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The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 665-667

www.thepharmajournal.com
Received: 12-11-2021
Accepted: 19-12-2021

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Effect of plant growth regulators and nutrients on fruit yield of tomato hybrid (COTH 3)

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Abstract
A research was conducted on tomato to know the effect of pre-harvest spray of growth regulators and nutrients on yield of tomato hybrid (COTH 3) at the college orchard, Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during the period 2014-2015. Design followed was RBD with seven treatments *Viz*., Control (without any growth regulators and nutrients); Chlormequat chloride @ 300 ppm on 30 DAT; Mepiquat chloride @ 500 ppm on 30 DAT; Calcium sulphate @ 1% on 45 DAT; Borax @ 0.2% on 45 DAT; Chlormequat chloride @300 ppm on 30 DAT + Calcium sulphate @ 1% on 45 DAT; Chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT; Mepiquat chloride @ 500 ppm on 30 DAT + Calcium sulphate @ 1% on 45 DAT; Mepiquat chloride @ 500 ppm on 30 DAT + Borax @ 0.2% on 45 DAT and these treatments are replicated thrice. The observations were recorded on number of flowers per cluster, number of fruits per plant, fruit length (cm), fruit width (cm), single fruit weight (g) and fruit yield per plant (kg). Results revealed that application of chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT gave highest fruit yield with mean fruit yield of 3.76 kg per plant

Keywords: Plant growth regulators, nutrients on fruit, tomato hybrid

Introduction
Tomato (*Solanum lycopersicum* L.) belongs to the family Solanaceae, is one of the most important vegetable crop because of its nutritive value. It is rich in vitamins and minerals. It has a chromosome number of 2n=24 and the origin of tomato was Peru-Equador region. It is one of the most popular salad vegetables and is taken with great relish. It is widely used in cannery and made into soups, conserves, pickles, ketchup, sauces, juices etc., Tomato juice has become an exceedingly popular appetizer and beverage (Uddain *et al*., 2009) [7].
Plant growth substances are essential for growth and development of tomato plant. It plays an important role in flowering and fruiting of tomato (Desai *et al*., 2012) [1].
Chlormequat chloride and Mepiquat chloride are plant growth retardants which are used to reduce the shoot length of plant in desired way without changing developmental patterns or being phytotoxic. They are antagonistic to gibberellins and auxins, the plant hormones that are primarily responsible for shoot elongation (Rademacher, 2000) [5].
Many scientists have been trying to control the stem elongation of vegetable plants by the application of growth retarding chemicals, which retard stem elongation and thereby increases green colour of leaves and indirectly affect the flowering and fruiting. Fruit set in tomato was successfully improved by application of plant growth regulators and micronutrients. In fact the use of growth regulators had improved the production of tomato including other vegetables with respect to better growth and quality (Desai *et al*., 2012) [1]. Hence, this study was taken up to find out the effect of pre-harvest spray of growth regulators and nutrients on yield of tomato hybrid (COTH 3)

Materials and Methods
The present study was carried out under field conditions in order to study the "Effect of pre-harvest spray of plant growth regulators and nutrients on yield of tomato hybrid COTH 3 (*Solanum lycopersicum* L.)" during the period 2014-2015 at the college orchard, Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. The design followed was RBD with nine treatments and three replications. The treatments were T_1: Control (without any growth regulators and nutrients); T_2: Chlormequat chloride @ 300 ppm on 30 DAT; T_3: Mepiquat chloride @ 500 ppm on 30 DAT; T_4: Calcium sulphate @ 1% on 45 DAT; T_5: Borax @ 0.2% on 45 DAT; T_6:

Chlormequat chloride @ 300 ppm on 30 DAT + Calcium sulphate @ 1% on 45 DAT; T_7: Chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT; T_8: Mepiquat chloride @ 500 ppm on 30 DAT + Calcium sulphate @ 1% on 45 DAT; T_9: Mepiquat chloride @ 500 ppm on 30 DAT + Borax @ 0.2% on 45 DAT.

Results and Discussion

In both the seasons, the treatment T_7 (Chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT) produced higher fruit yields with mean fruit yield of 3.76 kg per plant (Table 1). In *Kharif* season yield per plant differed significantly among the treatments. The treatment T_7 (Chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT) registered more yield per plant (3.81 kg) followed by T_9 (Mepiquat chloride @ 500 ppm on 30 DAT + Borax @ 0.2% on 45 DAT) with 3.37 kg. The treatment T_1 (control) recorded the minimum yield per plant (2.61 kg).

Similar trend was obtained in the summer season also. The treatment T_7 (Chlormequat chloride @ 300 ppm on 30 DAT + Borax @ 0.2% on 45 DAT) registered the highest fruit yield of 3.70 kg per plant followed by T_9 (Mepiquat chloride @ 500 ppm on 30 DAT + Borax @ 0.2% on 45 DAT) with 3.26 kg per plant. The lowest fruit yield of 2.5 kg per plant was recorded in T_1 (control).

The yield per plant was significantly increased due to the application of chlormequat chloride at 300 ppm and Borax at 0.2% (T_7) which was followed by Mepiquat chloride at 500 ppm and Borax at 0.2% in both *Kharif* and *Summer* seasons. This may be due to maximum number of flowers, number of fruits per plant and fruit size as these are all yield attributing characters. The other possible reason might be due to role of boron which enhance the movement of sugar borate complex from the leaves to the fruit and ultimately increased the fruit yield. The results are in accordance with the findings of Singh *et al*. (2003) [6] on tomato, Dubey *et al.* (2013) [2] on bell pepper and Prakash *et al*. (2001) [4] on potato.

The productivity of any crop depends on the processes of photosynthesis, which in turn depends on the chlorophyll content of leaves in plants. Chlormequat chloride enhances the chlorophyll content of leaves and helps in translocation of photo assimilates towards reproductive parts (FAO, 2003) [3].

Table 1: Effect of plant growth regulators and nutrients on fruit yield per plant (kg) in tomato hybrid (COTH 3)

Treatments	Fruit yield per plant (Kg)			Total fruit yield per hectare (tonnes)		
	Kharif	Summer	Mean	*Kharif*	Summer	Mean
T_1	2.61	2.50	2.56	96.6	92.6	94.6
T_2	2.98	2.87	2.93	110.3	106.2	108.2
T_3	2.93	2.81	2.87	108.5	104.0	106.2
T_4	3.13	3.03	3.08	116.0	112.2	114.1
T_5	2.84	2.75	2.80	105.1	101.8	103.4
T_6	3.09	2.98	3.04	114.4	110.3	112.3
T_7	3.81	3.70	3.76	141.1	137.0	139.0
T_8	3.21	3.10	3.16	118.8	114.8	116.8
T_9	3.37	3.26	3.32	124.8	120.7	122.7
Grand mean	3.11	3.00		115.0	111.0	
S.Ed	0.04	0.07		3.05	2.48	
CD(P=0.05)	0.09	0.15		6.47	5.26	

Table 2: Effect of plant growth regulators and nutrients on number of flowers per cluster in tomato hybrid (COTH 3)

Treatments	Number of flowers per cluster		
	Kharif	Summer	Mean
T_1	4.70	4.62	4.66
T_2	5.50	5.43	5.47
T_3	5.60	5.50	5.55
T_4	5.40	5.31	5.36
T_5	5.70	5.63	5.67
T_6	5.30	5.20	5.25
T_7	6.80	6.78	6.79
T_8	5.70	5.60	5.65
T_9	6.00	6.14	6.07
Grand mean	5.63	5.58	
S.Ed	0.10	0.13	
CD(P=0.05)	0.21	0.27	

Table 3: Effect of plant growth regulators and nutrients on number of fruits per plant in tomato hybrid (COTH 3)

Treatments	Number of fruits per plant		
	Kharif	Summer	Mean
T_1	40.0	38.0	39.0
T_2	51.4	49.5	50.5
T_3	50.9	48.8	49.9
T_4	51.6	49.3	50.5
T_5	46.2	44.1	45.2
T_6	51.6	48.6	50.1
T_7	56.8	54.6	55.7
T_8	50.9	49.9	50.4
T_9	53.1	52.0	52.6
Grand mean	50.3	48.3	
S.Ed	1.16	0.97	
CD(P=0.05)	2.48	2.05	

Table 4: Effect of plant growth regulators and nutrients on fruit length (cm) in tomato hybrid (COTH 3)

Treatments	Fruit length (cm)		
	Kharif	**Summer**	**Mean**
T_1	4.11	4.08	4.10
T_2	4.50	4.35	4.43
T_3	4.42	4.21	4.32
T_4	4.40	4.37	4.39
T_5	4.21	4.10	4.16
T_6	4.50	4.40	4.45
T_7	4.90	4.74	4.82
T_8	4.42	4.31	4.37
T_9	4.20	4.12	4.16
Grand mean	4.4	4.30	
S.Ed	0.18	0.08	
CD(P=0.05)	0.38	0.18	

Table 5: Effect of plant growth regulators and nutrients on fruit width (cm) in tomato (COTH 3)

Treatments	Fruit width (cm)		
	Kharif	**Summer**	**Mean**
T_1	5.02	5.10	5.06
T_2	5.31	5.21	5.26
T_3	5.12	5.03	5.08
T_4	5.20	5.34	5.27
T_5	5.40	5.45	5.43
T_6	5.10	5.02	5.06
T_7	5.51	5.82	5.67
T_8	5.11	5.17	5.14
T_9	5.23	5.39	5.31
Grand mean	5.30	5.28	
S.Ed	0.13	0.10	
CD(P=0.05)	0.28	0.22	

Table 6: Effect of plant growth regulators and nutrients on single fruit weight (g) in tomato hybrid (COTH 3)

Treatments	Single fruit weight (g)		
	Kharif	**Summer**	**Mean**
T_1	52.0	51.0	51.5
T_2	59.3	58.3	58.8
T_3	57.1	56.2	56.7
T_4	60.7	59.6	60.2
T_5	56.9	54.8	55.9
T_6	60.1	59.1	59.6
T_7	65.7	64.5	65.1
T_8	61.1	60.1	60.6
T_9	62.0	61.0	61.5
Grand mean	59.4	58.3	
S.Ed	1.19	1.04	
CD(P=0.05)	2.54	2.21	

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