





## EFFECT OF BIO-REGULATORS ON GROWTH AND YIELD PARAMETERS OF *CAPSICUM* CULTIVARS UNDER CONTROLLED CONDITION

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**ABSTRACT :** The investigation was carried out to study the effect of bio-regulators on growth and yield parameters in *capsicum* under protected condition in Garhwal region. The investigation revealed that bio-regulators spray had significant influence on growth and yield. Spraying of NAA @ 50ppm increased the plant height, number of secondary branches, leaf area, days taken for anthesis, number of flowers/plant, number of fruits/plant, fruit weight and yield per plot. The maximum height (114.38 cm) and maximum yield (1.85 kg) per plant was found in treatment T<sub>3</sub>.

**Keywords :** *Capsicum*, bio-regulators, growth, yield, controlled environment.

*Capsicum* (*Capsicum annuum* var. *grossum* L.), also called as bell pepper, 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, 9). Growing of *capsicum* under controlled condition has been reported to give high productivity of good quality produce in developed 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 no 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 and yield parameters of *capsicum* cultivars under controlled condition in Garhwal region.

### MATERIALS AND METHODS

The investigation was carried out using *capsicum* cultivars viz., California Wonder (V<sub>1</sub>) and Solan Bharpur (V<sub>2</sub>) under controlled condition, HNB Garhwal University, (Garhwal), Uttarakhand during 2011. Field experiments were conducted

during January 2011 to June 2011 and a plot size of 2x1.25 m was followed. Lay out was prepared by using randomized block design with three replications and treatment details were IAA at 100 ppm (T<sub>1</sub>), IAA at 200 ppm (T<sub>2</sub>), NAA at 50 ppm (T<sub>3</sub>), NAA at 100 ppm (T<sub>4</sub>), 2,4-D at 5 ppm (T<sub>5</sub>), 2,4-D at 10 ppm (T<sub>6</sub>), GA<sub>3</sub> at 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>). Seedling of 40 days old was transplanted on March 2<sup>nd</sup>, 2011 at the spacing of 40x35 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 and 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 and yield were recorded and mean value was subjected to statistical analysis (Snedecor and Cochran, 11).

### 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 was found in treatment with NAA at 50 ppm (T<sub>3</sub>) in both cultivars of *capsicum* viz., California Wonder and Solan Bharpur (114.38

cm and 111.66 cm, respectively). These results are similar to the findings of Thapa *et al.* (12) in chilli. The maximum number of secondary branches per plant was observed under treatment NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (13.33 and 11.33, respectively). The experimental findings are according to the previous findings of Balraj *et al.*, (1) in chilli. The maximum leaf area was observed under treatment NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (13.41 cm<sup>2</sup> and 12.38 cm<sup>2</sup>, respectively). These results are confirmed the findings of Joshi and Singh (4) in chilli.

In respect to the yield parameters (Table 1, 2 and 3), the minimum number of days taken for first flower was observed in NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (41.10 days and 41.66 days, respectively). These results are confirmed with the findings of Laxman and Mukharjee (6) in chilli. The maximum number of flowers per plant was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (63.11 and 57.21, respectively). These results are similar to the findings of Jayananadam and Bavaji (3) in chilli. The maximum number of fruits per plant was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (35.44 and 32.77, respectively). These results are similar to the findings of Gutam *et al.* (2). The minimum number of days taken for 50 per cent plant to flower was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (51 days and 51.33 days, respectively). These results are similar to the findings of Shetty *et al.* (8). The maximum fruit set per cent was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (57.69 and 57.70, respectively). These results are similar to the findings of Shetty and Manohar (7).

The minimum number of days taken for first picking was observed in NAA at 50 ppm (T<sub>3</sub>) in

both cultivars of capsicum viz., California Wonder and Solan Bharpur (58.66 days and 58.99 days, respectively). These results confirmed the findings of Singh (10). The maximum duration of marketable fruits was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (28.99 days and 29.33 days, respectively). These results are similar to the findings of Singh (10). The maximum weight of fruit was found in treatment NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (52.53 g and 39.21 g, respectively). These results are similar to the findings of Trivedi (13) in chilli. The maximum yield per plant was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (1.85 kg, and 1.26 kg respectively). These results are similar to the findings of Kannan *et al.* (5). The maximum yield per plot was found in NAA at 50 ppm.

The maximum number of seed per fruit was found in treatment NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (223.33 and 197.66, respectively). These results are similar to the findings of Gutam *et al.* (2). The maximum weight of 1000 seed was found in treatment NAA at 50 ppm in both cultivars of capsicum viz., California Wonder and Solan Bharpur (9.82 g and 10.66 g, respectively). The similar finding was also reported by Uniyal (14).

The maximum fruit length was found in treatment NAA at 50 ppm (T<sub>3</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (6.96 cm and 6.91 cm, respectively). The experimental finding was confirming the findings of Trivedi (13) in chilli. The maximum fruit breadth was found in treatment IAA at 100 ppm (T<sub>1</sub>) in both cultivars of capsicum viz., California Wonder and Solan Bharpur (6.30 cm and 6.83 cm, respectively). The experimental results supported the findings of Trivedi (13) in chilli.

The investigation on effect of bio-regulators on growth and yield of capsicum cultivars viz., California Wonder and Solan Bharpur under controlled condition revealed that the

Table 1: Effect of bio-regulators on growth and yield parameters of *Capsicum*.

Treatments	Plant height (cm)		Number of secondary branches per plant		Leaf area (cm <sup>2</sup> )		Days taken for first flower		Number of flowers per plant		Number of fruit per plant	
	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>
T <sub>1</sub>	98.33	102.22	10.66	9.66	12.65	12.11	41.66	41.77	49.33	48.21	24.77	23.77
T <sub>2</sub>	96.88	100.55	10.33	8.33	11.55	11.88	41.87	41.98	51.77	50.66	24.33	23.55
T <sub>3</sub>	114.38	111.66	13.33	11.33	13.81	12.38	41.1	41.66	63.11	57.21	35.44	32.77
T <sub>4</sub>	103.05	110.27	12.33	10.66	12.44	11.98	41.67	41.88	56.99	55.66	32.88	30.44
T <sub>5</sub>	88.05	88.94	10.00	7.33	6.23	5.88	42.66	42.11	46.66	44.66	22.77	19.88
T <sub>6</sub>	76.11	72.77	9.00	7.66	7.6	7.07	42.55	42.33	45.44	42.88	22.1	20.1
T <sub>7</sub>	86.38	97.22	6.66	6.33	10.5	10.11	53.44	53.99	45.99	47.33	22.88	23.99
T <sub>8</sub>	101.44	100.55	8.66	6.33	10.82	9.78	53.66	54.11	47.1	48.11	23.55	24.11
T <sub>9</sub>	98.33	99.16	7.66	7.66	8.57	9.4	46.11	44.33	46.88	47.99	23.44	23.77
T <sub>10</sub>	97.22	95.83	8.33	5.66	7.97	6.53	45.55	44.32	46.22	49.99	24.33	24.77
T <sub>11</sub>	86.94	85.33	6.00	5.00	5.7	5.00	43.66	43.33	42.66	43.11	20.55	19.44
C.D. (P=0.05)	19.17	16.68	2.37	1.65	3.92	4.07	2.79	1.32	2.79	6.52	2.01	3.12

Table 2: Effect of bio-regulators on yield parameters of *Capsicum*.

Treatments	Days taken for 50 per cent plants to flower		Fruit set per cent		Days taken for fruit set		Days taken for first picking		Duration of marketable fruit		Fruit weight (g)	
	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>
T <sub>1</sub>	51.33	52.44	49.48	49.75	8.88	8.77	59.22	63.33	27.1	24.55	47.81	37.8
T <sub>2</sub>	52	52.66	49.35	49.3	9.33	8.99	60.66	61.44	28.88	26.33	49.27	33.88
T <sub>3</sub>	51	51.33	57.69	57.7	8.44	7.99	58.66	58.99	28.99	29.33	52.53	39.21
T <sub>4</sub>	51.66	52.33	56.2	54.65	8.55	8.66	59.1	59.55	28.55	28.66	51.75	37.8
T <sub>5</sub>	52.66	52.33	48.78	45	10.1	9.55	67.1	68.44	18.33	18.22	28.7	30.05
T <sub>6</sub>	54.66	55.66	48.77	46.77	9.66	9.77	67.66	71.88	14.77	16.55	27.12	29.52
T <sub>7</sub>	63.66	64.66	49.77	47.46	9.99	8.88	72.1	71.22	18.88	17.99	33.67	35.93
T <sub>8</sub>	64.33	62.33	49.95	50.31	9.55	9	74.55	73.66	20.11	16.99	33.2	36.6
T <sub>9</sub>	56.66	55.33	50	49.64	9.44	8.99	71.77	69.66	17.55	18.33	33.5	31.62
T <sub>10</sub>	55	54	51.87	49.55	9.88	9.44	69.66	72.33	19.22	17.55	45.3	36.41
T <sub>11</sub>	62.33	62.38	47.99	44.59	10.44	10.44	67.99	67.66	19.22	18.44	38.45	26.69
C.D. (P=0.05)	7.84	4.99	3.16	5.5	0.63	0.77	3.05	3.26	2.83	2.66	8.02	4.29

**Table 3: Effect of bio-regulators on yield and quality parameters of *Capsicum*.**

Treatments	Yield per plant (kg)		Yield per plot (kg)		Number of seeds per fruit		1000 seed weight (g)		Fruit length (cm)		Fruit breadth (cm)	
	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>
T <sub>1</sub>	1.12	0.73	20.22	13.29	212.1	188.88	9.56	9.8	8.06	6.98	4.6	4.99
T <sub>2</sub>	1.19	0.78	21.42	14.28	202.44	147.99	9.39	9.14	5.2	6.62	5.23	5.67
T <sub>3</sub>	1.85	1.26	33.06	22.8	223.33	197.66	9.82	10.66	6.96	6.91	6.3	6.83
T <sub>4</sub>	1.67	1.11	26.64	21.84	220.21	196.66	9.57	10.42	6.85	6.45	6.17	6.29
T <sub>5</sub>	0.71	0.57	12.71	10.26	177.99	180.77	9.33	9.77	4.44	5.25	4.26	3.94
T <sub>6</sub>	0.61	0.56	13.26	11.82	196.33	147.99	9.66	9.5	4.35	4.18	4.14	3.77
T <sub>7</sub>	0.68	0.83	12.54	15	67.99	88.1	8.77	8.49	5.75	5.48	4.61	5.14
T <sub>8</sub>	0.9	0.87	12.27	15.81	68.77	69.33	8.78	9.21	5.43	5.26	5.21	5.57
T <sub>9</sub>	0.92	0.74	15.9	13.32	201	185.99	9.56	9.67	5.9	5.43	4.82	4.95
T <sub>10</sub>	1.11	0.88	20.1	16.02	207.33	94.44	9.2	9.71	5.98	6.09	5.21	4.93
T <sub>11</sub>	0.57	0.52	11.1	9.36	116.44	100.44	9.1	8.9	6.06	5.2	5.03	4.56
C.D. (P=0.05)	0.22	2.85	4.46	3.07	56.32	39.97	0.74	0.77	1.12	0.93	18.46	0.75

bio-regulators spray had significant influence on growth and yield. Spraying of NAA at 50 ppm significantly increased the plant height, number of secondary branches, leaf area, days taken for first flower, number of flowers/plant, number of fruits/plant, days taken for 50 per cent plants to flower, fruit set per cent, days taken for fruit set, days taken for first picking, duration of marketable fruit, fruit weight, yield/plant, yield/plot, yield/hectare, number of seed/fruit, 1000 seed weight, and fruit breadth, 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 controlled condition.

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