



Effect of organic manures and biofertilizers on growth, yield and quality of strawberry (*Fragaria ananasa*)

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Abstract: The experiment consisting 12 treatment with 3 replication was conducted in field plot with Randomized Block Design. The growth parameter viz., Plant height, plant spread, number of leaf/plant and petiole length. Different organic manures and bio-fertilizer viz., FYM poultry manure, Sheep manure, Azotobacter, phosphobacter, vermicompost are taken for the better growth and yield of strawberry. It was calculate that T₂ Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹ is the best for plant height, plant spread, no. of leaf/plant and petiole length etc. and for maximum yield and more profit.

Key words. : Strawberry, Poultry Manure, Sheep Manure, FYM, Vermicompost, Azotobacter, and Phosphobacter

Introduction

Strawberry is one of the important temperate fruit of India but also being grown in sub-tropical and tropical climates. It can be grown up to 12,000 feet from sea level in humid and dry regions. Its successful cultivation requires an optimum day temperature of 22-23°C and night temperature of 7-13°C in India. It is excellent sources of natural antioxidants including carotenoids vitamins, phenols, flavonoids, dietary glutathionine endogenous metabolites and exhibit a high level of antioxidant capacity against free radical species Singh et al. (2008) and Ustad et al. (2005) Strawberry thrives best in temperate climate. It is a short day plant, which requires exposure to about 10 days of less than 8 hours sunshine for initiation of flowering. Strawberry is a profitable fruit crop in the shortest possible time as compared to the other fruits. The fruits are delicious and attractive, having pleasant aroma and a delicate flavour. It is also nutrition and beneficial to anemic patient, rich in Vitamin C. There is a tremendous presence on non-renewable energy resource to meet the ever-increasing demand of quality fruits. Hence, it has become imperative to turn to more eco-friendly method of nutrition management in horticultural crops of which biofertilizers stands with prime importance. Biofertilizer that can be used in horticultural crops are mycorrhizae fungi, nitrogen fixer and phosphate solubilizer, Azotobacter is nitrogen fixer, generally fix non symbiotically at least 10mg of atmospheric nitrogen/g. also due to its ability to synthesize auxin vitamins, growth substance and its capacity to produce anti-fungal antibiotics which improve plant stands in inoculated fields Kumari et al., (1975) and Singh, (1977). vsm fungi can supply phosphorus which affects floral differentiation and growth. Hormonal and nutritional conditions as a result of vsm fungal colonizations are also believed to contribute to a considerable extent for better growth and productivity Chavez and Ferrera, (1990).

Materials and Methods

The present investigation was undertaken in the department of horticulture, SHIATS during the year 2011-2012. The experiment was laid out in RBD design having nine treatment and three replications. The strawberry cv. sweet charley procured from Wimcos seedling company Ltd. Bagwala- Rudrapur, (U.S.N.) Uttranchal. To assess the impact of different treatments, various parameters were observed at regular 20 days interval. The organic manure and biofertilizers were applied in each plot according to the treatment

combination and incorporated thoroughly in the soil by ranking as basal dressing. Recommended amount of manures viz. FYM, vermicompost, poultry manures, sheep manures azotobacter, phosphobacter applied before transplanting as per the treatment and mixed thoroughly in the soil. The data on growth, yield and quality parameters were subjected to method of analysis of Variance (ANOVA) Fisher, (1936) where the 'F' test was significant for comparison of the treatment means, CD values were worked out at 5% probability level.

Result and Discussion

Plant height, plant spread, no. of leaf/plant and petiole length were significantly increased by different treatment of organic manures and bio-fertilizer at all successive stage of growth. Maximum plant height (25.67cm), plant spread 36.27), No. of leaf/ plant (26.67cm) and petiole length (10.33 cm) were recorded with T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (25.67cm) plant height followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (24.77cm) whereas, T₁ minimum plant height control (18.55cm). Similar results were obtained by Shanmuragan et al., (1981) and Desilva et al., (1986). This might be due to the fact that FYM + Azotobacter + Phosphobacter fungi acts as nutriliink to the plants increase hormonal and nutritional conditions and contribute to a considerable extent for better plant height. T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (36.27cm) plant spread is better followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (32.55cm) and T₁ minimum spread control (25.07cm). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (26.670cm) number of leaves per plant maximum followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (32.55cm) (24.77) and T₁ minimum leaves per plant control (17.77cm). These results are in close conformity with the findings of many research workers, Khanizadeh et al. (1995) and Ravi and Malhotra (1999).

The increase in plant spread may be due to the fact Azotobacter + Phosphobacter stimulates uptake of Zinc, Copper, Sulphur and Potassium by plant. In this connection similar findings were reported by Catska, (1994). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (10.33 cm) length of petiole (cm) and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (9.55.cm) and T₁ minimum length of petiole control (7.00cm). Similar findings were reported by Srisakaran and Lymyong

Table-1: Effect of different organic manure and biofertilizers on growth, development and yield of strawberry (*Fragaria annanassa*) Cv. Sweet Charley

Treatments	Plant height (cm)	Plant spread (cm)	No. of leaves / plant	Length of petiole (cm)	Days taken to first flowering	No. of flowers /plant	Fruit yield/ plant (g)	Fruit yield/ plot	Fruit yield plant (g)	T.S.S of fruit (^o Brix)	Acidity (%)	pH of fruit	Fruit yield (q ha ⁻¹)
T ₁	18.55	25.07	17.77	7.00	69.33	1.00	211.83	1.27	127.10	7.39	1.31	4.73	127.10
T ₂	25.67	36.27	26.67	10.33	46.67	2.42	738.64	4.43	443.18	7.87	0.78	4.10	443.18
T ₃	21.07	27.33	18.88	7.88	62.00	1.58	229.36	1.38	137.62	7.47	1.07	4.50	137.62
T ₄	24.77	32.55	24.77	9.55	48.33	2.25	708.16	4.25	424.90	7.71	0.82	4.17	424.90
T ₅	24.07	31.93	21.33	9.27	55.67	2.08	587.52	3.53	352.51	7.67	0.86	4.20	352.51
T ₆	23.44	30.52	20.88	9.00	56.00	1.92	310.16	1.86	186.10	7.63	0.89	4.23	186.10
T ₇	22.27	29.44	19.67	8.44	58.00	1.67	274.64	1.65	164.78	7.56	0.96	4.30	164.78
T ₈	21.88	28.77	19.33	8.33	59.67	1.67	239.44	1.44	143.66	7.53	0.98	4.33	143.66
T ₉	22.67	29.88	20.07	8.77	57.00	1.75	309.36	1.86	185.62	7.59	0.92	4.27	185.62
T ₁₀	20.44	26.77	18.55	7.55	64.00	1.50	228.40	1.37	137.04	7.44	1.17	4.53	137.04
T ₁₁	19.07	25.44	18.27	7.17	67.67	1.42	225.36	1.35	135.22	7.42	1.21	4.57	135.22
T ₁₂	21.44	28.44	19.17	8.07	61.33	1.58	238.16	1.43	142.90	7.49	1.02	4.43	142.90
F-test	S	S	S	S	S	S	S	S	S	S	S	S	S
S.Ed. (±)	0.21	0.16	0.13	0.12	0.46	0.25	2.09	0.01	1.26	0.02	0.02	0.04	1.26
C.D.(P=0.05)	0.44	0.33	0.28	0.25	0.95	0.51	4.34	0.03	2.60	0.04	0.03	0.08	2.60

Treatments: T₁ - Control; T₂ - Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25t ha⁻¹; T₃ - Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹; T₄ - Azotobacter 5 kg ha⁻¹ + Vermicompost (VC) 12 t ha⁻¹; T₅ - Phosphobacter 5 kg ha⁻¹ + Vermicompost 12 t ha⁻¹; T₆ - Azotobacter 5 kg ha⁻¹ + Poultry manure(PM) 12 t ha⁻¹; T₇ - Phosphobacter 5 kg ha⁻¹ + Poultry manure 12 t ha⁻¹; T₈ - Azotobacter 5 kg ha⁻¹ + Sheep manure(SM) 15 t ha⁻¹; T₉ - Phosphobacter 5 kg ha⁻¹ + Sheep manure 15 t ha⁻¹; T₁₀ - Azotobacter 5 kg ha⁻¹ + FYM 7 t ha⁻¹ + VC 6 t ha⁻¹; T₁₁ - Phosphobacter 5 kg ha⁻¹ + FYM 7 t ha⁻¹ + VC 5 t ha⁻¹ + PM 5 t ha⁻¹; T₁₂ - Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 5 t ha⁻¹ + VC 5 t ha⁻¹ + PM 5 t ha⁻¹ + SM 5 t ha⁻¹

(1995). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (2.42cm) number of flowers per plant and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (2.25cm) and T₁ minimum number of flowers /plant control (1.00) T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (738.64cm) and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (708.16cm) and T₁ minimum number of fruit /plant control (211.83). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (5.43cm) fruit yield/plot(kg) and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (4.25cm) and T₁ minimum control(1.27). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (443.18cm) and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (424.90cm) and T₁ minimum control(127.10). T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (7.87cm) followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (7.71cm) and T₁ minimum total soluble solid (775) 7.39. T₂ (Azotobacter 5 kg ha⁻¹ Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (0.78cm) and followed by T₄ Azotobacter (5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (0.82cm) and T₁ maximum acidity control (1.31) T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) (4.10cm) followed by T₄ Phosphobacter 5kg ha⁻¹ vermicompost (VC) 12t ha⁻¹ (4.20cm) T₁ maximum control (4.73). The results are closely related to the reports given by Chavez and Ferrera (1990). The results were in conformity with Srisakran and Lumyong (1995) and Jaen, Contreras et al., (1997). It is clear from findings that T₂ Azotobacter 5 kg ha⁻¹ + Phosphorus 5 kg ha⁻¹ + FYM 25 t ha⁻¹ vigorous growth plant spread, maximum number of leaves and number buds resulted in maximum number of fruits. Similar findings have been reported by Brandstveit (1979) in strawberry. Similar findings have been reported by Brandstveit 1979 and Saxena and locascio (1968) in strawberry.

In the present investigation, it is concluded that treatment combination of T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹) is the best treatment for growth, yield and

fruit quality of strawberry and the maximum cost benefit ratio (1:3.98) was observed in T₂ (Azotobacter 5 kg ha⁻¹ + Phosphobacter 5 kg ha⁻¹ + FYM 25 t ha⁻¹)

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