

Research Article

Effect of Organic Manuring On Growth, Flowering and Yield Traits of Strawberry (*Fragaria X Ananassa* Duch.) Var. Sweet Charlie

Shiva Tripathi*, Saurabh Kasera, Sapna Roy, Sudhir Kumar Mishra and Mritunjay Tiwari

Research student, Department of Horticulture, N.P.G. College, Barhalganj, Gorakhpur, (U.P.), India 273402

Abstract

Among the fruit crops, Strawberry is one of the important fruit crop. An experiment was conducted at research field, Department of Horticulture, N.P.G. College Barhalganj, Gorakhpur (U.P.), during the year 2019-2020. The experiment was laid out in a Randomized Block Design having twelve treatments of organic manure at different levels with three replications. The observations were recorded on vegetative growth and yield related traits and statistically analyzed. The result revealed that treatment T₁₁ [Bone meal (25%) + Neem manure (25%) + FYM (25%) + Vermi-compost (25%)] was found to be best in terms of vegetative growth and flowering *i.e.* maximum plant height (14.32cm), plant spread (22.00cm), number of leaves (11.43), days to first flower (46.59 days), days to first harvest (63.09 days), number of flowers per plant (38.13), number of fruits per plant (30.28). Whereas in terms of yield related traits *i.e.* maximum fruit weight (24.13g), maximum fruit diameter (38.23mm), maximum fruit length (43.70mm), fruit yield per plant (0.68kg), fruit yield per plot (2.97kg) and fruit yield per ha (16.12 tons) was also noted in treatment T₁₁ (Bone meal 25% + Neem manure 25% + FYM 25% + Vermi-compost 25%).

All the characters were found minimum in control. The moderate treatment cost of cultivation (₹ 510785) was recorded under treatment T₁₁. The maximum cost of cultivation (₹ 570560) was recorded under treatments T₂. The maximum gross return (₹ 2015000) was recorded under treatments T₁₁. The maximum net return (₹ 1504215) was recorded under treatments T₁₁ with maximum benefit cost ratio (3.94).

Keywords: Strawberry, organic manures, growth, flowering and yield.

*Correspondence

Author: Shiva Tripathi

Email: shivatripathi8858@gmail.com

Introduction

The modern cultivated octoploid (2n = 8x =56) strawberry (*Fragaria x ananassa* Duch.) originated in France, but varieties are available which can be cultivated in subtropical climate. Strawberry (*Fragaria virginiana*) belonging to the family Rosaceae is one of the most delicious, delicate flavored, refreshing, and attractive red fruit of the world [1]. Strawberries are unique with highly desirable taste, flavor, and excellent source of vitamins, potassium, fiber and sugars [2]. As compared to other berry fruits, strawberries contain a higher percentage of vitamin C, phenolics and flavonoids [3]. The fresh ripe fruits of strawberry are rich source of vitamins and minerals. The strawberry fruit contains 0.5% total sugar and 0.90% to 1.85% acidity the prominent being malic and citric acids. The ripe fruit contains slightly more lipid than unripe fruits, and it contains more oleic acid and less linolenic acid. The fruit of strawberry is a complete fruit with 98% edible portion [4]. It is a soft and a highly perishable fruit, often shipped in frozen condition in Western countries. Strawberry thrives best in temperate climate. The greatest production of runners in soils of about pH 5.3 [5]. These specialized roots are formed at the nodes along a runner. The fruit is attractive and widely appreciated for its characteristic aroma, bright red color, juicy texture, and sweetness.

The quality and yield of fruits depends on different attributes which are closely associated with nutrient uptake by the plant. The supply of treatments to the plants should be balanced, ensuring not to over or under-fertilize. In addition to NPK, organic manures have a great bearing in influencing the yield attributes and fruit production. They even provide organic acids that help to dissolve soil nutrients and make them available for plants. FYM is prepared basically using cow dung, cow urine, waste straw and other dairy wastes. A small portion of N is directly available to the plants while a larger portion is made available as and when decomposes. Availability of Potassium and Phosphorus from FYM is similar to that from inorganic sources. Vermi-compost is the product of the decomposition process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food wastes bedding materials, and vermicast. Bone meal is a mixture of finely and coarsely ground animal bones and slaughter-house waste products. It is used as an organic fertilizer for plants. As a slow-release fertilizer, bone meal is primarily used as a source of phosphorus and protein. Calcium is the most significant nutrient in bone meal. Neem manure is rich in nitrogen, phosphorus, sulphur and calcium. It is a natural product and is used for growth and high yield of crops. Neem manures helps in producing a greater crop harvest than

synthetic manures. It not only helps to increase the fertility of the soil but also acts as a pest repellent.

Organic farming has several advantages over the conventional one, apart from the protection of both the environment and human health. Organic fertilizers improve soil fertility by modifying soil structure, pH, bio-physical conditions and availability of essential nutrients [6]. Improved better water quality, generation of rural employment, etc. are some of them. Organically-grown strawberries taste better, are more nutritious, and are better for soil and environment than are conventionally-grown strawberries. Organic strawberry farms produced better quality fruit and that their higher quality soils may have greater microbial functional capability and resilience to stress.

Materials and Methods

The present investigation entitled “Effect of organic manuring on growth, flowering and yield traits of Strawberry (*Fragaria x ananassa* Duch. var. Sweet Charlie)” under Gorakhpur region was carried out at experimental farm, Department of Horticulture, N.P.G. College, Barhalganj, Gorakhpur, during 2019-2020, in a randomized block design, replicated thrice. The experimental site is situated at latitude of 26.2846° N and longitude of 83.5066° E. The altitude of this place is 84 meters above mean sea level (MSL). Minimum temperature ranged from 4°-5°C (during Oct - Feb) and maximum temperature ranged from 45°- 48°C (during March - June). These healthy runners uniform were selected and transplanting in well-prepared field. Mulching was done before transplanting of over runners. To protect the strawberry plants from frost, fruits from touching the ground, conserve the moisture in the soil and control weeds in the plots, mulching with black polythene thickness 2 mm was done. One cultivar with uniform sized strawberry runners were planted during November 2019, maintaining a spacing of 30 X 30 cm. Five plants were randomly selected and tagged before flowering from each line to record the data on the following attributes. The organic manures were prepared as per the requirement and given to each treatments and replication at 30 days intervals and also observations recorded. The recommended package of practices was followed for raising the successful crop. Data on plant growth and yield of strawberry characters were recorded at all successive growth and yield stages. The different treatment combinations used are as follows: Treatments T₀ – Control, T₁ – [*Bone meal* (25%) + *Vermi-compost* (75%)], T₂ – [*Bone meal* (75%) + *FYM* (25%)], T₃ – [*Bone meal* (50%) + *Neem manure* (50%)], T₄ – [*Vermi-compost* (50%) + *FYM* (50%)], T₅ – [*Vermi-compost* (25%) + *Neem manure* (75%)], T₆ – [*FYM* (75%) + *Neem manure* (25%)], T₇ – [*Bone meal* (50%) + *Vermi-compost* (25%) + *FYM* (25%)], T₈ – [*Vermi-compost* (25%) + *Neem manure* (50%) + *Bone meal* (25%)], T₉ – [*FYM* (50%) + *Neem manure* (25%) + *Bone meal* (25%)], T₁₀ – [*Neem manure* (25%) + *Vermi-compost* (50%) + *FYM* (25%)], T₁₁ – [*Bone meal* (25%) + *Neem manure* (25%) + *FYM* (25%) + *Vermi-compost* (25%)]. The recorded data were statistically analyzed using analysis of variance as formulated at 5% level of significance. *The data collected on various characters was averaged and subjected to statistical analysis as suggested by Fisher & Yates, 1938.*

Results and Discussion

Growth parameters

The mean performance of the treatments for growth parameters like plant height, numbers of leaves per plant and plant spread have been presented in **Table 1** showing significant differences among treatments. Vigorous maximum plant height was observed with T₁₁ (14.32 cm) followed by T₈ (13.22 cm) and also T₉ (12.29 cm) and treatment T₁₁ had the maximum number of leaves (11.43) with maximum plant spread was recorded in treatment T₁₁ (22cm), followed by T₈ (20.12cm) and T₉ (19.33cm). While control exhibited least values for these traits, *i.e.* the remaining treatments recorded significant medium growth. Similar results reported by Bhattacharya *et al.* (2003) [7] and Odongo *et al.* (2008) [8].

Flowering and fruiting characters

The data pertaining to the flowering and fruiting characters like days to 1st flower, days to 1st harvest, number of flowers per plant and number of fruits per plant was recorded under one cultivar of strawberry and twelve treatments presented in Table 1. Significantly the minimum days to first flowering were recorded in treatment T₁₁ (46.56 days) followed by treatment T₈ (49.68 days) and treatment T₉ (49.82 days). Minimum days to first harvesting (63.09 days) were observed in treatment T₁₁ followed by treatment T₈ (65.88 days) and treatment T₉ (66.78 days). Maximum number of flowers per plant (38.13) was observed in treatment T₁₁ followed by treatment T₈ (37.10) and treatment T₉ (35.00). Maximum number of fruits per plant (30.28) was observed in treatment T₁₁ followed by treatment T₈ (28.81) and treatment T₉ (27.19). Similar results observed by Herencia *et al.* (2011) [9] and Krishnan *et al.* (2014) [10].

Table 1 Effect of organic manuring on growth and flowering parameters of strawberry

Treatment	Plant Height (cm)	Number of leaves / plant	Plant Spread (cm)	Days to first flowering	Days to first harvesting	Number of Flower per plant	Number of Fruits Per Plant
T ₀	8.73	6.26	11.57	62.30	76.65	23.55	15.36
T ₁	10.03	7.21	14.66	56.32	72.14	24.40	18.21
T ₂	9.72	6.75	13.70	57.12	73.01	25.18	17.41
T ₃	11.07	8.25	16.16	52.43	69.54	30.24	22.04
T ₄	11.52	8.40	16.85	51.93	69.03	31.99	23.78
T ₅	10.29	7.60	15.21	55.08	71.50	28.73	19.86
T ₆	10.85	8.06	15.67	54.94	70.85	29.56	20.95
T ₇	12.12	9.16	18.50	50.76	68.25	33.70	25.56
T ₈	13.22	9.83	20.12	49.68	65.88	37.10	28.81
T ₉	12.29	9.34	19.33	49.82	66.78	35.00	27.19
T ₁₀	11.67	8.78	17.43	51.45	68.83	32.60	24.17
T ₁₁	14.32	11.43	22.00	46.59	63.09	38.13	30.28
F - test	S	S	S	S	S	S	S
C.D. at 0.05%	0.52	0.39	0.78	2.19	2.55	1.64	1.65
S.Ed (±)	0.25	0.19	0.37	1.06	1.23	0.79	0.80

Yield parameters

The mean performance of the treatments for yield parameters like fruit weight, fruit length, fruit diameter, fruit yield per plant, fruit yield per plot and fruit yield t/ha have been presented in **Table 2** showing significant differences among treatments. Significantly maximum fruit weight (24.13g) was observed in treatment T₁₁ followed by treatment T₈ (22.03g) and treatment T₉ (21.53g). Maximum fruit diameter (38.23mm) was observed in treatment T₁₁ followed by treatment T₈ (35.47mm) and treatment T₉ (30.37mm). Significantly maximum fruit length (43.70mm) was observed in treatment T₁₁ followed by treatment T₈ (41.13mm) and treatment T₉ (38.70mm), whereas maximum fruit yield per plant (0.68 kg) was observed in treatment T₁₁ followed by treatment T₈ (0.57 kg) and treatment T₉ (0.52 kg). Maximum fruit yield per plot (2.97 kg) was observed in treatment T₁₁ followed by treatment T₈ (2.36 kg) and treatment T₉ (2.14 kg) and maximum fruit yield t/ha (16.12 t/ha) was observed in treatment T₁₁ followed by treatment T₈ (14.16 t/ha) and treatment T₉ (12.84 t/ha) Ali *et al.* (2003) [11] and Mehraj *et al.* (2014) [12].

Table 2 Effect of organic manuring on yield related traits of strawberry

Treatment	Fruit Weight (gm)	Fruit Diameter (mm)	Fruit Length (mm)	Fruit Yield/ Plant (kg)	Fruit Yield /Plot (kg)	Fruit Yield t/ha
T ₀	9.90	24.67	24.57	0.13	0.58	3.48
T ₁	13.66	27.00	27.03	0.24	1.08	6.48
T ₂	13.03	26.50	25.57	0.20	0.90	5.40
T ₃	16.20	27.27	31.17	0.31	1.39	8.34
T ₄	17.50	28.10	33.43	0.37	1.67	10.02
T ₅	14.36	27.10	27.67	0.25	1.12	6.72
T ₆	15.89	27.13	29.40	0.30	1.35	8.10
T ₇	19.43	28.43	34.67	0.44	1.98	11.88
T ₈	22.03	35.47	41.13	0.57	2.36	14.16
T ₉	21.53	30.37	38.70	0.52	2.14	12.84
T ₁₀	18.56	28.33	33.80	0.39	1.80	10.80
T ₁₁	24.13	38.23	43.70	0.68	2.97	16.12
F - test	S	S	S	S	S	S
C.D. at 0.05%	1.21	1.34	1.51	0.04	0.18	1.05
S.Ed (±)	0.58	0.65	0.73	0.02	0.09	0.51

Economics parameters

The mean performance of the treatments for economics parameters like Cost of cultivation, gross return, net return and benefit cost ratio have been presented in **Table 3** showing significant differences among treatments. The moderate treatment cost of cultivation (₹ 510785) was recorded under treatment T₁₁. The maximum cost of cultivation (₹ 570560) was recorded under treatments T₂. The maximum gross return (₹ 2015000) was recorded under treatments T₁₁. The maximum net return (₹ 1504215) was recorded under treatments T₁₁. Maximum benefit cost ratio (3.94) was recorded under treatments T₁₁. However, better quantitative and qualitative fruits obtained from the cultivar during winter season may be attributed due to application of different organic manures. Similar results observed by Arancon *et al.* (2004) [13], Rubee *et al.* (2013) [14] and Singh *et al.* (2002) [15].

Table 3 Effect of organic manuring on economics related traits of strawberry

Treatment	Cost of cultivation	Gross return (Rs./ha)	Net return (Rs./ha)	Cost Benefit Ratio
T ₀	437960	435000	-2960	0.99
T ₁	497535	810000	312465	1.63
T ₂	570560	675000	104440	1.18
T ₃	563360	1042500	479140	1.85
T ₄	458210	1252500	794290	2.73
T ₅	503585	840000	336415	1.67
T ₆	471460	1012500	541040	2.15
T ₇	533485	1485000	951515	2.78
T ₈	526285	1770000	1243715	3.36
T ₉	509660	1608750	1099090	3.16
T ₁₀	473710	1350000	876290	2.85
T ₁₁	510785	2015000	1504215	3.94

Conclusion

On the basis of present investigation it is conducted that the treatment T₁₁ (Bone meal 25% + Neem manure 25% + FYM 25% + Vermi-compost 25%) was found to be the best treatment combination in terms of growth and flowering with higher yield and maximum cost benefit ratio *i.e.* (3.94)

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