



## RESPONSE OF BIO-REGULATORS ON HORTICULTURAL TRAITS OF BELL PEPPER UNDER PROTECTED CONDITION

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**ABSTRACT:** The investigation on responses of bio-regulators on horticultural traits of bell pepper cv. California Wonder under protected condition was undertaken at Horticultural Research Centre of H.N.B. Garhwal University, Srinagar (Garhwal). The results revealed that the bio-regulators spray had significant influence on growth, yield and quality. Spraying of NAA at 50 ppm significantly increased the plant height, number of secondary branches, leaf area, days taken to first flower, days taken to 50 per cent flower, number of flowers/plant, number of fruits/plant, fruit set per cent, days taken to fruit set, days taken to first picking, duration of marketable fruit, fruit breadth, fruit weight, yield/plant, yield/plot, yield/hectare, number of seeds/fruit, 1000 seed weight, specific gravity, TSS while fruit length increased in IAA at 100 ppm. This experiment shows that bio-regulator especially NAA at 50 ppm is very helpful for enhancing the total production of capsicum under protected condition.

**Keywords:** NAA, bioregulators, bell pepper, growth, yield, protected conditions.

Bell pepper (*Capsicum annuum* var. *annuum* L.) also called as capsicum, belonging to the family Solanaceae, is one of the most popular and highly valued vegetable crop grown in tropical and sub-tropical parts of the world. It is believed to be the native of tropical South America (Sheomaker and Tesky, 10). Growing of capsicum under controlled condition has been reported to give high productivity of good quality produce in developing countries. Hence, there is a need for evaluating the performance of capsicum under controlled condition for getting higher productivity of excellent quality under Indian condition. Bio-regulators play an important role in growth and development of any crop including capsicum. Since not much information of sweet pepper with respect to varying levels of bio-regulators, there is an imminent need to assess the optimum levels of bio-regulators for its cultivation in controlled condition. Therefore, this experiment was carried out to study the effect of bio-regulators on growth, yield and quality parameters of capsicum cultivars under protected condition in Garhwal region.

### MATERIALS AND METHODS

The investigation was carried out using capsicum cultivar California Wonder under protected condition at HNB Garhwal University, (Garhwal), Uttarakhand during 2011. Field experiments were conducted during January 2011 to June 2011 and a plot size of 3 x 2 m<sup>2</sup> was followed. Layout was prepared by using randomized block design with three replications and treatment details were : IAA 100 ppm (T<sub>1</sub>), IAA 200 ppm (T<sub>2</sub>), NAA 50 ppm (T<sub>3</sub>), NAA 100 ppm (T<sub>4</sub>), 2,4-D 5 ppm (T<sub>5</sub>), 2,4-D at 10 ppm (T<sub>6</sub>), GA<sub>3</sub> 25 ppm (T<sub>7</sub>), GA<sub>3</sub> at 50 ppm (T<sub>8</sub>), GA<sub>3</sub> 25+NAA 50 ppm (T<sub>9</sub>), GA<sub>3</sub> 50+NAA 100 ppm (T<sub>10</sub>) and control (T<sub>11</sub>). 40 days old seedlings were transplanted on March 2<sup>nd</sup> 2011 at the spacing of 45 x 45 cm and the recommended dose of N: P: K at 100: 80: 80 kg was applied. The quantity of fertilizers was calculated to the area of plot and the half N, entire P and K, was applied as basal dose and the remaining N, was applied as top dressing. Freshly prepared aqueous solution of IAA, NAA, 2, 4-D and GA<sub>3</sub> was sprayed two times on flower cluster of plant. First and second spraying were

done at flower initiation and 20 days later from the first spray, respectively. Observations on growth, yield and quality were recorded and mean value was subjected to statistical analysis (Snedecor and Cochran, 12).

## RESULTS AND DISCUSSION

The results of the growth characters (Table 1) indicated that the different treatments have significant influence on growth characters. The maximum plant height and was found in treatment NAA at 50 ppm (T<sub>3</sub>) maximum number of secondary branches per plant (13.33). These results are similar to the findings of Thapa *et al.* (13) and Balraj *et al.* (1) in chilli. The maximum leaf area (13.41 cm<sup>2</sup>) was observed under treatment NAA @ 50 ppm (T<sub>3</sub>). While the number of primary branches per plant showed non-significant response and observed maximum under treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Joshi and Singh (4) and Thapa *et al.* (13) in chilli.

In respect to the yield and quality parameters in (Table 2), the minimum number of days taken to first flower (41.10) and the maximum number of flowers per plant (63.11) was found in treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Jayananadam and Bavaji (3) and Laxman and Mukharjee (6) in chilli. The maximum number of fruits per plant (35.44) and The minimum number of days taken to 50 per cent flowering (51 days) was found in treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Shetty *et al.* (9) and Gutam *et al.* (2). The maximum fruit set per cent (57.69%) was found in treatment NAA at 50 ppm (T<sub>3</sub>) and minimum days taken to fruit ( 8.44 day) set was found in treatment NAA at 50 ppm (T<sub>3</sub>) confirming the findings of Shetty and Manohar (8). The minimum number of days taken to first picking was observed in NAA at 50 ppm (T<sub>3</sub>) 58.66 days. These results are confirmed the findings of Singh (11).

The maximum duration of marketable fruits (28.99 days) was found in treatment NAA at 50 ppm (T<sub>3</sub>). The maximum weight of fruit (52.53 g) was also found in treatment NAA at 50 ppm (T<sub>3</sub>). These results

are similar to the findings of Singh (11) in bell pepper and Trivedi (14) in chilli respectively. The maximum yield per plant (1.85 kg) was recorded in treatment NAA at 50 ppm (T<sub>3</sub>) confirming to results to the findings of Kannan *et al.* (5). The maximum yield per plot (33.06 kg) was found in NAA at 50 ppm (T<sub>3</sub>). The maximum yield per hectare (132.44 t) was also found in treatment NAA at 50 ppm (T<sub>3</sub>). The maximum number of seeds per fruit (223.33) was found in treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Gutam *et al.* (2). The maximum weight of 1000 seed (9.82 g) was found in treatment NAA at 50 ppm (T<sub>3</sub>). The maximum fruit length 6.96 cm was found in treatment NAA at 50 ppm (T<sub>3</sub>). The maximum fruit breadth (6.30 cm ) was found in treatment IAA at 100 ppm (T<sub>1</sub>) in. The experimental results supported the findings of Trivedi (14) in chilli. The maximum specific gravity (1.44) was found in treatment NAA at 50 ppm (T<sub>3</sub>). The maximum ascorbic acid (115.33 mg/100 g) was found in treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Gutam *et al.* (2) in bell pepper. The maximum total soluble solids (4.06%) was found in treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Nagdy *et al.* (7) in chilli. While the fruit volume showed non-significant values but observed maximum under treatment NAA at 50 ppm (T<sub>3</sub>). These results are similar to the findings of Shetty *et al.* (9).

## REFERENCES

1. Balraj, R., Kurdikeri, M. B. and Revanappa. (2002). Effect of growth regulators on growth and yield of chilli (*Capsicum annuum*) at different pickings. *Indian J. Hort.*, **59**(1): 84-88.
2. Gutam, Sridhar, Koti, R.V., Chetti, M. B. and Hiremath, S. M. (2009). Effect of naphthalene acetic acid and mepiquat chloride on physiological components of yield in bell pepper (*Capsicum annuum* L.). *J. Agri. Res.* **47**(1): 53-62.
3. Jayananadam, V. D. S. and Bavaji, J.N.

Table 1. Response of bio regulators on quantitative horticultural traits of capsicum under controlled condition.

Treatments	Plant height (cm)	No. of primary branches per plant	No. of secondary branches per plant	Leaf area (cm <sup>2</sup> )	Days taken to first flower	Days taken to 50 per cent flower	No. of flowers per plant	No. of fruits per plant	fruit-set per cent	Days taken to fruit-set	Days taken to first picking	Duration of marketable fruits	Fruit length (cm)	Fruit breadth (cm)	Fruit weight (g)
T <sub>1</sub>	98.33	5.33	10.66	12.65	41.66	51.33	49.33	24.77	49.48	8.88	59.22	27.10	8.06	4.60	47.81
T <sub>2</sub>	96.88	4.70	10.33	11.55	41.87	52.00	51.77	24.33	49.35	9.33	60.66	28.88	5.20	5.23	49.27
T <sub>3</sub>	114.38	6.33	13.33	13.81	41.10	51.00	63.11	35.44	57.69	8.44	58.66	28.99	6.96	6.30	52.53
T <sub>4</sub>	103.05	6.00	12.33	12.44	41.67	51.66	56.99	32.88	56.20	8.55	59.10	28.55	6.85	6.17	51.75
T <sub>5</sub>	88.05	5.00	10.00	6.23	42.66	52.66	46.66	22.77	48.78	10.10	67.10	18.33	4.44	4.26	28.70
T <sub>6</sub>	76.11	4.33	9.00	7.60	42.55	54.66	45.44	22.10	48.77	9.66	67.66	14.77	4.35	4.14	27.12
T <sub>7</sub>	86.38	3.66	6.66	10.50	53.44	63.66	45.99	22.88	49.77	9.99	72.10	18.88	5.75	4.61	33.67
T <sub>8</sub>	101.44	4.33	8.66	10.82	53.66	64.33	47.10	23.55	49.95	9.55	74.55	20.11	5.43	5.21	33.20
T <sub>9</sub>	98.33	5.00	7.66	8.57	46.11	56.66	46.88	23.44	50.00	9.44	71.77	17.55	5.90	4.82	33.50
T <sub>10</sub>	97.22	3.66	8.33	7.97	45.55	55.00	46.22	24.33	51.87	9.88	69.66	19.22	5.98	5.21	45.30
T <sub>11</sub>	86.94	3.56	6.00	5.70	43.66	62.33	42.66	20.55	47.99	10.44	67.99	19.22	6.06	5.03	38.45
C.D. (P=0.05)	19.17	1.80	2.37	3.92	2.79	7.84	2.79	2.01	3.16	0.63	3.05	2.83	1.12	18.46	8.02

Table 2. Response of bio regulators on yield and quality traits of capsicum under controlled condition.

Treatments	Yield per plant (kg)	Yield per plot (kg)	Yield per hectare (t)	Number of seeds per fruit	Weight 1000 seed (g)	Fruit volume (cc)	Specific gravity	Ascorbic acid (mg/100 gm)	Total soluble solid (%)
T <sub>1</sub>	1.12	20.22	80.88	212.1	9.56	35.99	1.32	109.00	3.96
T <sub>2</sub>	1.19	21.42	86.16	202.44	9.39	34.22	1.12	82.33	2.90
T <sub>3</sub>	1.85	33.06	132.24	223.33	9.82	50.68	1.44	115.33	4.06
T <sub>4</sub>	1.67	26.64	120.72	220.21	9.57	49.88	1.04	114.00	3.96
T <sub>5</sub>	0.71	12.71	53.04	177.99	9.33	23.70	1.01	60.66	3.03
T <sub>6</sub>	0.61	13.26	49.20	196.33	9.66	22.44	1.23	61.00	3.03
T <sub>7</sub>	0.68	12.54	52.32	67.99	8.77	27.11	1.12	46.66	3.90
T <sub>8</sub>	0.90	12.27	64.96	68.77	8.78	24.33	1.24	92.66	3.83
T <sub>9</sub>	0.92	15.90	65.52	201.00	9.56	27.88	1.38	41.33	3.86
T <sub>10</sub>	1.11	20.10	80.41	207.33	9.20	32.00	1.41	95.00	3.86
T <sub>11</sub>	0.57	11.10	44.40	116.44	9.10	26.66	1.36	96.66	3.90
C.D. (P=0.05)	0.22	4.46	13.16	56.32	0.74	4.43	0.20	7.24	0.12

- (1976). A note on beneficial effect of NAA on chilli. *Andhra Agri. J.*, **23**(1-2): 180-182.
- Joshi, N. C. and Singh, D. K. (2003). Effect of plant bioregulators on growth and yield of chilli (*Capsicum annuum* L.). *Prog. Hort.*, **35**(2): 212-215.
  - Kannan, K., Jawaharlal, M. and Prabhu, M. (2009). Effect of plant growth regulators on growth and yield parameters of paprika cv. KtPl-19. *Agri. Sci. Digest.*, **29**(3): 157-162.
  - Laxman Singh and Mukherjee, S. (2000). Effect of foliar application of urea and NAA on yield and yield attributes of chilli (*Capsicum annuum* var. *longum*). *Agri. Sci. Digest.*, **20**(2): 116-117.
  - Nagdy, G. A.; Fouad, M. K. and Mohmoud, W. S. (1979). Effect of ethrel treatments on pepper plant, *Capsicum annuum* L. *Res. Bull. Faculty Agri. Ainshams Univ.*, **11**(5): 16.
  - Shetty, G. R. and Manohar, R. K. (2008). Influence of pruning and growth regulators on flowering, fruit set and yield of coloured capsicum (*Capsicum annuum* L.) cv. Orobelle under naturally ventilated greenhouse. *Asian J. Hort.*, **3**(2): 213-216.
  - Shetty, G. R. Manohar, R. K. Vishwanath, A. P. Kempegowda, K. and Raghavendra. (2008). Influence of pruning and growth regulators on the shelf life of coloured capsicum (*Capsicum annuum* L.) cv. Bombi under greenhouse. *Mysore J. Agri. Sci.*, **42**(1): 33-37.
  - Shoemaker, J. S. and Tesky, B. J. E. (1955). *Practical Horticulture*, John Wiley and sons. Inc. New York.
  - Singh, N. P. (1982). Effect of plant growth substances on fruit yield and some agronomical characters in bell pepper. *M.Sc. thesis* U.H.F Solan (H.P.).
  - Snedecor, G. W. and Cochran, W. G. (1968). *Statistical Methods*. Oxford and IBH Publishing company, New Delhi. 593.
  - Thapa, U. Pati, M. K. Chattopadhyay, S. B. Chattopadhyay, N. and Sharangi, A. B. (2003). Effect of growth regulators on growth and seed yield of chilli (*Capsicum annuum* L.). *J. Interacademia.*; **7**(2): 151-154.
  - Trivedi, S. K. (1989). Response of chilli (*Capsicum annuum*. L.) var. Pant C-1 to concentrations and methods of application of 2, 4-D and NAA. *Ph.D. (Hort.) thesis* submitted to G.B.P. Univ. of Agri. and Tech., Pantnagar, p. 86.