EFFECT OF PLANT GROWTH REGULATORS ON THE SUCCESS OF SUMMER TOMATO PRODUCTION IN CENTRAL TERAI REGION

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ABSTRACT

Tomato (Solanum tuberosum L.) is one of the major vegetable crops, which is grown during winter in Terai. Due to higher temperature and rainfall, its yield declines and price increases during summer season. Therefore, this experiment was conducted in three subsequent years to evaluate and identify the proper growth regulators for summer tomato production. Seven different treatments of growth regulators were applied two times on tomato plants; CV. Pusa Ruby. Vegetative and yield parameter were compared with control. Result showed that Vegimex 0.125 ml/L significantly increased average weight of fruit (8.8 g), yield (25.2%), number of fruits per plant (7.6%) and followed by GA_3 50 ppm which increased average weight of fruit (1.5 g), yield (17.3%), and number of fruits per plant (2.8%), respectively as compared to control. Economically, Vegimex @0.125 ml/L and GA3 50 ppm provided additional net benefit Rs. 81,972.00 and 69,250.00 per hectare. Hence, Vegimex @0.125 ml/L or GA_3 50 ppm spraying improved the yield and quality of summer tomato production as compared to without any foliar application of growth regulators.

Key words; Growth hormones, foliar spray, net benefit, summer tomato production

INTRODUCTION

Tomato is one of the major vegetable crops, which is grown during winter in Terai. Due to higher temperature and rainfall, its yield declines and price increases during summer season. The area of fresh vegetable is increasing every year but the productivity is not satisfactory in farmer's field in terai condition. It may be due to the improper use of plant nutrients, soil fertility problems and imbalance of plant hormones within the plant itself. Plant growth hormones have been reported to influence the growth, flowering and sex expression and promote fruit yield.

There is the interaction of the genetic and hormonal regulation of growth, flowering and sex expression in plants (Chailakhyan, 1979). The initiation of flowering in plants is controlled by environmental and endogenous signals 1,2. The endogenous signals regulate the autonomous and gibberellins pathways (Austin *et al.* 1990). Application of certain plant hormones promote flowering. For example, the hormone ethylene promotes flowering in pineapple and other bromeliads. Treating a biennial rosette, i.e. carrot, with the plant hormone gibberellic acid stimulates it to flower (Hershey, 2002). Singh and Chaudhary (1979) observed that Etheral at 50 and 100 ppm induced the first pistillate flowers earlier at lower nodes.

In Nepal, research in growth regulators on vegetable crops is rarely done. In India and abroad, research on plant growth regulators in different vegetable crops has been done and results had shown an increase in fruit setting and yield of different vegetable crops. Aora *et al.*, (1987) reported that the application of 50 ppm PCPA at full bloom stage in summer season tomato produced the highest yield of tomato fruits. Chaudhary *et al.*, (1999), concluded that the foliar application of GA_3 at 60 ppm resulted into maximum fruit yield of tomato CV. Pusa Early Dwarf. Kooner *et al.*, (2000) also reported that the application of Maleic Hydrazide (MH), Etheral and Cycocel increased the number of female flowers and ultimately the total fruit yield in bottle gourd.

In stress condition, flowers and fruits drop in tomato mostly occurs due to the lack of indigenous plant hormones inside the plant itself. Exogenous application of plant growth substances help in over coming stress conditions (temperature and moisture) in tomato which promote in flowering and fruit setting.

The main objective of this experiment is to evaluate and identify the proper growth regulators that improve fruit setting in tomato for more yields during adverse condition of temperature and moisture stress.

MATERIALS AND METHODS

This study was conducted for three consecutive years at RARS Parwanipur, Bara. This trial was laid out in randomized complete block design (RCBD) with three replications of seven treatments. The treatments were; control (water spray), superfix (NAA) @0.24 ml,Miraculan (triacantanol a.i. 0.05%) @0.5 ml, Vegimex (trace elements plus vitamins) @ 0.125 ml, vegimex@0.25 ml, and superfix (NAA) @ 0.24 ml, and superfix @0.48 ml per liter of water. Plot size was 3.5 m x 3.0 m (10.5 m^2) where seedlings were transplanted by maintaining the spacing 70 cm line to line and 60 cm plant to plant. Fertilizer was applied at the rate of 100:80:80 kg NPK and 20 ton farm yard manure (FYM) per hectare. Chemicals (growth regulators) were applied two times 15 days after transplanting (DAT) and before flowering. Seedlings were transplanted in first week of Magh and first harvest started from 2nd week of Chaitra each year and it was continued until Asadh 2nd week. Insecticide (Rogar) and fungicide (Blitox) were sprayed to control aphid and late blight (LB) disease, respectively. Plants were supported with bamboo sticks and other intercultural operations were done as needed.

Observations were recorded on plant survival, plant height, canopy coverage (%), days to 50 percent flowering, fruits yield; number and weight.

RESULTS AND DISCUSSION

Survival (%)

During the early fruiting stage, number of plants survived was counted. Among them, Superfix (NAA) @0.24 ml/L, Miraculan @0.5 ml/L and control (water) sprayed plot had the highest plant survival percent (98%) followed by GA_3 100 ppm, Superfix (NAA) @0.48 ml, and Vegimex 0.25 ml/L (97%) (Table 1).

Plant height (cm)

Tallest plant (94 cm) was measured in GA_3 @100 ppm followed by Miraculan @0.5 ml/L (92 cm) and Vegimex @0.25 ml/L (91 cm), respectively whereas the shortest plants (86 cm) were noticed in Superfix (NAA) @0.48 ml/L (Table 1).

Days to 50% flowering

Significant effect of growth substances was noticed on days to flowering. Days to 50% flowering was ranged from 67 days to 69 days.

Table 1. Effect of growth regulators on plant growth and flowering in three years subsequently.

Treatments	Survival (%)	Plant height (cm)	Days to 50% flowering plants
GA_3 50 ppm	95.3 b	88	68 bc
GA_3 100 ppm	97.0 ab	94	69 a
Superfix @0.24ml/L	98.0 ab	87	69 a
Superfix @0.48ml/L	97.3 ab	86	69 a
Vegimex@0.125ml/L	95.3 b	90	68 bc
Vegimex@0.25ml/L	97.3 ab	91	68 bc
Miraculan@0.5ml/L	98.0 ab	92	67 d
Control: water spray	98.3 a	87	68 bc
CV%	1.58	7.3	0.81
F-test	*	ns	*
LSD	2.689	11.4	0.974
Year x Treatment	ns	ns	ns

Number of fruits per plant

The highest number of fruits per plant (37) was counted on Vegimex @0.125 ml/L sprayed plot followed by GA_3 50 ppm (35) whereas the lowest number of fruits per plant (30) was recorded on Superfix (NAA)

@0.24 ml/L, 0.48 ml/L, and Vegimex 0.25 ml/L. Hence, as compared to control, only Vegimex@0.125 ml and GA_3 50 ppm had increased number of fruits per plant 7.6% and 2.8%, respectively (Table 2).

Average fruit weight

As far as average fruit weight is concerned, all the treatment had improved average fruit weight. The highest average fruit weight (28.3 g) was recorded in Vegimex @0.125 ml/L followed by GA_3 50 ppm (21.0 g) whereas control plot had 19.5 g. Increment of average fruit weight was 11.0% in Vegimex @0.125 ml/L followed by 8.2% in GA_3 50 ppm, and Miraculan (0.5%), respectively (Table 2).

Fruit yield (ton/ha)

The highest fruit yield (23.1 ton/ha) was given by Vegimex @0.125 ml/L followed by GA_3 50 ppm whereas the other treatment have given lower yield as compared to control (21.6 ton/ha). As compared to control, Vegimex @0.125 ml/L and GA_3 50 ppm had increased the yield 25.20% and 20.5%%, respectively (Table 2).

Table 2. Effect of growth regulators on fruit parameter in three years

Treatment	Fruits/plant (no.)	Increment fruit (no)/plant (%)	Average wt.of fruit (g)	Increment fruit wt. (%)	Yield (ton/ha)	Yield increment (%)
GA_3 50 ppm	35 ab	+ 2.8 ab	21.0 ab	+ 8.2 a	21.65 ab	+ 17.3
GA_3 100 ppm	31 bcd	+ 8.0 bc	20.9 b	+ 7.9 a	19.80 abc	+ 7.3
Superfix @0.24ml/L	30 cd	- 6.4 bc	20.6 b	+ 6.7 a	18.75 bc	+ 1.6
Superfix @0.48ml/L	30 cd	- 10.6 c	20.5 b	+5.3 a	17.29 c	- 6.3
Vegimex@0.125ml/L	37 a	+ 7.6 a	28.3 a	+11.0 a	23.10 a	+ 25.2
Vegimex@0.25ml/L	30 d	- 11.3 c	19.9 b	+ 1.3 a	17.02 c	- 7.7
Miraculan@0.5ml/L	31 bcd	- 7.2 bc	20.9 b	+ 8.1 a	18.56 bc	0.6
Control: water	34 abc	0 abc	19.5 b	0	18.45 bc	0.0
CV%	7.3	-	19	-	11.5%	-
F-test (0.05)	* (4.1)	* (12.1)	ns (7.3)	ns (11.5)	ns (3.96)	ns(23.5)

Economical Benefit

When net benefit was calculated on monetary value, the highest net benefit (Rs. 2,01,072.00 per hectare) was obtained from Vegimex @ 0.125 ml/L followed by Rs. 1,88,350.00/ha from GA_3 50 ppm. Likewise, the highest benefit cost ratio (132:1) was obtained in Vegimex @0.125 ml/L followed by 71:1 in GA_3 50 ppm (Table 3).

Table 3. Effect of growth regulaotrs on economical benefit in three consecutive years

Treatment	Income amount (Rs)/hectare	Cost of growth regulators /ha (Rs)[y]	Benefit (Rs)/ha[z]	Benefit cost ratio[x]
GA_3 50 ppm	3,41,000.00	2,650.00	1,88,350.00	71: 1
GA_3 100 ppm	3,19,750.00	3,220.00	1,66,530.00	52: 1
Superfix @0.24ml/L	3,03,300.00	4,840.00	1,48,460.00	31: 1
Superfix @0.48ml/L	2,97,800.00	5,650.00	1,42,150.00	25: 1
Vegimex@0.125ml/L	3,52,600.00	1,528.00	2,01,072.00	132: 1
Vegimex@0.25ml/L	2,79,050.00	2,056.00	1,26,994.00	62: 1
Miraculan@0.5ml/L	2,86,250.00	5,125.00	1,31,125.00	26: 1
Control: water	2,69,100.00	0.00	1,19,100.00	0.0

[z] Benefit = Income – cost of production (Cost of production + Cost of growth regulators)

[x] Benefit cost ratio = Benefit (Rs)/ha[z] / Cost of growth regulators /ha (Rs)[y]

CONCLUSION AND RECOMMENDATION

It is concluded that Vegimex @0.125 ml/L and GA_3 50 ppm was found beneficial for summer tomato production. These two growth regulators had improved the yield (25.2% and 17.3%) and average weight of fruit (11.0% and 8.2%), and net benefit (Rs.81,972.00 and 69,250.00) respectively as compared to control.

Hence, these two growth regulators are recommended to use in summer tomato production in Central Region Terai condition.

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