



EFFECT OF PLANTING TIME ON THE PERFORMANCE OF STRAWBERRY CV CHANDLER IN SUBTROPICAL REGION OF PUNJAB

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ABSTRACT

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A field experiment was carried out in the Department of Horticulture, Khalsa College, Amritsar during the year 2016-17 to standardize the planting time of strawberry cv. Chandler in subtropical region of Punjab. The runners of strawberry cv Chandler were planted at 30x40 cm apart on the raised beds on seven times of planting i.e. 1st September, 15th September, 1st October, 15th October, 30th October, 15th November and 30th November 2017 respectively. The experiment was laid out in Randomised Block Design (RBD). The results of the study indicated that out of the various planting times the vegetative growth, flowering and fruiting of strawberry was increased in the planting time of 15th October with the maximum plant establishment (89.17 %), plant height (21.11 cm), number of shoots per plant (10.00), leaves (26.06), leaf area (82.19 cm²), number of flowers (31.10), fruits (23.16) and fruit set (80.1%) respectively.

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INTRODUCTION

The strawberry (*Fragaria ananassa*) is one of the most important soft fruits of the world. It is a temperate fruit crop and belongs to the family Rosaceae. It is a hybrid between two species (*Fragaria chiloensis* × *Fragaria virginiana*). It is a short day plant growing predominantly in the temperate climate but it can also be grown in tropical and sub-tropical conditions (Bakshi *et al* 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 processing industry (Sharma and Sharma 2003). Cultivated strawberry is an octaploid, dicotyledonous, perennial and low growing herb grown in most arable regions of the world. The name strawberry may have derived from the practice of using straw mulch for cultivation, or it may have come from the Anglo-Saxon word strew meaning to spread (Kaur and Kaur 2014). Strawberry gives quicker and very high remunerative returns per unit area on the capital investment, as the crop is ready for harvesting within six months of planting, so it is considered more profitable in the shortest possible time as compared to other fruits. But in spite of being such an important and favourite fruit in many regions of the world, it could not become very popular in India as it should have due to vagaries of climatic conditions (Kaur 2010). Season and date of planting varied from place to place depending upon the climate of the area, so the optimization of time is of great importance. Planting dates within a season greatly influence the time of flowering and harvesting, yield and runner production in India. Planting time

has direct effect on day and night temperature, day light intensity and photoperiod which affect the floral production, fruit size, quality and production (Rahman *et al* 2014). The planting of runners in October and November usually does not require any extra care for their establishment. Under Punjab conditions runners of strawberry are usually planted in the month of October (Chopra *et al* 2003). However, there are several reports available in the literature indicating that strawberry can be planted on different times of the year, depending on the variety, location and climate (Sharma and Sharma 2004). So planting time of strawberry is important for partitioning, the assimilates which directly influence the growth and yield of strawberry. According to Anna *et al* (2003) for successful strawberry cultivation, time of planting plays a very significant role and its optimization is pre-requisite. Furthermore, higher profitability and productivity of strawberry is being taken in many countries through manipulation of planting time. However, turning of planting time are the important ways to achieve higher yield of strawberries (Rahman 2014).

MATERIALS AND METHODS

The research study was conducted in the nursery of Horticulture Department, Khalsa College, Amritsar. Runners of strawberry cv. Chandler were planted on seven dates viz., T₁ (1st September); T₂ (15th September); T₃ (1st October); T₄ (15th October); T₅ (30th October); T₆ (15th November); T₇ (30th November) during 2016-2017 with planting distance of 30x40cm, replicated thrice. The growth parameters of the plants were recorded in terms of plant establishment, plant height, number of shoots per plant, number of leaves per

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plant, leaf area, number of flowers, time taken for runner formation, number of runners per plant, number of fruits per plant and fruit set percent. The data were statistically analysed by the method of analysis of variance using RBD.

Table 1 Effect of planting time on plant characters of strawberry cv. Chandler

Treatments	Plant establishment (%)	Plant height (cm)	No. of shoots per plant	No. of leaves per plant	Leaf area (cm ²)
T ₁ 1 st September	0	Nil	Nil	Nil	Nil
T ₂ 15 th September	24.33	21.06	7.03	19.28	76.03
T ₃ 1 st October	63.12	18.31	8.03	21.03	78.19
T ₄ 15 th October	89.17	21.11	10.00	26.06	82.19
T ₅ 30 th October	83.06	19.1	9.40	24.15	80.15
T ₆ 15 th November	79.04	18.32	8.00	19.17	74.06
T ₇ 30 th November	71.02	17.06	7.1	18.11	70.03
CD (5%)	0.36	1.00	0.32	0.36	0.56

Table 2 Effect of planting time on flowering and fruiting of strawberry cv. Chandler

Treatments	Time taken for runner formation (days)	No. of runners/plant	No. of flowers/plant	No. of fruits per plant	Fruit set (%)
T ₁ 1 st September	0	Nil	Nil	Nil	Nil
T ₂ 15 th September	167	6.36	26.25	16.61	68.47
T ₃ 1 st October	159.03	7.24	27.04	18.51	74.10
T ₄ 15 th October	142.10	8.15	31.10	23.16	80.10
T ₅ 30 th October	141.03	8.95	24.21	21.16	79.26
T ₆ 15 th November	140.07	4.16	19.10	15.18	65.39
T ₇ 30 th November	140.14	4.10	16.45	12.43	61.29
CD (5%)	0.25	0.22	0.32	0.44	0.53

The data with regard to plant establishment presented in Table 1 as influenced by different planting time showed that the maximum plant establishment 89.17% were recorded under treatment T₄ (15th October) followed by T₅, T₆, T₇, T₃, T₂ and T₁ With 83.06, 79.04, 71.02, 63.12, 24.23 and 0 percent respectively. All of these treatments were highly significant with each other. The earlier planted plants of Chandler revealed lesser plant establishment percentage perhaps because of the unfavourable climatic conditions of Punjab as there was a drastic rise in temperature during the month of September, during early planting high temperature accelerated plant mortality. Similarly, Lee *et al* (2005) stated that damage caused by mites, thrips and powdery mildew increased with increasing duration of the high temperature period. The Findings of Rahman (2014) and Kaur (2010) also stated the same in strawberry cvs. Festival, Camarosa, Sweet Charlie and Chandler respectively.

The data regarding plant height showed that the maximum plant height 21.11 cm was recorded under treatment T₄ (15th October) followed by T₅, T₆, T₇, T₃ and T₂ with 19.10 cm, 18.32 cm, 17.06 cm, 18.31 cm and 21.06 cm respectively. The treatment T₂, T₃, T₄, T₅ and T₆ were found to be at par with each other. The maximum plant height found in the plants of strawberry during mid October planting was perhaps because of congenial climatic conditions, favourable for growth and development of plants. Thus availability of low temperature, high relative humidity and low light intensity for plants of mid October and mid November planting in our study might have favoured good growth in the plants of strawberry. The reproductive development may antagonize the vegetative growth of strawberry cv. Chandler plants. So latter planted plants in the end November might had less time for plant height (Perez-de-Camacaro 2002). The research findings of

Kher (2010) and Kaur (2010) in strawberry cv. Chandler are in close conformation with the present results. Rahman (2014) also reported the same in Festival, Camarosa and Sweet Charlie strawberry cultivars.

It is evident from the data on shoot number per plant that the maximum number of shoots 10.00 were recorded under treatment T₄ (Mid-October) which was found to be at par over all the treatments. The treatments T₁, T₂, T₃, T₄, T₅, T₆ and T₇ have 0, 7.03, 8.03, 9.40, 8.00 and 7.10 shoots per plant respectively. The plants which were planted on the last of November produced lesser (7.10) shoots per plant. This might be due to the temperature variation and changing weather conditions which affected the vegetative growth in terms of shoot number in strawberry plants. The results are in accordance with the findings of Kaur (2010) who also reported the more no. of shoots in mid October cultivated plants of strawberry cv. Chandler.

The perusal of data in Table 1 revealed significant effect of planting time on leaf number during the year of investigation. The maximum number of leaves 26.06 were observed under treatment T₄ (15th October) which was highly significant over all the treatments. The treatments T₅, T₆, T₇, T₃, and T₂ had 24.15, 19.17, 18.11, 21.03 and 19.28 number of leaves per plant respectively. The treatment T₆ and T₂ were found at par with each other. Mid October planting generated more number of leaves because of congenial climatic conditions, which were favourable for growth and leaf production. The planting time of last week of November generated lesser leaves due to the fact that the reproductive development might antagonize vegetative growth of strawberry. (Perez-de-camacaro *et al* 2002) The research findings of Kher *et al* (2010), Kaur (2010) are in support with the present studies. Rahman (2014) also reported more leaf number in the plants of Festival, Camarosa and Sweet Charlie plants planted during mid October which is in agreement with the present findings.

The data on the average leaf area of the strawberry plants as affected by different planting times revealed that the average leaf area showed a rapid increase in T₄ as compared to other treatments. It was noted that the plants under T₄ (15th October) produced maximum average leaf area of 82.19 cm² which was found to be statistically significant over all the treatments. It was followed by treatments T₂, T₃, T₅, T₆ and T₇ with 76.03 cm², 78.11 cm², 70.03 cm², 74.06 cm² and 80.15 cm² leaf area respectively. The increase in leaf area in October planting plants might be due to congenial climatic conditions favourable for growth and development of plants which resulted in more leaves with greater leaf area. These results are in line with the findings of Rahman *et al* (2014) and Menzil and Smith (2012) in strawberry plants. Kaur (2010) also reported the same in strawberry cv. Chandler.

It is evident from the data that the plants of strawberry which were planted in the month of November took minimum days (140.07 and 140.14) for runner formation as compared to the plants planted in the month of September and October with (167-141) days respectively. This variation in number of days might be due to the fact that in late planting the reproductive development might have antagonized the vegetative growth which led to the runner formation earlier as compared to the other plants. The research findings of Perez-de-Camacaro (2002) are in support with the present results.

It is evident from the data on the number of runners per plant that there was a significant variation in the number of runners per plant as affected by the different planting times. The maximum runners 8.95 was recorded by the plants under treatment T₅ (30th October) followed by T₄, T₃, and T₂ with 8.15, 7.24 and 6.36 runners per plant. The plants planted in the month of November produced lesser number of runners per plant accounting to 4.16 when planted in 1st November and the minimum of 4.10 in case of end November plantation. These results are in accordance with the findings of Turemis and Kaska (1995) who also reported that the maximum runners were produced while planting in October than November in strawberry cv. Chandler. This might be due to the higher temperature that prevailed during growth because higher temperature hastened vegetative growth which in turn produced more runners than late planting. Kaur (2010) also reported the same in strawberry cv. Chandler. From the perusal of the data regarding number of flowers per plant it is clear that the maximum number of flowers 31.10 per plant were found under T₄ Treatment (15th October) which was highly significant to all other treatments. The other treatments T₅, T₆, T₇, T₃, and T₂ produced 24.21, 19.10, 16.45, 27.04 and 26.25 number of flowers per plant respectively. No flowers were found in treatment T₁ (1st September) because none of the plant survived due to unfavourable weather conditions present at that time under sub tropical areas of Punjab. Early planting dates showed higher number of flowers because those plants exhibited better plant growth which induced more flower buds and resulted in more number of flowers as compared to later planting dates. Tripathi *et al* (2000), Singh *et al* (2007), Mesbahuddin *et al* (2011) and Rahman (2014) also observed the same in their investigation in strawberry plants. It is clear from the data that the maximum number of fruits 23.16 were recorded under treatment T₄ (15th October) which was found to be highly significant over all the treatments while the minimum number of fruits (12.43) per plant were produced by the plants which were planted at the end of November. This might be due to the lesser number of flowers produced in these plants. This might be due to the improper vegetative growth of the plants due to unfavourable climatic conditions. The research work of Tripathi *et al* (2000), Singh *et al* (2007), Mesbahuddin *et al* (2011) and Rehman (2014) is in support with the present findings. Mawkhiew and Pereira (2015) of Festival and Chandler respectively. Kaur (2010) also reported the same in strawberry cultivars.

The data pertaining to fruit set as influenced by different planting time depicted that the maximum fruit set 80.10 percent was observed under treatment T₄ (15th October) which was highly significant over all the treatments. It was followed by plants under treatments T₅, T₃, T₂, T₆, and T₇ with 79.26, 74.10, 68.47, 65.39 and 61.29 fruit set percent. The end November planted plants showed minimum (61.29 %) fruit set percentage. This might be due to the fact that the congenial temperature increased flowering site, reduced the abortion of female flowers and increased the fruit set per cent. Tripathi *et al* (2000) reported early flowering and better fruit set in strawberry cv. Chandler in the month of October. These results are in close agreement with the findings of Mawkhiew *et al* (2015) who also reported the highest fruit set in October planted plants than September in strawberry cv. Chandler. Kaur (2010) also reported the same in Chandler cultivar of strawberry.

CONCLUSION

From the results of the present experiment, planting of strawberry cv. Chandler on 15th October appears to be more beneficial in the improvement of vegetative and floral characters. It also increased the plant establishment and runner attributes of the strawberry. Hence October 15-30 can be considered the best planting time for strawberry cv. Chandler in sub tropical areas of Punjab.

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