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Performance of Strawberry (*Fragaria x ananassa* Duch.) Varieties for Growth and Fruit Physical Parameters under Western Malwa Plateau Conditions of Madhya Pradesh, India

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A B S T R A C T

A research trial was carried out in the experimental field of Department of fruit science, KNK College of Horticulture Mandsaur Madhya Pradesh during the year 2017-2018 to evaluate some strawberry varieties in sub-tropical region (Wastern Malwa Plateau condition) of Madhya Pradesh. The runners of 12 strawberry varieties i.e., *viz*. V_1 (Northwest), V_2 (Tioga), V_3 (Pajaro), V_4 (Seascape), V_5 (Fern), V_6 (Chandler), V_7 (Shimla Delicious), V_8 (No.5), V_9 (Dil Pasand), V_{10} (Larson), V_{11} (Torrey) and V_{12} (Sweet Charlie) were planted at 30x30 cm apart on the ridge beds at end of October. The design of experiment was Randomized block design (RBD). The results of the study indicated that out of the varieties tried, the strawberry variety V_6 (Chandler) proved to be the best in producing maximum plant height (14.27 cm), Number of leaves per plant (18.07) except the number of crown's per plant. The number of crown(s) per plant was recorded in variety V_{10} (Larson) 2.43. Maximum fruit diameter (2.47 cm), fruit weight (8.58 g), fruit volume (8.23 ml) were found in variety V_6 (Chandler) whereas fruit length (3.80 cm) observed in variety V_{10} (Larson). Best specific gravity was recorded in variety V_{11} (Torrey). Fruit full maturity after fruit set (31.11 days) were found in variety V_2 (Tioga).Based on the experimental findings it was concluded that variety V_6 (Chandler) be recommended as best variety under the Wastern Malwa Plateau condition of Madhya Pradesh.

Introduction

Strawberry (*Fragaria x ananassa* Duch.) is an important fruit of family Rosaceae and occupies an important place among the small fruits.It is an aggregate fruit and octapoloid in nature having basic chromosome number 2n = 8x = 56 (Singh *et al.*, 2016). Strawberry is one of the important fruit crops of temperate region. It is also grown to a limited extent in subtropical areas (Kumar and Kumar, 2011). There is a considerable variation among different strawberry varieties for their adaptability in a particular set of agro-climatic conditions (Sharma *et al.*, 2014). It is very much liked for its cool and refreshing nature. Fruits are of high demand for fresh market and for processing industries. The other important advantage of strawberry cultivation as gives early and high returns from a unit area. Yield and fruit quality of strawberry is influenced by a number of factors like

growing environment, soil condition and cultivars (Kumar, A. and Kumar, P. 2011). The research work for finding suitable varieties has however, been limited to sub-tropical regions (Wastern Malwa Plateau condition) of Madhya Pradesh. Therefore, the present investigation was planned with the objective to assess the performance of 12 different strawberry varieties in district Mandsaur of Madhya Pradesh.

Strawberry is eaten as fresh and highly used in processing industry for making various products. Fruit colour, texture, odour and the balance between sweetness and sourness have been identified as important determinants of overall quality of strawberry fruit (Shamaila *et al.*, 1992).

Materials and Methods

The present investigation was laid out in RBD with 12 varieties as treatments and three replications during the year 2017-2018 at the *Instructional cum Research Fruit Orchard*, Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur (M.P.).Runners of 12 strawberry varieties i.e., *viz*. V_1 (Northwest), V_2 (Tioga), V_3 (Pajaro), V_4 (Seascape), V_5 (Fern), V_6 (Chandler), V_7 (Shimla Delicious), V_8 (No.5), V_9 (Dil Pasand), V_{10} (Larson), V_{11} (Torrey) and V_{12} (Sweet Charlie). The runner were procured from Veer Chandra Singh Gadwali Uttarakhand Horticulture and Forestry University Bharsar Podi Gadwal and acclimatized for a day. The soil of the experiment plot was well prepared by repeated ploughing followed by planking to obtain a fine tilth. The soil ploughed 2-3 times by soil turning, plough, harrowed, leveled and the weeds were rooted out. The well rooted runners of uniform size were transplanted on well prepared raised beds. Runners of strawberry having 2-3 full open leaves were transplanted randomly at the spacing 30 cm x 30 cm in the experimental plots. Healthy and sound runners were selected for planting. Runners were placed in the receiving medium to a depth so that the crown remained exposed but the roots were all buried. Once in place, the soil around the plant was packed and patted firm, down, around the base of the stem. After planting the plants were irrigated immediately. Various post planting operations were done which mainly include spraying of nutrients, irrigation, mulching, plant protection measures etc. Optimum soil moisture level was maintained in the plots through light irrigation as and when required. Observations on morphological characters were recorded on 5 randomly selected plants in each treatment. The data were subjected to statistical analysis following standard procedures (Panse and Sukhatme, 1989).

Results and Discussion

The significant differences take notice in the growth and fruit physical parameters among the 12 varieties tested are presented in table. The maximal plant height was found variety V_6 (Chandler) 14.27 cm which was statistically at par with varieties V_3 (Pajaro) 14.00 cm and V_9 (Dil Pasand) 13.41 cm also followed variety V_8 (No. 5) 12.13 cm, whereas minimal plant height was recoded in variety V_5 (Fern) 9.65 cm.In the climatic conditions prevalent at subtropical conditions at Madhya Pradesh, the plants of all the cultivars were observed tall in comparison to plants raised at Bihar (Das *et al.,* 2015). The reason for the variation in these cultivars could be that the genes responsible for the plant height did not express them fully with the same degree as it does at other places because of different agro-climatic conditions. Varietal differences in plant spread and height was also noted by Singh *et al.,* (2008) in Meghalaya which supports the present observation. On observing the Table it was found that the maximum numbers of leaves was observed in the variety V_6 (Chandler) 18.07 followed by the varieties V_4 (Seascape)

16.67 and V_5 (Fern) 16.40. Although minimum number of leaves per plant was recorded under the variety V_2 (Tioga) 13.47. The number of leaves per plant recorded in the present studies was on higher side as reported earlier by Sharma *et al.,* (2014). Variation with respect to 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). Variety V_4 (Seascape) regarding maximum number of crowns 2.43. Varieties V_6 (Chandler) 2.21 and V_9 (Dil Pasand) 2.13, followed by the Variety V_4 (Seascape) 2.43. Minimum number of crowns was recorded in variety V_7 (Shimla Delicious) 1.03.The results are in disagreement with the work of Rahman *et al.,* (2013) obtained a minimum number of crowns per plant in FA 009 (15.33) and FA 006 (14.67) but maximum number of crowns per plant in FA 009 (6.67). The fruit shape of various varieties varied from conic in varieties V_3 (Pajaro), V_4 (Sea scape), V_2 (Torrey) and V_{12} (Sweet Charlie) to long conic in varieties V_1 (Northwest), V_9 (Dil Pasand) and V_{10} (Larson). The fruit shape of varieties V_7 (Shimla delicious) and V_8 (No. 5) was Long wedge while V_6 (Chandler) exhibited both conic and long wedge forms varieties V_2 (Tioga) and V_5 (Fern) had necked and long conic fruits shape respectively. The fruit shape of cv. Camarosa was reported to be long wedge, while in Selva it varied from medium conic to flat and wedge. The fruits of Sweet Charlie were similar in shape to those of Selva (Anonymous, 2000). The variation in fruit shape of different varieties may be due to their genetic characters. The maximum fruit length was found in varieties V_{10} (Larson) 3.80 cm. Varieties V_7 (Shimla Delicious) 3.78 cm, V_4 (Seascape) 3.65 cm and V_6 (Chandler) 3.61 cm were statistically at par with V_{10} (Larson) 3.80 cm, however the minimum fruit length was recorded in variety V_{11} (Torrey) 2.82 cm. The variations in the size of the fruit might be due to differential genetic make of the genotypes. This observation finds support from the findings of Dwiwedi *et al.,* (2004). Although maximum fruitbreadth was recorded in variety V_6 (Chandler) 2.47 cm were statistically at par with variety V_{11} (Torrey) 2.45 cm, followed by varieties V_{12} (Sweet Charlie) 2.21 cm and V_{10} (Larson) 1.94 cm, whereas minimum fruit diameter was observed in variety V_1 (Northwest) 1.58 cm. (Lal and Rao 2010) found that fruit diameter of Larsan and Dana was 18.20 mm and 18.00 mm respectively which are in agreement with the present work. *Kumar et al.,* (2012) reported the mean value of fruit breadth ranged from 18.78 mm to 33.93 mm which is higher than the present investigation. Singh *et al.,* (2012) reported the fruit breadth of Larsan was 16.50 mm which is in agreement with the present work. The variation in berry breadth may be due to the genetic makeup of the cultivars (Sharma and Sharma, 2006). The maximum fruit weight was attained by the variety V_6 (Chandler) 8.58 g. Varieties V_{12} (Sweet Charlie) 7.39 g were statistically at par and variety V_1 (Northwest) 7.18 g followed by the variety V_6 (Chandler), whereas the minimum fruit weight was noticed in V_{11} (Torrey) 5.23g. The results are in accordance with the work of Kumar *et al.,* (2011), who observed significant variation in days to fruit maturity. This might be due to the excessive vegetative growth, which warranted periodic thinning and pruning of runners. Highest fruit volume was recorded in variety V_6 (Chandler) 8.23 ml were statistically at par with varieties V_{12} (Sweet Charlie) 7.23 ml, V_7 (Shimla Delicious) 7.17 ml, followed in the variety V_1 (Northwest) 6.94 ml, whereas lowest fruit volume was observed in variety Torrey (5.41 ml).

Table.1

Varieties	Plant height (cm)	Number of leaves/plant	Number of crowns /plant	Fruit shape	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (ml)	Specific gravity	Days taken to full maturity after fruit set
V_1 (Northwest)	10.38	14.60	1.83	Long conic	3.58	1.58	7.18	6.94	1.03	34.66
V_2 (Tioga)	10.36	13.47	1.61	Necked and Long conic	3.09	1.90	5.89	5.71	1.02	31.11
V_3 (Pajero)	14.00	14.80	2.02	Conic	3.56	1.84	7.12	6.93	1.02	41.11
V_4 (Seascape)	11.85	16.67	2.43	Conic	3.65	1.73	6.82	6.61	1.03	45.22
V_5 (Fern)	9.65	16.40	1.66	Necked and Long conic	3.36	1.94	6.54	6.36	1.03	35.11
V_6 (Chandler)	14.27	18.07	2.21	Conic and long wedge	3.61	2.47	8.58	8.23	1.01	39.44
V_7 (Shimla Dalicious)	11.23	15.67	1.03	Long wedge	3.78	1.94	6.35	7.17	1.01	38.77
V_8 (No. 5)	12.13	14.93	1.83	Long wedge	3.42	1.89	6.19	5.64	1.03	37.55
V_9 (Dil Pasand)	13.41	14.47	2.13	Long conic	3.35	1.80	5.89	5.73	1.02	34.55
V_{10} (Larson)	9.95	14.07	1.80	Long conic	3.80	1.94	6.73	6.59	1.01	36.22
V_{11} (Torrey)	9.89	14.33	1.63	Conic	2.82	2.45	5.23	5.41	1.00	38.00
V_{12} (Sweet Charlie)	11.21	15.43	1.43	Conic	3.44	2.21	7.39	7.23	0.96	37.77
S.Em.±	**0.24413**	**0.40167**	**0.01601**		**0.08379**	**0.03225**	**0.42117**	**0.38119**	**0.01159**	**0.51508**
CD at 5%	**0.71602**	**1.17806**	**0.04695**		**0.24575**	**0.09457**	**1.23526**	**1.11799**	**0.03399**	**1.51068**
CV (%)	**3.66828**	**4.56454**	**1.53934**		**4.2006**	**2.82954**	**10.9538**	**10.0839**	**1.97952**	**2.38166**

It was observed that the specific gravity of the varieties have negligible difference aspect the variety V_{12} (Sweet Charlie) 0.96. Although the maximum specific gravity was recorded in variety V_4 (Seascape) 1.03 and minimum specific gravity was recorded in the variety V_{12} (Sweet Charlie) 0.96.There is negligible difference in specific gravity by this might be due to different time of fruit maturity and environment conditions. Minimum days for fruit maturity was taken by variety V_2 (Tioga) 31.11 days, whereas variety V_4 (Seascape) the taken maximum days 45.22 and next early fruit maturating varieties V_9 (Dil Pasand) 34.55 days, V_1 (Northwest) 34.66 days and V_5 (Fern) 35.11 days for fruit maturity.

On the basis of results, it is concluded that out of 12 strawberry varieties, the variety V_6 (Chandler) resulted best in growth and fruit physical parameters plant height, number of leaves, fruit diameter, fruit weight, fruit volume. Variety V_{12} (Larson) observed for maximum fruit length and highest number of crowns was recorded in variety V_4 (Seascape). The noticed earliest fruit maturity after fruit set variety V_2 (Tioga) and specific gravity was best found in variety V_{11} (Torrey).

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