Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2018; 7(5): 3157-3160
Received: 29-07-2018
Accepted: 30-08-2018

**Jitendra Singh Gurjar**
M.Sc. Student,
College of Agriculture, Indore,
Madhya Pradesh, India

**RNS Banafar**
Professor, College of Agriculture,
Indore, Madhya Pradesh, India

**NK Gupta**
Associate Professor,
College of Agriculture, Indore,
Madhya Pradesh, India

**PKS Gurjar**
Scientist Horticulture,
RVSKVV, Gwalior,
Madhya Pradesh, India

**Lal Singh**
Scientist Horticulture,
RVSKVV, Gwalior,
Madhya Pradesh, India

**Correspondence**
**Jitendra Singh Gurjar**
M.Sc. Student,
College of Agriculture, Indore,
Madhya Pradesh, India

# Effect of NAA, $GA_3$ on growth and yield of tomato varieties

**Jitendra Singh Gurjar, RNS Banafar, NK Gupta, PKS Gurjar and Lal Singh**

**Abstract**
The present investigation entitled "Response of tomato varieties to different plant growth regulators under Malwa condition" was conducted near Hi-Tech. Horticultural Area, Department of Horticulture, College of Agriculture, Indore during *rabi* season of 2008-09. The treatments comprising 4 varieties [$V_1$-J.T.-99, $V_2$-Pusa Ruby, $V_3$-Sel.-7, $V_4$-DVRI-1] and 3 combinations of plant growth regulators at different concentrations [$H_1$- 15 ppm $GA_3$ followed by 25 ppm NAA, $H_2$- 30 ppm $GA_3$ followed by 50 ppm NAA, $H_3$- 45 ppm $GA_3$ followed by 75 ppm NAA] laid out in randomized block design, replicated 3 times. The soil was low in available nitrogen and phosphorus and high in available potassium. A uniform dose 120 kg N/ha through urea, 60 kg $P_2O_5$/ha through SSP and 80 kg $K_2O$/ha through MOP were applied in all the experimental plots. Variety 'Sel.-7' gave higher values of most of the growth characters, plant height, number of branches/plant, number of leaves/plant and shoot girth and yield attributing characters like fruit length and diameter, weight per fruit, number of fruits per plant and fruit yield per plant and resulted in significantly highest fruit yield followed by 'Pusa Ruby'. Foliar application of 15 ppm $GA_3$ followed by 25 ppm NAA produced superior growth and yield attributing characters and ultimately fruit yield of tomato. Higher concentrations of $GA_3$ and NAA beyond 15 and 25 ppm were not found advantageous for tomato crop. Combination of variety 'Sel.-7' and 15 ppm $GA_3$ 25 ppm NAA was found best in respect increasing productivity of tomato crop. Variety 'Sel.-7' sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA gave highest gross and net return along with B:C ratio (Rs. 132821/ha, Rs. 99581/ha and 4.00) followed by 'Pusa Ruby' sprayed with same concentration of plant growth regulators (Rs. 122363/ha, Rs. 89123/ha and 3.68).

**Keywords:** Tomato, varieties, $GA_3$, NAA, growth and yield

## Introduction
Tomato (*Lycopericon esculentum* L.) is one of the most important commercial vegetable crops grown all over the world and occupies the 3rd position among vegetables in area and production in the world. It belongs to the family Solanaceae and said native of Tropical America (Thompson and Kelly, 1957) [16]. The fresh and ripe tomato fruits are widely used throughout the year as salad. Tomato number one processing vegetables is used to produce sauce, ketchup, juice, powder, paste, chutney, puree and in a lot of other ways. Tomato is universally treated as ''Protective food". Tomato fruit is being rich in vitamins and minerals. It is reported to have anticancer properties of mouth, stimulates torpid liver and also useful in chronic dyspepsia. India is the second largest producer of vegetables (101.43 million tonnes) after China (423.30 million tonnes) and shares about 11.5% of the total production in the world while China shares about 48% of the total production. In India, Tamilnadu leads in vegetable productivity (28.9) followed by Kerala (23.1) MT/ha. In India, Tomato ranks third in production with share of 8.52%, production 8637.7 thousand MT and the area fourth rank share of 7.37%, area 497.6 (000 ha), and productivity 17.4 MT/ha under vegetable (Salaria and Salaria 2008), while in Madhya Pradesh, it is cultivated about an area of 23000 ha with a production of 0.52 million tones.

Plant growth regulators are the organic compounds other than nutrient, which in small amounts, promote or modify the physiological processes of plant. The yield and quality can be improved of a great extend by genetic manipulations. However, the spray with Plant growth regulators has also been observed to improve the yield quality of tomato. In regards to influence of Plant growth regulators, Naphthalene acetic acid (NAA) plays an important role in high quality of vegetable and fruit production. NAA is being used to boost up the remarkable vegetative propagation. NAA helps to promote plant growth by enhancing the cell division, cell elongation and cell differentiation which may initiate the development of plant organs. It is also essentially required for the formation of root cambium and epicycle which may induce the formation lateral roots.

It's also interesting to note that NAA also enhanced the flowering, heavy fruit setting and check abortion of young embryo and fruit drop. If a plant is sufficiently developed premature flowering may be induced by direct application of GA to young plants. This action is not sustained and treatment may have to be repeated. Formation of male flower is generally promoted by concentration of 100 to 200 ppm, female flower by concentration of 200 to 300 ppm concentration more than 600 ppm markedly suppress initiation of both male and female flower. Spraying fruit tree at full-blossom or when the blossoms being to wither can offset the detrimental effect of frost. When there is difficulty with fruit set because of incomplete pollination, GA may be effectively used to increased fruit set. The resulting fruit may be partially or entirely seedless. It is also obtained that highest yield was recorded due to application of 30 ppm gibberellic acid which was 26% higher than control (Singh and Rajodia, 2001) [13]. Keeping these facts in view the present investigation is being proposed.

## Materials and Method

The experimental was laid out near Hi-tech Horticulture Area, Department of Horticulture, College of Agriculture, Indore (M.P.), during *Rabi* season of 2008-09 to evaluate the response of tomato varieties to different plant growth regulators under Malwa condition. Indore is situated in the Malwa plateau in western part of M.P. at 22º 43' N latitude and of 75º 66' E longitude with an altitude of 555.5 m above sea level. Indore belongs to sub-tropical and semi arid climate having a temperature range of minimum 7 ºC and maximum 44 ºC in winter and summer, respectively. In this area most of the rainfall is received during mid-June to early October with occasional showers in winter. Southwest monsoon is responsible for major part of annual precipitation. The average rainfall is 941 mm. The soil of the experimental field was medium black clay (vertisols) with uniform topography and pH 7.5 with 0.47 organic carbon content, analyzing available N (220 kg/ha), low P (9.70 kg/ha) and K (290 kg/ha) contents having 0.50 mmhos/cm electrical conductivity in 2008-09. The experiment was laid out in Randomized block design with 3 replications having 4 tomato variety (J.T.-99, Pusa ruby, Sel. 7, DVRI-1) and 3 combinations of plant growth regulators at different concentrations. The total treatment combination was 36. The data of various parameters were recorded at different stages of plant growth and yield parameters the data recorded at 20 days intervals analyzed statistically by method of analysis of variance.

## Result and Discussion

### Growth attributes

The growth parameters (table no.1) like plant height, number of branches/plant, number of leaves/plant and shoot girth were significantly influenced by varieties at all the growth stages except number of leaves per plant at 20 DAT. In final observation, At 20, 40 and 60 DAT, the variety 'J.T.-99' (29.16 cm) followed by 'Sel.-7' (27.89 cm) recorded taller plants than rest of the varieties. Data on plant height further revealed that variety 'DVRI-1' produced significantly dwarf plants as compared to rest of the varieties. At 80 and 100 DAT, 'Sel.-7'and 'Pusa Ruby' had significantly taller plants (61.49 cm and 60.81 cm; 75.02 cm and 73.94 cm, respectively) than other varieties. The dwarf plant was noted in case of variety 'DVRI-1'. Foliar application of plant growth regulators reduced the plant height when applied at higher concentrations at all crop growth stages. The reduction in plant height due to plant growth regulators treatment $H_2$ (30 ppm $GA_3$ followed by 50 ppm NAA) and $H_3$ (45 ppm $GA_3$ followed by 75 ppm NAA) over $H_1$ (15 ppm $GA_3$ followed by 25 ppm NAA) was also found statistically significant. Pundir and Yadav (2001) reported that the treatment $GA_3$ 50 ppm recorded the highest plant height (75.33 cm). It was at par with the treatment $GA_3$ 25 ppm. While the lowest plant height was recorded in absolute control. The data indicated that the plant height increased at higher concentration of growth regulating substances. This might be due to the effect of $GA_3$ on cell enlargement and cell division in sub-apical meristem.

The maximum and minimum number of branches per plant were annexed with growth regulators treatment $H_1$ (15 ppm $GA_3$ followed by 25 ppm NAA) and $H_3$ (45 ppm $GA_3$ followed by 75 ppm NAA) at almost all crop growth stages. The results are in agreement with those obtained by Kishan-Swaroop *et al.* (2001) [6] that maximum numbers of primary branches (4.73) in the treatment NAA 25 ppm. While the lowest number of primary branches was recorded in the treatment boron 50 ppm. Number of primary branches was not influenced by the growth regulatory substances.

Significantly higher number of leaves per plant was produced by 'Sel.-7' (128.06, 218.99, 327.62 and 311.52) than 'J.T.-99' (109.11, 201.59, 299.07 and 285.25) and 'DVRI-1' (109.49, 198.08, 303.85 and 289.00) at 40, 60, 80 and 100 DAT, respectively and also to 'Pusa Ruby' at 60 DAT only. At all crop growth stages, variety 'DVRI-1' followed by 'J.T.-99' produced the lowest leaves/plant, which was significantly less than that produced by other varieties. Kumar and Ray (2000) reported that application of NAA beyond 100 ppm reduced the number of leaves per plant of cauliflower.

The girth of shoot was significantly higher in 'Pusa Ruby' (0.46, 0.78, 0.90, 1.09 and 1.34 cm) than 'DVRI-1' (0.37, 0.68, 0.82, 1.02 and 1.17 cm) at all the crop growth stages. Furthermore, 'Pusa Ruby' also produced significantly more girth of shoot over 'Sel.-7' at 20 and 100 DAT; and 'J.T.-99' at 40 and 100 DAT. Significantly minimum girth of shoot was annexed with variety 'DVRI-1'. A positive response to growth attributing characters was also reported by Bokade et al. (2006) [2], Gupta *et al.* (2001) [4], Rai *et al.* (2006) [10] and Singh and Lal (2001) [14].

### Yield attributes

The Yield attributing characters (Table no. 2) viz., weight per fruit, number of fruits per plant, fruit yield per plant and fruit yield varied significantly due to varieties. The variety 'Sel.-7' attained the highest weight per fruit (65.51 g), which was significantly superior to rest of the varieties. The minimum weight per fruit (49.72 g) was recorded in 'J.T.-99' followed by 'DVRI-1' and both varieties were at par. Crop sprayed with 15 ppm GA3 followed by 25 ppm NAA produced significantly heavier fruit (65.83 g weight per fruit) over both higher levels of plant growth substance. Furthermore, foliar application of 45 ppm GA3 followed by 75 ppm NAA resulted in significantly lowest weight per fruit (47.28 g) over both lower levels. The maximum weight of 77.40 g per fruit was recorded when the seedlings of 'Sel.-7' sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA. Singh *et al.* (2002) [15] advocated that application of NAA at higher concentration (100 ppm) reduced the number of fruit set per cluster, fruit length, fruit width, number of locules per fruit, weight per fruit and fruit yield over lower concentration i.e. 50 ppm.

The Variety 'Sel.-7' resulted in significantly highest fruits (24.97/plant) over rest of the varieties. The minimum number of fruits (16.25/plant) was registered with variety 'J.T.-99'.

The interaction of varieties and plant growth substance levels was also significant. Under each level of plant growth substance, variety 'Sel.-7' produced significantly higher number of fruits per plant over other varieties. On the other hand, increasing level of plant growth substance decreased the number of fruits per plant. Thus, as a result, seedlings of 'Sel.-7' sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA resulted in significantly highest fruits over rest of the treatment combinations. Dhar and Majumdar (2003) [3] obtained reduced number of fruit per plant and percentage of fruit setting in chilli with increased concentration of NAA (40 and 80 ppm) as compared to 20 ppm.

The overall effect of various varieties on fruit yield per plant was found significant. Variety 'Sel.-7' followed by 'Pusa Ruby' produced significantly highest fruit yield per plant (1.24 and 1.20 kg) over rest of the varieties. Variety 'J.T.-99' recorded lowest (1.05 kg) followed by 'DVRI-1' (1.06 kg). The results indicated that fruit yield per plant was highest when the crop sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA which was significantly higher than that produced by the crop when sprayed with higher concentrations of plant growth regulators. However, maximum 1.74 kg fruit yield per plant was recorded when the seedlings of 'Sel.-7' was sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA. Gupta *et al.* (2003) [5] reported that the application of 75 ppm NAA along with multiplex resulted in largest fruit size at maturity stage of tomato and gave maximum yield.

Significantly higher fruit yield/ha was produced by 'Sel.-7' (317.04 q) than 'DVRI-1' (271.52 q) and 'J.T.-99' (267.42 q) but statistically similar to 'Pusa Ruby' (307.00 q). Fruit yield of tomato was also significantly influenced with the foliar application of plant growth regulators. Application of plant growth regulators at lower concentration (15 ppm $GA_3$ followed by 25 ppm NAA) recorded significantly higher fruit yield (393.04 q/ha) with the percentage increase of 39.19 and 87.21 over higher concentrations i.e. 30 ppm $GA_3$ followed by 50 ppm NAA and 45 ppm $GA_3$ followed by 75 ppm NAA, respectively. Further reference to data on fruit yield indicated that both the treatments of higher levels of plant growth substance significantly decreased the fruit yield over lower level. The interaction between varieties and plant growth substance levels for fruit yield was found to be non significant. However, maximum fruit yield (442.74 q/ha) was noted with treatment combination $V_3H_1$. Orzolek, and. Kaplan (2006) [8] observed that the combination treatment of $GA_3$ and Nutra-Phos 3–15 appeared antagonistic and resulted in significantly lower fruit yield and delayed maturity. However, $GA_3$ and Nutra-Phos 3–15 treatments alone produced higher fruit yields than the combination with no effect on fruit maturity compared to the control. The similarly results was also found in the work of Alam and Khan (2002) [1] and Serrani *et al.* (2007) [12].

**Table 1:** Growth attributes characters

| Treatments | Plant height (cm) at DAT | | | | | Branches/plant at DAT | | | | Leaves/plant at DAT | | | | | Shoot girth (cm) at DAT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 40 | 60 | 80 | 100 | 40 | 60 | 80 | 100 | 20 | 40 | 60 | 80 | 100 | 20 | 40 | 60 | 80 | 100 |
| **Varieties** | | | | | | | | | | | | | | | | | | | |
| V1 | 29.16 | 37.32 | 46.82 | 59.94 | 71.83 | 1.27 | 3.92 | 7.09 | 14.53 | 50.33 | 109.11 | 201.59 | 299.07 | 285.25 | 0.45 | 0.73 | 0.88 | 1.06 | 1.20 |
| V2 | 24.42 | 33.83 | 44.19 | 61.49 | 73.94 | 1.54 | 4.08 | 7.67 | 19.73 | 52.07 | 125.75 | 211.20 | 322.95 | 305.72 | 0.46 | 0.78 | 0.90 | 1.09 | 1.34 |
| V3 | 27.89 | 35.87 | 46.06 | 60.81 | 75.02 | 1.64 | 4.08 | 10.5 | 24.74 | 50.53 | 128.06 | 218.99 | 327.62 | 311.52 | 0.40 | 0.76 | 0.88 | 1.06 | 1.22 |
| V4 | 22.32 | 30.78 | 41.16 | 54.79 | 64.11 | 1.38 | 3.24 | 6.99 | 14.26 | 53.82 | 109.49 | 198.08 | 303.85 | 289 | 0.37 | 0.68 | 0.82 | 1.02 | 1.17 |
| SEm± | 0.53 | 0.23 | 0.26 | 0.44 | 0.38 | 0.06 | 0.09 | 0.27 | 0.39 | 1.51 | 1.09 | 1.20 | 3.26 | 2.57 | 0.011 | 0.016 | 0.014 | 0.022 | 0.055 |
| CD (p=0.05) | 1.56 | 0.66 | 0.78 | 1.29 | 1.12 | 0.17 | 0.25 | 0.79 | 1.15 | NS | 3.20 | 3.52 | 9.56 | 7.55 | 0.032 | 0.047 | 0.041 | 0.066 | NS |
| **Plant growth substance levels** | | | | | | | | | | | | | | | | | | | |
| H1 | 26.96 | 35.79 | 45.65 | 59.99 | 72.50 | 1.60 | 3.98 | 8.68 | 20.02 | 49.75 | 122.05 | 209.67 | 319.51 | 302.28 | 0.45 | 0.73 | 0.87 | 1.05 | 1.18 |
| H2 | 25.33 | 33.68 | 44.13 | 59.30 | 70.99 | 1.36 | 3.81 | 8.19 | 18.38 | 53.85 | 115.38 | 208.38 | 313.98 | 297.73 | 0.41 | 0.72 | 0.85 | 1.09 | 1.33 |
| H3 | 25.55 | 33.88 | 43.89 | 58.48 | 70.19 | 1.42 | 3.70 | 7.31 | 16.56 | 51.47 | 116.88 | 204.35 | 306.64 | 293.61 | 0.40 | 0.75 | 0.89 | 1.04 | 1.19 |
| SEm± | 0.46 | 0.20 | 0.23 | 0.38 | 0.33 | 0.05 | 0.07 | 0.23 | 0.34 | 1.31 | 0.95 | 1.04 | 2.82 | 2.23 | 0.010 | 0.014 | 0.012 | 0.019 | 0.047 |
| CD (p=0.05) | 1.35 | 0.57 | 0.67 | 1.12 | 0.97 | 0.15 | 0.22 | 0.68 | 1.00 | NS | 2.78 | 3.05 | 8.28 | 6.54 | NS | NS | NS | NS | NS |

- **Note:** $V_1$ –J.T.-99, $V_2$ – Pusa Ruby, $V_3$ – Sel.-7, $V_4$ – DVRI-1
- $H_1$ – Application of 15 ppm $GA_3$ followed by 25 ppm NAA
- $H_2$ – Application of 30 ppm $GA_3$ followed by 50 ppm NAA
- $H_3$ – Application of 45 ppm $GA_3$ followed by 75 ppm NAA
- DAT - Days after transplanting

**Table 2:** Yield attributes characters

| Plant growth substance levels (H) | Varieties (V) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fruit weight (g) | | | | | No. of fruits per plant | | | | | Fruit yield per plant (kg) | | | | | Fruit yield (q/ha) | | | | |
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | Mean | $V_1$ | $V_2$ | $V_3$ | $V_4$ | Mean | $V_1$ | $V_2$ | $V_3$ | $V_4$ | Mean | $V_1$ | $V_2$ | $V_3$ | $V_4$ | Mean |
| $H_1$ | 57.75 | 69.30 | 77.40 | 58.88 | 65.83 | 18.76 | 23.47 | 29.16 | 21.90 | 23.32 | 1.41 | 1.60 | 1.74 | 1.42 | 1.54 | 358.63 | 407.88 | 442.74 | 362.92 | 393.04 |
| $H_2$ | 49.70 | 61.08 | 63.35 | 50.99 | 56.28 | 15.85 | 18.51 | 26.02 | 17.91 | 19.57 | 0.97 | 1.23 | 1.21 | 1.02 | 1.11 | 248.18 | 313.60 | 308.40 | 259.30 | 282.37 |
| $H_3$ | 41.70 | 47.35 | 55.79 | 45.04 | 47.47 | 14.16 | 15.49 | 19.72 | 15.13 | 16.12 | 0.77 | 0.78 | 0.78 | 0.75 | 0.77 | 195.44 | 199.52 | 199.99 | 192.33 | 196.82 |
| Mean | 49.72 | 59.24 | 65.51 | 51.64 | | 16.25 | 19.16 | 24.97 | 18.31 | | 1.05 | 1.20 | 1.24 | 1.06 | | 267.42 | 307.00 | 317.04 | 271.52 | |
| **Interaction** | | | | | | | | | | | | | | | | | | | | |
| | V | | H | | V×H | V | | H | | V×H | V | | H | | V×H | V | | H | | V×H |
| SEm± | 1.69 | | 1.46 | | 2.92 | 0.41 | | 0.35 | | 0.71 | 0.04 | | 0.03 | | 0.06 | 9.55 | | 8.27 | | 16.53 |
| CD (p=0.05) | 4.95 | | 4.29 | | NS | 1.20 | | 1.04 | | 2.08 | 0.11 | | 0.10 | | NS | 28.00 | | 24.25 | | NS |

- **Note:** $V_1$ –J.T.-99, $V_2$ – Pusa Ruby, $V_3$ – Sel.-7, $V_4$ – DVRI-1
- $H_1$ – Application of 15 ppm $GA_3$ followed by 25 ppm NAA
- $H_2$ – Application of 30 ppm $GA_3$ followed by 50 ppm NAA
- $H_3$ – Application of 45 ppm $GA_3$ followed by 75 ppm NAA

## Conclusion

It was concluded that Variety 'Sel.-7' gave higher values of most of the growth and yield attributing characters and resulted in significantly highest fruit yield followed by 'Pusa Ruby'. The Foliar application of 15 ppm $GA_3$ followed by 25 ppm NAA produced superior growth and yield attributing characters and ultimately fruit yield of tomato. Higher concentrations of $GA_3$ and NAA beyond 15 and 25 ppm were not found advantageous for tomato crop. Combination of variety 'Sel.-7' and 15 ppm $GA_3$ 25 ppm NAA was found best in respect increasing productivity of tomato crop. It Variety 'Sel.-7' sprayed with 15 ppm $GA_3$ followed by 25 ppm NAA gave highest gross and net return along with B:C ratio (Rs. 132821/ha, Rs. 99581/ha and 4.00) followed by 'Pusa Ruby' sprayed with same concentration of plant growth regulators (Rs. 122363/ha, Rs. 89123/ha and 3.68).

## References


1. Alam SM, Khan MA. Fruit yield of tomato as affected by NAA spray. Asian J of plant sci. 2002; 1(1):24.
2. Bokade N, Bhalekar MN, Gupta NS, Deshpande A. Effect of growth regulaters on growth and yield of tomato in summer. J Maharashtra Agric. Univ. 2006; 31(1):64-65.
3. Dhar S, Majumdar TK. Effect of NAA on the yield and fruit quality of two cultivated varieties of chilli. Indian J Plant Physiol. 2003, 471-474.
4. Gupta PK, Gupta NK, Reddy S. Efficiency of plant growth regulators and micronutrient mixtures on growth and shelf life of tomato (*Lycopersion esculentum* Mill.) fruits. Indian J. Agric. Biocem. 2001; 14(1&2):63-65.
5. Gupta PK, Gupta NK, Reddy S. Response of plant growth regulators and micronutrient mixture on fruit size, colour and yield of tomato. Anm. Agri. Res. New series. 2003; 24(1):100-103.
6. Kishan-Swaroop TV, Sharma RS, Attri BI. Effect of alpha-naphthalene acetic acid and 2-4-D, on growth, quality and yield tomato cultivars. Madras Agri. J. 2001, 10-12, 723-726.
7. Kumar V, Ray N. Effect of plant growth regulators on cauliflower cv. Pant Subhra. The Orissa J of Hort. 2000; 28(1):65-66.
8. Orzolek MD, Kaplan RC. Effect of the addition of growth regulators in gel on growth and yield of tomatoes. ISHS Acta Horticulturae, 2006, 198.
9. Pundir JPS, Yadav PK. Effect of GA3, NAA and 2-4-D on growth, yield and quality of tomato var. Punjab Chhuhara. Curr. Agri. 2001; 25:1-2.
10. Rai N, Yadav DS, Patel KK, Yadav RK, Asati BS, Chaubey T. Effect of plant growth regulators on growth yield and quality of totamo (*Solanum lycopersicon* (Mill.) Wettsd.) growtn under mid hill of Meghalaya. Veg. Sci. 2006; 33(2):180-182.
11. Salaria AS, Salaria BS. Horticulture at a Glance, Jain Brothers New Delhi. 2008; II:27-28.
12. Serrani JC, Sanjuán R, Rivero OR, Fos M, Martínez JL. Gibberellin Regulation of Fruit Set and Growth in Tomato. Pl. Physiol. 2007; 145(1):246-257.
13. Singh M, Rajodia RB. Effect of gibberellic acid on growth and yield-attributes of radish varieties. Crop Res. 2001; 21(2):174-177.
14. Singh DK, Gulshan Lal. Effect of plant bioregulators on the growth and yield of tomato (*Cycopersicon esculentum* Mill.). Prog. Hort. 2001; 33(4):61-64.
15. Singh J, Singh KP, Kalloo G. Effect of some plant growth regulators on fruit set and development under cold climatic conditions in tomato (Lycopersicon esculentum Mill.). Prog. Hort. 2002; 34 (2):211-214.
16. Thompson HC, Kelly WC. Vegetable crops (5th ed.), Mc Graw-Hill Book Company Inc. New York, 1957.