International Journal of Agricultural Sciences
Volume **10** | Issue 1| January, 2014 | 272-275

RESEARCH PAPER

Influence of gibberellic acid and blossom removal on flowering and yield of strawberry (*Fragaria* x *ananassa* Duch.) cv. Belrubi

RAKESH KUMAR*, S. SARAVANAN[1], AMIT JASROTIA, PARSHANT BAKSHI[2], RAFIQ SHAH AND VISHAL RAINA

Regional Horticulture Research Sub-Station (SKUAST-J), Gwari, Bhaderwah, JAMMU (J&K) INDIA

(Email : rakesh_sangwal@yahoo.com)

Abstract : A study was carried out to investigate the effect of gibberellic acid (GA_3) and blossom removal on flowering and yield characteristics of strawberry cv. Belrubi under subtropical region. Various parameters were monitored with the application of three concentrations of GA_3 50 ppm, 100 ppm and 150 ppm and three levels of blossom removal *viz*., without deblossoming, partial deblossoming and full blossoming. Results showed that the GA_3 150 ppm treated plants took minimum days to initiate flowering (54.22/ 53.55) and bud formation (60.77/60.08), meanwhile highest number of flowers per plant (23.64/22.56), fruit yield per plant (288.74/ 269.89g) and (17.67/ 16.50 q/ha) were registered with 50ppm GA_3 both the years experimentation. From this study, it can be concluded that 50 ppm GA_3 treated plants showed improved the flowering and fruit yield per plants.

Key Words : Strawberry, GA_3, Deblossoming

View Point Article : Kumar, Rakesh, Saravanan, S., Jasrotia, Amit, Bakshi, Parshant, Shah, Rafiq and Raina, Vishal (2014). Influence of gibberellic acid and blossom removal on flowering and yield of strawberry (*Fragaria* x *ananassa* Duch.) cv. Belrubi. *Internat. J. agric. Sci.*, **10** (1): 272-275.

Article History : Received : 29.07.2013**; Revised :** 20.10.2013**; Accepted :** 18.11.2013

INTRODUCTION

Strawberry (*Fragaria* x *ananassa* Duch.) is the most refreshing and delicious fruit crop which belongs to family Rosaceae. It is a rich source of vitamins and minerals with delicate flavour (Sharma, 2002). Its fruit is most attractive in shape, with distinct, pleasant and refreshing aroma. Strawberry fruits also contain high percentage of other components including phenolics and flavonoid (Hakkinen and Torronen, 2000). Strawberry is a good source of vitamin-C (30-100mg/100g of fruit) as well as foliate and photochemical compound such as the ellagic acid. Consuming strawberries can reduce the risk of developing cancer by 50% due to higher levels of vitamin-C. Eating strawberries, which are rich in nitrate, can increase the flow of blood and oxygen to the muscles by 7%. The area under cultivation of this crop in subtropical and tropical region is very low and thus the fruit price remains very high Rs.150-170 kg. Due to this reason poor community can not eat this fruit because of their higher cost. It has been well documented that the size and quality of the fruits can be affected in horticultural cultural practices, such as the application of plant growth hormones (Guardiola, 1992). It has been demonstrated that GA_3 enhanced diphenols and hence decrease the activity of IAA oxidase, resulting in high auxin level. Some reports have indicated GA as stimulation of auxin biosynthesis by hydrolysis of protein and release of tryptophan. Gibberellins stimulate pollen germination and

*** Author for correspondence**

[1]Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottam Institute of Agricultural Technology and Sciences, ALLAHABAD (U.P.) INDIA

[2]Division of Fruit Sciences, Sher-e-Kashmit University of Agriuculture Science and Technology (J), JAMMU (J&K) INDIA

pollen tube growth and exogenous application of gibberellins to flower can result in fruit set in the absence of fertilizer (Gustafson, 1960), whereas removal of partial crop in overbearing fruit plants enable the remaining crop to receive the great share of manufactured food by leaves, while working on several strawberry cultivars. The objective of this study was to investigate the effects of spraying GA_3 and blossom removal on strawberry plant cv. Belrubi that could be helpful in future for improvement of flowering and fruiting in subtropical areas.

MATERIAL AND METHODS

The present investigations were carried out to identify the effect of gibberellic acid and blossom flower on flowering and yield of strawberry cv. BELRUBI were conducted in the Research Farm, Department of Horticulture, Allahabad Agricultural Institute Deemed University, Allahabad, U.P. India. The experimental site is located in south-eastern part of Horticulture Department at 20 degree and 15 north 60 degree east longitude city and is about 129.2 cm above the sea level. Temperature widely varying from 4-5 ^{0}C low during winter to 46 ^{0}C during summer. Before transplanting of strawberry runners, the research plots were ploughed 2-3 times by soil turning plough, harrowed, leveled and made weed free by uprooting them. The soil of the experimental field was sandy loam in texture having pH 6.35 mixed well rotten FYM @ 30 tonnes /hectare and fertilizer were applied in each plot according to treatment combination and incorporated thoroughly in the soil by rank as basal dressing. The fertilizer were applied at 150 kg N, 75 kg P_2O_5 and100kg K_2O reported by (Joolfka *et al.*, 1986), half dose of the nitrogen along with total phosphorus and potash were applied as basal dressing before transplanting and well incorporated in soil. The rest of N was top dressed at 30 days and 60 days after transplanting in both the years of experimentation *viz*., 2003-04 and 2004-05.The experiment was laid out into two designs 4 x 2 and 4 x 3factorial an Randomized Block Design design. There are eight treatments [T_1=water spray and without deblossoming (G_OD_0); T_2=water spray and partial deblossoming (G_OD_1) ; T_3= GA_3 50 ppm and without deblossoming (G_1D_0); T_4= GA_3 50 ppm and partial deblossoming (G_1D_1); T_5= GA_3 100 ppm and without deblossoming (G_2D_0) ; T_6= GA_3 100 ppm and partial deblossoming (G_2D_1) ; T_7= GA_3 150 ppm and without deblossoming (G_3D_0) ; T_8= GA_3 150 ppm and partial deblossoming (G_3D_1)] replicated thrice in 24 well raised beds of 1.5 m x 2.0 m size with planting distance of 30 cm x 45 cm. Healthy runners of almost equal size and vigour were transplanted at evening hours. All cultural practices and plant protection measures were applied uniformly to all the experiment plots as per the package of practices for strawberry cultivation. Spraying with GA_3 was done 35 and 50 DAT, while blossom removal practice were started 45 days after transplanting runners during both the years. The volume of spray solution required was calculated by spraying measured quantity of water in non-experimental beds. The stock solution of GA_3 was prepared by dissolving the weigh quantity of these chemical in alcohol. The quantity was measured by measuring cylinder and dissolved in alcohol and than distilled water was added to makes up the required amount of solution. The chemicals were sprayed with the help of fine hand sprayer. Spraying was preformed carefully by covering the adjacent bed with polyethylene sheets. The observations were recorded on first flower initiate, total no. of flowers, bud formation, days taken to fruit set, total no. of fruit and fruit yield q/ha. Fruit weight was measured with digital balance.

RESULTS AND DISCUSSION

The results showed that among all the treatments GA_3 150 ppm took minimum days to initiate flowering (54.22/ 53.55) during two successive years. Whereas, the maximum days (57.55/ 55.88) were taken by untreated plants (Table 1). The application of GA_3 induce early flower development in several cultivars of strawberry (Tafazoli and Vincepruce, 1978). GA_3 and levels of deblossoming showed significant influence on number of flowers per plant during both the years and the highest number of flowers per plant (23.64/ 22.56) were registered with 50 ppm followed by 100ppm GA_3 (23.16/21.83).The least number of flowers were recorded with untreated plants during both the years. The interaction between GA_3 and levels of deblossming showed significant effect on number of flowers per plant. The highest number of flowers per plant (24.05/22.81) was recorded in complete deblossomed 50 ppm GA_3 treated plants. The least number of flowers (18.21/ 17.71) were registered when untreated plants. These results are in conformity with the results of Ozuguven and Kaska (1994). The effect of GA_3 treatment and level of deblossoming showed significant effect on days taken to fruit development and number of fruits per plant as presented in Table 2. Among different GA_3 treatments GA_3 150ppm took minimum number of days to bud formation (64.01/ 60.08) during both the years of experimentation. Whereas, untreated plants took maximum days (60.01/62.98) to fruit development during respective years. The interactions between GA_3 and level of debossoming showed significant effect on days taken to fruit bud development. The minimum days (60.33/ 59.99) were noticed with 150 ppm GA_3, while no deblossoming. The maximum days (64.30/ 63.98) were registered with control. These results are in close conformity with the results of Bubu and Rajput (1982). The data pertaining to fruit yield (g) per plant and fruit yield (q/ha) presented in Table 3 showed that the 50 ppm GA_3 plants showed highest fruit yield per

Table 1 : Influence of gibberellic acid and levels blossom removal on days taken to produce first flower and number of flowers of strawberry cv. Belrubi (2003-04 and 2004-05)

Conc. GA_3	Without (D_0)	Partially (D_1)	Full blossom removal	Mean	Without (D_0)	Partially (D_1)	Full blossom removal	Mean	Without (D_0)	Partially (D_1)	Full blossom removal	Mean	Without (D_0)	Partially (D_1)	Full blossom removal	Mean
Control	57.33	58.00	57.33	57.55	56.00	55.33	56.33	55.88	18.21	18.37	18.38	18.32	17.71	17.92	18.04	17.89
GA_3 50ppm	55.33	55.66	55.33	55.44	54.66	54.00	54.66	55.77	23.72	23.16	24.05	23.64	22.24	22.65	22.81	22.56
$GA_3$100ppm	55.66	55.33	55.00	55.33	54.33	54.66	54.33	54.44	23.09	23.21	23.20	23.16	21.56	21.95	21.98	21.83
GA_3 150ppm	54.33	54.00	54.33	54.22	53.66	53.33	53.66	53.55	20.87	21.31	21.34	21.17	20.47	20.98	21.39	20.94
Mean	55.44	55.74	55.49		54.66	54.58	54.74		21.47	21.51	21.74		20.49	20.87	21.05	
GA_3(P0.05)			0.63					0.68				0.30				0.36
Del. (P0.05)			NS					NS				0.26				0.31
Inter.(G x D) (P=0.05)			NS					NS				0.51				NS

NS=Non-significant

Table 2 : Influence of gibberellic acid and blossom removal on bud formation and Nos. of fruit of strawberry fruit cv. belrubi (2003-04 and 2004-05)

Concentration GA_3	Without (D_0)	Partially (D_1)	Mean	Without (D_0)	Partially (D_1)	Mean	Without (D_0)	Partially (D_1)	Mean	Without (D_0)	Partially (D_1)	Mean
Control	63.73	64.30	64.01	62.07	63.90	62.98	16.33	8.40	12.36	15.81	8.02	11.91
GA_3 50ppm	61.77	61.95	61.86	61.42	62.42	62.10	22.18	11.98	17.08	21.29	10.83	16.06
$GA_3$100ppm	60.57	61.92	61.24	60.24	61.92	61.08	20.20	10.97	15.58	20.37	10.41	15.39
GA_3 150ppm	60.33	61.22	60.77	59.99	60.18	60.08	18.90	9.52	14.21	18.70	9.68	14.19
Mean	61.60	62.34		60.93	62.19							
GA_3(G)(P0.005)		0.42			0.49				0.25			0.34
Del.(P0.005)		0.29			0.35				0.18			0.23
Inter(GXD)(P0.005)		0.57			0.69				0.36			0.49

Table 3 : Influence of gibberellic acid and blossom removal on fruit weight (g) and fruit yield Q/ha of strawberry fruit cv. belrubi (2003-04 and 2004-05)

Concentration GA_3	Without (D_0)	Partially (D_1)	Mean	without (D_0)	Partially (D_1)	Mean	Without (D_0)	Partially (D_1)	Mean	Without (D0)	Partially (D_1)	Mean
Control	248.69	136.76	192.72	233.65	130.65	182.21	15.21	8.36	11.78	14.29	7.95	11.12
GA_3 50ppm	288.74	151.51	220.12	269.89	137.72	203.80	17.67	9.27	13.47	16.50	8.42	12.46
$GA_3$100ppm	244.63	139.00	191.81	232.34	128.21	180.27	14.97	8.50	11.73	14.21	7.84	11.02
GA_3 150ppm	213.83	123.36	168.59	204.00	114.28	159.14	13.08	7.54	10.31	12.48	7.29	9.88
Mean	248.97	137.65		234.97	127.74		15.23	8.40		14.37	7.87	
GA_3(G)(P0.005)			1.58			1.60			0.17			0.38
Del.(P0.005)			0.37			0.79			0.12			0.27
Inter(GXD)(P0.005)			1.48			3.17			0.24			0.53

plant (220.12/ 203.80) than other treatments during both the seasons of experimentation. Whereas the lowest values (168.59/ 159.14) were noticed with 150ppm treated plants during same year. Among different deblossoming levels the highest fruit yield per plant (248.97/ 234.97) and lowest fruit yield per plant (137.65/127.74) were obtained without deblossoming and partial debossoming, respectively. The interaction between GA_3 and deblossoming significantly affect fruit yield per plant and the highest value (288.74/ 269.89g) were registered with 50ppm GA_3 without deblossoming, while the lowest (123.36/ 114.28g/plant) were noticed with 50ppm GA_3 with partial deblossoming. These results are agreements with (Nakasone and Paull, 1998). The maximum fruit yield (13.47/ 12.46 q/ha) were registered from GA_3 50ppm treated plants, while minimum fruit yield (10.31 and 9.88 q/ha) were registered with 150 ppm during both the years of experimentation. The level of deblossoming also affects the fruit yield, the highest (15.23/ 14.37 q/ha) and lowest (8.40/ 7.87 q/ha) was obtained from with no deblossoming and partial deblossoming. The interaction between GA_3 and deblossoming was significant. The highest fruit yield (17.67 q/ha, 16.50 q/ha) were registered with 50ppm GA_3 without deblossoming and lowest yield (7.54 / 7.29 q/ha) was registered with 150ppm GA_3 with partial deblossoming during both the years of experimentation. These results are agreement with Wahab (1966) who reported that lower concentration of GA_3 enhance fruit size

REFERENCES

Bubu, R.S.H. and Rajput, C.B.S. (1982). Effect of Zinc, 2-4D and GA_3 on flowering in Kagzi lime. *Punjab Hort. J.*, **22** (2/3): 140-144.

Guardiola, J.L. (1992). Fruit set and growth. In: Donadio LC (ed) Second International Seminar on Citrus. Univ. of Bebedouro, pp. 1-30.

Gustafson, F. (1960). Influence of gibberellic acid on setting and development of fruits in tomato. *J. Plant Physiol*., **35** : 521-523.

Hakkinen, S.H. and Torronen, A.R. (2000). Content of flavones and selected phenolic acids in strawberries and vaccinium species: influence of cultivar, cultivation site and technique. *Food Res. Internat.,* **33** *:* 517-524.

Joolfka, N.K., Badiyala, S.D. and Lakhan Pal, S.C. (1986). Proc. Symp. On temperate fruits, Solan India pp. 225- 227.

Nakasone, H.Y. and Paull, R. E. (1998). *Tropical fruit* PP. 149-172. C.A.B. International, Willingford, U.K.

Ozguven, A.I. and Kaska, N. (1994). Effect of GA_3 application on the yield and quality of strawberries grown in high tunnels in summer planting. *Bahce.*, **19** (1-2) : 41-52.

Tafazoli, E. and Vincepruce, D. (1978). A comparison of the effect of long days and exogenous growth regulators on growth and flowering in strawberry (*Fargaria x ananassa)*. *J. Hort. Sci.,* **53** : 255-259.

Wahab, A . (1966). Effect of GA_3 on strawberry. Ann. Rep. Agri. Res. Instt. Peshawar, part 1 90 pp.