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Effect of organic and inorganic fertilizer on vegetative growth, fruit yield and quality of strawberry (*fragaria* x *ananassa* Duch.)

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Abstract: A field experiment was carried in randomized block design with 15 treatments in three replications on different levels of biogen, floragen, vermicompost and RDF. The results revealed that maximum plant height (24.87cm), number of leaves (13.47), plant spread (33.15cm^2) and petiole length (14.73cm), were recorded in T_{10}(50% RDF + 50% Vermicompost + Biogen + Floragen). Vermicompost were applied at rates of 5 or 10 t ha1 supplemented with inorganic fertilizers to balance fertilizer recommendations for strawberries of 85-155-125 kg NPK ha1.

Key words: Strawberry, Biogen, Floragen, Vermicompost, NPK, Growth, Yield and Quality

Introduction

The modern cultivated strawberry (*Fragaria* × *ananassa* Duch.) is one of the most delicious, refreshing and nutritious among soft fruit of the world. They belong to the botanical family rosaceae with a basic chromosome number of X=7. It also makes excellent ice cream and Jam on account of its rich aroma. At present, chemical fertilizers are not only in short supply but are expensive too. Hence, there is need of alternate source of safe fertilizers which may enhance crop yields without having adverse effects on soil properties. Organic manures like vermicompost applied to improve the soil physical properties, pH, water holding capacity and recommended dose of fertilizers (RDF) as important fertilizer to the soil increases the nutrient availability and its ultimate absorption by plant. Biofertilizers like *Biogen and Floragen* are a good source of fertilizer. Biogen helps the root zone from unwanted gases suffocation, helps the roots healthy and fresh, provides a long term oxygen reservoir, releasing oxygen slowly, adjust pH (Soil and water) value and prevent ammonium damage, enhances microbial metabolism to remediate pollutants.

Floragen is a new fertilizer in fruit and flower physiology. The action path of flowers & fruit formation in the shoot vegetative growth floragen alters metabolism. Translocation of flower, stimulus to shoot & transform action of vegetative shoot apex to reproductive shoot & apex. Initiation of flower primordial development of bud, flower and fruit. The presence of plant growth-influencing substances, such as plant growth hormones and humic acids in vermicompost has also been suggested as a possible factor contributing to increased plant growth and yields (Arancon *et al*., 2013). An experiment on strawberry cv. Festival Naya and Kamsomolka with the application of N P_2O_5 and K_2O at 100:60:80 kg/ha along with vermicompost at 5 t/ha. The addition of N increased fruit weight by 12-31% and fruit sugar was constant but decreased total of N increased acidity. Different type of Nitrogenous fertilizers did not differ in their effect on fruit chemical composition (Panova *et al.,* 1979). The organic manures and bio-fertilizers help in better utilization of added inorganic fertilizers thus reduce its quantity of application as well as reduce the ill effect of harsh chemical residues that the inorganic fertilizers leave in the soil. Leaf areas, numbers of available suckers, numbers of flowers, shoot weights, and marketable fruit yields of strawberries all increased significantly in response to supplemented vermicompost applications compared to those from strawberries that received inorganic fertilizers only in other experiments, amounts of soil nitrogen increased significantly after incorporating vermicompost into soils (Nethra *et al.,* 1999). The integrated use of nutrient significantly influenced the fruit yield. the maximum fruit yield with T_{10} **-**50% recommended dose of NPK + 50% Vermicompost + Biogen + Floragen due to number of flower bud, maximum number of flower bud, maximum number of fruit per plant at different interval of picking. These findings are supported by Venkatesh *et al.* (1999); Kumari *et al.* (1999); Pandey and Mishra (1983). Integrated nutrient management plays an important role in improving crop yield and quality. Organic manures like vermicompost helps in escaping from the harmful effects of chemical fertilizers and supply microfertilizer as well as organic matter. Organic manures improve the physical, chemical and biological conditions of the soil.

In present time the harmful effects of chemical fertilizers is a major problem. So the Integrated nutrient management is best way to obtain quantity and quality yield in strawberry

Materials and Methods

The present investigation "strawberry (*Fragaria* x *ananassa* Duch.)," cv. sweet charley was conducted during the winter season of the year, 2013-14.The experiment was carried out at the Fruit Research Farm, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Science and Technology, Allahabad (U.P.). The experimental site is situated at latitude of 20° and 15° north and longitude of 60 ° 33" East and at an altitude of 98 meters above sea level.

Method of fertilizers applications: Vermicompost were broadcasted as soil application in specified plots before one month of transplanting. Biofertilizers Biogen applied in soil treatment on the before planting and basal dressing of Nitrogen 1/2 part of recommended doses + full dose of P_2O_{5+} K_2O, and floragen applied foliar application at the time of 45 DAT, at 50% flowering and at the time of fruit development.

Details of layout

Design of experiment	: RBD
No. of treatments	: 15
No. of replication	: 3
Spacing	: 45×30cm.
Total no. of plots	: 45
Size of each plot	: 2 m^2 (1.0X1.0 m)
Width of main irrigation channel	: 1.0 m
Width of sub irrigation channel	: 0.5 m
Width of bunds	: 0.3 m
Total length of experimental plot	: 19.8 m^2
Total Width of experimental plot	: 4.0 m^2
Net cultivated area	: 45 m^2
Gross cultivated	: 79.2 m^2
Total number of plant per plot	: 6
Total number of plant in the experimental field	: 270

Results and Discussion

The maximum plant height and spread increased with application of Biogen, Floragen, vermicompost and NPK at all successive stage of growth. The treatment combination T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) showed the maximum plant height (24.87cm) and plant spread (33.15cm). Minimum plant height (15.07cm) and plant spread (21.08 cm) was observed with T_0 (control). Maximum number of leaves(13.87cm), number of flowers (19.27) per plant and petiole length (14.73 cm) recorded with the treatment combination T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) respectively and minimum number of leaves (9.27 cm) number of flowers (8.67) and petiole length (10.06 cm) per plant was noticed in T_0 (control). The number of fruit per plant was observed in T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen), had (15.07) maximum number of fruits per plant whereas minimum

Table-1: Treatment combination

Treatments	Particulars
T_0	Control
T_1	Recommended dose of fertilizer (RDF)
T_2	25%RDF+ 75% Vermicompost
T_3	50% RDF + 50% Vermicompost
T_4	75% RDF + 25% Vermicompost
T_5	Recommended dose of fertilizer (RDF) + Biogen
T_6	Recommended dose of fertilizer (RDF) + Biogen + Floragen
T_7	25%RDF+ 75% Vermicompost + Biogen
T_8	25%RDF+ 75% Vermicompost + Biogen + floragen
T_9	50% RDF + 50% Vermicompost + Biogen
T_{10}	50% RDF + 50% Vermicompost + Biogen + floragen
T_{11}	Biogen
T_{12}	Biogen + floragen
T_{13}	Vermicompost
T_{14}	Floragen

Table-2: Effect of organic and inorganic fertilizer on Strawberry (*Fragaria* x *annanasa* Duch.) cv. Sweet Charley at 120 DAT

Treatment No.	Treatment	Plant height (cm)	Number of leaves per plant	Plant spread (cm)	Petiole length (cm)
T_0	Control	15.07	9.27	21.84	10.06
T_1	100% RDN (NPK 150: 75: 100 kg ha^{-1})	22.40	10.93	27.47	13.63
T_2	25% RDN + 75% Vermicompost	23.20	11.80	28.01	13.94
T_3	50% RDN + 50% Vermicompost	23.63	12.13	28.57	14.10
T_4	75% RDN + 25% Vermicompost	23.53	11.93	28.13	14.03
T_5	100% RDN + Biogen	23.13	11.67	27.89	13.89
T_6	100% RDN + Biogen + Floragen	23.73	12.33	28.87	14.18
T_7	25% RDN + 75% Vermicompost + Biogen	23.93	12.47	29.13	14.27
T_8	25% RDN + 75% Vermicompost + Biogen + Floragen	24.27	13.13	29.85	14.55
T_9	50% RDN + 50% Vermicompost + Biogen	24.07	12.67	29.45	14.39
T_{10}	50% RDN + 50% Vermicompost + Biogen + Floragen	**24.87**	**13.47**	**33.15**	**14.73**
T_{11}	Biogen	22.00	10.67	27.17	13.47
T_{12}	Biogen + Floragen	23.00	11.53	27.79	13.83
T_{13}	Vermicompost (VC) 10 t ha^{-1}	22.67	11.20	27.61	13.75
T_{14}	Floragen	21.93	10.47	26.84	13.33
	F- test	S	S	S	S
	S. Ed. (±)	0.05	0.05	0.06	0.03
	C. D. (P = 0.05)	0.10	0.11	0.12	0.07

Table-3: Effect of organic and inorganic fertilizer on Strawberry (*Fragaria* x *annanasa* Duch.) cv. Sweet Charley

Treatment No.	No. of flowers/ plant	No. of fruits/ plant	Fruit set (%)	Fruit yield/ plant (g)	Fruit yield (t ha^{-1})	Wt. of fruit (g)	Length diameter ratio of fruit	Specific gravity	TSS	Total sugar (%)	pH	acidity (%)	Ascorbic acid (mg/ 100g)	Benefit cost ratio
T_0	8.67	5.87	67.69	55.57	3.33	9.47	1.25	1.26	4.80	3.93	4.64	0.86	43.07	0.83
T_1	14.67	11.47	78.19	156.69	9.40	13.67	1.39	1.59	6.63	5.73	4.16	0.75	54.40	2.31
T_2	16.20	12.73	78.60	195.25	11.72	15.33	1.47	1.68	6.88	6.53	3.62	0.69	55.53	2.86
T_3	17.33	13.47	77.74	217.27	13.04	16.13	1.49	1.71	6.96	6.87	3.57	0.66	56.53	3.19
T_4	16.60	13.07	78.71	204.71	12.28	15.67	1.48	1.70	6.90	6.67	3.60	0.67	56.07	3.01
T_5	15.87	12.40	78.15	184.36	11.06	14.87	1.46	1.65	6.79	6.33	3.65	0.71	55.27	2.71
T_6	17.60	13.67	77.65	225.05	13.50	16.47	1.52	1.73	7.07	7.13	3.55	0.65	56.73	3.28
T_7	17.87	13.80	77.23	232.79	13.97	16.87	1.55	1.76	7.13	7.33	3.50	0.64	57.13	3.40
T_8	18.40	14.33	77.90	250.37	15.02	17.47	1.59	1.81	7.26	7.70	3.46	0.62	58.13	3.62
T_9	18.13	14.07	77.57	240.08	14.40	17.07	1.57	1.77	7.18	7.53	3.48	0.64	57.53	3.51
T_{10}	19.27	15.07	78.20	270.23	16.21	17.93	1.63	1.86	7.33	7.93	3.43	0.60	60.67	3.92
T_{11}	14.07	10.93	77.73	145.79	8.75	13.33	1.38	1.58	6.57	5.63	4.23	0.78	54.33	2.18
T_{12}	15.60	12.13	77.77	176.36	10.58	14.53	1.44	1.63	6.73	6.13	3.68	0.73	54.67	2.61
T_{13}	15.27	11.87	77.72	170.11	10.21	14.33	1.42	1.61	6.68	5.87	3.70	0.74	54.53	2.48
T_{14}	13.40	10.47	78.10	131.21	7.87	12.53	1.37	1.57	6.46	5.50	4.33	0.80	54.20	1.95
F- test	S	S	S	S	S	S	S	S	S	S	S	S	S	-
S.Ed.(±)	0.13	0.11	1.08	2.70	0.16	0.14	0.01	0.01	0.03	0.05	0.01	0.01	0.06	-
C.D. (P = 0.05)	0.26	0.23	2.21	5.52	0.33	0.30	0.01	0.01	0.05	0.11	0.03	0.01	0.12	-

number of fruits per plant (5.68) was in control (Arancon et al., 2004, 2013). The maximum yield of fruit/plant was recorded in T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen), with (270.23g/plant) and fruit set% (78.20), minimum yield of fruit/plant (55.57g/plant) and fruit set% (67.69 %) was recorded in T_0 (control). As for as the maximum fruit weight is concerned T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) proved most effective. Maximum fruit weight (17.93g) recorded and minimum fruit weight (9.47g) was noticed with control. The maximum specific gravity and Length-diameter ratio of fruit was recorded with T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) (1.86) (1.63), and the minimum was recorded in T_0 control with (1.26) (1.25). As far as the quality of fruit is concerned T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) was most effective (Usha et al., 1999; Pandey et al., 1983). Maximum T.S.S (7.33) and juice content (94.47%) was recorded in fruits of plants receiving. Whereas minimum T.S.S (4.87) and juice content (79.67 %) was noticed with control. Acidity and pH of juice minimum acidity (0.60 %) and pH (3.43) were recorded in plants receiving 50% RDN + 50% Vermicompost + Biogen + Floragen. Whereas maximum acidity (0.86 %) and pH (4.64) was found in (control). Total Sugar % of the fruit is concerned T_{10} (50% RDN + 50% Vermicompost + Biogen + Floragen) most effective (Venkatesh et al., 1999; Panova et al., 1979; Nethra et al., 1999). Maximum sugar % (7.93) and minimum (3.93) was noticed with control. Ascorbic acid content (60.67mg/100gm) was maximum in 50% RDN + 50% Vermicompost + Biogen + Floragen. Whereas minimum ascorbic acid content (43.07mg/100gm) was recorded in control.

From the experimental findings, it is concluded that application of 50% RDN + 50% Vermicompost + Biogen + Floragen was significantly superior in respect of growth, highest yield, quality and attributing characters, sugar and ascorbic acid of fruit juice, highest profits, from Strawberry cultivation.

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