SUMMARY

Investigations on the present topic were conducted in the Faculty of Agriculture and Forestry, Guru Nanak Dev University, Amritsar during the cropping seasons of 2004-05 and 2005-06. The study was planned in two sets of experiments with a view to study the effect of protected conditions on plant and fruit characters of strawberry cv. Chandler and to evaluate the various strawberry cultivars under field conditions. In the experiment I, two times of planting (T₁: Oct 12 and T₂: Oct 26), four protected conditions (white polytunnel 100 gauze, white polytunnel 200 gauze, reed cover and open field control) were tried, three concentrations of GA₃ (25, 50 and 100 ppm) treatments were also applied as foliar spray in the first week of flowering to access the plant and fruit characteristics of strawberry cv. Chandler. For experiment II, ‘Performance of strawberry cultivars under field conditions, runners of five cvs. Chandler, Tioga, Fern, Selva and Blackmore were planted on three different times (T₁: Oct 15, T₂: Oct 30, T₃: Nov 15) under field conditions at Amritsar. In this experiment plant characteristics, flowering observations, physical and biochemical fruit characteristics were studied to observe the effect of time of planting on the above aspects of plants.

Time of planting, protected conditions and various concentrations of GA₃ significantly influenced the height of strawberry cv. Chandler plants. Plantation of Oct 12 (T₁), white polytunnel (100 gauge) produced plants with maximum height during both the cropping seasons, GA₃ 100 ppm also increased height of plants. Maximum number of shoots per plant were produced from the runners planted on Oct 12 and protected under white polytunnel (100 gauze), GA₃ 100 ppm was also found to be helpful in increasing shoot number. Number of leaves were counted to be maximum in the plants of October 12 plantation under reed cover protection, here also GA₃ 100 ppm produced maximum leaf number per plant. Maximum leaf area was measured under October 26 planting time and under protection of white polytunnel (100 gauze), GA₃ 100 ppm found helpful in producing maximum leaf area followed by its 50 and 25 ppm treatments. Maximum runner production per plant was registered in plantation time of Oct 12 and polytunnel (100 gauze) protected condition, here GA₃ 50 ppm resulted in maximum number of runners per plant followed by GA₃ 100 ppm and 25 ppm. Minimum number of days taken for flower initiation were counted in the plantation of Oct 12 and polytunnel (100 gauze) protected
conditions, GA₃ 50 ppm treated plants took maximum number of days for flower formation while the plants under control recorded delayed flowering. Maximum duration of flowering were noticed in the Oct 12 planting time and under white polytunnel (100 gauze), GA₃ 50 ppm treatment also recorded maximum duration of flowering amongst GA₃ treatments. Maximum number of flowers per plant counted in the plantation of Oct 12 and under the protection of white polytunnel (100 gauze) GA₃ 100 ppm treatment produced maximum number of flowers per plant closely followed in line by its 50 ppm and 25 ppm treatments. Maximum number of fruits per plant was counted in Oct 12 plantation, white polytunnel 100 gauze protected condition also produced maximum fruits during both the cropping seasons, GA₃ 100 ppm showed its supremacy with regard to this character. Planting time of Oct 12, white polytunnel (100 gauze) and GA₃ 100 ppm lead to highest fruit set percentage followed by Oct 26, white polytunnel (200 gauze) and GA₃ 50 ppm treatment. Maximum fruit yield and marketable yield were recorded with Oct 12 planting time and white polytunnel (100 gauze) protected conditions, among GA₃ treatments 100 ppm concentration increased yield and marketable yield per plant followed by its 50 and 25 ppm treatments and plants under control trailed behind. Planting time, protected conditions and gibberellic acid treatments significantly influenced the size (length and breadth) and weight of strawberry fruits. Oct 12 plantation, white polytunnel (100 gauze) and GA₃ 50 ppm increased the length of the fruits. Fruit breadth was also registered maximum with Oct 12 planting time, but interestingly here white polytunnel (200 gauze) protected condition and GA₃ 100 ppm increased breadth of fruits, the plants under control produced the fruits of shorter size. Maximum fruit weight was recorded under Oct 12 planting and in white polytunnel (100 gauze) protected condition, GA₃ 100 ppm treatments also found helpful in the production of fruits with maximum weight. Attractive bright cherry red coloured glamourous fruits were produced in the plantation of Oct 12 and under white polytunnel 100 gauge protected condition during both the cropping seasons. The growth regulator treatments GA₃ 50 and 100 ppm were also found useful in producing very impressive red coloured fruits with almost the same gradation, the colouration of fruits under GA₃ 25 ppm was although dark reddish but not attractive while under control, the fruits were of dull light colour with patches. Highest organoleptic rating was noted in fruits from plants of October 12 plantation and polytunnel 100 gauze protected conditions. The fruits under
GA$_3$ 50 and 100 ppm treatments scored almost similar grading of palatability. Total soluble solids, in general, increased significantly with the planting time of Oct 12, protected condition of white polytunnel (100 gauze) and GA$_3$ 100 ppm, the strawberry fruits from plants under control recorded minimum of its contents, however these were non significant. Higher total sugars were registered in the fruits from plants of Oct 12 planting, white polytunnel (100 gauze) and GA$_3$ 100 ppm were recorded while maximum sugars were observed under reed cover protected conditions. Reducing sugars were also found to be maximum in fruits from plants which were planted on Oct 12, protected under white polytunnel (100 gauze) and sprayed with GA$_3$ 50 ppm and minimum of its contents were noted under control. The planting time of Oct 26 and reed cover protected conditions registered maximum acidity levels of strawberry fruits, GA$_3$ 100 ppm treated fruits also recorded minimum of its contents, fruits from plant under its 50 ppm treatment and control recorded maximum of its contents. Maximum ascorbic acid content was registered in the plants of Oct 12 planting time, protection of reed cover and GA$_3$ 50 ppm while the minimum ascorbic acid contents were recorded in strawberry fruits from control.

Performance of strawberry cultivars under field conditions was studied by considering plant and physico-chemical characteristics of fruits. Plant establishment was significantly affected by the planting time, as plantation of T$_1$ i.e. mid Oct resulted in maximum plant establishment followed by T$_2$ last week of Oct and T$_3$ mid Nov times during both the cropping seasons. The cv. Chandler recorded highest plant establishment followed by cv. Blackmore during both the cropping seasons. Maximum plant height of strawberry plants was recorded in T$_1$ planting time followed by T$_2$ and T$_3$ planting times, the cv. Blackmore produced the maximum plant height followed by cv. Tioga, during both the years of study. An ascending trend in the number of shoots per plant was observed with the advancement in time of plantation, cv. Chandler produced maximum number of shoots followed by cv. Tioga. The leaf number also decreased with the advancement in time of planting, maximum number of leaves were counted in cv. Chandler followed by cv. Tioga while cv. Fern recorded minimum number of leaves. In the first cropping season leaf area was recorded to be maximum in plantation of T$_2$, followed by T$_1$ and T$_3$ times of planting, while in the second cropping seasons maximum leaf area was recorded in T$_1$ plantation followed by T$_2$ and T$_3$ times of planting respectively. Leaf area was measured to
be maximum in cv. Blackmore and minimum in cv. Selva. Early planting influenced the time of runner formation being maximum in T1 followed by T2 and T3 plantation times. The cv. Tioga took maximum time followed by cv. Selva, the cv. Chandler took minimum days for runner formation. Maximum number of runners were counted in T1 plantation followed by T2 and T3 times during both the planting seasons, maximum number of runners were produced in cv. Chandler followed by cv. Blackmore. The number of days taken for flower initiation showed descending trend with the delay in time of planting. The cv. Fern took minimum days for flower initiation. Longest duration of flowering was observed in earlier plantation then in the delayed plantation. The longest duration of flowering was registered in cv. Selva followed by cv. Fern during first cropping season, in the second cropping season cv. Chandler recorded maximum duration of flowering. A descending trend with regard to number of flowers per plant was observed with the advancement in time of planting, cv. Chandler registered maximum number of flowers during both the years of study. Likewise fruit count also showed the similar trend with the advancement of time, cv. Chandler registered maximum fruits count followed by cvs. Blackmore and Tioga during both the years of study. Per cent fruit set was calculated to be maximum on the T1 (first plantation time) then it showed decline and again upward trend was noticed in plantation of T3 time. Maximum per cent fruit set was recorded in cv. Chandler followed by cv. Fern whereas, least fruit setting was registered in cv. Selva during first year and cv. Tioga during second year of study. Maximum fruit yield and marketable yield were obtained in plants of T1 plantation, cv. Chandler also recorded maximum yield during both the seasons, the fruit yield aspects decreased with the delay in planting time of strawberry cultivars. Time of planting had significant effect on the size (length x breadth) of strawberries, size of fruit showed decreasing trend with the advancement in time of plantation. Strawberry cv. Chandler produced the large sized fruits and cv. Selva, the shortest in both the cropping seasons. Heavy fruits were noticed in the earlier plantation (T1) followed by T2 and T3 plantation, maximum fruit weight was recorded in cv. Chandler followed in line by cvs. Fern. Tioga, Blackmore and lowest in cv. Selva in both the cropping seasons. Bright red coloured fruits of strawberry were observed during earlier plantation than in the delayed ones, cv. Chandler produced attractive, glamorous red fruits, attractive fruit colour of cv. Blackmore was also observed while the fruits of other
cultivars were not up to the mark. The strawberry fruits from earlier planting scored good organoleptic score, cv. Chandler and Blackmore individually awarded top scoring with regard to organoleptic rating then the other cultivars under study. Total soluble solids contents of strawberry fruits found decreased with the delay in plantation. Strawberry cv. Chandler recorded maximum total soluble solids followed in cv. Blackmore during both the cropping seasons. Advancement in plantation recording of strawberries registered descending trend of total and reducing sugars contents. Highest percentage of sugars were analysed in cv. Chandler followed by cv. Blackmore during both the cropping seasons. Acidity level of strawberry fruits decreased with the increased gap of plantation in both the cropping seasons, highest titratable acidity per cent was registered in cv. Chandler and minimum was recorded in cv. Tioga. Ascorbic acid content also showed descending trend with the advancement of time of planting, it was noted maximum in cv. Chandler and minimum in cv. Blackmore which decreased with the planting times during both the cropping seasons.