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Studies on the effect of bio-regulator and fermented cow dung on growth, flowering and fruit setting of different cultivars of Strawberry (*Fragaria × ananassa* Duch.)

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Abstract

Strawberry (*Fragaria × ananassa* Duch.) belongs to the family Rosaceae. The present investigation was carried out at the Horticulture Research Center, of the Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut during 2016-2017. Three varieties of strawberry namely Chandler, Selva and Confictura were planted at spacing of 50x30cm in a plot size 1.5x2.0m during October, 2016. Maximum plant height and leaves per plant were recorded in the variety Confictura which was followed by Selva. The variability among the varieties were due to genetic makeup of the different varieties. The maximum leaf area (107.2cm²) was recorded in the variety Selva which was followed by Confictura. The minimum leaf area (103.59 cm²) was recorded in variety Chandler. The maximum days for flower initiation (56.51 days) was recorded in the variety Confictura which was followed by Chandler. The minimum days (52.62 days) was recorded in variety Selva. The maximum days (67.05) was recorded in the variety Chandler which was followed by Confictura. The minimum days (62.55) was recorded in variety Selva. A minute observation recorded among the treatments evince that the application of Gibberellic acid (GA₃) 75ppm + fermented cow dung@10% was found to be the best treatment in response to peak flowering among different varieties of strawberry. The minimum fruit setting period (4.80 days) were recorded in the variety Selva and Confictura both with the application of Gibberellic acid (GA₃) 75ppm + fermented cow dung@10% while the maximum (11.0 days) was recorded in the variety Chandler with the application of Gibberellic acid (GA₃) 25ppm + fermented cow dung@10%. So, Selva and Confictura were found to be the earliest variety in the response of fruit setting. The variability among the varieties were due to their genetic makeup.

Keywords: bio-regulator, fermented cow, *Fragaria × ananassa*

Introduction

Strawberry is one of the important fruit in the world. It has become favourite fruit crop among the Indian growers near towns and cities, because of its remunerative prices and higher profitability, which has resulted a phenomenal increase in its area and production in the recent years; (Sharma *et al.*, 2006). The plant is a surface feeder therefore fertility, moisture, drainage and microbial status of the upper layer of soil have great impact on growth, development, fruit yield, quality and production of runners. Modern day intensive crop cultivation results the huge application of chemical fertilizers which are not only in short supply but also expensive and pollute the environment, soil and water too. Therefore, the current emphasis is being given to explore the possibilities of supplementing the organic manure with hormonal treatment.

Methods and materials

The uniform healthy runners of strawberry cultivar as Chandler, Selva and Confictura were selected and single uniform runner was planted in each raised bed plots of 1.5x2.0 m² size at the spacing of 50x 30cm apart on 10.10.2016. Out of them 5 plants were randomly selected for recording the data. A light irrigation was done just after planting for proper establishment of the plant. After establishment of runners uniform cultural operations were performed regularly in each plot to maintain the plants in proper health.

Gibberelic acid 25, 50 and 75 ppm combined with fermented Cow dung 1, 5 and 10 % solution were sprayed after one month of planting and repeated thrice at 15 days interval according to treatments. The control measure for insect pest and disease were also taken from time to time.

Result and discussion

Plant height

The maximum plant height (28.07 cm) was recorded in the variety Confictura which was followed by Selva. The minimum plant height (25.18 cm) was recorded in variety Chandler which was statistically inferior to other varieties.

Table 1: Plant height, Leaves per plant, and different cultivars of Strawberry.

Treatments	Plant height (cm)				Leaves per plant				Leaf area (cm ²)			
	Chandler	Selva	Confictura	Pooled	Chandler	Selva	Confictura	Pooled	Chandler	Selva	Confictura	Pooled
Control	19.66	19.5	20.67	19.94	13.6	15.98	16.9	15.49	92.2	99.4	97.0	96.2
GA ₃ 25 ppm +1% fermented Cow dung	22.22	24.87	25.67	24.25	19.33	21.00	22.00	20.77	99.3	104.1	103.2	102.2
GA ₃ 25 ppm +5% fermented Cow dung	24.23	26.56	27.34	26.04	21.37	23.00	24.44	22.93	102.0	104.3	104.7	103.67
GA ₃ 25 ppm +10% fermented Cow dung	26.3	28.33	29.34	27.99	23.11	25.00	26.00	24.70	103.0	106.2	106.0	114.06
GA ₃ 50 ppm +1% fermented Cow dung	23.12	25.22	26.12	24.82	22.11	22.00	23.00	22.37	104.0	106.5	105.4	105.3
GA ₃ 50 ppm +5% fermented Cow dung	25.23	27.34	28.5	26.99	24.17	24.00	25.00	24.39	105.7	107.5	107.0	106.73
GA ₃ 50 ppm +10% fermented Cow dung	27.34	29.31	30.45	29.03	26.89	26.00	27.44	26.77	106.7	109.1	108.3	108.03
GA ₃ 75 ppm +1% fermented Cow dung	25.67	26.88	28.88	27.14	24.00	25.00	28.00	25.67	106.0	110.6	108.0	108.2
GA ₃ 75 ppm +5% fermented Cow dung	28.00	30.00	31.33	29.77	28.00	27.33	30.00	28.44	108.0	111.2	110.1	109.76
GA ₃ 75 ppm +10% fermented Cow dung	30.00	31.11	32.45	31.18	30.00	30.5	32.00	30.83	109.2	113.1	112.2	111.5
Gen. Mean	25.18	26.91	28.079	26.71	23.25	23.97	25.478	24.23	103.5	107.2	106.17	106.56
C.D. at 5% for variety	1.50				1.306				1.12			
C.D. at 5% for treatment	N/A				N/A				N/A			
C.D. at 5% for variety x treatment	2.60				2.262				1.95			

Leaves per plant: Maximum leaves per plant (25.47) were recorded in the variety Confictura which was followed by Selva. The minimum leaves (23.25) was recorded in variety Chandler. The increase in plant height and number of leaves might be due to fact that the fermented cow dung has the higher water holding capacity and make available almost all the essential elements to the plant for their better growth and development. Fermented cow dung contains more organic matter than other substrates and provide sufficient nutrient supply to plant which resulted in increased vegetative growth. The present findings are in conformity with the findings of Dwivedi and Negi (2001) [6].

Statistically significant response to plant height of different treatments of strawberry was recorded the highest as 28.07 cm and was followed by the treatments Gibberellic acid (GA₃) 75 ppm + Fermented cow dung @10% and Gibberellic acid (GA₃) 75 ppm + Fermented cow. The increase in plant height and leaf number during the present investigations with 75

ppm GA₃ application may be due to increase in cell elongation and corresponding increase in stem length. The increase in the cell elongation with GA₃ application might be due to increased synthesis of auxin in the strawberry plant system (Kaur and Singh, 2009 and Dwivedi, 2001) [7, 6].

Leaf area: The maximum leaf area (107.2 cm²) was recorded in the variety Selva which was followed by Confictura. The minimum leaf area (103.59 cm²) was recorded in variety Chandler. A minute observation recorded among the treatments evince that the application of Gibberellic acid (GA₃) 25 ppm + fermented cow dung 10% was found to be the best treatment in response to leaf area among different varieties of strawberry and recorded 114.06 cm² as per pooled and it was followed by the treatment Gibberellic acid (GA₃) 75 ppm + fermented cow dung 10% and Gibberellic acid (GA₃) 75 ppm + fermented cow dung 5%. (Bhandari, M. and Roy, S. K. 2014) [3].

Table 2: Flower initiation, time of peak flowering and time of fruit setting of different cultivars of strawberry.

Treatments	Time of flower initiation				Time of peak flowering				Time of fruit setting			
	Chandler	Selva	Confictura	Pooled	Chandler	Selva	Confictura	Pooled	Chandler	Selva	Confictura	Pooled
Control	50.0	48.5	53.5	50.67	62.5	58.5	60.0	60.33	7.0	6.0	7.0	6.67
GA ₃ 25 ppm +1% fermented Cow dung	52.0	50.75	55.0	52.58	64.0	60.0	62.5	62.16	9.0	8.0	9.0	8.67
GA ₃ 25 ppm +5% fermented Cow dung	53.0	53.0	56.0	54.0	66.0	61.5	63.0	63.5	10.0	9.0	10.0	9.67
GA ₃ 25 ppm +10% fermented Cow dung	53.0	50.0	54.1	52.36	64.0	61.0	64.0	63.0	11.0	10.0	10.5	10.5
GA ₃ 50 ppm +1% fermented Cow dung	54.0	52.5	55.0	53.83	66.5	62.0	65.3	64.6	9.5	8.6	8.5	8.86
GA ₃ 50 ppm +5% fermented Cow dung	55.5	54.0	57.0	55.5	68.0	63.5	66.4	65.96	8.5	7.5	7.4	7.8
GA ₃ 50 ppm +10% fermented Cow dung	55.0	53.0	55.0	54.33	67.5	62.0	65.5	65.0	8.0	6.0	7.0	7.0
GA ₃ 75 ppm +1% fermented Cow dung	56.5	54.0	57.0	55.83	68.0	63.0	66.0	65.67	7.5	5.6	6.6	6.56
GA ₃ 75 ppm +5% fermented Cow dung	57.5	55.0	59.5	57.33	69.0	64.0	67.0	66.67	6.5	5.2	5.0	5.56
GA ₃ 75 ppm +10% fermented Cow dung	58.8	56.0	60.0	58.26	75.0	70.0	68.0	71.0	6.0	4.8	4.8	5.2
Gen. Mean	54.53	52.67	56.51	54.46	67.05	62.55	64.77	64.78	8.30	7.07	7.58	7.64
C.D. at 5% for variety	2.98				3.32				0.44			
C.D. at 5% for treatment	N/A				N/A				N/A			
C.D. at 5% for variety x treatment	N/A				N/A				0.77			

Time of flower initiation: The maximum days (56.51) was recorded in the variety Confictura which was followed by Chandler. The minimum days (52.62) was recorded in variety Selva. A minute observation recorded among the treatments evince that the application of Gibberellic acid (GA₃) 75 ppm + fermented cow dung 10% was found to be the best treatment in response to first flowering day among different varieties of

strawberry and recorded 58.26 days as per pooled and it was followed by the treatment Gibberellic acid (GA₃) 75 ppm + fermented cow dung 5% and Gibberellic acid (GA₃) 75 ppm + fermented cow dung @1%. Further a minute observation showed that the variety Confictura has maximum days i.e. 60.0 with the spray of Gibberellic acid (GA₃) 75 ppm and application of fermented cow dung 10%. The earliest

flowering was recorded in the cultivar Selva under study. (Asadi *et. al.* 2013)

Peak flowering (days) of strawberry: The maximum days (67.05) was recorded in the variety Chandler which was followed by Confictura. The minimum days (62.55) was recorded in variety Selva. A minute observation recorded among the treatments evince that the application of Gibberellic acid (GA₃) 75ppm + fermented cow dung@10% was found to be the best treatment in response to peak flowering among different varieties of strawberry and recorded 75.0 days and was followed by the treatments Gibberellic acid (GA₃) 75ppm + fermented cow dung5% and Gibberellic acid (GA₃) 75ppm + Fermented cow dung1%.

Time of fruit setting: The maximum fruit setting period (8.30 days) was recorded in the variety Chandler which was followed by Confictura. The minimum time (7.07days) taken by Selva variety. So, it was found to be the earliest variety in the response of fruit setting. A minute observation recorded among the treatments evince that the application of Gibberellic acid (GA₃) 75ppm + fermented cow dung10% was found to be the best treatment in response to time of fruit setting among different varieties of strawberry and recorded 5.2 days as per pooled and it was followed by the treatment Gibberellic acid (GA₃) 75ppm + fermented cow dung5% and Gibberellic acid (GA₃) 75ppm + fermented cow dung1%. The maximum fruit setting period was taken under GA₃ 25 PPM +10% fermented Cow dung treatment among all the varieties. Further an observation showed that the variety Confictura and Selva responded hastening effect on fruit setting same period of fruit setting i.e. 4.8 days with the spray of Gibberellic acid (GA₃) 75ppm and application of fermented cow dung10% and was followed by Chandler. The maximum time was taken for fruit setting by Chandler variety within the same treatment. (Asadi *et. al.* 2013)

Conclusion

For selection and improvement in yield, emphasis may be given to the characters like plant height, leaves per plant, leaf area, time of flowering initiation, peak flowering day and time of fruit setting. So, Selva and Confictura were found promising for commercial cultivation.

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