Madras Agric. J. 89 (1-3) : 63-66 January-March 2002
https://doi.org/10.29321/MAJ.10.A00185

Effect of plant growth regulators on yield, quality, available soil nutrients and uptake of nutrients by chilli

R. MURALIDHARAN, A. SARAVANAN AND P. MUTHUVEL
Dept. of Soil Science and Agrl. Chemistry, Tamil Nadu Agrl. Univ., Coimbatore-641 003, Tamil Nadu.

Abstract: A field experiment was conducted in a sandy loam soil at Agricultural Research Station farm, Bhavamsagar, Tamil Nadu, during (Dec-June) 1999-2000 to study the effect of plant growth regulators on yield, quality, available soil nutrients and uptake of nutrients by chilli cv. Co1. The results of the investigation revealed that foliar application of vipul 0.1 per cent EC at 300 ml ha^{-1} for three times at 25, 45 and 65 days after transplanting maximized the dry pod yield of chillies (3.08 t ha^{-1}), improved the quality attributes (capsaicin, total soluble solids and ascorbic acid contents) and enhanced the uptake of major nutrients (N, P and K). Miraculan 0.05 per cent EC at 300 ml ha^{-1} also had a favourable influence on dry pod yield and total soluble solid content of the red ripe fruits. *(Key words: Plant growth regulators, Chilli, Vipul, Nutrient uptake, Miraculan).*

Pungent pepper commonly known as 'Chilli' *(Capsicum annuum* Linn.) earns an attractive export value in the foreign markets as a major condiment. Hence the emphasis now lies on the higher production per unit area in our country besides improving its nutritive values. The dynamic role of plant growth regulators in various physiological and biochemical processes of plant is well known, which enables a rapid change in the phenotype of the plants to achieve desirable results. Plant growth regulating substances have been commercialized and are available in the market, which can improve the physiological efficiency including photosynthetic ability of the plants and a significant role in raising the productivity of crops (Dashora and Jain, 1994). The plant growth regulator Triacontanol is reported to increase photosynthesis, reduce photorespiration and promote growth and yield of several vegetable crops (Ries and Wert, 1978; Jones *et al.* 1979). This experiment was conducted with the objective of studying the efficiency of triacontanol containing products developed by the Indian Association of Plant Growth Products, Mumbai, on the yield, quality attributes, available soil nutrients and uptake of nutrients by chilli.

Materials and Methods

A field trial was conducted at Agricultural Research Station farm, Bhavanisagar, Tamil Nadu, during (Dec-June) 1999-2000. The treatment details are given below.

T_1 - Vipul 0.1% @200 ml ha^{-1}
T_2 - Vipul 0.1% @250 ml ha^{-1}
T_3 - Vipul 0.1% @ 300 ml ha^{-1}
T_4 - Miraculan 0.05% @200 ml ha^{-1}
T_5 - Miraculan 0.05% @250 ml ha^{-1}
T_6 - Miraculan 0.05% @300 ml ha^{-1}
T_7 - Triacontanol granules 0.05% @20 kg ha^{-1}
T_8 - Triacontanol granules 0.05% @25 kg ha^{-1}
T_9 - Triacontanol granules 0.05% @30 kg ha^{-1}
T_{10} - Planofix 45% SL @50 ppm
T_{11} - Water spray (control)

Treatments were tested in a randomized block design with three replications. Foliar sprayings at 25, 45 and 65 days after transplanting were given. Granules were applied directly to soil before transplanting. The texture of the soil is sandy loam belonging to Irugur series (Typic Ustropept). Fertility status of the soil was low (225 kg ha^{-1}), medium (17 kg ha^{-1}) and medium (250 kg ha^{-1}) for N, P and K respectively. The experimental soil was neutral in pH. The test crop chilli cv. Co1 received uniform dose of 75:35:35 kg ha^{-1} N, P and K through urea, single super phosphate and muriate of potash. Routine cultural practices were followed. The net plot size of the experimental trial was 5 m x 4 m and spacing adopted was 60 cm x 45 cm. The dry pod and stover samples were analysed for their nutrient contents and uptake computed. The soil samples collected at post harvest stage of crop were analysed for available nutrients. At maturity the yield of dry pod was recorded and the biochemical analysis *viz.* TSS of the fresh

Table 1. Efficacy of plant growth stimulants on dry pod yield and uptake of nutrients- chillies.

Treatments	Dry pod yield	Stover yield	N Content(%)		N uptake (kg ha^{-1})		P Content (%)		P uptake (kg ha^{-1})		K Content (%)		K uptake (kg ha^{-1})	
	(t ha^{-1})	(t ha^{-1})	Dry pod	Stover	Dry pod	Stover	Dry pod	Stover	Dry pod	Stover	Dry pod	Stover	Dry pod	Stover
T_1	2.47	1.59	1.59	1.87	41.5	29.8	0.26	0.36	6.9	5.6	1.82	2.75	49.9	43.8
T_2	2.69	1.75	1.68	1.89	47.7	33.2	0.35	0.39	9.9	6.8	1.88	2.86	52.7	50.1
T_3	3.08	1.87	1.91	1.95	61.7	36.2	0.38	0.41	12.3	7.6	2.07	3.18	67.7	59.5
T_4	2.21	1.36	1.26	1.67	29.6	22.9	0.20	0.33	4.8	4.5	1.72	2.65	41.4	36.1
T_5	2.47	1.49	1.26	1.82	33.1	27.2	0.24	0.35	6.2	5.3	1.80	2.72	48.3	40.6
T_6	2.81	1.61	1.54	1.84	45.5	29.7	0.31	0.38	9.3	6.2	1.88	2.93	56.4	47.2
T_7	2.19	1.10	1.26	1.57	28.1	17.3	0.19	0.27	4.3	2.9	1.57	2.43	35.1	26,8
T_8	2.35	1.34	1.31	1.70	32.7	23.0	0.21	0.32	5.3	4.3	1.61	2.52	40.3	33.9
T_9	2.47	1.60	1.31	1.75	34.7	28.0	0.24	0.34	6.2	5.5	1.82	2.58	48.3	41.4
T_{10}	2.18	1.40	1.31	1.68	30.5	23.7	0.23	0.29	5.3	4.0	1.61	2.65	36.5	37.1
T_{11}	1.98	1.02	1.17	1.55	24.9	16.0	0.18	0.27	3.8	2.7	1.52	2.42	32.3	24.9
SEd	0.11	0.17	0.10	0.04	3.1	3.2	0.02	0.01	0.7	0.7	0.05	0.05	2.1	4.8
CD	0.23	0.35	0.21	0.08	6.4	6.7	0.04	0.03	1.4	1.4	0.09	0.10	4.4	10.0

ripe ftits (by using 'Zeiss' hand refractometer), capsaicin content of the dry pods as suggested by Thenmoli Balasubramaniam, 1982 and ascorbic acid contents of fresh ripe and dry pods (titration method using 2, 6 - dichlorophenol indophenol dye as outlined by Freed, 1966) were also done.

Results and Discussion

Dry pod yield

A perusal of data in the Table 1 revealed that foliar application of bioregulators was found to be superior to soil application of triacontanol granules. Among the foliar application of bioregulators, vipul 0.1 per cent EC at the rate of 300 ml ha^{-1} significantly increased the dry pod yield (3.08 t ha^{-1}) as compared to control. The percentage increase in yield of dry chillies was 56 due to this treatment over control. The highest dose of miraculan 0.05 per cent EC also had a perceptible influence in increasing the pod yield of chillies (2.81 t ha^{-1}). The enhanced yield in chillies by the application of vipul might be due to increased number of flowers, fruits and fruit set per cent. Yet another reason for increased yield might be the accumulation of increased photosynthates, proper partitioning of assimilates from source to sink and increase in chlorophyll content and photosynthetic area of the plant. This stands with the views of Ray (1991) and Thakur *et al.* (1999) in chillies.

Nutrients uptake

The promising effect of plant growth promoters on the uptake of N, P and K by dry pods and stover was well evidenced from the Table 1. Foliar application of vipul 0.1 per cent EC at 300 kg ha^{-1} recorded the maximum uptake of nutrients. The N, P and K uptake by dry pod was in the order of 61.7, 12.3 and 67.7 kg ha^{-1}. Similarly stover uptake also has been increased by this treatment (36.2 kg ha^{-1} for N, 7.6 kg ha^{-1} for P and 59.5 kg ha^{-1} for K). The uptake of nutrients is primarily a function of total biomass production and nutrient content. The increase in total uptake of N, P and K might be attributed to the increase in photosynthetic efficiency by

Table 2. Effect of plant growth stimulants on quality attributes and available soil nutrient contents - chillies.

Treatments	Capsaicin (mg 100 g^{-1})	TSS (°B)	Ascorbic acid (mg100 g^{-1})		Available soil N (alkali-$KMnO_4$-N)	Available soil P (Olsen's-P)	Available soil K (NH_4OAc-K)
			Ripe fruit	Dry pod			
T_1-Vipul 0.1 % @ 200 ml ha^{-1}	4.38	11.2	108	43.4	180	15.6	188
T_2-Vipul 0.1 % @ 250 ml ha^{-1}	4.52	11.6	110	48.9	178	13.4	175
T_3-Vipul 0.1 % @ 300 ml ha^{-1}	4.70	12.0	123	62.4	176	12.7	173
T_4-Miraculan 0.05 % @ 200 ml ha^{-1}	4.25	9.7	99	38.3	184	16.7	210
T_5-Miraculan 0.05 % @ 250 ml ha^{-1}	4.37	11.3	104	42.6	187	16.1	207
T_6-Miraculan 0.05 % @ 300 ml ha^{-1}	4.52	11.7	113	46.5	180	12.7	188
T_7-Triacontanol granules 0.05 % @ 20 kg ha^{-1}	4.23	9.5	100	37.2	200	19.0	263
T_8-Triacontanol granules 0. 05 % @ 25 kg ha^{-1}	4.25	10.2	113	45.2	181	17.9	253
T_9-Triacontanol granules 0.05 % @ 30 kg ha^{-1}	4.42	10.9	113	52.2	183	19.4	238
T_{10}-Planofix 45 % SL @ 50 ppm	4.37	10.3	113	54.3	199	19.4	258
T_{11}-Water spray (control)	4.18	8.2	73	32.9	222	22.8	272
SEd	0.08	0.3	2	1.8	3	1	7
CD	0.16	0.6	4	3.7	7	2	14

triacontanol application leading to higher biomass production (Dashora and Jain, 1994).

Quality attributes

Capsaicin content

The exogenous application of plant growth stimulants vipul, miraculan and vipul granules at the highest doses showed a significant increase in capsaicin content of fruit as compared to control. The capsaicin content of dry pods presented in the Table.2 revealed that the highest amount was produced from the plants sprayed with vipul 0.1 per cent at 300 ml ha^{-1} (4.70 mg 100 g^{-1}). The increased amount of capsaicin content of dry pods could be attributed to the increased cell metabolism, enzymatic activity and mineral composition. Generally dry pods recorded higher capsaicin content compared to fresh ripe fruits, which might be due to the dehydration of fruits, resulting in loss of moisture and accumulation of crude capsaicin. This stands with the views of Ray (1991) and Thakur, *et al.* (1991) in chillies.

Total soluble solids

Among the different plant growth substances tested, higher doses of vipul 0.1 per cent and miraculan 0.05 per cent registered the maximum amount of TSS in red ripe fruits of chillies (Table 2). The highest amount of TSS of chilli fruit (12.0°B) was observed in plants sprayed with vipul 0.1 per cent at 300 ml ha^{-1}. Miraculan 0.05 per cent at 300 ml ha^{-1} also had a significant influence on TSS content. The increase in TSS of red ripe fruits of chillies may probably be attributed to increased accumulation and translocation of photosynthates from source to sink in response to the hormonal stimulation. This is in line with the findings of Rajamani (1987) in chillies.

Ascorbic acid

The ascorbic acid content of the fruits was improved by the application of plant growth stimulants especially in the form of foliar applications. The treatment vipul 0.1 per cent at 300 t ha^{-1} had a profound influence on ascorbic acid content of red ripe fruits and dry pods and recorded the maximum of 123 mg 100 g^{-1} and 62.4 mg 100 g^{-1} respectively. Planofix at 50 ppm also recorded higher values in ascorbic acid content in dry pods (Table 2). The augment of ascorbic acid might be either due to the encouragement of biosynthesis of ascorbic acid by triacontanol application or protection of oxidation of synthesised ascorbic acid through the enzyme ascorbic acid oxidase.

Available soil nutrients

Application of growth regulators had a significant influence on the available soil nutrients at post harvest stage of the crop. The growth promoter vipul 0.1 per cent EC showed its efficiency on N, P and K content by depleting the nutrients from the soil to greater extent there by reducing the available nutrient contents. Low available soil nutrients (176 kg ha^{-1} for N, 12.7 kg ha^{-1} for P and 173 kg ha^{-1} for K) were recorded by the dose of 300 ml ha^{-1} of vipul 0.1 per cent (Table 2). A negative trend of decreased soil nutrient contents with the increased crop yield indicated that plant growth promoters enable the crop to exploit the nutrients to the fullest possible. Production of active roots and consequent improvement in root growth and development by growth promoters application enable the plants to forage or absorb nutrients effectively from the soil. Higher biomass production (including dry pod and stover) might be another reason for decreased nutrients in the treated plots. These results suggest that succeeding crop should receive a judicious application of manures and fertilizers.

References

Dashora, L.D. and Jain, P.M. (1994). Effect of growth regulators and Phosphorus levels on growth and yield of soybean. *Madras Agric J.* **81**: 235-237.

Freed, M. (1966). Methods of Vitamin Assay. Interscience, Pub. Inc. New York.

Jones, J., Wert, V. and Ries, S.K. (1979). Specificity of 1-triacontanol as a plant growth stimulator and inhibition of its effect by other long chain compounds. *Planta*, **144**: 277-282.

Rajamani, K. (1987). Effect of triacontanol, 2,4-D and boron on the growth and yield of certain chilli (*Capsicum annuum* Linn.) cultivars. M.Sc. (Ag.). Thesis. Tamil Nadu Agricultural University, Coimbatore-3.

Ray, R.C. (1991). Effect of triacontanol on growth and yield of capsicum (*Capsicum annuum Linn.*). *Adv. Hort. Science*, **5**: 153-156.

Ries, S.K. and Wert, V. (1978). Triacontanol : New growth stimulant. *Farm Chemcials*, **1**: 42-46.

Thakur, A.S., Jindal, K.K. and Sud, A. (1991). Effect of growth substances on vegetative growth, yield and quality parameters in strawberry. *Indian J Hort.* **48**: 286-290.

Thakur, A., Thakur, P.S., Attri, S. and Kanaujia, S.P. (1999). Effect of bioregulators on fruit yield and quality of bell pepper varieties under water stress. *Ann. Agric. Res.* **20**: 313-317.

Thenmoli Balasubramaniam. (1982). Capsaicin content and plant characters in chillies. *Indian J Hort.* **39**: 239-243.

(Received: September 2000; Revised: April 2001)