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Performance of strawberry (*Fragaria x ananassa* Duch.) varieties for yield and biochemical parameters

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Abstract

The present investigation was carried out with 15 genotypes and experiment was laid out in RBD at Research field of Horticulture department during 2013-2015. On the basis of results, it is concluded that, the cultivar Chandler resulted higher yield of better size fruits however, the maximum juice content (89.98%) with cv. Dana, Total sugar (7.23%) was observed with Belruby. Maximum acidity content (0.19%) was recorded with Phenomenal and Selva, while the minimum acidity (0.09%) was recorded with Sweet Charlie, cv. Phenomenal recorded the highest ascorbic acid (50.00%) and the highest pH of juice (5.92) content was observed in the fruits of cv. Sweet Charlie.

Keywords: strawberry, yield, biochemical parameters, Sweet Charlie

1. Introduction

Strawberries fruit has a sweet-sour taste and mostly eaten fresh, the ripe strawberries attain attractive red colour on maturity and have soft, melting pulp of a characteristic flavor. The red colour of the fruit is mainly due to the presence of an anthocyanin, i.e., pelargonidin 3-monoglucoside and traces of cyanidin (Singh and Sharma, 1970; Mitra, 1991) ^[19, 9] and are consumed not for the food value but for the flavor. Besides dessert purpose, strawberries are processed into various value added products, canned strawberry, jam, jelly, ice-cream, freeze strawberry, wine and other soft drinks.

Strawberries are known for their characteristic aroma, which is attributed to the presence of volatile esters. The most important aroma compounds are ethyl hexanoate, methyl hexanoate, ethyl heptanoate, ethyl propionate, ethyl butanoate, methyl butanoate, furanone and linalool. Essential oil can also be extracted from strawberry leaves. The major constituents of strawberry oil are linalool and nonanal (Khanizdeh and Belanger, 1993). In strawberry ellagic acid (naturally occurring plant phenol) has been found to inhibit cancer disease (Danial *et al.*, 1989) ^[3]. The regular consumption of this fruit also controls Asthma (Mangal, 1998) ^[8]. The fresh ripe fruits of strawberry are the rich source of vitamins and minerals and among vitamins it is a fairly good source of vitamin-A (17 IU) and vitamin-C (84.7 mg/100g). Strawberry also has high pectin, in the form of calcium pectate, which serves as an excellent ingredient for jelly-making (Mitra, 1991) ^[9].

Many strawberry cultivars have been grown around the world and new varieties appear at frequent intervals (Nielsen and Lovell 2000) ^[14]. The continued introduction of strawberry cultivars to the market increases the need for reliable methods of identification and genetic diversity assessment (Degani *et al.* 2001) ^[4]

Keeping these points in view the present investigation work was carried out in the Department of Horticulture during 2013-2015 with the objective, Collection, Evaluation and Characterization of Strawberry Genotypes for yield and biochemical parameters.

2. Materials and methods

The present investigation was laid out in RBD with 15 genotypes as treatments and three replications during the year 2013-2015 at research field of Horticulture department, SHIATS, Allahabad. Runners of fifteen strawberry genotypes i.e., Sea Scape, Sweet Charlie, Etna, Dana, Belruby, Larson, Phenomenal, Torrey, Jutogh special, Shimla delicious, Selva, Addie, Fern, Pajero and Chandler were with an intact earth ball were procured from IARI regional station Amartara Cottage, Shimla -171004.

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.

Runners of strawberry having 2-3 full open leaves were transplanted 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.

To assess the impact of different treatments, various parameters on yield and fruit quality were recorded. The mean values of genotypes in each replication were used for analysis. The data were analyzed according to randomized block design (Panse and Suklhatme, 1969) [15].

3. Result and Discussion

The perusal of data reveals that significant variation exist among various strawberry cultivars with respect to number of fruits per plant. On the basis of mean performance of both year data, the highest number of fruits per plant was found in cv. Chandler (28.04), which was statistically at par with cv. Pajero (22.53), followed in Larson (20.14).

Table 1: Mean performance of strawberry genotypes for Yield parameter

Genotypes	No. fruits per plant			Fruit weight (g)			fruits yield/pt (g)		
	2013-14	2013-14	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Sea Scape	19.45	18.77	19.11	8.73	9.17	8.95	169.67	171.67	170.67
Sweet Charlie	20.04	20.50	20.27	17.98	17.66	17.82	360.33	361.67	361.00
Etna	17.65	16.99	17.32	7.82	7.97	7.9	138.00	135.33	136.67
Dana	16.53	16.68	16.61	12.70	12.51	12.61	210.00	208.33	209.17
Belruby	18.40	18.21	18.30	15.02	14.85	14.94	276.33	270.33	273.33
Larson	20.14	20.40	20.27	10.19	9.84	10.02	205.33	200.67	203.00
Phenomenal	16.43	16.58	16.51	11.64	11.62	11.63	191.33	192.00	191.67
Torrey	15.15	15.52	15.34	10.21	9.72	9.97	154.67	150.67	152.67
Jutogh special	14.45	14.17	14.31	16.24	15.89	16.06	235.00	225.00	230.00
S. delicious	12.57	12.84	12.71	17.33	15.93	16.63	218.00	204.33	211.17
Selva	16.33	16.01	16.17	14.34	14.05	14.19	234.00	224.67	229.33
Addie	18.29	17.82	18.06	5.14	5.05	5.09	94.00	90.00	92.00
Fern	17.81	18.18	18.00	12.65	11.90	12.28	225.33	216.33	220.83
Pajero	22.53	22.17	22.35	16.13	16.01	16.07	363.33	354.33	358.83
Chandler	28.04	28.42	28.23	20.19	21.70	20.95	566.00	616.33	591.17
C.V.	1.69	3.49	2.09	5.99	4.03	3.78	5.70	1.05	2.89
S.Ed.	0.25	0.52	0.31	0.64	0.43	0.40	11.30	2.06	5.71
F-test	S	S	S	S	S	S	S	S	S
C.D. 5%	0.52	1.06	0.64	1.31	0.87	0.82	23.40	4.23	11.70
C.D. 1%	0.70	1.44	0.86	1.77	1.18	1.11	31.22	5.70	15.78

Table 2: Mean performance of strawberry genotypes for quality parameter

Genotypes	Juice content (%)			TSS (°B)			Total Sugar (%)		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Sea Scape	75.98	76.42	76.2	11.06	11.2	11.13	5.18	5.53	5.35
Sweet Charlie	85.78	85.2	85.49	12.31	12.33	12.32	6.46	6.31	6.39
Etna	48.22	48.22	48.22	7.88	7.99	7.94	5.5	5.63	5.57
Dana	89.93	90.02	89.98	8.48	8.75	8.62	5.93	5.83	5.88
Belruby	60.73	60.26	60.5	11.58	11.58	11.58	7.24	7.22	7.23
Larson	73.11	71.91	72.51	7.83	7.81	7.82	6.22	6.36	6.29
Phenomenal	67.55	67.56	67.56	8.12	8.28	8.2	5.24	5.26	5.25
Torrey	74.07	73.81	73.94	9.31	9.57	9.44	6.41	6.36	6.38
Jutogh special	66.88	67.52	67.2	9.19	9.2	9.19	6.21	6.21	6.21
S. delicious	86.45	87.37	86.91	9.55	9.55	9.55	6.12	6.14	6.13
Selva	56.22	57.93	57.08	8.04	8.21	8.12	6.5	6.46	6.48
Addie	75.98	75.57	75.78	6.86	7.01	6.94	5.33	5.4	5.36
Fern	83.48	83.52	83.5	8.75	8.6	8.67	6.44	6.37	6.41
Pajero	67.86	64.45	66.15	7.18	7.24	7.21	6.31	6.32	6.32
Chandler	77.84	73.81	75.83	8.74	8.7	8.72	6.11	6.07	6.09
C.V.	3.24	1.46	1.57	2.52	5.6	3.02	3.28	6.51	3.71
S.Ed.	1.92	0.86	0.93	0.18	0.41	0.22	0.16	0.32	0.18
F-test	S	S	S	S	S	S	S	S	S
C.D. 5%	3.93	1.76	1.91	0.38	0.85	0.46	0.33	0.66	0.38
C.D. 1%	5.3	2.37	2.57	0.51	1.15	0.61	0.45	0.9	0.51

Table 3: Mean performance of strawberry genotypes for quality parameter

Genotypes	Acidity (%)			Ascorbic acid (mg/100g of pulp)			pH of the Juice (pH)		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Sea Scape	0.12	0.12	0.10	49.16	49.17	49.17	4.76	4.81	4.79
Sweet Charlie	0.09	0.09	0.14	48.83	48.84	48.84	5.92	5.93	5.92
Etna	0.18	0.19	0.17	49.36	49.36	49.36	4.14	4.14	4.14
Dana	0.15	0.15	0.13	49.29	49.30	49.3	4.30	4.30	4.3
Belruby	0.11	0.12	0.15	49.03	49.02	49.03	4.77	4.89	4.83
Larson	0.18	0.18	0.19	49.36	49.34	49.35	4.20	4.20	4.2
Phenomenal	0.19	0.20	0.17	50.01	49.99	50	3.84	3.80	3.82
Torrey	0.13	0.14	0.13	49.26	49.22	49.24	4.60	4.62	4.61
Jutogh special	0.12	0.12	0.15	49.17	49.13	49.15	4.73	4.70	4.71
S. delicious	0.19	0.18	0.18	49.96	49.92	49.94	4.46	4.59	4.53
Selva	0.19	0.20	0.18	50.00	49.96	49.98	3.94	3.97	3.96
Addie	0.17	0.17	0.16	49.33	49.29	49.31	4.31	4.30	4.31
Fern	0.15	0.16	0.15	49.12	49.08	49.1	4.42	4.40	4.41
Pajero	0.13	0.13	0.15	49.19	49.15	49.17	4.80	4.53	4.67
Chandler	0.17	0.17	0.09	49.38	49.34	49.36	4.38	4.41	4.4
C.V.	11.69	21.31	10.52	0.08	0.05	0.04	3.03	4.93	3.02
S.Ed.	0.01	0.03	0.01	0.03	0.02	0.02	0.11	0.18	0.11
F-test	S	S	S	S	S	S	S	S	S
C.D. 5%	0.03	0.06	0.03	0.06	0.04	0.03	0.23	0.37	0.26
C.D. 1%	0.04	0.07	0.04	0.08	0.06	0.04	0.31	0.50	0.31

The minimum fruit yield per plant was recorded in cv. Addie (92.00 g). The highest fruit weight (20.95 g) was observed in Chandler, followed by S. Charlie (17.82 g) and S. Delicious (16.63). The lowest fruit weight (5.09 g) was recorded in cv. Addie. The maximum fruit yield per plant was observed in Chandler (591.17 g) cultivar followed by S. Charlie (361.00 g) and Pajero (358.83 g).

The maximum juice content (89.98%) and minimum juice content (48.22%) was recorded in cv. Etna the maximum TSS was observed in Sweet Charlie (12.32 °B) cultivar followed by Belruby (11.58 °B) and Sea Scape (11.13 °B). The minimum TSS was recorded in cv. Addie (6.94 °B). Maximum total sugar (7.23%) was observed in Belruby, followed by Selva (6.48%) and Fern (6.41%). The minimum total sugar (5.25%) was recorded in cv. Phenomenal. Maximum acidity content (0.19%) was observed in Phenomenal and Selva, while the minimum acidity content (0.09%) was recorded in cv. Sweet Charlie. Among the various cultivars, the cv. Phenomenal recorded the highest ascorbic acid (50.00%) on the basis of mean performance. However, the lowest ascorbic acid (48.84%) was recorded in cultivar Sweet Charlie. The highest pH of juice (5.92) content was observed in the fruits of cv. Sweet Charlie on mean performance of cultivar, followed by cultivar Belruby (4.83). However, the lowest pH of juice (3.82) was recorded in cv. Phenomenol.

Differences in Number of fruits per plant, fruit weight, yield per plant, Juice content, TSS, total sugar, acidity, ascorbic acid and pH of juice content of various strawberry genotypes may be attributed to adaptability potential under Allahabad agro-climatic conditions and may also be due to their genotypic differences. Similar results were obtained by Das *et al.*, (2007)^[2], Sharma and Thakur (2008)^[16], Singh *et al.*, (2012)^[13], Sharma *et al.*, (2012)^[17, 18], Rao and Lal (2010)^[10], E. Al-Ramamneh *et al.*, (2013)^[5] and Ankita and Chandel (2014)^[1].

4. Conclusion

On the basis of results, it is concluded that out of 15 genotypes, the cultivar Chandler resulted in higher yield of better size fruits and cultivar Sweet Charlie recorded for maximum juice content, high TSS, pH of juice and minimum

acidity. The high acidity and minimum pH of juice content was observed in with Phenomenal.

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