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RESEARCH PAPER

Growth and yield response of strawberry (*Fragaria x ananassa*) cultivars under northern transitional tract of Karnataka

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Abstract: A research trial was carried out in the experimental field at Hi-Tech Horticulture Unit, Main Agricultural Research Station, UAS, Dharwad during *rabi* season of 2021-22 to study this response and evaluate the performance of strawberry cultivars for the Northern transitional tract of Karnataka. The results revealed that cultivar Winter Dawn produced higher vegetative growth with higher Plant height (24.31 cm), number of leaves (23.39), plant spread (37.60 cm), leaf area 146.43 cm^2), number of crowns (5.92) and least number of runners per plant (2.82), while the minimum was in cultivar Sweet Ann. Early flowering and fruiting (22.25 days) was observed by Florida Beauty and Winter Dawn (24.75 days), respectively whereas Pircinque was too late in flowering. Maximum number of flowers and fruits per plant was recorded in cultivar Winter Dawn and Brilliance, respectively. Larger and higher fruit weight having maximum duration of harvesting was observed in Winter Dawn while highest number of pickings was obtained in Brilliance. The highest fruit yield per plant was produced by Winter Dawn (618.28 g/plant) followed by Brillinace. Hence the suitable variety for the Northern transitional tract of Karnataka is Winter Dawn followed by Brilliance.

Key words: Growth, Response, Strawberry, Yield

Introduction

The modern cultivated strawberry (*Fragaria* × *ananassa* Duch.) is one of the world's most popular and appealing soft fruit known for its delicious and refreshing quality. It is a hybrid obtained by two wild strawberries *i.e., Fragaria virginiana* (Meadow strawberry) and *Fragaria chiloensis* belongs to the Rosaceae family. All cultivated varieties are octaploid (2n=56) in nature. Botanically it is an aggregate fruit which is highly perishable. It is a short day herbaceous plant, behaves as perennial in temperate condition and as annual in sub-tropical climate. It has shallow root system with a short stem known as crown. The edible portion is modified receptacle and achenes (true seeds) which is a non-climatric and propogated through runners (Coombey, 1976). Fruits turns full red stage within 28-30 days after anthesis, having the maximum fruit weight and size which is rich in vitamin C (60 IU/100 g of edible portion) and ellagic acid. The world production of strawberries is 8.9 million tonnes, led by China (38%), United States and Egypt as other significant producers (FAOSTAT,). According to latest statistical report by National Horticulture Board 2021-22, Haryana ranks first in the production (4.26t) followed by Maharashtra and Jammu and Kashmir. The evaluation of strawberry cultivars for a specific region is essential for improving the production and productivity as it is gaining importance due to the availability of day neutral cultivars, yet due to the crop's thermo sensitive nature, these cultivars need be evaluated for adaptability in new locations before being recommended for commercial production.

Material and methods

The present investigation was carried out at Hi-Tech Horticulture Unit, Main Agricultural Research Station, UAS, Dharwad, during *rabi* 2021-22. The experimental area located in Northern Transitional Zone (Zone VIII) of Karnataka state, situated at 15^0 26' North latitude, $75^0$07' East longitude and at an altitude of 678 meter above the mean sea level under open field condition. Seven strawberry cultivars Brilliance, Winter Dawn, Sensation, Florida Beauty, Pircinque, Eliana, and Sweet Ann among which Florida Beauty and Sweet Ann are day-neutral, while the other varieties are short-day plants were evaluated using a completely randomized block design with four replications. The plots were 5m x 1m, with a spacing of 30 x 30 cm.

Five plants from each treatment were randomly tagged and observations were recorded on vegetative growth parameters such as plant height (cm), number of trifoliate leaves per plant, plant spread (cm), leaf area (cm^2), number of crowns and runners $plant^{-1}$, days to 50 per cent flowering and number of flowers $plant^{-1}$ while yield attributes such as days taken for first harvest, number of fruits $plant^{-1}$, fruit weight (g), fruit length (cm), fruit diameter (cm) and yield per plant (g). The data were analyzed statistically and presented in Table 1 and 2.

Results and discussion

The findings of the trial of different growth and yield parameters are presented under the following heads:

Growth parameters

Plant height

The data presented in Table 1 shows that significant difference in plant height, which recorded maximum in Winter Dawn (24.31 cm) followed by Brilliance (21.63 cm) and Sensation (21.16 cm) while minimum plant height was recorded in Sweet

Table 1. Performance of strawberry cultivars for growth parameters under northern transitional zone

Cultivars	Plant height (cm)	Number of leaves per plant	Plant spread (cm)	Leaf area (cm^2)	Number of runners $plant^{-1}$	Number of crowns $plant^{-1}$	Days to 50% flowering	Number of flowers $plant^{-1}$
Brilliance	21.63	23.39	34.65	115.22	3.13	5.01	41.64	25.81
Winter dawn	24.31	31.62	37.60	146.43	2.82	5.92	40.99	28.24
Sensation	21.16	21.19	31.40	102.03	10.07	4.78	45.45	23.98
Florida beauty	15.83	20.41	30.68	96.73	6.11	4.21	46.83	22.64
Pircinque	16.47	19.88	29.59	102.39	4.52	3.85	47.58	20.03
Eliana	16.92	17.73	30.32	96.35	4.19	3.43	53.84	21.12
Sweet ann	15.66	13.36	26.54	94.39	5.74	3.01	56.98	20.34
S.Em±	1.69	1.52	1.52	4.57	0.34	0.19	1.74	1.25
C.D.@ 5%	5.02	4.52	4.52	13.58	1.03	0.57	5.18	3.73

Ann (15.66 cm). The increase in plant height in Winter Dawn may be due to increased length and erect growth of leaf which is upright controlled by genetic factor of the cultivars which differs from one another. Variation in height was also noted by Neetu and Sharma (2020) in Chattisgarh which supports the present observation.

Number of trifoliate leaves $plant^{-1}$

The maximum number of trifoliate leaves per plant was observed in Winter Dawn (31.62) followed by Brilliance and sensation (23.39 and 21.19, respectively) while minimum (13.36) in Sweet Ann (Table 1). This may be due to increase in length of epidermal and parenchyma cells, higher rate of cell division and cell elongation in sub apical meristem of shoots, which acts differently to light, temperature, photoperiod. Similar variation in number of trifoliate leaves among the cultivars have been reported previously by Ankita and Chandel (2014), Uddin *et al*. (2016).

Plant spread

Significant difference was recorded among the cultivars with respect to plant spread (Table 1). The maximum plant spread was recorded in cultivar Winter Dawn (34.65 cm) which was on par with Brilliance (34.65) whereas Sweet Ann recorded minimum plant spread (26.54 cm). It may be due to maximum length and weeping growth of leaf petioles which lean outwards resulting in maximum plant spread. The obtained result is in conformity with the findings Mahesh gowda (2016).

Leaf area

The leaf area differed significantly among the cultivars (Table 1). Winter Dawn had maximum leaf area (146.43 cm^2) followed by Brilliance (115.22 cm^2) and Pircinque (102.39 cm^2) while minimum leaf area was found in Sweet Ann (94.39 cm^2). Increase in leaf length and breadth might contributed to increased leaf area along with genetic factor and acclimatization of cultivar to particular region. These results are in line with the findings of Hossan *et al*. (2013).

Number of runners per plant and number of crowns per plant

Significantly the maximum number of runners per plant (10.07) was recorded in Sensation followed by Florida Beauty (6.11) and minimum (2.82) was recorded in Winter Dawn (Table 1). The maximum number of crowns (5.92) was recorded in Winter Dawn followed by Brillinace (5.01) and least number of crowns (3.01) in Sweet Ann. This may be due to variation in allocation of photosynthates from source to sink which is controlled by genetic factor of cultivars and environmental conditions. This results is in conformity with the findings of Uddin *et al*. (2016) and Neetu and Sharma (2020).

Days to 50 per cent flowering

The data presented in Table 1 shows that the minimum days of 40.99 was taken by Winter Dawn for 50 per cent flowering which was on par with Brilliance (41.64 days) and Sensation (45.45 days). Variability in flowering period of different cultivars may also be due to variation in genetic factor and their chilling requirement as suggested by Joolka and Badiyala (1983) and these observations are in line with findings of Oliveira and Scivittaro (2011).

Number of flowers per plant

Significantly higher number of flower $plant^{-1}$ (28.24) was recorded in Winter Dawn followed by Brilliance (25.81) and Sensation (23.98). The minimum number of flowers $plant^{-1}$ (20.03) was observed in Pircinque (Table 1). This variation might be

Table 2. Performance of strawberry for yield and yield attributes

Cultivars	Days to first harvest	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Yield per plant (g)
Brilliance	65.34	25.61	4.17	3.33	22.00	563.42
Winter dawn	63.85	26.00	4.77	3.38	23.78	618.28
Sensation	68.87	22.43	3.78	3.31	19.35	434.02
Florida beauty	79.67	21.25	3.48	3.30	19.34	410.97
Pircinque	69.62	16.23	3.50	2.65	18.62	325.08
Eliana	80.07	17.74	3.42	2.45	17.22	374.66
Sweet ann	82.45	13.81	3.56	2.01	16.45	227.17
S.Em ±	2.67	1.87	0.13	0.11	0.97	21.57
C.D@ 5%	7.95	5.70	0.40	0.35	2.95	64.08

due to light intensity and environmental factors of the region and also depends on the number of days taken for flower emergence. The same results were previously obtained by Maheshgowda. (2016).

Yield parameters

Days to first harvest

Early harvesting (63.85) was observed by cultivar Winter Dawn followed by Brilliance (65.34) and Sensation (68.87). later (82.45) in cultivar Sweet Ann to harvest (Table 2). Similar results was also obtained by Islam *et al*. (2012) and Aslam (2017). This earliness in harvest in the cultivars may be due to the number of days taken for flower emergence and agro-climatic condition (differences in temperature and light intensity).

Number of fruits per plant

Significantly higher fruits per plant (23.78) was recorded in Winter Dawn followed by Brilliance (22.00) and Sensation (19.35) respectively. Minimum numbers of fruits per plant (16.45) was obtained in Sweet Ann (Table 2). The accumulation of higher starch, carbohydrates and photosynthates which leads to setting of higher number of flowers per plant and thereby increase in fruit set percentage leads to increase in number of fruits per plant. The findings are in line with the results of Pradeep *et al*. (2002) and Neetu and Sharma (2020).

Fruit weight, length and diameter

Significantly higher fruit weight (26.00 g), length (4.77 cm) and diameter (3.38 cm) were recorded in Winter Dawn on par with Brilliance fruit weight (25.61 g), length (4.17 cm) and diameter (3.33 cm). While minimum fruit weight and diameter (13.81 g and 2.01 cm, respectively) in Sweet Ann and minimum fruit length was recorded in Eliana (3.42 cm) and the data is presented in Table-2. The variation might be due to varietal character and the findings are supported with the results of Janick and Eggert (1968) who reported that fruit size in strawberry depends on interaction between blossom position, number of developed achene and competition of plant vigour.

Yield per plant

Among the different cultivars, highest yield per plant was recorded in Winter Dawn (618.28 g) followed by Brilliance (563.42 g) and Sensation (434.03 g), respectively. Whereas, lowest yield was recorded in Sweet Ann (227.17 g) (Table 2). For important parameters kindly provide on par results generally suggest at least 3 to 4 varieties on the basis of merit This may be due to increased vegetative growth and early emergence of flowers which enables higher fruit set and fruit weight due to formation of more metabolites by large leaves and high rate of photosynthesis. The findings is in line with the results of Hossan *et al*. (2013) and Ahsan *et al.* (2014). Various components like yield per plant, number of crowns, number of leaves per plant, plant size, number of inflorescence, number of fruits per plant, fruit set and total number of achenes per berry are related with the yield per unit area Mitra (1991).

Conclusion

The study shows that cultivar Winter Dawn excelled other cultivars in terms of growth and yield qualities, even though other cultivars meet quality requirements. As a result, the Winter Dawn cultivar is suitable for Karnataka's northern transitional zone, where it should be planted during the *rabi* season, which runs from October to February or even until March.

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