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Short Research Article

Effect of Organic Sources of Nutrients on Flowering Characters and Yield of Strawberry (*Fragaria ananassa* Duch) cv. Douglas

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Abstract

An experiment was carried out at Birsa agricultural university to evaluate the effect of different organic sources of nutrients on flowering characters and yield parameters of strawberry (*Fragaria ananassa* Duch) cv. Douglas during season i.e. October 2012 and April 2013 in Ranchi conditions under chhotanagpur plateau region of Jharkhand. The experiment comprised of thirteen treatments with organic manures, biofertlizers and their combinations along with the recommended dose of fertilizers the treatment were laid out in randomized block design with three replications each. The minimum number of days taken for first flowering (101.00 days), maximum Number of flowers (27.45), Length of flower stalk (13.95 cm), minimum number of days taken to fruit set (4.13 days) was recorded with treatment FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1}) +PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}). The same treatment also recorded maximum number of fruits $plant^{-1}$ (19.66), Yield $plant^{-1}$ (0.166 kg), Yield $plot^{-1}$ (6.00 kg), Yield ha^{-1} (66.66 q) was recorded with FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}). Treatments FYM (10 t ha^{-1})+vermicompost (4.25 t ha^{-1}), vermicompost (6.37 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}), RDF 100:60:60 NPK (kg ha^{-1}) were all statistically at par with FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) for most of the flowering, yield and yield attributing characters and hence, can also be tried for obtaining higher yield of fruits in strawberry.

1. Introduction

Strawberry belongs to the family *Rosaceace*. The modern cultivated Strawberry originated in France. It can be grown under temperate, sub tropical climate even at high altitudes of tropical climate. The taste of fruits mainly depends on three compound viz. Sugar, acid and aromatic compounds. The fruit of strawberry is complete fruit with 98% edible portion. The edible portion is succulent thalamus of the flower. Strawberry being a surface feeder requires optimum moisture and temperature condition of upper layer of the soil. The important cultivars adapt very easily in pulverized soils. Water should not stagnate in the field. Since most of its roots are found in the top 15−30 cm layer of soils, this layer should be kept porous and rich in humus. In light soils, frequent irrigation is required for proper establishment of the runners and to maintain good berry size and fruit quality. It prefers slight acidic soils with a pH of 5.7−6.5. Flowering in strawberry is strongly influenced by photo-period, temperature and interaction of both. In subtropical region, flowering occurs in short light period of (10 hr) and with long dark period (14 hr). An optimum growing temperature of 15 °C has been reported for most of the strawberry cultivars and species, though it grows well at a temperature range between 20 °C and 26 °C. In recent years the use of chemical fertilizers has increased many folds to derive higher yield but its hazardous effect on soil and human health cannot be ruled out. There is a demanding need to find out alternative sources of nutrients in term of its economy, non-hazardous and eco-friendly nature. Therefore, there is a need to go for the use of organic sources of nutrients which are cheaper and eco-friendly. Phosphate solubilising bacteria have the ability to solubilize organic phosphate compounds present in the organic manures and soils. *Azotobacter* inoculation saves addition of nitrogenous fertilizers by 10–20%. The present investigation was under taken to study the effect of organic sources of nutrients on flowering characters and yield of strawberry.

2. Materials and Methods

The present investigation was conducted in the Department

of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India during the year 2012 in winter season. It is situated in the Chhotanagpur plateau region of Jharkhand. The experiment was laid out in a Randomized Block Design (RBD) with thirteen treatments, each replicated three times, keeping thirty six plants plots^{-1} in a Plot size 3×3 m^2 as a unit treatment^{-1}. Treatments were T_1 – FYM (20 t ha^{-1}); T_2 –Vermicompost (8.5 t ha^{-1}); T_3 –Karanj cake (2.5 t ha^{-1}); T_4 – Mustard cake (2 t ha^{-1}); T_5 – FYM (10 t ha^{-1})+Vermicompost (4.25 t ha^{-1}); T_6 – FYM (15 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}); T_7 –Vermicompost (6.37 t ha^{-1})+PSB (5 kg ha^{-1})+ *Azotobacter* (5 kg ha^{-1}); T_8 –Karanj cake (1.87 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}); T_9 –Mustard cake (1.5 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}); T_{10} –FYM (7.5t ha^{-1})+Vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}); T_{11} –RDF-100:60:60 N: P: K kg ha^{-1}; T_{12} –50% RDF; T_{13} –Control. The organic nutrients were applied fifteen days in advance to facilitate their easy decomposition and early availability to the crop.

3. Results and Discussion

Data presented in Table 1 revealed that all the parameters of flowering characters and fruit yield were significantly influenced by the application of organic sources of nutrients. Regarding number of days to first flowering, T_{10}- FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) recorded the minimum days to first flowering (101.00 days).This might be due to adequate amount of nitrogen present in plants with satisfactory carbohydrate content leading to early flowering as was reported by Kadlad et al. (2010); Nowsheen et al. (2006).

The maximum flowers were obtained in T_{10}-FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) i.e. 27.45 while, T_5-FYM (10 t ha^{-1})+vermicompost (4.25 t ha^{-1}), T_7-Vermicompost (6.37 t ha^{-1})+PSB (5 kg ha^{-1}) +*Azotobacter* (5 kg ha^{-1}), T_{11}-RDF-100:60:60 NPK (kg ha^{-1}), and T_9-Mustard cake (1.5 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) were at par with T_{10}. Increase in carbohydrate content with the application of organic nutrients and biofertilizers inoculation may be because of their influence on enzyme reaction, formation of metabolites for carbohydrates and proteins and also utilization of sugar and starch. Plant growth regulators like auxin, cytokinin released by biofertilizers promote flowering. Ali et al. (2003); Sahoo and Singh (2005) also obtained similar results in strawberry.

Length of flower stalk was maximum (13.95 cm) in T_{10}-FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) followed by T_5-FYM (10 t ha^{-1}) +vermicompost (4.25 t ha^{-1}), T_7-vermicompost (6.37 t ha^{-1}) +PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}), T_{11}-RDF-100:60:60 NPK (kg ha^{-1}). The length of flower stalk was longer because nitrogen fixation bacteria also produces growth promoting

Table 1: Effect of organic sources of nutrients on flowering characters and yield

Sl. No.	No. of days to first flowering	No. of flowers plant^{-1}	Length of flower stalk (cm)	No. of days taken to first fruit set	No. of fruits plant^{-1}	Yield plant^{-1} (kg)	Yield plot^{-1} (kg)	Yield ha^{-1} (q)
T_1	103.04	23.73	10.93	4.30	14.33	0.116	4.17	46.40
T_2	105.81	24.48	11.80	4.53	15.00	0.135	4.87	54.13
T_3	109.46	24.06	9.13	5.79	13.66	0.093	3.35	37.28
T_4	102.75	23.80	11.06	4.56	14.66	0.096	3.45	38.39
T_5	101.13	26.26	13.10	4.23	17.66	0.152	5.49	61.06
T_6	102.33	24.36	10.90	4.46	16.33	0.138	4.99	55.51
T_7	105.72	26.06	12.50	4.26	17.33	0.146	5.25	58.80
T_8	109.11	23.32	9.26	5.68	16.00	0.112	4.05	45.06
T_9	106.53	25.36	11.06	4.73	16.66	0.139	4.80	53.33
T_{10}	101.00	27.45	13.95	4.13	19.66	0.166	6.00	66.66
T_{11}	103.40	25.40	12.73	4.36	17.00	0.147	5.31	59.09
T_{12}	109.73	25.02	11.46	5.60	12.33	0.087	3.15	35.01
T_{13}	111.00	21.00	7.53	5.80	6.33	0.039	1.41	15.67
SEm±	1.96	0.80	0.92	0.17	1.06	0.01	0.41	4.52
CD (p=0.05)	3.22	2.32	2.66	0.52	3.08	0.03	1.20	13.18
CV %	5.73	5.65	14.04	6.36	12.06	16.40	16.31	16.23

substances like IAA and GA_3 which go a long way in enhancing the flower stalk length. Days taken to fruit set and fruit was minimum (4.13 days) in the plants under T_{10}-FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}). This may be due to the fact that plant growth regulators like IAA, GA_3 and cytokinin are released by biofertilizers in plants and this might have helped in fruit set in strawberry.

The maximum number of fruits $plant^{-1}$ were observed under T_{10}-FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) application. The increase in number of fruits may be due to the fact that organic nutrients are involved in metabolic processes of plant that enhance vegetative growth. Hence, Carbohydrate accumulation due to increased photosynthesis produced more number of flowers and fruits. Similar results were obtained by Sahoo and Singh (2005) in strawberry and Gautam et al. (2012) in mango.

The highest fruit yield $plot^{-1}$ and yield ha^{-1} i.e. 6.00 kg and 66.66 q, respectively was recorded in the plants under T_{10}-FYM (7.5 t ha^{-1})+vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) and treatments T_5- FYM (10 t ha^{-1})+vermicompost (4.25 t ha^{-1}), T_{11}-RDF 100:60:60 NPK (kg ha^{-1}), T_7-vermicompost (6.37 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}), T_6-Karanj cake (1.87 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}), T_2-vermicompost (8.5 t ha^{-1}) and T_9-Mustard cake (1.5 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) were at par with T_{10} but significantly superior over T_{13}-(control), which recorded minimum yield $plot^{-1}$ (1.41 kg) and yield ha^{-1} (15.67 q). The higher yield may be due to increased flowering, more fruit set, higher fruit weight, size and volume of fruits. These results are in consonance with the work of other workers like Sahoo and Singh, (2005); Dutta et al. (2010); Yadav et al. (2010) who obtained similar result.

4. Conclusion

In order to get higher economical yield in strawberry cv.Douglas, FYM (7.5t ha^{-1})+Vermicompost (3.18 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) proved to be most effective treatment. Other treatments like FYM (10 t ha^{-1})+vermicompost (4.25 t ha^{-1}), vermicompost (6.37 t ha^{-1})+PSB (5 kg ha^{-1})+*Azotobacter* (5 kg ha^{-1}) and RDF-100:60:60 N:P:K kg ha^{-1} were also equally effective and may be tried for getting higher yield of fruits in strawberry.

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