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Effect of spray treatment of plant growth substances at different stages on growth and yield of sweet pepper (*Capsicum annuum* L.) cv. Indra under green house

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ABSTRACT

Study of different spray treatment of plant growth substances on sweet pepper was carried out under green house condition.The results revealed that among different spray treatment of plant growth substances, the maximum height of plant (30.15 cm) at 30 days after transplanting was found significant with spray of GA_3 50 ppm (P_3). The minimum days taken for edible maturity was also superior with GA_3 50 ppm. Whereas, the maximum number of branches (5.52) and minimum days taken for initiation of flower (48.50 days) was recorded with ethrel 100 ppm (P_7) treatment. The maximum fruit set (70.78 %) was recorded with spray of GA_3 25 ppm (P_2). Regarding yield parameter, spray treatment of GA_3 50 ppm (P_3) was superior with respect to average weight of fruit (96.58 g), yield/plant (1.84 kg) and yield/ha (244.65 q/ha). Among two stages of spray, S_2 (Spray at 20 days after transplanting) was recorded the maximum girth of stem at 30 days after transplanting (0.47 cm). Whereas, S_1 (Spray at 20 days after sowing) was recorded initiation of first flower (49.96 days). No any beneficial effect was recorded on yield parameters.

Key words : Sweet pepper, plant growth substances, stages of spray

The genus Capsicum belongs to family Solanaceae which is grown in several parts of the world. Sweet pepper is believed to be originated in Tropical South America. Sweet pepper (Capsicum annuum L.) also known as 'Shimla mirch' or 'bell pepper' or 'capsicum' is an important Solanaceous vegetable. It provides good levels of carbohydrates and are rich in vitamins A and C (Burt, 2005). The hormonal use in the plant system and their importance is the outstanding discovery and achievement of plant sciences. A number of techniques for application of growth substances have been tried on various vegetables.

MATERIALS AND METHODS

The experiment was carried out during the year 2011-12 in Naturally Ventilated Greenhouse of Department of Vegetable Science, College of Horticulture, S. D. Agricultural University, Sardarkrushinagar. The experiment was laid out in Completely Randomized Design with Factorial concept. There were sixteen (16) treatment combinations comprised eight levels of plant growth substances *viz.*, P_0 (Control), P_1 (Water spray), P_2 (GA_3 25 ppm), P_3 (GA_3 50 ppm), P_4 (NAA 20 ppm), P_5 (NAA 40 ppm), P_6 (Ethrel 50 ppm), P_7 (Ethrel 100 ppm) and two stages of spray *viz.*, S_1 (spray at 20 days after sowing) and S_2 (spray at 20 days after transplanting). A number of observation *viz.*, height of plant and girth of stem at 30, 60, 90 and 120 days after transplanting (cm), number of branches, days taken for first initiation of flower after transplanting, percentage fruit set per plant, days taken for flowering to edible maturity stages, days taken for first picking, total number of fruits per plant, average weight of fruit (g), yield of fruits per plant (kg), yield per hectare (q/ha) were recorded.

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RESULTS AND DISCUSSION

Effect on growth

In the present study, the height of sweet pepper plant has been found to increase with the advancement of development stages. It is clearly seen from the data that there was an increase in the height of plant due to application of GA_3 @ 50 ppm. This increase in plant height is due to its effect on stem elongation by rapid cell elongation and multiplication of cells in sub-apical meristem. The rapid growth that occurs is a result of both the greater number of cells formed and elongation of individual cells. The increase in plant height by GA_3 application has also been reported by Patel (1998), Naruka and Paliwal (1999), Sorte *et al.*, (2001) in brinjal, Kore, *et al.*, (2003) in bottle gourd and Natesh *et al.*, (2005) in chilli and the highest number of branches (5.52) was observed due to application of ethrel. The above results were in consonance with those of Das and Das (1996) in pumpkin, Bharadwaj *et al.*, (1998) in capsicum, Dixit *et al.*, (2001) in watermelon, Girde *et al.*, (2006) in sponge gourd and Hilli, *et al.*, (2010) in ridge gourd.

Effect on flowering and fruit setting

The first initiation of flower was found due to the application of ethrel. The above results were in agreement with those of Krishnappa, (2002) in tomato, Kooner *et al.*, (2000) in bottle gourd and Dixit *et al.*, (2001) in watermelon and the maximum per cent of fruit setting (70 %) was recorded with the application of GA_3 Whereas, minimum fruit setting (39.44%) was recorded in control. Similar finding have also been obtained by Irulappan and Muthukrishnan (1974) in tomato, Chattopadhyay and Sen (1974) in chilli, Nair *et al.*, (1974) in tomato, Sorte *et al.*,(2001) in okra and Natesh *et al.*, (2005) in chilli.

Table 1 Effect of spray treatment of plant growth substances at different stages on height of plant, girth thickness of stem, number of branches and days taken for initiation of first flower.

Treatments	Height of plant at 30 DAT (cm)	Girth of stem at 30 DAT (cm)	Number of branches	First initiation flowering
Plant growth substances(P)				
P_0 - Control (No spray)	28.17	0.47	4.33	49.00
P_1 - Water spray	28.03	0.47	3.67	48.56
P_2 - GA 3-25 ppm	29.08	0.44	4.87	52.83
P_3 - GA 3-50 ppm	30.15	0.46	4.28	56.61
P_4 - NAA - 20 ppm	20.89	0.42	4.33	54.06
P_5 - NAA - 40 ppm	21.72	0.46	4.11	55.04
P_6 - Ethrel - 50 ppm	28.87	0.48	5.21	48.50
P_7 - Ethrel - 100 ppm	26.57	0.46	5.52	48.50
S.Em. ±	1.69	0.02	0.21	1.22
C.D. at 5%	4.88	NS	0.60	3.52
Stages of spray(S)				
S_1 -At Seedling stage (20 days after seed sowing)	26.56	0.44	4.50	49.96
S_2 -After transplanting (20 days after transplanting)	26.81	0.47	4.58	53.32
S.Em. ±	0.85	0.01	0.10	0.61
C.D. at 5%	NS	0.03	NS	1.76
Interaction (P X S)				
S.Em. ±	2.39	0.03	0.30	1.73
C.D. at 5%	NS	NS	NS	4.98
C.V.%	15.53	9.62	11.28	5.79

Table 2 Effect of spray treatment of plant growth substances at different stages on per cent fruit set, days taken for flowering to edible maturity and days taken for first picking.

Treatments	Fruit set per plant (%)	Days tak en for flowering to edible maturity	Days taken for first picking .
Plant growth substances (P)			
P_0 - Control (No spray)	39.44	38.72	87.72
P_1 - Water spray	41.67	33.17	82.22
P_2 - GA 3-25 ppm	70.78	27.94	80.61
P_3 - GA 3-50 ppm	60.89	26.55	82.94
P_4 - NAA - 2 ppm	61.95	36.94	90.89
P_5 - NAA - 40 ppm	62.83	36.67	91.44
P_6 - Ethrel - 5 ppm	60.28	37.28	85.61
P_7 - Ethrel - 100 ppm	58.06	35.77	84.27
S.Em. ±	4.61	1.83	2.23
C.D. at 5%	13.27	5.27	6.43
Stages of spray (S)			
S_1 - At Seedling stage (20 days after seed sowing)	56.40	34.35	84.26
S_2 - After transplanting (20 days after transplanting)	57.57	33.91	87.16
S.Em. ±	2.30	0.91	1.12
C.D. at 5%	NS	NS	NS
Interaction (P X S)			
S.Em. ±	6.52	2.58	3.16
C.D. at 5%	NS	7.45	9.10
C.V.%	19.80	13.11	6.38

The earlier edible maturity (26.55 days) was obtained by application of GA_3. Similar beneficial effect of growth substances has been reported by Dixit *et al.*, (2001) in watermelon, Bisaria and Bhatnagar (1978) in brinjal. Whereas, the effect of plant growth substances was found significant on earlier picking. The earlier picking of fruits was increased due to application of plant growth substances like GA_3. Similar finding have also been obtained by Natesh *et al.*, (2005) in chilli.

Effect on yield attributes and yield

The maximum yield attributes *viz.* average weight of fruit (96.58 g), yield of fruit per plant (1.83 kg) and yield per hectare (244.64 q/ha) was obtained in GA_3 50 ppm treatment. An increase in average fruit weight treated plants may further attributed to the reason that plants remain physiologically more active to build up sufficient food stock for the developing flowers and fruits. The above results were in agreement with Nimje *et al.*, (1990), Kumar and Ray (2000) in cauliflower, El-Helaly (2009) in potato, Naruka and Paliwal (1999) and Kore *et al.*, (2003) in okra.

Table 3 Effect of spray treatment of plant growth substances at different stages on total number of fruits per plant, average weight of fruit (g), yield of fruits per plant (kg) and yield per hectare (q/ha).

Treatments	Total No. of fruits/ plant	Average wt. of fruit (g)	Yield of fruits/ plant (kg)	Yield / hectare (q/ha)
Plant growth substances(P)				
P_0 - Control (No spray)	10.10	71.96	0.68	90.86
P_1 - Water spray	10.78	77.75	0.61	81.02
P_2 - GA 3 - 25 ppm	15.05	88.82	0.71	94.56
P_3 - GA 3 - 50 ppm	10.61	96.58	1.83	244.64
P_4 - NAA - 20 ppm	11.34	90.63	0.56	74.56
P_5 - NAA - 40 ppm	12.00	84.18	0.85	113.71
P_6 - Ethrel -50 ppm	11.61	88.63	0.76	101.23
P_7 - Ethrel -100 ppm	11.22	93.00	0.66	88.16
S.Em. ±	1.10	4.80	0.06	8.04
C.D. at 5%	NS	13.83	0.17	23.17
Stages of spray(S)				
S_1 - At Seedlingstag (20 days after seed sowing)	12.57	85.79	0.84	112.18
S_2 - After transplanting (20 days after transplanting)	10.83	87.10	0.83	110.00
S.Em. ±	0.55	2.40	0.03	4.02
C.D. at 5%	1.59	NS	NS	NS
Interaction (P X S)				
S.Em. ±	1.56	6.78	0.09	11.37
C.D. at 5%	NS	NS	0.25	32.77
C.V.%	23.10	13.60	17.69	17.73

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