Effect of Plant Growth Regulators on Growth, Yield and Yield Attributing Characters of Rainfed Chilli (*Capsicum annuum* L.)

B. N. Gare*, P. U. Raundal and A. V. Burli
Agricultural Research Station (Mahatma Phule Krishi Vidyapeeth), Gadhinglaj, District Kolhapur, Maharashtra - 416 502 (India)

Abstract

The experiment to assess the effect of plant growth regulators on growth, yield and yield attributing characters of rainfed chilli (*Capsicum annuum* L.) was conducted during kharif 2013, 2014 and 2015 at the Agricultural Research Station, Gadhinglaj, District Kolhapur (Maharashtra). The experiment was laid out in randomized block design with ten treatments and three replications. The treatments comprised of T_1-NAA 40 ppm, T_2-NAA 50 ppm, T_3-NAA 60 ppm T_4-Ehtrel 150 ppm, T_5-Ehtrel 200 ppm, T_6-Ehtrel 250 ppm, T_7-Tricontanol 1 ppm, T_8-Tricontanol 2 ppm, T_9-Tricontanol 3 ppm and T_{10}-control. Phule Sai variety of chilli was evaluated in this experiment. Based on three years of the experimentation it was observed that foliar application of 60 ppm of NAA at 6, 8 and 10 weeks after transplanting gave significantly highest dry red chilli yield (1910 kg ha^{-1}) and was on par with 50 ppm. The highest fruit setting (84.2%) and lowest flower drop (15.8%) was recorded in the same treatment. Similarly, this treatment also recorded the highest net profit (₹ 89439 ha^{-1}) with B:C ratio of 2.70.

Chilli (*Capsicum annuum* L.) is an important spice crop grown extensively in most parts of Maharashtra. The fruits are available in the market throughout year since chillies are produced in all the seasons in one or other part of the state. The production of chilli is governed not only by the inherent genetic yield potential but it is greatly influenced by several environmental factors and management practices. The production of chilli is adversely affected due to flower and fruit drop which is caused by physiological and hormonal imbalance in the plants particularly under unfavorable environments, such as extremes of temperature i.e. too low or high temperatures (Rylski 1973, Rylski and Halevy 1975, Erickson and Markhart 2001). Studies on the effect of plant growth regulators in solanaceous fruit and vegetable crops have revealed that the application of some of the plant growth regulators have been found effective in reducing the flower and fruit drop thereby enhancing production of chilli per unit area and per unit time. The varying responses of chilli to plant growth regulators have been reported by Chattopadhay and Sen (1974), Minraj and Shanmugavelu (1987), Balraj *et al*. (2002) and Joshi *et al*. (1999). However, information regarding the effectiveness of plant growth regulators on growth and yield of chilli is meager in sub-montane zone of Maharashtra. The present study was, therefore conducted with suggested concentration of imposed plant growth regulators in foliar spray to determine their effectiveness in promoting growth and yield of chilli under rainfed conditions.

***Corresponding author :** ars_gadhinglaj@rediffmail.com

Materials and Methods

The experiment was conducted during *kharif* 2013, 2014 and 2015 at the Agricultural Research Station, Gadhinglaj, District Kolhapur which is geographically situated in sub-montane zone of Maharashtra, India. It is situated between 16° 13′ N latitude, 74° 21′ E longitude and at an altitude of about 640.24 m above MSL. Average rainfall of this station is 930 mm in 70 rainy days. The soil of the experimental site was medium to deep black and clayey in texture, medium in organic carbon (0.640) per cent, low in available nitrogen (210.20 kg ha^{-1}), medium in available phosphorus (20.83 kg ha^{-1}) and higher in available potash (474.81 kg ha^{-1}) with 7.5 pH. Phule Sai variety of chilli was selected for the study which was planted in second fortnight of June at 60 x 45 cm. The experiment was laid out in randomized block design with ten treatments and three replications. The treatments comprised of T_1-NAA 40 ppm, T_2-NAA 50 ppm, T_3-NAA 60 ppm, T_4-Ehtrel 150 ppm, T_5-Ehtrel 200 ppm, T_6-Ehtrel 250 ppm, T_7-Tricontanol 1ppm, T_8-Tricontanol 2 ppm, T_9-Tricontanol 3 ppm and T_{10}-control. The gross and net plot sizes were 5.40 x 4.20 m^2

and 3.60 x 3.60 m^2 respectively.

Results and Discussion

The pooled mean data on various attributes presented in Table 1 and 2 showed that foliar application of NAA 60 ppm at 6, 8 and 10 weeks after transplanting recorded significantly highest dry red chilli yield (1910 kg ha^{-1}) than rest of the treatments and was at par with 50 ppm NAA (1885 kg ha^{-1}). Improvement in yield and its component characters due to application of NAA might be ascribed to more efficient utilization of food for reproductive growth (flowering and fruit set), higher photosynthetic efficiency and enhanced source to sink relationship of the plant, accumulation of sugar and other metabolites. Similar results were reported by Rylski (1973). The significantly highest fruit yield with 60 ppm NAA could be attributed To higher fruit set (84.2%), and lowest flower drop (15.8%) than rest of the treatments. Similar beneficial effects of NAA on chilli have been reported by several workers *viz*. Singh *et al*., (1990); Joshi *et al*., (1999); Balraj *et al*., (2002) Muralidharan *et al*.,(2002); Joshi and Singh (2001, 2003) and Chaudhary *et al*., (2006). Amongst the growth parameters, the plant height, plant spread, number of branches $plant^{-1}$ and fruit length were found to be nonsignificant due to the foliar application of 60 ppm NAA at 6, 8, and 10 weeks after transplanting. However, the number of fruits $plant^{-1}$ (53.4) and red chilli yield $plant^{-1}$ (61.41g) was significantly highest than rest of the treatments and at par with 50 ppm (51.00) and (58.65 g) respectively. The present findings are in agreement with Chaudhary *et al*., (2006). The highest gross (₹ 1,43,250 ha^{-1}) and net (₹ 89,439 ha^{-1}) monetary returns recorded by the 60 ppm NAA followed by 50 ppm NAA which recorded gross (₹ 1,41,375 ha^{-1}) and net (₹ 89,050 ha^{-1}) monetary return with the highest B:C ratio (2.70).

Thus three years pooled data revealed that foliar application of the plant growth regulator NAA@ 50 ppm at 6, 8 and 10 week after transplanting of rainfed chilli

Table 1. Pooled Mean Yield, gross, net monetary returns, B:C ratio, per cent fruit set and per cent flower drop of chilli as influenced by different treatments (2013-15). Dry red chilli market rate = ₹ 7500 q^{-1}

Treatments	Dry red chilli yield (kg ha^{-1})	Gross M.R. (₹ ha^{-1})	Net M.R. (₹ ha^{-1})	B:C ratio	Total No. of flowers $plant^{-1}$	Percent fruit set	Percent flower drop
NAA 40 ppm	1810	135750	83556	2.60	62.4	73.5	26.5
NAA 50 ppm	1885	141375	89050	2.70	63.1	80.8	19.2
NAA 60 ppm	1910	143250	89439	2.66	63.4	84.2	15.8
Ethrel 150 ppm	1594	119550	65649	2.22	64.2	66.8	33.2
Ethrel 200 ppm	1657	124275	70217	2.30	65.0	67.1	32.9
Ethrel 250 ppm	1701	127575	73314	2.35	64.7	69.9	30.1
Tricontanol 1 ppm	1722	129150	75339	2.40	65.2	69.6	30.4
Tricontanol 2 ppm	1761	132075	78164	2.45	65.0	70.6	29.4
Tricontanol 3 ppm	1812	135900	81729	2.51	64.8	79.6	20.4
Control	1491	111825	60431	2.18	64.0	61.3	38.8
SE ±	26.34	2288	2288	--	1.44	1.17	1.17
CD at 5 %	79.56	6864	6864	--	NS	3.53	3.53
CV %	9.5	12.1	12.1	--	7.4	9.7	9.7

note: M.R.=Monetary Returns

Table 2. Pooled Mean yield attributing characters of chilli as influenced by different treatments (2013-15).

Treatments	Plant height (cm)	Plant spread (cm)	No. of branches plant^{-1}	Fruit length (cm)	No. of fruits plant^{-1}	Dry red chilli yield g plant^{-1}
NAA 40 ppm	62.4	58.7	5.9	9.1	47.6	54.74
NAA 50 ppm	63.1	59.1	5.3	8.5	51	58.65
NAA 60 ppm	63.4	59.7	5.7	8.9	53.4	61.41
Ethrel 150 ppm	64.2	60.3	5.7	8.9	42.9	49.34
Ethrel 200 ppm	65.0	61.3	5.3	8.5	43.6	50.14
Ethrel 250 ppm	64.7	61.0	5.6	8.8	45.2	51.98
Tricontanol 1 ppm	65.2	61.5	5.7	8.9	45.4	52.21
Tricontanol 2 ppm	65.0	61.3	5.4	8.6	45.9	52.79
Tricontanol 3 ppm	64.8	61.1	5.5	8.3	49.7	54.16
Control	62.0	58.3	5.3	8.5	39.2	45.08
SE ±	1.14	1.37	0.31	0.53	1.04	1.58
CD at 5%	NS	NS	NS	NS	3.13	4.74
CV %	7.8	9.2	7.7	10.5	10.9	10.2

could be recommended for obtaining higher yield and economic returns.

References

Balraj, R., Kurdikeri, M. B. and Revanappa. 2002. Effect of growth regulators on growth and yield of chilli (*Capsicum annuum* L.) at different pickings. Indian J. Hort., 59:84-88.

Chattopadhyay, T. K. and Sen, S. K. 1974. Studies on the effect of different growth regulators on reproductive physiology and morphology of chilli (*Capsicum annuum* L.). Veg. Sci., 1:42-45.

Chaudhary, B. R., Sharma, M. D., Shakya, S. M. and Gautam, D. M. 2006. Effect of plant growth regulators on growth, yield and quality of chilli (*Capsicum annuum* L.) at Ranpur, Chitwan. J. Inst. Agric. Anim. Sci., 27:65-68.

Elangovan, M. S. Pandian, S. and Rangoswamy, P. 1982. Evaluation of Chilli (*Capsicum annuum* L.) under Konilpatti conditions. S. Indian Hort., 30:37-38.

Erickson, A. N. and Markhart, A. H. 2001. Fower production, fruit set and physiology of bell pepper during elevated temperature and vapor pressure deficit. J. American Soc. Hort. Sci., 126:697-702.

Joshi, N. C. and singh, D. K. 2001. Effect of plant bioregulators on chilli. Veg. Sci., 28:74-75.

Joshi, N. C. and Singh, D. K. 2003. Effect of plant bioregulators on growth and yield of chilli (*Capsicum annuu*m L) Prog. Horti., 35:212-215.

Joshi, N. C., Singh, D. K. and Jain, S. K. 1999. Response of Plant bioregulators on growth and yield of chilli during summer season. Adv. Hort. and For., 7:95-99.

Minraj, N. and Shanmugavelu, K. G.1987. Studies on the effect of tricontanol on growth, flowering yield, quality and nutrient uptake in chilli (*Capsicum annuum* L) S. Indian Hort., 35:262-366.

Murlidharan, R., Saravanan, A. and Muthuve P. 2002. Effect of plant growth regulators on yield and quality of chilli (*Capsicum annuum* L) .S. Indian Hort., 50:254-257.

Rylski, I. 1973. Effect of night temperature on shape and size of sweet Pepper (*Capsicum annuum* L). American Soc. Hort. Sci., 98:149-152.

Rylski, I. and Halevy, A. H. 1975. Optimal environment for set and development for set and development of sweet pepper fruit. Acta Hort., 42:55-62.

Singh, D. K., Lal. G. and Singh R. P. 1990. Effect of Synthetic auxins on the performance of chilli (*Capsicum annuum* L.) cultivars under tarai conditions of UP during winter season. Prog. Hort., 22:191-197.

Received 12 February 2017; revised accepted 19 July 2017