



Evaluation of Strawberry Crops in Temperate Fruit for Its Adoptability and Productivity in Rohtas District of Bihar

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field trial was carried out in the experimental field of Dhangain farm and four other farmers' field during 2013-14 and 2014-15 to evaluate some strawberry cultivars in the plain region of Rohtas to assess different cultivars of strawberry. This experiment was conducted with four treatment and 3 replication with one control in Randomized Block Design (R.B.D). The finding of field trial conducted to assess different cultivar of strawberry in Rohtas district of Bihar in 2013-14 and 2014-15. This short day cultivars were more tolerant to insect pest in compared to day neutral cultivars, particularly in the later stage of fruit development leading to record higher yield. The treatment were 4 varieties Festival (T₁), Sweet Charlie (T₂), Camarosa (T₃), Kamila (T₄) and control Local Sweety (T₅). Results revealed that Festival produced higher yield, fruit weight, yield per plant and also plant height (22.36), flowering duration (60.56), fruit length (4.20), fruiting duration (56.25 days) and yield (16.5 t/ha). It was also revealed that are evitable microclimate was required for optimum plant growth, higher crop yield and best quality fruits.

Keywords: Strawberry; festival; sweet charlie; Camarosa; Kamila; local sweety.

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1. INTRODUCTION

The cultivated strawberry is one of the luscious and soft fruits of the world. It is a hybrid of two Native American species *Fragaria chiloensis* and *Fragaria virginiana* and belongs to the Rosaceae family. All cultivated varieties are octa ploid ($2n=56$). In temperate and climate condition its plants behave like a small perennial herb [1] with shallow root system whereas in sub-tropical climate it is a modified receptacle one-seeded fruit or achiness which is located on the outer surface (Szezesniak and Smith, 1969). Owing to its medicinal properties (anti carcinogenic, anti-diabetic and anti oxidant), strawberry is gaining its significance among all age group consumers [2]. Strawberries are a good source of natural anti oxidant [3] and [4]. It is non-clinacteric fruits which reach in full red stage within 28-30 days after anthesis having the maximum fruit weight and size [5].

Strawberries have traditionally been a popular delicious fruit for its flavour taste, fresh use, freezing and processing. It contains numerous important dietary components and is a rich source of vitamin C (Riyaphan et al. 2005). It contains relatively high quantities of eley and having a range of biological activity and especially the fruit contains higher vitamin C concentration than orange or lemon. The lower calorific value, the absence of cholesterol and a higher level of minerals like phosphorus, potassium, calcium, iron and especially vitamin C (40-100 mg./10 g berried) [6]. Carotenoids, vitamins, phenols, flavonoids dietary, glutathionon and metabolites [7]. It exhibits a high level of antioxidant capacity against free radical species, superoxide radicals hydrogen peroxide, hydroxyl radicals and singlet oxygen [8]. Vitamin B, proteins, which may it ideal for health-conscious consumers. It is highly demanded table purpose as well as for Jam, canine, ice-cream preparation, beverage wine drink and other quality products. It is a complete face with 98 per cent edible portions. Among the fruits the maximum economic return in the shortest possible time.

The climate of Bihar is suitable for growth and better yield. Strawberry fruit due to excellent flavour, attractive colour and rich in nutritional contents has become a very popular fruit crop in Bihar [9]. Strawberry contains 87.8% water, 0.7% protein, 0.2% fat and 0.3 % iron in 100 g of fresh fruit, providing approximately 30 kcal of energy. It performed better under temperate ranges

between 15°C to 35°C [10] necessarily having a temperate range of 14-18°C at flavouring and soil rich in organic contents with light clay to loam and pH (5.6 to 6.5). Plant growth parameters play a significant role in cultivars and climate change. Poly tunnel might have created favourable micro-climate condition for faster growth as expressed by Kaska et al. [11] in strawberry. According to the response of varieties to photoperiod, two types of strawberry are now grown commercially i.e. day neutral and short day plant. Long day (everbearing) varieties are also available but they are rarely grown outside the home garden. Short day types are actually facultative [9]. The temperature and day-length (photo-periodism) have considerable effects on the growth and yield of strawberry probably through the control of the production of plant hormones (Patel et al., 2015). High growth rates of strawberries are maintained at day temperatures of 22-23°C. The climate of Rohtas district having mild and shorter summer than other parts of Bihar enabling plant to sustain for a longer period of time leading to more production during trial [9]. An average growing temperature of 15°C has been reported for most of the strawberry cultivars and species. Mulching and essential cultural practices for strawberry cultivation have been recorded to be very effective for higher yield as it helps in soil moisture conservation, weed control keeping the fruits clean and avoiding fruit rotting due to soil contamination [9]. Mulching should be done after proper establishment of runners and before flowering (30-45 days after planting).

Sweet Charlie is a day neutral cultivar and adjusted well with growing periods. The fruits are firm having a deep red colour. Leaves are medium to dark green, slightly cupped and semi-glossy. Sweet Charlie plants have a typical ripening profile that can be quite variable. Sweet Charlie fruit has two weeks of early production and after initial two weeks, size tends to drop off drastically. In the early mid season and even in second crops, very large fruits are produced in the last week of the season [9].

Camarosa is a short day pedigree having larger and fruits are firm that Chandler. Its fruits are very flute, conical over an extended period at low latitude. Festival is a short day (*Rosa linda* x *Rosa grande*) cultivars. It produces numerous runners; fruit with long pedicles, fruits are firm, fleshy, conical and deep red on the outside and bright red inside (Patel et al., 2015).

Keeping in view the facts mentioned above, the present trial was planned and carried out to assess the performance of different cultivars in respect of quality and yield of strawberry in the climatic conditions of Rohtas and to study the impact of change in weather parameters on flowering and fruiting behaviour of strawberry.

2. MATERIALS AND METHODS

The trial was conducted in the field of ten farmers' plot in the year of 2013-14 and 2014-15 which represented the replication. The treatments consist of three replication and five varieties of strawberry was cultivated Sweet Charlie (T₁), Camarosa (T₂), Festival (T₃), Kamila (T₄) and Local Sweety (T₅) which were replicated in 3 replication of every ten farmers' field. The plot size for each treatment was 2.5 m² recommended package of practices were followed uniformly in all the treatments. Healthy runners were transplanted on a raised bed with two rows a part from 60 cm. Planting distance was 25 cm. Mulching was done by ply mulch and irrigation was provided by drip method. Observation were recorded and growth and yield parameters of fruits on 10 randomly selected plants in each treatment. Average plant height was recorded in centimetre with the help of metre scale. Average flowering duration was recorded as the number of days taken from initiation of flowering to fruit set. Fruiting duration was recorded as the number of days taken from first fruit set to the last fruit set. Total number of fruits per plant, fruit length and breadth in centimetre were recorded. Average fruit weight in gram was computed and yield of fruit per plant was recorded. The yield per hectare in tons and B:C ratio were recorded. Data pertaining to fruit size, fruit weight were recorded at each harvest and average was taken after completion of all

harvests. These data were subjected to statistical analysis following standard procedures [12].

3. RESEARCH FINDING AND DISCUSSION

The finding of the trial of different growth and yield parameters are presented under the following heads.

Plant height:- The data in Tables 1 and 2 showed that plant height varied significantly in different varieties festival was found to have the maximum plant height 22.36 cm to 22.32 cm respectively are being par at sweet charlie 20.085 cm to 20.42 cm. While local sweety had the minimum 18.12 cm to 18.10 cm. The most profuse growth witnessed by festival might be the cause of its maximum plant height which is in agreement with the views expressed by Ram and Ahmad (2012). Singh et al. [13] also endorsed that the varietal difference in plant spread and height in Meghalaya supports the present observation.

Flowering duration:- Data presented in Table 1 revealed that flowering duration varied significantly among the varieties. Festival cultivar recorded the maximum flowering duration 60.56 days to 60.54 days while local sweety is recorded the minimum 53.82 days to 53.90 days. The minimum flowering local sweety might be attributed to its short crop period which is in conformity with the observation made by Montero et al. [14]. Variability in flowering period in different varieties might also be due to differences in their chilling requirement as suggested by Badiyala and Joolka (1983) or due to differences in their genetic makeup as opined by Li et al. [15].

Table 1. Comparison of the varieties of strawberry based on different parameters in 1st year

Varieties	Plant height (cm)	Flowering duration (days)	Fruiting duration (days)	Fruit length (cm)	Fruit width (cm)	No. of fruit/plant	Fruit weight (g)	Yield/plant (g)	Yield /ha (ton)	B.C ratio
Sweet Charlie	20.08	54.52	50.27	3.34	2.29	16.22	12.90	205.6	12.46	2.32
Camarosa	18.16	56.38	46.92	2.90	2.05	15.15	12.46	190.4	11.22	2.18
Festival	22.36	60.56	56.25	4.20	3.12	19.6	13.56	260.2	16.05	3.08
Kamila	19.17	57.18	52.13	3.52	2.18	16.06	12.82	200.2	11.8	2.26
Local Sweety	12.12	53.82	45.86	2.85	2.04	15.0	12.42	180.2	10.5	2.06
C.D.	2.52	7.98	8.06	0.42	0.46	3.32	0.24	50.64	13.14	-
CV(%)	8.43	8.42	8.93	16.6	10.45	16.20	3.62	13.35	13.46	-

Table 2. Comparison of the varieties of strawberry based on different parameters in 2nd year

Varieties	Plant height (cm)	Flowering duration (days)	Fruiting duration (days)	Fruit length (cm)	Fruit width (cm)	No. of fruit/plant	Fruit weight (g)	Yield/plant (g)	Yield /ha (ton)	B.C ratio
Sweet Charlie	20.12	54.55	50.42	3.38	2.31	16.20	12.88	208.4	12.44	2.34
Camarosa	18.14	56.42	46.58	2.92	2.07	15.2	12.44	192.2	11.28	2.20
Festival	22.32	60.54	56.22	4.20	3.12	19.5	13.54	264.6	16.5	3.06
Kamila	19.23	57.24	52.32	3.53	2.16	16.1	12.80	202.4	11.8	2.28
Local Sweety	18.10	53.90	45.84	2.84	2.05	15.1	12.40	181.6	10.52	2.08
C.D.	2.50	8.02	8.08	1.16	0.48	3.36	0.20	51.12	3.76	-
CV(%)	8.38	8.40	8.95	15.9	0.48	16.20	3.54	13.83	13.65	-

Fruiting duration:- A perusal of data Tables 1 and 2 revealed that the varieties differed significantly in respect to their fruiting period. Festival T₃ witnessed the longest fruiting duration 56.23 days to 56.22 days while local sweety had the shortest fruiting period 45.86 to 45.84 days along with par at Camarosa and Sweet charlie longer fruiting period in Festival might be attributed to its profuse growth.

Fruit size:- The data Tables 1 and 2 showed significant variation in the size (length & breadth) of fruit among the varieties. Festival was found to have the longest fruit (4.20) in both years through being at par with Local sweety (2.85) to (2.84) cm. respectively. Similarly, the varieties differed significantly in width also. Festival recorded the maximum width (3.12) to (3.14) cm respectively followed by Local sweety (2.04) and (2.05) cm with par at Sweet charlie and Camarosa. The varieties in the size of the fruit might be due to differential genetic make of the genotypes. Thus observation finds support from the findings of Dwiwedi et al. [16] in the cold condition of Ladakh and Himachal.

Fruit weight:- It appears from the data (Tables 1 and 2) that there was significant variation in fruit weight. Festival is (13.56) to (13.54) gm respectively. The minimum fruit weight are shown on local sweety (12.42) to (12.40) gm.

Number of fruits/plant:- The data presented in Tables 1 and 2 showed that the number of fruits/plant varied significantly in different varieties. Festival was observed to have maximum number (260.2)g of fruit/plant being at par with Sweet charlie and Kamila. While Local sweety is minimum (180.2) to (181.6) g respectively. It might be due to more number of shoots in festival than other varieties. This finding

is in confederation with the observation made by Asrcy and Singh [17] in the varietal difference in respect of number of fruit/plant in semi-arid region of Punjab.

Yield/ ha:- Data in Tables 1 and 2 revealed that there was a significant difference in yield /ha in different varieties. Festival was found significantly superior to other varieties in respect of yield of fruits/ha. It gave the highest yield (16.05) to (16.50) followed by Sweet Charlie (12.46) to (12.44) respectively. While Local sweety (10.5) to (10.3) and Camarosa and Kamila are statistically par at (11.22) to (11.28) and (11.8) in both years. The highest yield of Festival might be attributed due to more number of fruits borne by its plant. This finding is in agreement with the observation made by Coombey [5]. The varietal difference in yield depends on a number of factors viz. fruit-bearing potential of the cultivar development of growth of plants, weather condition Kiprijanovski and Arsov [18].

4. CONCLUSION

The present study revealed that the farmers of Rohtas can switch over to the cultivation of strawberry in place of their traditional crops for economic returns, as crop stands well and gives good economic return in such an agro-climatic condition of Bihar.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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