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TRIACONTANOL – INDUCED CHANGES IN GROWTH, YIELD AND QUALITY OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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KEYWORDS

Triacontanol, foliar spray, *Lycopersicon esculentum*, lycopene, beta-carotene, ascorbic acid.

ABSTRACT

A pot experiment was conducted to study the effect of foliar spray of plant growth regulator triacontanol – a naturally occurring long-chain aliphatic alcohol – on growth, yield and quality parameters of two varieties (Hyb-SC-3 and Hyb-Himalata) of tomato (*Lycopersicon esculentum* Mill). Plants were sprayed twice with 0, 0.25, 0.5, 1.0 and 2.0 ppm aqueous triacontanol. Increasing levels of the growth regulator up to 1.00 ppm enhanced most parameters, including fruit yield, particularly of Hyb-SC-3. Surprisingly, beta-carotene and lycopene contents were also increased by triacontanol application, although it was expected that both should show inverse relationship as the former comes in the downstream of the later in their biosynthetic pathway. However, ascorbic acid was not affected by the spray of triacontanol.

INTRODUCTION

Triacontanol [CH_3 $(CH_2)_{28}$ CH_2OH] is a straight chain fatty alcohol of 30 carbon atoms and has been recognized as prominent chemical for plant growth promotion of many agricultural and horticultural crops [32-26]. It exists as constituent of cuticular waxes (16). It has great stimulatory effect on various processes including growth [32-2925-1-14-22-37-19], protein content [11-13-39-40-20]. Triacontanol is a natural growth promotant and has been shown to enhance growth rates and yield of many crops. Triacontanol improved the rate and extent of plants growth. It also stimulates photosynthesis and several enzyme activities [10]. Triacontanol also increase dry weight, carbon dioxide fixation, reducing sugars and free amino acids leading to the enhancement of plant growth and crop yield [27-36].

Keeping the stimulatory effect on various characteristics in view, it was decided to study the effect of triacontanol spray on performance of two varieties of tomato.

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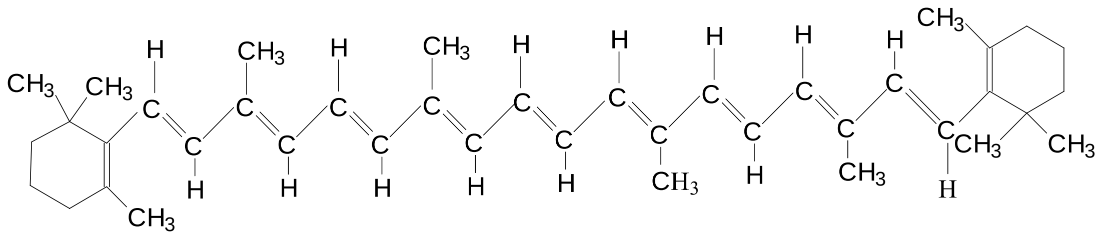
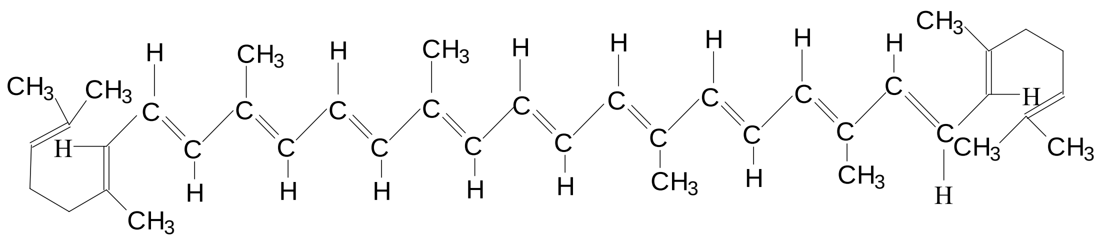
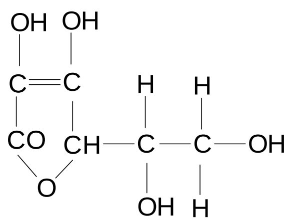


β–CAROTENE



LYCOPENE



ASCORBIC ACID

Fig 1.Structural formulae of beta-carotene, lycopene and ascorbic acid

MATERIAL AND METHODS

A pot experiment was conducted on two cultivars, namely, Hyb-SC-3 (C_1) and Hyb-Himalata (C_2) of tomato (*Lycopersicon esculentum* Mill.) in a net house of the Department of Botany, Aligarh Muslim University, Aligarh. The aim of this experiment was to study the effect of foliar spray of five aqueous concentrations of triacontanol (0, 0.25, 0.50, 1.00 and 2.0 ppm) on response of two cultivars of tomato. The above varieties were selected on the basis of a screening test performed earlier at Aligarh [15]. The earthen pots (25 cm diameter) were filled with 4 kg homogenous mixture (3:1) of soil and cowdung manure. The soil was analysed for various characteristics (texture-sandy loam, pH (1:2)-7.5; E.C. (1.2)-1.0 dS m^{-1}, available N-238.2 kg ha^{-1}, P-12 kg ha^{-1} and K-377kg ha^{-1}. The seeds obtained from the Sungro Seed Company, New Delhi, were sterilized in ethyl alcohol for half an hour and then washed and soaked in double distilled water for 12 hrs before sowing. The four-week old seedlings were transplanted into the pots at the rate of one plant per pot. The pots were watered as and when required. Triacontanol treatments were applied six and eight weeks after transplanting. At the time of fruit development, the plants were supported by sticks (stacks). At harvest fresh weight of shoot plant^{-1}, fresh weight of root plant^{-1}, dry weight of shoot plant^{-1}, dry weight root plant^{-1}, fruits plant^{-1}, weight fruit^{-1}and fruit yield plant^{-1}. Fruit lycopene, beta-carotene and ascorbic acid content were measured at 503, 436 and 540 nm respectively using spectrophotometer by the method described by Sadasivam and Manickam [34]. The data were analyzed statistically [6].

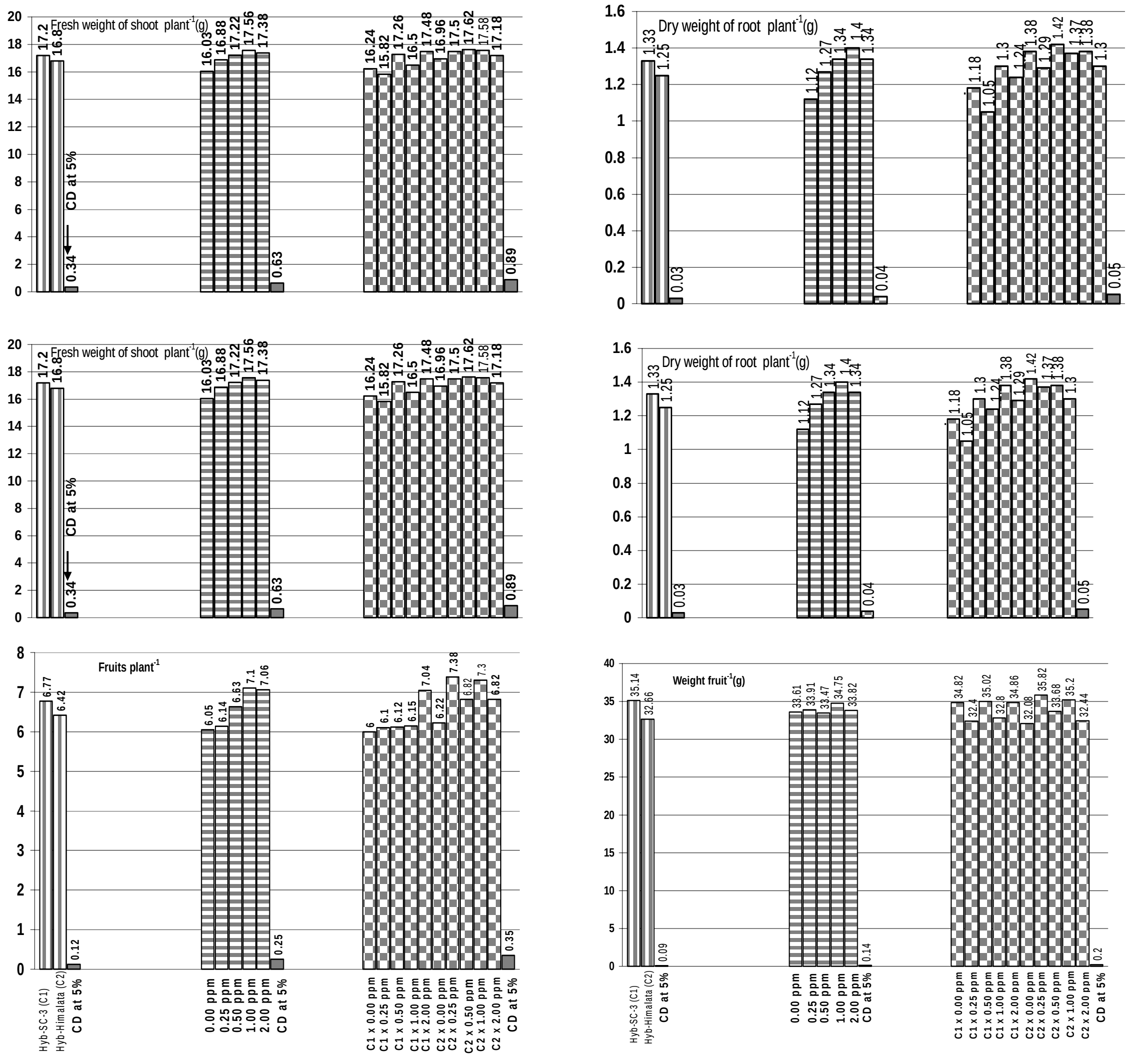


Fig.2: Effect of triacontanol on fresh weight of shoot and root, dry weight of shoot and root, number of fruits per plant of two varieties of tomato.

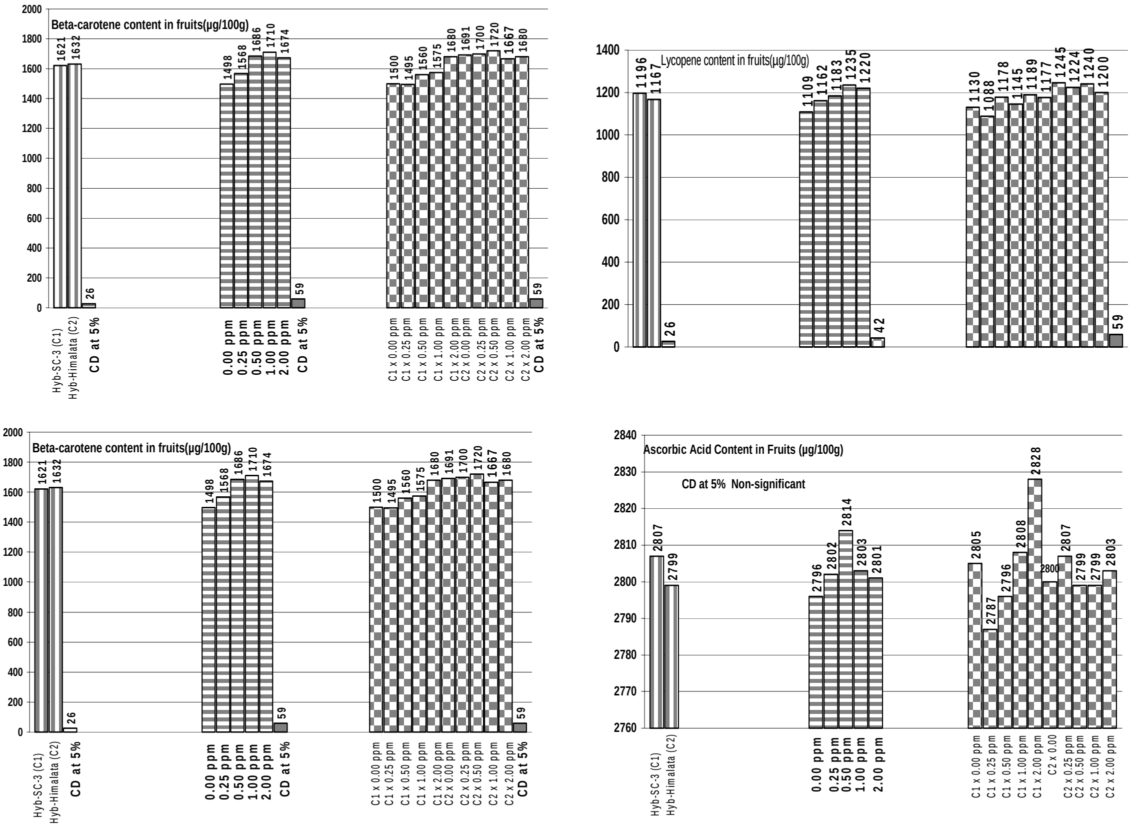


Fig.3: Effect of triacontanol on fruit yield, lycopene, beta-carotene and ascorbic acid contents in fruits of two varieties of tomato.

RESULTS

Cultivars differences and effect of triacontanol and their interaction were found to be significant on most of the parameters studied (Fig. 2& 3). The details are as follows.

Fresh weight of shoot plant^{-1}: C_1 gave higher value than that of C_2 sparay of triacontanol at 2.00 ppm gave the maximum fresh weight and 0 ppm (control), the minimum value. Among the interactions, C_2 x 1.00 ppm gave the highest value while C_2 x 0.5 ppm the minimum value (Fig. 2).

Fresh weight of root plant^{-1}: C_1 gave higher value than that of C_2 triacontanol at 1.00 ppm gave the highest value and 0 ppm the minimum. C_1 x 2.00 ppm gave the highest value while C_2 x 0.25 ppm the minimum (Fig.2).

Dry weight of shoot plan^{-1}: C_1 gave higher dry weight than C_2. Among the treatments, 1.00 ppm gave the highest value while 0 ppm, the minimum value. C_1 x 0.25 ppm combination gave maximum dry weight (Figure 2).

Dry weight of root plant^{-1}: Like fresh weight, dry weight of root given by C_1 was higher than that of C_2. Concentration 1.00 ppm gave higher value while 0 ppm the minimum. C_1 x 1.00 ppm gave maximum dry weight. The value was at par with that of C_1 x 2.00 ppm, C_1 x 0.50, and C_2 x 1.00 ppm (Fig. 2).

Fruits plant^{-1}: Like other parameters, C_1 gave higher value than C_2. Spray of triacontanol at 1.00 ppm gave maximum value and 0 ppm the minimum. However, the value of 2.00 ppm was statistically equal with that of 1.00 ppm,. Among the interactions, C_1 x 2.00 ppm, C_1 x 1.00 ppm and C_1 x 0.50 ppm gave being at par the highest value (Fig. 2).

Weight plant^{-1}: C_1 produced heavier fruits than C_2. Among the treatments, 1.00 ppm gave the maximum value while 0 ppm the minimum. C_1 x 1.00 ppm gave the maximum value however; C_2 x 0.50 gave minimum value (Figure 2).

Fruit yield plant^{-1}: C_1 gave higher yield than C_2. Among the treatments,1.00 ppm equaled by 2.00 ppm gave maximum yield of tomato and 0 ppm gave minimum value. Interaction C_1 x 1.00 ppm, equaled by C_1x 2.00 ppm, gave maximum fruit yield. The lowest yield was produced by C_2 x 0 ppm. C_1 x 1.00 gave 24 % higher yield than C1 x 0 ppm (Fig. 3).

Lycopene contents in fruits: The content was higher in C_1 than C_2. Among the treatments, 1.00 ppm gave maximum value. However, the value was at par with that of 2.00 ppm. The control gave minimum value. Interaction C_1 x 1.00 ppm, equaled by C_1 x 2.00 ppm, C_2 x 2.00 ppm, C_2 x 1.00 ppm and C_1 x 0.5 ppm gave maximum lycopene content. C_2 x 0 ppm gave minimum content (Fig. 3).

Beta-carotene content in fruits: Beta-carotene content was at par in both cultivars. Out of different doses of triacontanol, 1.00 ppm gave maximum value which was at par with 0.50 and 2.00 ppm. Among the interactions, C_2 x 1.00 ppm equaled by C_1 x 1.00 ppm, C_2 x 0.5 ppm, C_1 x 0.5 ppm, C_2 x 2.00 ppm and C_1 x 2.00 ppm highest content gave higher content than other interactions were at par themselves (Fig. 3).

Ascorbic acid content: No significant cultivars differences and treatment and interactions effect on the ascorbic acid content were noted (Figure 3).

DISCUSSION

The growth promoting effect of triacontanol on the whole plant specially the fresh and dry weight has been established in a variety of plants including tomatoes by [23-2-17-13-38-27-31-18-5-3-12-24-28-35-32]. Our finding that 1.00 ppm of triacontanol increased the biomass production of tomato is in accordance of the above reports. The increased in dry weight accumulation of the plant with foliar application of triacontanol suggests that it is involve in growth parameters and photosynthesis [5-8-9-19-37]. All these findings support the results of this work that show the gradual increase of biomass production by the gradual increase of levels of triacontanol. On the other hand, triacontanol also enhanced not only the number of fruits but weight per fruit that indicate it increased the flowering as well as heaviness as there would be more partitioning of photosynthates to the developing sink. Several workers have reported boosted yield by triacontanol application on tomato [4-13-38-21] and other plants [7-22-19-25-30-1-32-28]. Lycopene and beta-carotene are tetraterpenoids, derived from isoprenes [33] are very similar structure (Fig1). They should show a little different response to triacontanol as beta-carotene is in downstream of lycopene in the biosynthetic pathway. The effect of triacontanol was insignificant on ascorbic acid content. This finding is in accordance with the findings of Hashim and Lundergan [7].

CONCLUSION

Thus, triacontanol may be used as growth, yield and quality promotion of tomato. According to this experiment, variety Hyb-SC-3 (C_1) proved better and may be adopted and be sprayed with 1.00 ppm triacontanol for best yield and quality.

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