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Performance of strawberry cultivars for quantitative and qualitative parameters in naturally ventilated polyhouse conditions

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Abstract

Performance and evaluation of cultivars for specific location helps in obtaining better economic yield. In the present study six cultivars of strawberry were grown in a naturally ventilated polyhouse in Randomized block design (RBD) with four replications at College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during 2018-19 and 2019-20. The analysis of variance suggests that they were significant differences for all vegetative, yield and quality traits. The maximum fruit weight (15.81 and 16.05g), yield per plant (204.32 and 210.97 g) was recorded for Cultivar Winter Dawn. Similarly it also showed minimum number of days to emergence of first flower (74.51 and 76.34 days), maximum fruit set (83.45 and 85.17 %), anthocyanin (62.89 and 64.01 mg/100g) and ascorbic acid (47.38 and 48.10 mg/100g) content.

Keywords: Cultivars, strawberry, polyhouse, winter dawn, yield

Introduction

Strawberry (*Fragaria × ananassa* Duch.) is an herbaceous plant belongs to the family Rosaceae and native to temperate regions of northern hemisphere. The modern cultivated strawberry (*Fragaria × ananassa* Duch.) evolved by crossing two species, *Fragaria chilonensis* and *Fragaria virginiana*.

The strawberry fruit crop has spread over the globe, from the arctic to the tropics, with the United States leading the way with 34.0 percent, followed by Turkey (8.20 percent), Spain (5.60 percent), Egypt (5.40 percent), and Mexico (5.30 percent) (FAOSTAT, 2020).

Strawberry is a temperate-zone crop, however some cultivars that adapt to short day length can be cultivated in the plains during the winter. This can only be achieved if various cultivars are evaluated for their growth, yield and quality characters in the plains.

Strawberry has considerable genetic variability and precise information on cultivars performance under different agro-climatic conditions is essential before their recommendation for cultivation. Further, over time, demand for new cultivars has been increasing over a period of time. Hence, proper and systematic evaluation of germplasm would yield useful information about their suitability for commercial cultivation (Garg, 2013) [15].

Selection of cultivars for a particular location is a prominent factor for obtaining economic yields. The varietal performance of strawberry under diverse agro-climatic conditions varies and a cultivar performing well in one location may not be in another location. So, testing of elite cultivars in different agro-climatic conditions is imperative for obtaining desirable yields and quality. There was no research work conducted on cultivation of strawberry under Telangana conditions. Consequently, need to introduce the improved strawberry cultivars to the targeted location is crucial for strawberry production and productivity. Therefore the present study aimed and initiated to select best and elite strawberry cultivars for telangana conditions.

Materials and Methods

Study area

The study was conducted at the University Farm of Sri Konda Laxman Telangana State Horticultural University, College of Horticulture, Rajendranagar at the latitude of 170.19' N and 790. 23'E longitude, at an altitude of 542.6 m above mean sea level. The topography of the experimental site was fairly uniform.

The experiment was conducted from September 2018 to February 2019 in the first year (2018/19) and from September 2019 to February 2020 in the second year (2019/20) in naturally ventilated polyhouse and post harvest experiment was conducted subsequently in 2018-19 and 2019-20. Before conducting the experiment, soil was analyzed for its physicochemical properties and physicochemical characteristics is presented in Table 1. The soil inside the polyhouse was made friable using power tiller before making the raised beds. Based on the soil test results, the recommended manure and chemical fertiliser doses for strawberry cultivation are 50 tonnes of Farm Yard Manure and 80, 40, and 40 kg ha of N, P₂O₅, and K₂O respectively (Karkara and Dwivedi, 2002; Verma *et al.*, 2003; Chadha, 2003) [20, 45, 7]. The source of these fertilizers are Urea, Single super phosphate and Murate of potash. The beds were covered with 25 microns black silver plastic mulch and drip lines of 16 mm diameter laterals provided under the plastic mulch. The emitters spaced 50 cm apart with a discharge capacity of four liters per hour was used in experiment.

Experimental material

The experimental material comprised of six cultivars (Winter Dawn, Sweet Charlie, Barak, Hadar, Yasmin and Shani) of strawberry, procured from KF Bio plants, Pune. A total of 240 well rooted tissue cultured plants of uniform size, free from diseases and insect pests were selected as planting material. Ten plants of each variety planted in 1.5 x 1.0 m raised beds, replicated four times randomly using Randomized block design. Within each bed, a spacing of 50 x 30 cm between the rows and plants was respectively maintained and other cultural practices were applied for better crop growth. The data presented in the Fig 1 shows that Relative Humidity 70 to 77% and air temperature around 21-26 °C was maintained with help of foggers by opening and closing the retractable sidewalls.

Sampling and measurement

Morphological parameter such as plant height and spread was measured with the scale and the average was expressed in centimeters at 150 days after planting. The number of runners of five demarcated plants in each plot was counted at the time of last picking and average was worked out. The number of days to runner formation and number of days taken from planting to the appearance of first flower in each replication was counted and average days from planting to days to runner formation and days required to first flower were worked out and expressed in days. The flowering duration from date of opening of first flower and the date of opening of last flower in each variety was recorded and duration required for fruit set after flowering of five demarcated flowers from each plot were recorded and average was worked out. Fruit set percent was noted by counting total number of flowers from five plants and fruit set in these plants were recorded at five days interval. Fruit length and diameter were also determined in the samples by using vernier scale and expressed in centimeters. The fruits were harvested from different pickings and average was worked out, which was expressed as number of fruits per plant. The yield of fruits per plant was recorded from each treatment and in each picking. The total weight of fruits harvested in each picking computed and expressed in yield per plant in gram. Quality traits, viz., total soluble solids (TSS), acidity, reducing sugars were estimated using standard procedures (AOAC 1990) [2]. Ascorbic acid and anthocyanin

content in the sample was determined using procedure given by (Ranganna, 1986) [36], anthocyanin content spectroscopy method as given by Ranganna (1997) [37].

Statistical analysis

The data was statistically analyzed using ANOVA technique procedure given by Panse and Sukhtme (1985) [31]. The overall significance of difference among the treatments was tested using critical differences (C.D) at 5% level of significance. The results were statistically analysed with the help of a windows-based computer package OPSTAT (Sheoran, 2004) [40].

Results and Discussion

Growth Parameters

The data presented in Table 2 shows plant growth attributes like plant height, plant spread, number of runners, days to runner formation revealed significant variation among different cultivars during 2018-19 and 2019-20.

Plant height (cm)

Plant height measured highest in Winter Dawn (25.00 and 26.10 cm) and it was at par with Sweet Charlie (24.61 and 24.72 cm), Barak (24.13 and 23.84 cm) and Hadar (23.90 and 23.56 cm) while lowest in Shani (20.75 and 21.81 cm).

Variation in strawberry cultivars grown in naturally ventilated polyhouse is due to the genetic differences exists at each genotype. These results are supported by Luitel *et al.* (2012) [24] reported significant different in plant height of tomato cultivars under green house conditions.

Plant Spread (East-West cm) and (North-South cm)

During 2018-19 and 2019-20, cultivar Winter Dawn was found to have significantly maximum plant spread (34.28 and 36.58 cm East-West) and it was on par with Sweet Charlie (33.43 and 35.83 cm East-West) and Barak (32.10 and 33.04 cm East-West). However, lowest plant spread (27.68 and 29.20 East-West) was registered in Yasmin and Shani.

Among the cultivars Winter Dawn recorded maximum plant spread (37.53 and 39.16 cm North-South) and statistically on par with Sweet Charlie (36.43 and 37.20 cm North-South), Barak (35.12 and 36.45 cm North-South) and Hadar (34.59 and 36.12 cm North-South) while minimum plant spread (32.21 and 33.51 cm North-South) was noticed in Yasmin and Shani during the year 2018-19 and 2019-20 respectively.

The reason for increase in plant spread might be due to increased length and weeping growth of leaf petioles which lean outwards resulting in higher plant spread. The increased plant spread in different cultivars provides larger area for photosynthetic activities and assimilates needed for fruit formation. The research results are in conformity to the findings of Kumar *et al.* (2011) in strawberry and Ankit and Chandel (2014) in strawberry.

Number of runners per plant

It was observed from the data significantly highest number of runners per plant (5.82 and 5.96) was produced by Winter Dawn and it was followed by Sweet Charlie (4.98 and 5.08) and Barak (4.37 and 4.90) whereas Yasmin and Shani cultivars recorded lowest number (2.86 and 3.12) of runners per plant during 2018-19 and 2019-20.

Strawberry cultivars exhibited significant variation for number of runners per plant. The highest number of runners by Winter Dawn variety may be due to variation in transfer of

photosynthates from source to sink which was controlled by genetic factor of the variety. These findings are similar to that of Maheshgowda *et al.* (2017)^[25] in strawberry.

Days to runner formation after planting

Cultivars Winter Dawn and Sweet Charlie recorded earliest and took least number of days (139.00 and 145.00 days) for runner formation during the year 2018-19. In contrast, Shani (168.00) took almost twenty nine days more for runner production in comparison to Winter Dawn (139.00) and differed significantly from rest of the cultivars.

In the year 2019-20, Yasmin took longer period of 170.00 days and it was on par with Shani (166.00) while Winter Dawn took least days (141.00 days) for runner formation. The vast differences in days to runner formation in the various cultivars may be ascribed either a varietal character or genetic makeup of the plants or both which affect the plants to react differently under the same agro-climatic conditions (Kaur and Singh, 2017). These findings are supported by the reports of Maheshgowda *et al.* (2017)^[25] in strawberry.

Phenological Parameters

It was revealed from the study all the flowering parameters were found significant.

Days to emergence of first flower

The earliest flowering (74.51 and 76.34) was recorded in variety Winter Dawn and it was followed by Sweet Charlie (77.45 and 78.81) and Barak (78.15 and 79.09) while cultivars Yasmin and Shani flowered lately (81.42 and 83.18) compared to other cultivars during 2018-19 and 2019-20 (Table 3). The variability in flowering period in different cultivars might also be due to genetic makeup of cultivars. The results obtained in the present study are in line with Maheshgowda *et al.* (2017)^[25] in strawberry, Kumar *et al.* (2008)^[21] in cucumber.

Flowering duration (days)

The present investigation revealed variety Winter Dawn recorded longest flowering duration (56.93 and 59.66 days) but statistically similar with Sweet Charlie (53.68 and 55.71), Barak (52.24 and 54.60) and lowest flowering duration (48.00 and 51.30 days) was noticed at Shani during 2018-19 and 2019-20 respectively.

The flowering duration of different strawberry cultivars showed significant variation and variation was mainly governed by genetic makeup of variety. These findings are in conformity with reports of Maheshgowda *et al.* (2017)^[25] in strawberry.

Yield and yield component parameters

Results from the present study demonstrate a significant difference in fruit set, length, fruit diameter, fruit weight, total number of fruits, days to maturity and fruit yield per plant.

Fruit set (%)

The variety Winter Dawn registered significantly highest fruit set (83.45 and 85.17%) whereas lowest fruit set was (75.30% and 79.10%) was recorded in Yasmin and Shani during 2018-19 and 2019-20.

The variation in per cent may be due to genetic makeup of the cultivars (Jami *et al.*, 2015)^[19]. These results are supported by the findings of Chandel and Badiyala (1996)^[6] in strawberry.

Fruit length (cm)

The maximum fruit length was measured in Sweet Charlie (4.05 cm), which was significantly higher from all other cultivars and it was on par with Winter Dawn (3.99 cm), Barak (3.83 cm) and Yasmin (3.67 cm) whereas minimum fruit length (3.15 cm) was recorded at Shani during the year 2018-19.

The fruit length was highest (4.01 cm) in Winter Dawn and it was on par with Sweet Charlie (3.86 cm), Barak (3.62 cm) and Hadar (3.49 cm). However, minimum fruit length (2.95 cm) was registered in Yasmin during the year 2019-20. Bodende (2002)^[5] also stated that fruit length is directly related for the determination of fruit yield in tomato.

Fruit diameter (cm)

The maximum fruit diameter (3.70 cm) was recorded in Winter Dawn, which was statistically similar to Sweet Charlie (3.66 cm) and Barak (3.40 cm) while lowest diameter of (2.79 cm) was noticed in Shani during 2018-19. During the year 2019-20, maximum fruit diameter (3.68 cm) was recorded in Sweet Charlie and it was statistically similar with Winter Dawn (3.49 cm), Barak (3.38 cm) and Hadar (3.21 cm) whereas lowest fruit diameter (2.90 cm) was registered in Shani.

The fruit diameter of different strawberry cultivars showed significant variation and difference in the diameter of fruits may be due to the capacity of fruits to accumulate assimilates and genetic nature of the variety. Similar results were reported by Kumar *et al.* (2011) in strawberry, Kumar *et al.* (2008)^[21] in Cucumber.

Fruit weight (g)

The fruit weight directly related with fruit yield per plant. The fruit weight of strawberry cultivars ranged from 13.60 to 15.81 grams and 14.38 to 16.05 grams during 2018-19 and 2019-20 (Table 4).

The average fruit weight was maximum in variety Winter Dawn (15.81 g) which was statistically on par with Sweet Charlie (15.79 g), Barak (15.56 g) and Hadar (14.58 g) whereas minimum fruit weight (13.60 g) was noticed in Yasmin during 2018-19. During the year 2019-20, the highest average fruit weight was recorded for variety Winter Dawn (16.05 g) and it was on par with Sweet Charlie (15.91 g) and Barak (15.65 g) as well as lowest (14.38 g) was noticed in Shani.

The variation in fruit weight of strawberry cultivars in relation to achene number might be due to differential activity of achenes in the production of growth promoting hormones and differential sensitivity of receptacle tissues as suggested by Moore *et al.* (1970)^[28].

Total number of fruits per plant

The variety Winter Dawn gave maximum number of fruits per plant (12.93 and 13.14) but it was statistically similar with Sweet Charlie (12.57 and 12.82) and Barak (12.27 and 12.53) while Yasmin and Shani cultivars gave minimum number of total fruits per plant (10.38 and 11.17) during 2018-19 and 2019-20 respectively.

The significant response of strawberry cultivars to total number of fruits per plant is due to genetic make up of cultivars. The results are in line with the findings of Luitel *et al.* (2012)^[24] in tomato cultivars.

Fruit yield per plant (g)

The Fig 2 shows that variety Winter Dawn produced significantly highest yield per plant (204.32 and 210.97 g) but it was statistically at par with yield obtained in Sweet Charlie (198.53 and 203.95 g) while lowest yield per plant (141.07 and 160.56 g) was recorded for Shani and Yasmin during 2018-19 and 2019-20 respectively.

The results were in accordance with the data recorded in plants those producing maximum number of fruits per plant and higher individual fruit weight are observed as high yielder variety. Aravindakumar and Mulge (2002) [3], who also noticed positive association of number of fruits per plant with fruit yield per plant. These results are accordance with the findings of Maheshgowda *et al.* (2017) [25] in strawberry variety, Varsha *et al.* (2016) [43] in cucumber, Kumar *et al.* (2008) [21] in cucumber. Owing to its probably high genetic vigor, Winter Dawn produced maximum growth, development and physiological activity, and thus resulted maximum number and weight of fruits and finally the maximum fruit yield per plant. It confirms with report of Singh *et al.* (2015) [42] for Priya cucumber hybrid sown in polyhouse.

Quality Parameters

The ANOVA point toward that the quality parameters total soluble solids, acidity, reducing sugars, ascorbic acid and anthocyanin were significant.

Total soluble solids (°Brix)

It was presented in Table 5 total soluble solids content was measured highest (7.37 and 7.24 °Brix) in Sweet Charlie but it was on par with Winter Dawn (7.06 and 7.15 °Brix), Hadar (7.04 and 7.02 °Brix) and Barak (6.96 and 7.08 °Brix) whereas, the lowest total soluble solids (6.55 and 6.63 °Brix) were noticed in variety Yasmin and Shani during year 2018-19 and 2019-20.

These variations with respect to total soluble solids may be and genetic makeup of cultivars (Maheshgowda *et al.*, 2017) [25]. These findings are supported by the results of Vergara *et al.* (2018) [44] in strawberry.

Acidity (%)

The acidity content among the cultivars ranged from 0.74 (Hadar) to 0.84% (Yasmin) and 0.72 (Yasmin) to 0.85% (Shani) in 2018-19 and 2019-20. A comparison of acidity among cultivars revealed that high acidity content (0.84%) was observed in Yasmin but it was on par with Winter Dawn (0.80%) and Sweet Charlie (0.82%) while very low (0.74%) in Hadar during 2018-19. Similarly during the year 2019-20, maximum acidity (0.85%) was recorded in Shani but it was statistically similar with Sweet Charlie (0.83%). However, minimum acidity (0.72%) was noticed in Yasmin.

The variation in the acidity content of various cultivars and this could be attributed to the genetic makeup of the cultivars (Dhaliwal and Singh, 1983) [11]. These results are also supported by the reports of Chandel and Badiyala (1996) [6] in strawberry.

Reducing sugars (%)

The data pertaining to year 2018-19, highest per cent (4.57%) of reducing sugar was observed in the variety Sweet Charlie which was statistically at par with Winter Dawn (4.34%) and Hadar (4.18%) whereas lowest per cent (3.73%) of reducing sugars was observed in the variety Yasmin (Table 5).

Reducing sugar content was estimated to be maximum (4.45%) in Sweet Charlie it was statistically similar with Winter Dawn (4.39%), Barak (4.21%), Hadar (4.15%) and Yasmin (4.05%) while minimum (3.49%) in Shani during the year 2019-20.

The reason for variation and increase in the content of reducing sugars of cultivars may be due to genetic makeup of cultivars. The present results are in line with the findings of Maheshgowda *et al.* (2017) [25] in strawberry, Silva *et al.* (2015) [41] in strawberry.

Ascorbic acid (mg/100 g)

Performance of strawberry cultivars for ascorbic acid content revealed maximum ascorbic acid content (47.38 and 48.10 mg/100g) was noticed in Winter Dawn followed by Sweet Charlie (45.17 and 46.74 mg/100g) whereas lowest ascorbic acid content (40.05 and 41.68 mg/100g) was noticed in Yasmin and Shani during the years 2018-19 and 2019-20 respectively.

Ascorbic acid content among different strawberry cultivars showed wide variation. The variations in ascorbic acid content of different cultivars may be genetic constituent of variety and its acclimatization to the area which influence the ascorbic acid content. These results are supported by the findings of Maheshgowda *et al.* (2017) [25] in strawberry, Lee and Kader (2000) [22] in strawberry.

Anthocyanin content (mg/100 g)

Among the cultivars significantly maximum anthocyanin (62.89 and 64.01 mg/100g) was noticed in Winter Dawn while minimum anthocyanin (51.05 and 55.43 mg/100 g) was recorded in Yasmin and Shani during 2018-19 and 2019-20. The variety Winter Dawn (64.01 mg/100 g) was on par with Sweet Charlie (62.84 mg/100g) with respect to anthocyanin during 2019-20.

The variability in anthocyanin content confirms the role of variety as the main source of variation in anthocyanin (Crespo *et al.*, 2010) [9]. The results were in the agreement with the studies of Neocleous and Vasilakakis (2012) [30] who also found the same results in strawberry.

Table 1: Physicochemical properties of red sandy loamy soil in naturally ventilated polyhouse, College of Horticulture, Rajendranagar

Physicochemical properties of red sandy loamy soil	
Soil texture	Loamy sand
pH	7.38
EC	0.33 dS/m
Organic carbon	0.48%
N	237.8 kg/ha
P ₂ O ₅	10.54 kg/ha
K ₂ O	145.28 kg/ha

Table 2: Comparison of growth parameters among strawberry cultivars

Cultivars	Plant height (cm)		Plant Spread (East-West)		Plant Spread (North-South)		Number of runners per plant		Days to runner formation after planting	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Winter Dawn	25.00	26.10	34.28	36.58	37.53	39.16	5.82	5.96	139.00	141.00
Sweet Charlie	24.61	24.72	33.43	35.83	36.43	37.20	4.98	5.08	145.00	146.00
Barak	24.13	23.84	32.10	33.04	35.12	36.45	4.37	4.90	151.00	153.00
Hadar	23.90	23.56	30.06	32.77	34.59	36.12	3.95	4.26	158.00	161.00
Yasmin	20.75	22.19	27.68	31.57	32.21	35.10	2.86	4.07	164.00	170.00
Shani	22.55	21.81	28.36	29.20	33.92	33.51	3.10	3.12	168.00	166.00
SEm±	0.91	0.87	1.30	1.41	1.05	1.11	0.17	0.17	1.43	1.45
CD (5%)	2.75	2.62	3.90	4.25	3.18	3.36	0.51	0.51	4.31	4.37

CD: Critical Difference, SEm±: Standard Error Mean

Table 3: Comparison of phenological parameters among strawberry cultivars

Cultivars	Days to emergence of first flower		Flowering duration (days)		Fruit Set (%)		Fruit length (cm)		Fruit diameter (cm)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Winter Dawn	74.51	76.34	56.93	59.66	83.45	85.17	3.99	4.01	3.70	3.49
Sweet Charlie	77.45	78.81	53.68	55.71	81.19	83.67	4.05	3.86	3.66	3.68
Barak	78.10	79.09	52.24	54.60	78.51	81.09	3.83	3.62	3.40	3.38
Hadar	78.58	80.15	51.20	53.14	77.05	80.94	3.51	3.49	3.19	3.21
Yasmin	81.42	82.63	51.08	52.28	75.30	79.52	3.67	2.95	3.32	3.04
Shani	79.15	83.18	48.00	51.30	76.92	79.10	3.15	3.18	2.79	2.90
SEm±	0.71	0.74	1.71	1.75	0.74	0.77	0.17	0.17	0.16	0.17
CD (5%)	2.21	2.24	5.16	5.29	2.23	2.31	0.51	0.51	0.48	0.50

CD: Critical Difference, SEm±: Standard Error Mean

Table 4: Comparison of yield and yield component traits among strawberry cultivars

Cultivars	Fruit weight (g)		Days to maturity		Total Number of fruits per plant		Fruit yield per plant (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Winter Dawn	15.81	16.05	28.30	27.46	12.93	13.14	204.32	210.97
Sweet Charlie	15.79	15.91	29.29	28.13	12.57	12.82	198.53	203.95
Barak	15.56	15.65	29.85	28.89	12.27	12.53	189.32	196.27
Hadar	14.58	15.10	30.89	29.05	11.94	11.98	173.30	180.88
Yasmin	13.60	14.97	31.83	29.73	10.38	11.55	141.07	172.83
Shani	14.01	14.38	31.15	31.50	11.36	11.17	158.82	160.56
SEm±	0.43	0.21	0.31	0.73	0.30	0.22	4.97	4.21
CD (5%)	1.31	0.65	0.93	2.21	0.91	0.65	14.99	12.68

CD: Critical Difference, SEm±: Standard Error Mean

Table 5: Comparison of quality traits among strawberry cultivars

Cultivars	Total Soluble Solids (°Brix)		Titratable acidity (%)		Reducing Sugars (%)		Ascorbic acid (mg/100g)		Anthocyanin (mg/100g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Winter Dawn	7.06	7.15	0.80	0.79	4.34	4.39	47.38	48.10	62.89	64.01
Sweet Charlie	7.37	7.24	0.82	0.83	4.57	4.45	45.17	46.74	60.10	62.84
Barak	6.96	7.08	0.78	0.77	4.11	4.21	44.87	45.38	57.26	61.05
Hadar	7.04	6.99	0.74	0.75	4.18	4.15	42.69	43.05	55.71	59.36
Yasmin	6.55	6.89	0.84	0.72	3.73	4.05	40.05	42.18	51.05	57.91
Shani	6.74	6.63	0.76	0.85	4.03	3.49	41.60	41.68	53.82	55.43
SEm±	0.15	0.11	0.02	0.02	0.14	0.20	0.42	0.43	0.55	0.57
CD (5%)	0.46	0.32	0.05	0.05	0.42	0.60	1.28	1.29	1.64	1.72

CD: Critical Difference, SEm±: Standard Error Mean

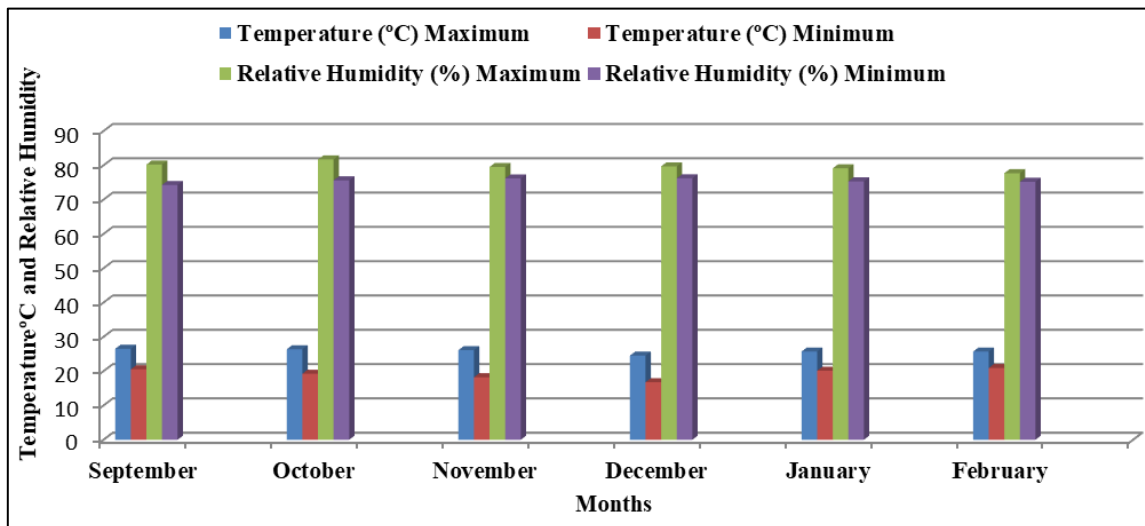


Fig 1: Mean Temperature and Relative Humidity in naturally ventilated polyhouse

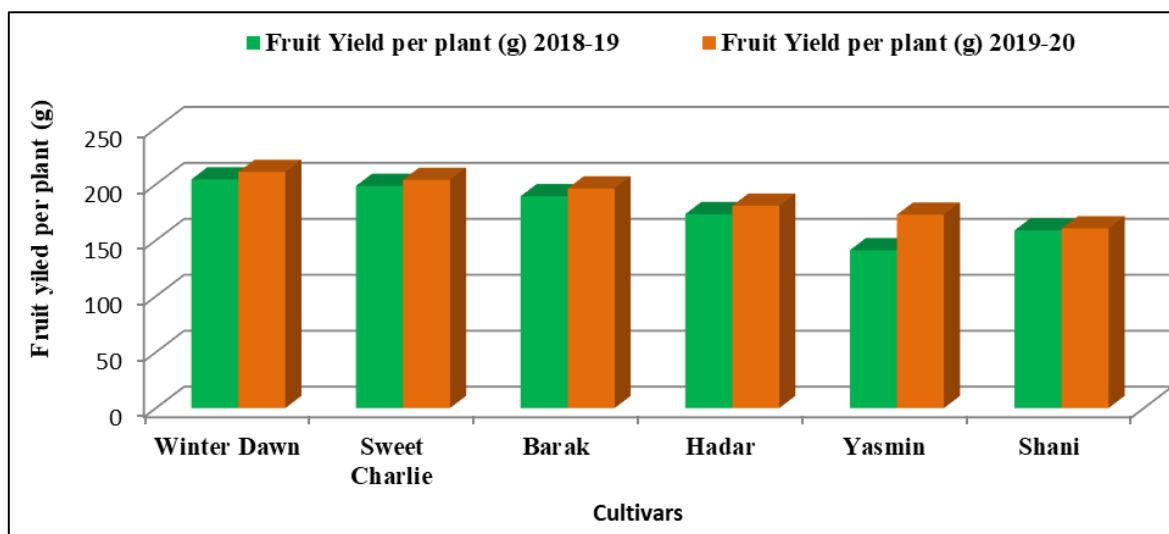


Fig 2: Differences in yield among strawberry cultivars

Conclusion

It can be concluded from the present investigation that significant difference was noticed for strawberry cultivars for growth, yield and quality attributes. Based on the results strawberry cultivars Winter Dawn and Sweet Charlie are highly recommended for cultivation in telangana.

Acknowledgement

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