



## Studies on Growth and Flowering Attributes of Different Strawberry Cultivars (*Fragaria x ananassa* Duch.) in Himachal Pradesh

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**ABSTRACT:** Fifteen strawberry cultivars were evaluated at the Strawberry Germplasm Block of University of Horticulture and Forestry, Solan for various growth and flowering traits. Results revealed that cultivar 'Dana' exhibited highest plant height (26.03 cm), 'Chandler' exhibited maximum plant spread (44.777 cm) and 'Selva' maximum number of leaves per plant (17.2'1) and leaf area (80.41cm<sup>2</sup>). The maximum number of runners were produced in cultivars Etna (22.47) followed by Fern (21.67), Howard (21.42), Brighton (20.67) and Chandler (19.83) etc. Cultivars Pajaro, Howard, Catskill, Tioga, Dana and Chandler were earliest in flowering. On the overall basis cultivar Chandler was rated to be the most promising under mid hills of Himachal Pradesh based upon various growth and flowering attributes.

**Keywords:** Duration of flowering, Leaf area and runner formation.

### INTRODUCTION

Strawberry (*Fragaria x ananassa* Duch.) is one of the important fruit crops of temperate regions of the world and has an important place among small fruits. Strawberry displays a wide variation in adaptation to environmental conditions. Early efforts to popularize its cultivation in Himachal Pradesh received a setback on account of poor return per unit area. A major breakthrough was seen with the introduction of few cultivars from America during late seventies, some of which like Tioga and Torrey displayed high yield of excellent quality berries. Recently, several new strawberry cultivars have been introduced from different parts of the world which could be exploited for bringing about improvement in strawberry production in the state. The climatic conditions of the state are congenial for the production of fruits as well as runners. The runner production in strawberry does not take place in warm areas. So keeping in view the demand of runner production and importance of other growth and flowering attributes, present investigation were carried out.

### MATERIAL AND METHODS

A cultivar trial comprising of fifteen strawberry cultivars viz. Addie, Belrubi, Blakemore, Brighton, Catskill, Chandler, Dana, Etna, Fern, Howard, Pajaro, Selva, Shasta, Tioga and Torrey was planted during 2010, 2011, 2012 and 2013 at the Strawberry Germplasm Block of Department of Fruit Breeding and Genetic Resources, UHF, Solan situated at 30.50 °N and 77.8°E and having altitude of 1275 m. Plant material consisted of runners planted in the field on 29<sup>th</sup> October, 2010 to 2013. Twelve plants per plot of each cultivar were randomized in three blocks. The runners were planted in 15 cm high, two rows raised beds and spaced 45 cm between the rows and 30 m in the rows. The bed was 1.8 x 0.9 m in size. Data was collected on plant height, plant spread, number of leaves, leaf area, runner formation, days to flowering and duration of flowering. The statistical analysis was performed as per Panse and Sukhatme (1995).

## RESULTS AND DISCUSSION

A lot of variation was observed for various growth and flowering character in strawberry (Table 1). Plant height and spread was found maximum in 'Dana' (26.03 cm) and 'Chandler' (44.77 cm), respectively, while height and spread was found to be minimum in 'Catskill' and 'Brighton' (14.43 cm and 24.73 cm, respectively). Other cultivars ranged from 17.50 cm in 'Tioga' to 24.25 cm in 'Blakemore' for plant height and 25.03 cm in Tioga to 36.46 cm in 'Belrubi' for plant spread. In the climatic conditions prevalent at subtropical conditions at Solan, the plants of all the cultivars were observed tall in comparison to plants raised at Hisar (Beniwal *et al.*, 1989). Similarly, the plant height and spread observed in the present studies was not in agreement with others (Atwal, 1976; John and Dana, 1966). The reason for the variation in these cultivars could be that the genes responsible for the above aspect did not express them fully with the same degree as it does at other places because of different agro-climatic conditions.

There was wide variation among different strawberry cultivars with respect to number of leaves per plant and leaf area. Number of leaves per plant was observed maximum in cv. Selva (17.21) and minimum in 'Shasta' (11.88), whereas the leaf area did not follow the same pattern as it was maximum in 'Chandler' (91.66 cm<sup>2</sup>) and minimum in 'Etna' (43.66 cm<sup>2</sup>), The number of leaves per plant and leaf area recorded in the present studies were on higher side as reported earlier by Beniwal *et al.*, 1989). Variation with respect to leaf area and number of leaves could be attributed to the fact that different cultivars may react differently to photoperiod, light, temperature, nutrient status of soil, available metabolites and their allocation to the above ground plant parts (Tanaka and Muzuta, 1974; Strik, 1988).

The number of runners per plant (Table 2) was maximum in cv. Etna (22.47) closely followed by 'Fern' (21.67), whereas cv. Belrubi exhibited minimum (7.85). The poor runnering in some cultivars like Belrubi may be due to the insufficient day length prevailing in Northern India in summer as some cultivars produced runners early in 16 hours day length (Smeets, 1955, Rao and Lal, 2010).

Variation was also found to be exist when the number of days were calculated from date of planting to flower initiation and duration of flowering (Table 2). Cultivar Pajaro was earliest to flower which took 115.50 days to produce first flower and the flowering period lasted for 96.0 days, whereas, cultivar Selva was rated late as it took maximum days (134.85) to produce first flower and the flowering span lasted for only 82.83 days. The variation in the time of flowering among strawberry cultivars may be probably due to the fact that different cultivars differ widely in their chilling requirement and plants of these cultivars were capable of growing and producing early flowers without a prolonged chilling period (Craig and Brown, 1977, Nicoll and Galletta, 1987). The present study revealed in interesting phenomenon regarding duration of flowering. The early blooming cultivars had more prolonged flowering season In comparison to late blooming cultivars which had shorter flowering duration. These findings were in agreement with several workers (Beniwal *et al.*, 1989; Kidmore *et al.*, 1996, Rao and Lal, 2010). The mother plants initiated the runner formation when flowering was about to cease. This fact was in agreement with the findings of Kidmore *et al.*, 1996. There was a time interval of 51 days between the commencement of runners in 'Chandler' and 'Belrubi' after plantation. 'Chandler' took a minimum of 166.20 days, whereas this duration was maximum in 'Belrubi' (217.30 days).

**Table 1: Evaluation of different strawberry cultivar for plant height, spread, leaf area and number of leaves per plant.**

Cultivars	Plants height (cm)	Plant spread (cm)	No. of leaves per plant	Leaf area (cm <sup>2</sup> )
Addie	22.25	29.51	16.01	68.60
Belrubi	21.37	36.46	16.21	85.44
Blakemore	24.25	26.12	12.87	59.38
Brighton	19.92	24.73	15.75	85.16

Catskill	14.43	28.55	14.62	63.35
Chandler	23.16	44.77	16.67	91.66
Dana	26.03	31.57	15.58	73.83
Etna	21.25	27.06	14.46	43.66
Fern	18.59	30.80	12.87	80.38
Howard	20.29	26.48	13.41	79.02
Pajaro	20.87	26.02	12.25	51.99
Selva	19.28	35.02	17.21	<b>80.41</b>
Shasta	18.96	27.58	11.88	67.80
Tioga	17.50	25.03	14.62	88.06
Torrey	20.54	31.56	15.75	80.74
CD <sub>0-05</sub>	1.62	2.28	1.32	0.52

**Table 2: Evaluation of different strawberry cultivar for days taken to produce first flower, duration of flowerings (days), duration of runner formation and runner per plant.**

<b>Cultivars</b>	<b>Duration of runner formation from planting date (days)</b>	<b>Runners per plant</b>	<b>Days taken to produce first flower</b>	<b>Duration of flowering (days)</b>
Addie	174.80	11.30	128.35	88.67
Belrubi	217.30	7.85	127.00	71.00
Blakemore	197.80	14.83	131.20	68.50
Brighton	171.70	20.67	118.15	96.33
Catskill	185.00	19.55	112.00	99.83
Chandler	166.20	19.83	115.50	98.50
Dana	167.50	12.53	115.15	101.80
Etna	174.30	22.47	118.15	96.00
Fern	171.20	21.67	116.00	97.83
Howard	172.00	21.42	111.65	102.30
Pajaro	172.70	16.33	111.50	96.00
Selva	195.00	8.25	134.85	82.83
Shasta	167.30	19.50	123.50	75.67
Tioga	171.00	11.67	114.50	98.33
Torrey	168.50	18.67	130.15	80.67
CD <sub>0-05</sub>	4.65	2.35	4.32	3.75

## CONCLUSION

On the basis of present study made to evaluate the performance of fifteen strawberry cultivars, Chandler exhibited the maximum desirable traits with respect to various growth and flowering attributes under mid hill condition of Himachal Pradesh.

## REFERENCES

1. Atwal, B. S. (1976) Studies on the performance of some strawberry (*Fragaria* sp.) varieties in the plains of Punjab. M.Sc. Thesis, G.N.D.U, Amritsar.
2. Beniwal, L. S., Daulta, B. S. and Birla, S. S. (1989) Evaluation of different strawberry (*Fragaria ananasa* L.) cultivars under Hisar conditions. I-Growth, flowering and fruiting. *Haryana J Hort.* 18(1-2), 34-39.
3. Craig, D. L. and Brown, G. L. (1977) Influence of digging date, chilling, cultivars and culture on greenhouse strawberry production in Nova Scotia, *Can. J Plant Sci.* 57, 571-576.
4. John, O. L. and Dana, M. N. (1966) Fruiting and growth of strawberry plants, *Proc. Amer. Soc. Hort. Sci.*, 71, 205-15.
5. Kidmore, U, Anderson, H. and Petersen, P. (1996) Yield and quality attribute of strawberry cultivars grown in Denmark 1990-91. *Fruit Var. J.* 50(3), 160-167.
6. Nicoll M. F. and Galletta G. J. (1987) Variation in growth and flowering habits of june bearing and everbearing strawberries, *Journal American Society Horticultural Sciences.* 122(5), 872-880
7. Panse, V. G. and Sukhatme, P. V. (1995) Statistical methods for agricultural workers. New Delhi: ICAR Publication.
8. Rao V. K. and Bharat Lal (2010) Evaluation of promising strawberry genotypes under Garwal Himalayan conditions, *Indian Journal of Horticulture*, 67(4), 470-474.
9. Smeets, L. (1955) Runner formation in strawberry plants in autumn and winter, *Euphytica*, 4(3), 240-244.
10. Strik B. C. (1988) Photosynthesis, yield component analysis, and growth analysis of strawberry. Dissertation-Abstracts-International, *B-Sciences-and-Engineering*, 48(8), 2175.
11. Tanaka, Y. and Muzuta, M. (1974) Nutritional - physiological studies on strawberry cv. Hokowase in long term cultivation. I. Influence of nitrogen on growth, yield and absorption of nutrients, *Bull Nara. Agric. Expt. Sta.*, 6, 38-43.