lowest number of shoots (7.00) per plant were observed under treatment T₄. The obtained results seemed to compliment with the findings of Qureshi *et al* (2012) in strawberry plants.

Number of leaves per plant

The data on the number of leaves per plant in strawberry as affected by various cultivation systems showed that the maximum number of leaves per plant (38.57) was observed under the treatment T₇. The lowest number of leaves (24.30) were observed under the treatment T₄. The maximum water use efficiency by the plants grown in plastic crates, raised beds and ridges reduced the weed growth which positively reflected on vegetative growth characters resulting in more leaf production (Gimenez *et al* 2002). The research findings of Evan and Hensley (2004) in tomato, Qureshi *et al* (2012), Paroussi *et al* (1995), Hassan *et al* (2011) and Miralles *et al* (2012) in strawberry cv. Chandler are in support with the present results.

Average leaf area (cm²)

The perusal of the data regarding average leaf area of strawberry plants as affected by various cultivation systems showed a rapid increase under treatment T₇ as compared to other treatments with average leaf area (89.93 cm²) which was found to be statistically significant over all other treatments. The minimum leaf area (68.93 cm²) was recorded in the plants which were grown in soilless media (T₄). Increase in average leaf area might be attributed to better soil hydrothermal regimes and suppression of weeds in cultivation systems which decreased the competition among the plants and weeds and helped the plant to produce more leaves with more leaf area. The enhancement of soil properties like cation exchange capacity and soil microbial activity also led to the growth of the leaf acquiring more leaf area. The current results are in collaboration with the research findings of Evan and Hensley (2004) in tomato, Qureshi *et al* (2012), Paroussi *et al* (1995), Hassan *et al* (2011) and Miralles *et al* (2012) in strawberry cv. Chandler.

Number of runners per plant

The perusal of the data related to number of runners per plant showed that the treatment T₇ produced maximum number of runners 9.43 while the strawberry plants under treatment T₄



produced the lowest (4.23) runners per plant . The results of the present study are in line with the research findings of Evan and Hensley (2004) in tomato, Qureshi *et al* (2012), Paroussi *et al* (1995), Hassan *et al* (2011) and Miralles *et al* (2012) in strawberry cv. Chandler.

Number of flowers per plant

According to the results of the present study the maximum number of flowers per plant (27.87) was observed in the plants grown under plastic crates (T₇). The lowest number of flowers (16.90) were observed in the strawberry plants under soilless media. The observed enhancement effect on flowering parameters in plastic crates and raised beds might be attributed to the benefit which led to decreased water loss and soil temperature , reduced soil erosion and suppressed weeds which in turn promoted vegetative growth which positively reflected on flowering traits. These results seemed to be in general agreements with those reported by Adekiya *et al* (2002) and Qureshi *et al* (2012) in strawberry plants.

Number of fruits per plant

The data on the number of fruits per plant in strawberry as affected by various cultivation treatments showed that the maximum number of fruits per plant 25.03 was observed in plants with treatment T₇. Lowest number of fruits (13.23) were observed in soilless media. This might be attributed to the fact that the plastic crates and raised beds enhanced the number of flowers due to the decreased water loss and soil temperature which in turn increased the number of fruits respectively. These results are in support to the findings of Evans and Hensley (2004) in tomato. Adekiya *et al* (2001) and Qureshi *et al* (2012) also reported the same in strawberry plants.

Fruit set per cent

The data pertaining to fruit set as influenced by various cultivation systems enhanced the fruit set per cent depicting maximum fruit set per cent 89.80 observed in plants under the treatment T₇. Minimum fruit set per cent 74.87 was observed under the treatment T₄. The cultivation of strawberry plants in plastic crates and raised beds improved the nutrients and moisture level of the soils and improved the fruit set in strawberry as it reduces the drop of flowers by reducing the moisture stress and hence increased the fruit set per cent. Higher number of fruits per plant under raised conditions has also been reported by Qureshi *et al* (2012) in strawberry plants and Evans and Hensley (2004) in tomato.

Yield (g/plant)

Maximum fruit yield per plant was observed in the plants under treatment T₈ with 215.33 g/plant and proved to be significantly superior over other treatments. Minimum fruit yield 45.03 g/plant was recorded under treatment T₄. Hence results of the study showed that low tunnels had positive effect on increasing the fruit yield of strawberry. It might be due to the proper balance of microclimate especially moisture and temperature for strawberry plants which creates favourably modified hydrothermal conditions improving and metabolites translocation leading to an increased yield of strawberry plants under low poly tunnels as reported by Ali and Radwan 2008, Medina *et al* 2011 and Quershi *et al* (2012) in strawberry plants. The present findings also finds



support with the research findings of Arin and Ankara (2001), Salame-Donoso *et al* (2010), Kumar *et al* (2011) and Menzel *et al* (2013) in strawberry. Mohamed *et al* (2015) also reported the same in cultivar sweet Charlie and festival of strawberry under low tunnels.

Table 1: Impact of various cultivation systems on the vegetative growth in strawberry cv. Chandler

Treatments	Plant height (cm)	Number of shoots	Number of leaves	Leaf area (cm ²)	Number of runners
T ₁ Flat beds	19.87	9.70	34.57	84.07	6.50
T ₂ Raised beds	21.47	13.00	37.50	89.57	8.57
T ₃ Ridges	20.6	11.70	36.57	86.43	7.67
T ₄ Soilless media	15.57	7.00	24.30	68.93	4.23
T ₅ Polythene bags	16.57	7.70	27.30	80.73	5.43
T ₆ Cement pots	15.70	7.30	25.93	74.93	4.33
T ₇ Plastic crates	21.53	13.30	38.57	89.93	9.43
T ₈ Low tunnels	19.93	10.30	35.97	84.63	7.47
CD (5%)	0.87	2.44	0.89	0.51	0.52



Table 2 : Impact of various cultivation systems on yield attributes in strawberry cv. Chandler

Treatments	Number of flowers	Number of fruits	Fruit set per cent	Yield/ plant (g)
T ₁ Flat beds	23.83	20.93	83.20	131.33
T ₂ Raised beds	25.93	22.97	88.57	128.07
T ₃ Ridges	24.83	22.83	87.10	87.53
T ₄ Soilless media	16.90	13.23	74.87	45.03
T ₅ Polythene bags	18.97	14.43	80.93	60.43
T ₆ Cement pots	17.83	14.20	78.27	61.37
T ₇ Plastic crates	27.87	25.03	89.80	158.47
T ₈ Low tunnels	24.80	21.63	84.40	215.33
CD (5%)	0.79	3.53	0.79	41.00

CONCLUSION

It can be concluded from the present studies that the cultivation of plants in plastic crates proved to be the most effective in increasing the vegetative growth of strawberry cv. Chandler in terms of plant height, leaf area, number of flowers, fruits and fruit set per cent while yield was increased in the plants under low poly tunnels. Therefore cultivation of strawberry under plastic crates proved to be a successful practice for improving the vegetative growth while low poly tunnels increased the yield of strawberry fruits.



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