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RESEARCH ARTICLE

INFLUENCE OF PLANTING TIME AND PROTECTED CONDITIONS ON PLANT GROWTH, YIELD AND FRUIT QUALITY OF STRAWBERRY CV. CHANDLER UNDER SUBTROPICAL CONDITIONS

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ABSTRACT

A field experiment was planned to study the effects of plantation time and protected conditions on strawberry. The runners of strawberry cv. Chandler were planted at 30x40 cm apart on the raised beds in the second (T₁) and last week of October (T₂). Protected conditions of white polythene of thickness 100 gauge (P₁), 200 gauge (P₂), reed cover (P₃) were applied during peak winter months to protect strawberry plants from frost and chilling weather. Early planting on second week of October (T₁) and protected condition (P₁) treatment proved to be the most efficacious in improving vegetative growth, yield and fruit quality. Ascorbic acid level of the fruits was also found higher with early planting. Increased sugar contents and reduced acidity level of fruits was also observed by this treatment. It also improved plant vigour, physio-chemical characteristics of strawberry fruits and yield.

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INTRODUCTION

The modern cultivated strawberry (*Fragaria x ananassa* Duch) is a glamorous red, delicious, refreshing, nutritious soft fruit with a distinct tantalizing aroma which packs lot of nutritional value within itself, rich source of vitamins A, B, C and niacin, minerals like phosphorus, potassium, calcium and iron (Karakara and Dwivedi, 2002). It is a short term cash crop, the fruit of which is mostly consumed as fresh and in processed form. Although, strawberry is a native of temperate region, but its low chilling cultivars can be successfully grown in the subtropical areas of Punjab (Asrey and Singh, 2004). The time of planting and protected conditions proved to be quite effective in enhancing fruit maturity, improving fruit quality and yield (Khanizadeh, 2011; Singh *et al.*, 2009). The present experiment was planned to study the effect of planting time and protected conditions on growth of plants, physio-chemical characteristics of strawberry fruits and yield aimed at high economic returns from its cultivation.

MATERIALS AND METHODS

The present experiment was conducted in the nursery of Horticulture Department, Khalsa College, Amritsar during

2014-15 and 2015-16 respectively. The runners of strawberry cv. Chandler were planted during second week (T₁) and last week (T₂) of October at 30x40 cm apart on raised beds. The experiment was laid out according to completely randomized block design with factorial arrangement with three replications. Protected conditions (P₀, P₁, P₂, P₃) were applied to plants during peak winter months, the plants under control were left uncovered. The observations were recorded on vegetative, floral and fruit characteristics and pooled data of both the years were analysed statistically. TSS was determined by using hand refractometer while acidity, sugars and ascorbic acid were determined by following the standard procedures of AOAC (2000).

RESULTS AND DISCUSSION

Time of planting exerted significant variation with respect to characters like plant height, shoot number, leaf number and flower number per plant. Protected conditions also influenced these parameters significantly. Maximum plant height, shoot number and leaf number /plant were recorded in T₁ (Oct 12) planting time with 24.82 cm, 11.74 and 27.01 respectively than T₂ (Oct 26) planting time which recorded these characters as (20.75 cm, 11.46 and 25.44 cm), respectively. The better vegetative growth in early planting may be synchronized with congenial climatic conditions. Maximum plant height (24.49 cm), shoot number (12.45) and leaf number (26.91) were

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Table 1. Effect of planting time and protected conditions on vegetative, floral characters and yield of strawberry cv. Chandler

Planting Time	Plant Height (cm)	No. of Shoots	no. of leaves/Plant	no. of flowers /plant	Fruit Set (%)	Fruit yield(g) /plant
Oct. 12 (T ₁)	24.82	11.74	27.01	14.76	80.28	171.43
Oct. 26 (T ₂)	20.75	11.46	25.44	13.95	79.37	160.45
C.D.(P=0.05)	0.44	0.23	0.30	0.06	1.14	4.11
Treatments						
P ₁ White Poly tunnel (100 gauze)	24.49	12.26	26.29	15.53	81.54	196.93
P ₂ White Poly tunnel (200 gauze)	24.16	12.45	26.41	14.75	80.19	181.24
P ₃ reed cover	21.11	11.33	26.91	13.66	79.20	144.03
P ₀ Control	20.80	10.61	25.28	13.50	78.38	141.42
C.D.(P=0.05)	0.52	0.19	1.27	0.79	0.27	4.95
Interaction: Timex	0.53	0.25	NS	NS	0.28	NS
Treatments						
NS - Not Significant						

Table 2. Effect of planting time and protected conditions on fruit characteristics of strawberry cv. Chandler

Planting Time	Fruit Length (mm)	Fruit Breadth (mm)	Fruit Weight (g)	TSS	Total Sugars (%)	Titrateable Acidity (%)	Ascorbic Acid (mg/100g)
Oct. 12 (T ₁)	23.79	19.14	13.33	8.93	7.05	0.81	81.68
Oct. 26 (T ₂)	23.18	19.01	12.86	8.71	6.83	0.84	79.97
C.D.(P=0.05)	2.06	0.92	0.49	0.27	0.26	0.04	1.12
Treatments							
P ₁ White Poly tunnel (100 gauze)	25.93	19.68	16.81	9.31	6.22	0.78	78.94
P ₂ White Poly tunnel (200 gauze)	24.50	19.73	12.94	8.89	6.39	0.81	81.20
P ₃ reed cover	22.33	18.67	11.75	8.71	7.80	0.84	86.10
P ₀ Control	21.18	18.21	10.87	8.37	7.35	0.85	77.08
C.D.(P=0.05)	0.46	0.46	2.25	0.52	0.73	NS	0.30
Interaction: Timex	0.79	NS	80.79	NS	NS	NS	0.30
Treatments							
NS - Not Significant							

registered with protected conditions P₁, P₂ and P₃ respectively and minimum were recorded under control (p₀). Improvement in plant vigour might be due to cell elongation, improved stomatal conductance, accumulation of higher amounts of metabolites under suitable temperature conditions when covered with polytunnels (Kasperbauer, 2000; Singh *et al.*, 2009). The findings of (Andriolo *et al.*, 2002) in strawberry supported the results of the present experiment. During the whole experiment it was noted that number of flowers /plant and fruit set (Table 1) were significantly higher (14.76 and 80.28%) in early plantation of October 12 than in the late October 26 plantation (13.95 and 79.37%). Vegetative growth and accumulation of higher metabolites in early plantation might be responsible for it. Protected condition (P₁) effectively registered the maximum number of flowers (15.5) and fruit set (81.5%), which attributed to the proportional reduction in vegetative growth and stimulation of flowering by reciprocal increase of inflorescence under protection (Kasperbauer, 2000; Tripathi, 1997). The early plantation showed little influence on the fruit size and fruit weight but it significantly improved the fruit yield. Maximum fruit size in terms of fruit length (25.93 mm) and breadth (19.73 mm) were recorded with P₁ and P₂ (Table 2). The highest yield (196.9 g/plant) was estimated with P₁ followed by P₂ (181.2 g/plant) and minimum (141.4 g/plant) yield was registered under control (P₀), the increase in yield may due to enhanced flower production and fruit set under protected conditions. (Fan and Charelbasis, 2012) Who also reported these types of observations supported the results of the present studies. Protected condition P₁ proved its effectiveness in increasing sugar levels and reducing acid contents of the strawberry fruits. Maximum total sugars (7.80%) were obtained with P₁ which in turn produced fruits with least acidity (0.78%) levels. The results of the present experiment are in line with the earlier. Findings of (Antuono *et al.*, 2000; Fan and Charelbasis, 2012). The ascorbic acid

content was higher in the fruits of early plantation, significant effect on ascorbic acid content was exhibited by Protected conditions.

Conclusion

In the whole research trial it was found that out of the planting times the first planting time Oct 12(T₁) proved to be the best. Out of the protected conditions White polytunnel (P₁) Proved to be the best for the strawberry cv. Chandler. Both the parameters proved successful in terms of vegetative growth, fruit yield and the quality of the fruit under sub-tropical conditions. Hence strawberry cv. Chandler can be successfully cultivated under polytunnel 100 gauze thickness in the mid October month in sub-tropical climatic conditions.

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