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EFFECT OF GA_3 AND NAA ON GROWTH AND YIELD OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) - A REVIEW

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Abstract

Plant growth regulators have quicker impact on vegetative as well as yield of the various crops. Plant growth regulator is either natural or synthetic chemical that is applied to a seed or plant in order to alter its characteristics. Tomato is rich source of various vitamin and minerals. The fruit have manifold uses in human diet which can be consumed raw, cooked and can also be processed in to various products. It is very important crop so it is very important to boost the production in India and these versatile resources greatly help the researchers. PGRs regulate the activity of vegetable and finally enhance the vegetable production.

Introduction

In India, wide variety of vegetables crops are grown round the year due to presence of various agro-climatic condition. Vegetables are valuable source of various proteins, vitamins, minerals, carbohydrates etc. therefore, plays an important role in balanced nutrition. Among all the vegetables grown in country, solanaceous group plays an important role and in solanaceous family, tomato (*Solanum lycopersicum* L.) is one the most important crop. It is a good source of an antioxidant (lycopene),Vitamin C and Vitamin B; consumption of tomato and its products has been associated with lower risk of developing digestive tract and prostate cancers (Giovannucci *et al*., 2002). Among all the vegetables, tomato (*Lycopersicon esculentum* Mill.) is one of the most popular and widely grown vegetables in the world, ranking second after potato and it is grown under wide range of climatic conditions. A large amount of tomato is used to produce soup, juice, ketchup, paste, puree and powder. Both pulp and juice of tomato is easily digestable, mild apparent so it has many medicinal value like acts as promoter of gastric secretion, blood purifier etc. Plant absorbed very small quantity of nutrients by the leaf during foliar application. Therefore, plant growth growth regulators have been known to be one of the quick means of increasing production. Presently, a large number of growth regulators are available in the market but basically they are of two types *i.e.* growth promoters and growth inhibitors or retardants. Among growth promoters, Gibberellic Acid (GA_3) and Naphthalene Acetic Acid (NAA) play an important role to improve the plant growth and yield of vegetable crops. GA_3 is one of the important growth stimulating substances which, promote cell elongation and cell division thus, help in the growth and development of many plants. NAA affects the physiological processes, hastens maturity and improving the quality of fruits. Application of plant growth regulators for improving the yield and quality of many vegetable crops has been emphasized by several workers (Pundir and Yadav, 2001; Bhosle *et al.,* 2002 and Meena, 2008). So, this review paper presents the effect of important plant growth regulators on growth and yield of tomato.

Role of GA_3 on growth of tomato

Kurosava was the Japanese scientist who discovered gibberellins in 1926. It is the second growth regulator. It was extracted from the fungus "*Gibberella fujikuroi*" which is the causal organism of "foolish seedling of rice". GA_3 stimulate germination of seed and maturation of flower and fruit. It play important role in cell division and elongation ultimately have positive effect on plant growth (Batlang *et al*., 2006). It play important role on controlling pre harvest fruit drop which is a major problem and also increases fruit setting percentage, fruit yield and extend shelf life.

Verma *et al.* (2014) studied the effect of GA_3 (20,30,40 ppm) on average height of plant, days to first flowering, number of flower per plant , number of fruit per cluster, number of flower cluster per plant, number of fruit per plant, inter-nodal length, average fruit length, average fruit weight, total soluble solids, percentage of fruit set and he reported that application of GA_3 at 40 ppm concentration have positive effect on all parameters under study. Masoor *et al.* (2006) observed that tomato treated with GA_3 increases in plant height, leaf area, leaf P content, fruit number, fruit yield and also lycopene content of fruit. GA_3 @ 125ppm gave maximum plant height, number of leaves, number of branches per plant, number of fruits, number of flowers, fruit clusters, diameter of fruit, yield per plant (kg) and per plot (kg) and yield per hectare (tonnes) were found to be maximum (Akand *et al*., 2015). Prasad *et al*., 2013 revealed that tomato plant sprayed with 80ppm GA_3 showed maximum plant height *i.e.* and 82.3 cm and also high yield *i.e,* 472.2 q/ha. Various parameters related to vegetative growth and flowering were significantly influenced by different concentrations of plant bio-regulators. Tomato treated with foliar application of GA_3 (50 ppm) showed significantly higher vegetative growth, *viz*., plant height (101.45cm) & internodes length (6.20 cm) and flowering parameters *viz.,* minimum number of days to first flowering (24.60) and maximum number of flower per plant (50.13) as compared to other treatments (Ujjwal *et al*., 2018). Tomato plant treated with different concentration of GA_3 (25, 50 and 75 ppm). First spray was done after 7 days of transplanting and subsequently two sprays were done at 7 days intervals showed maximum plant height (104.33 cm), number of leaves per plant (64.73) and number of branches per plant (11.20) at 90 days after transplanting, minimum days to 50 % flowering (44.40 days), maximum numbers of flower per plant (61.00), fruit length (6.10 cm), fruit diameter (5.93 cm), number of fruit per plant (30.80), fruit yield per plant (3.66 kg) and fruit yield per ha (1355.56 tonnes) with 50 ppm GA_3. Same findings has been reported by Kumar *et al.,* (2014) and Chauhane *et al*., 2017. Another study conducted by Shashank

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Kumar (2018) and he reported that tomato plant sprayed with GA_3 40 ppm concentration showed significant effects on growth, flowering, yield and quality.

Role of NAA on growth of tomato

NAA is commonly used in horticulture crops. The higher concentrations of NAA inhibit growth and exert toxic effects on the plants so, optimum concentrations are required for find out to beneficial effects of NAA. The effect of NAA has been observed mainly as cell elongation, improves phototropism, apical formation, respiration and flower bud initiation. The mode of action of NAA is mainly by its (i) direct effect of cell wall components (ii) effect on permeability through plasma membrane (iii) function as co-enzyme or co enzyme components (iv) induction of synthesis of specific R.N.A. and protein which in turn leads to an increase in cell wall elasticity and extension (Krishnamoor, 1981). It is commonly used at relatively low concentration to elicit auxin type responses in cell growth, cell division, fruit setting and rooting (Sun and Hong, 2010). At lower concentration of NAA adventitious root production was increased while at higher concentration it decreased.

Patil and Mahajan (1971) found that tomato seedlings treated with NAA at 0.05, 0.10, 0.20 or 0.40 ppm before transplanting, yields were enhanced by highest rate of NAA. Ujjwal *et al*.,2018 revealed that NAA has positive effect on number of flowers. Akhtar *et al.* (1996) reported that when flower clusters of tomato sprayed with different concentrations of NAA, it had significant effects on fruit bearing, individual fruit weight, size and yield per plant and per hectare. The highest yield (11.21 t ha) was obtained when the plants were sprayed with 25 ppm NAA. Fruit diameter of tomato increased with the application of NAA (Patel *et al*., 2012). An another study conducted by Verma *et al*., 2014 reported that Application of tomato significantly increased fruit set. Mehta and Mathai (1976) reported that tomato plant sprayed with NAA 0.2 ppm ant 0.1 ppm gave significantly increased fruit set, and number of days taken to fruit setting was significantly lesser to control. Tomato plant treated with 25 ppm of NAA recorded minimum day for fruit setting in plant Gupta *et al*., (2001). Rodrigue *et al. (*2001) observed the effect of NAA and he reported that mean polar diameter, equatorial diameter, fruit weight, fruit set percentage, number of seeds per fruit and seed yield were highest in tomato plant sprayed with 10 ppm NAA.

Conclusion

The use of GA_3 and NAA considerably increases the number of fruits per plant, fruit settings, the weight of fruits and significantly increases the total yield per hectare. In many cases GA_3 promote vegetative growth *i.e.* height of the plant because it promotes cell division and elongation. Both the growth regulator increases the plant height, number of fruits per plant, number of flower clusters which ultimately responsible for increasing the yield.

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