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# Influence of biostimulants on yield and quality of tomato (*Lycopersicon esculentum* Mill.)

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**Abstract** : A field experiment was conducted in a sandy loam soil at Agricultural Research Station farm, Bhavanisagar, Tamil Nadu, during August - December 1999 to study the effect of biostimulants on yield and quality of tomato. Foliar sprays of different growth stimulants significantly influenced the yield and quality parameters of PKM 1 tomato. The highest yield response was obtained by foliar sprays of vipul 0.1 per cent EC (Triacontanol) at 300 ml ha$^{-1}$ for three times at 25, 45 and 65 days after transplanting (36.0 t ha$^{-1}$). Besides this, fruit quality parameters were improved by this treatment. (*Key Words : Plant growth regulators, Tomato, Vipul, Fruit quality, Triacontanol*).

Tomato (*Lycopersicon esculentum* Mill.) is a common vegetable in the tropics and has attained worldwide importance because of its versatility in use in very many preparations. Special premium is being paid for good coloured fruits having high nutritive values. Plant growth regulators or biostimulants are known to control various physiological processes associated with growth and development of plants. Synthetic growth regulators produce their effects through changing the endogenous levels of the naturally occurring plant hormones resulting in improvement of yield and quality in the desired direction and to the desired extent. Triacontanol is one of the latest additions to growth regulators that are currently in use for enhanced productivity of crops. Hence the present investigation was aimed to study the influence of bioregulators developed by Indian Association of Plant Growth Products, Mumbai, on tomato crop.

## Materials and Methods

A field experiment was conducted during August - December, 1999 at Agricultural Research Station farm, Bhavanisagar to study the effect of various plant growth regulators on yield and quality parameters of tomato fruit. The texture of the soil is sandy loam belonging to Irugur series (Typic Ustropept). Fertility status of the soil was low (208 kg ha$^{-1}$), medium (13.5 kg ha$^{-1}$) and medium (245 kg ha$^{-1}$) for N, P and K respectively. The treatments comprised of control (water spray), foliar sprays of vipul 0.1 per cent EC (at 200, 250 and 300 ml ha$^{-1}$), miraculan 0.05 per cent EC (at 200, 250 and 300 ml ha$^{-1}$) and planofix at 50 ppm which were given for three times and basal application of triacontanol granules 0.05 per cent (at 20, 25 and 30 kg ha$^{-1}$). The experiment was laid out in a randomized block design with three replications. The net plot size of experimental trial was 5m x 4m. Tomato cultivar PKM 1 was the test crop. The tomato seeds were line sown and transplanted in the main field 25 days after sowing by adopting a spacing of 60 cm x 45 cm. A uniform dose of 150:100:50 kg ha$^{-1}$ of N, P and K was applied through urea, single super phosphate and muriate of potash. Besides that borax @ 10 kg ha$^{-1}$ and zinc sulphate @ 50 kg ha$^{-1}$ were also applied as basal dose. Routine cultural practices were followed. Foliar sprayings were given at 25, 45 and 65 days after transplanting and triacontanol granules were applied directly to the soil before transplanting of tomato seedlings. At maturity the yield of fruit was recorded and the biochemical analyses *viz.*, TSS (by using 'Zeiss' hand refractometer), sugar content (by following the procedure suggested by Hedge and Horreiter, 1962), titratable acidity and ascorbic acid content (by following the method of AOAC ; 1980) were also done on the pulped blemish less red ripe fruits.

**Results and Discussion**

*Fruit yield*

Among the various growth regulators tried foliar application of triacontanol containing plant growth regulator surpassed the effect of soil application of granular formulation. The foliar application of vipul 0.1 per cent at the rate of 300 ml $ha^{-1}$ recorded the highest fruit yield (36 t $ha^{-1}$). This treatment registered an increase of 49 per cent in yield over control (Table 1). Similarly application of vipul 0.1 per cent at 250 ml $ha^{-1}$ and miraculan 0.05 per cent at 300 ml $ha^{-1}$ also resulted in significant increase in fruit yield of 42 and 41 per cent respectively over control. The increase in yield might be due to the result of enhanced number of flowers and fruits, which are contributory factors for increase in yield interms of number of fruits and fruit weight. The fruit weight and fruit volume were markedly higher in the treatment of vipul 0.1 per cent at 300 ml $ha^{-1}$ and hence naturally the yield. Subbiah *et al.* (1980) attributed the increased yield of tomato due to the application of triacontanol to the accumulation of increased photosynthates and increase in chlorophyll content and photosynthetic area of the plants, which is responsible for the increased photosynthetic efficiency.

*Quality attributes of fruits*

*Total soluble solids*

A perusal of data (Table 1) indicated that the level of total soluble solids in the fruit was influenced by the application of different growth regulators. Maximum TSS in terms of brix value was recorded from plants sprayed with vipul 0.1 per cent at 300 ml $ha^{-1}$, (4.68°B), whereas in control it was only 4.10°B. The reason for increase in TSS of fruits might be due to the increased translocation of assimilates from leaves in response to hormonal stimulation (Booth *et al.* 1962).

*Ascorbic acid*

The highest ascorbic acid content was recorded in vipul 0.1 per cent at the rate of 300 ml $ha^{-1}$ (20.7 mg 100 $g^{-1}$). The chemical vipul 0.1 per cent EC seemed to have the promising effect followed by miraculan 0.05 per cent at 300 ml $ha^{-1}$, which recorded the maximum of 17.9 mg 100 $g^{-1}$ (Table 1). The increase in ascorbic acid content of tomato fruit is possible be due to the catalytic conversion of sucrose or hexose sugar into ascorbic acid.

*Sugar content*

The influence of growth regulators on the sugar content of the tomato fruits was well pronounced. Among the treatments, vipul 0.1 per cent at 300 ml $ha^{-1}$ had a significant influence over control and registered the highest sugar content of 5.01 per cent. Vipul 0.1 per cent at 250 ml and miraculan 0.05 per cent at 300 ml $ha^{-1}$ also enhanced the sugar content (Table 1). The increase in sugar content of fruits might be due to the increased translocation of assimilates from vegetative shoot to the economic parts. The increased sugar content as observed in the present study is in line with the findings of Gunasekaran (1982) in tomato.

*Titratable acidity*

Free acidity or titratable acidity of fruit was impressively influenced by growth regulators. A decreasing trend of titratable acidity with increasing concentrations of both foliar and granular formulation was observed (Table 1). The acidity of the fruity was greatly reduced by foliar application of vipul 0.1 per cent at 300 ml $ha^{-1}$ and the lowest acidity observed in fruit was 0.45 per cent. The decreased acidity in the plant growth stimulant treated fruits indicated that the fruits were at a higher stage of maturity due to the increased rate of respiration.

*Number of fruits per plant*

The data on the number of fruits per plant presented in the table 2 revealed that treatment of plant growth stimulants had a significant influence over control. Foliar sprays of vipul 0.1 per cent at 300 ml $ha^{-1}$ recorded the maximum number of fruits per plant followed by miraculan 0.05 per cent at 300 ml $ha^{-1}$. The increase in number of fruits per plant due to the spraying of triacontanol can be attributed to the synergistic effect of increased induction of flowers and increased fruit set per cent.

*Fruit weight and fruit volume*

It could be seen from the table 2 that exogenous application of triacontanol containing products augmented the individual fruit weight significantly. The treatment vipul 0.1 per cent at 300 ml $ha^{-1}$ influenced the individual fruit weight to the maximum of 41.6 g. Water spray control plants recorded the lowest fruit weight of 30.4 g. The fruit

**Table 1.** Effect of plant growth regulators on yield and quality of tomato fruit

| Treatment | Yield (t ha$^{-1}$) | TSS (°B) | Ascorbic acid (mg 100 g$^{-1}$) | Sugar content (%) | Titrable acidity (%) |
|---|---|---|---|---|---|
| $T_1$ - Vipul 0.1% @ 200 ml ha$^{-1}$ | 30.3 | 4.32 | 18.3 | 4.86 | 0.53 |
| $T_2$ - Vipul 0.1% @ 250 ml ha$^{-1}$ | 34.4 | 4.47 | 19.9 | 5.00 | 0.51 |
| $T_3$ - Vipul 0.1% @ 300 ml ha$^{-1}$ | 36.0 | 4.68 | 20.7 | 5.01 | 0.45 |
| $T_4$ - Miraculan 0.05% @ 200 ml ha$^{-1}$ | 27.5 | 4.22 | 16.0 | 4.76 | 0.54 |
| $T_5$ - Miraculan 0.05% @ 250 ml ha$^{-1}$ | 28.6 | 4.30 | 16.8 | 4.87 | 0.52 |
| $T_6$ - Miraculan 0.05% @ 300 ml ha$^{-1}$ | 34.1 | 4.55 | 17.9 | 4.91 | 0.51 |
| $T_7$ - Triacontanol granules 0.05% @ 20 kg ha$^{-1}$ | 26.1 | 4.15 | 14.9 | 4.23 | 0.67 |
| $T_8$ - Triacontanol granules 0.05% @ 25 kg ha$^{-1}$ | 27.5 | 4.32 | 16.1 | 4.76 | 0.64 |
| $T_9$ - Triacontanol granules 0.05% @ 30 kg ha$^{-1}$ | 28.6 | 4.40 | 16.9 | 4.98 | 0.59 |
| $T_{10}$ - Planofix 45% SL @ 50 ppm | 28.5 | 4.43 | 16.0 | 4.64 | 0.61 |
| $T_{11}$ - Water spray (control) | 24.2 | 4.10 | 14.1 | 3.45 | 0.69 |
| SE(d) | 2.3 | 0.07 | 0.2 | 0.07 | 0.06 |
| CD | 4.9 | 0.15 | 0.4 | 0.15 | 0.13 |

**Table 2.** Effect of plant growth promoters on numer of fruits per plant and physical characteristics of tomato fruits

| Treatment | Number of fruits per plant | Individual fruit weight (g) | Fruit volume (cm$^3$) | Fruit firmness (mm) |
|---|---|---|---|---|
| $T_1$ - Vipul 0.1% @ 200 ml ha$^{-1}$ | 34 | 36.8 | 31.5 | 1.69 |
| $T_2$ - Vipul 0.1% @ 250 ml ha$^{-1}$ | 33 | 37.6 | 31.7 | 1.75 |
| $T_3$ - Vipul 0.1% @ 300 ml ha$^{-1}$ | 37 | 41.6 | 32.6 | 1.79 |
| $T_4$ - Miraculan 0.05% @ 200 ml ha$^{-1}$ | 30 | 35.0 | 29.7 | 1.55 |
| $T_5$ - Miraculan 0.05% @ 250 ml ha$^{-1}$ | 33 | 38.3 | 31.1 | 1.62 |
| $T_6$ - Miraculan 0.05% @ 300 ml ha$^{-1}$ | 36 | 38.3 | 35.3 | 1.76 |
| $T_7$ - Triacontanol granules 0.05% @ 20 kg ha$^{-1}$ | 29 | 36.0 | 30.3 | 1.52 |
| $T_8$ - Triacontanol granules 0.05% @ 25 kg ha$^{-1}$ | 30 | 36.5 | 30.9 | 1.53 |
| $T_9$ - Triacontanol granules 0.05% @ 30 kg ha$^{-1}$ | 32 | 37.9 | 31.2 | 1.64 |
| $T_{10}$ - Planofix 45% SL @ 50 ppm | 31 | 37.1 | 30.4 | 1.60 |
| $T_{11}$ - Water spray (control) | 27 | 30.4 | 24.7 | 1.50 |
| SE(d) | 2 | 1.5 | 1.7 | 0.06 |
| CD | 4 | 3.2 | 3.6 | 0.13 |

volume was enhanced by the application of miraculan 0.05 per cent at 300 ml ha$^{-1}$ (35.3 cm$^3$) followed by vipul 0.1 per cent at 300 ml ha$^{-1}$ (32.6 cm$^3$). The increase in fruit weight and or volume is the output of increased photosynthetic activity as result of triacontanol application, which enhanced the accumulation of carbohydrate leading to formation of larger and heavier fruits (Sharma, 1995) in tomato.

*Fruit firmness*

The chemical vipul 0.1 per cent at 300 ml ha$^{-1}$ imparted in more firmness to the fruit (1.79 mm) and control treatment recorded the less firmness of 1.50 mm. Fruit firmness was improved by the application of vipul 0.1 per cent at 300 ml probably through the reduced pectinase activity (Table 2). Pectin is the partially esterified methyl ester of poly galacturonic acid, which is normally broken down, by (PGA) poly galacturonic acid during the process of ripening. The TRIA (triacontanol) application would have triggered the mechanism of slowing down the synthesis of pectinase thereby it could have protected the pectin from breaking down (Hua *et al.* 1985).

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# Timing of insecticide application for the control of pigeonpea podfly

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**Abstract** : A field experiment was conducted at National Pulses Research Centre, Vamban, during the year 1994 to asses the critical stage for the insecticidal application to manage the pigeonpea pod fly, *Melanagromyzae obtusa* Malloch. Also a laboratory experiment was conducted to find out the preferred age for oviposition by pod fly adults which is essential for timing of insecticidal application. The results showed that the plots sprayed at the pod age of 5-10 days recorded the lowest grain damage of 12.4% and 16.8% respectively. Under laboratory condition it was found that more number of eggs *viz.*, 16.1 and 16.7 were laid in 10 and 15 day old pods than other age groups. Hence it may be concluded that the pod age of 10-15 day is the critical stage for the insecticidal application, when pod fly incidence alone is noticed.

(*Key Words* : *Pigeonpea pod fly, Pod age, Insecticidal application).*

Pulses are one of the important dietary requirements of human beings. In India, although there has been an increase in their production, the availability does not match with an increasing human