

## EFFECT OF ANTITRANSPIRANTS ON GROWTH, PHOTOSYNTHETIC RATE AND YIELD CHARACTERS OF BRINJAL

P. KARUPPAIAH\*, S. RAMESHKUMAR, K. SHAH AND R. MARIMUTHU

Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar – 608 002.

Received on 19 Feb., 2002, Revised on 17 May, 2003

A field study was conducted with different antitranspirants viz kaolin, phenyl mercuric acetate, salicylic acid and liquid paraffin on brinjal to find out their effects on growth, photosynthesis and yield characters. Antitranspirants significantly influenced the plant biomass, number of branches, plant height, leaf area and number of flowers. Kaoline (7.5%) spray was found to be the best which improved both plant biomass and number of flowers. All antitranspirants affected the photosynthetic characters such as net photosynthetic rate, stomatal conductance, intercellular CO<sub>2</sub> concentration, transpiration and relative water content (RWC). Maximum net photosynthetic rate, RWC and minimum transpiration were observed with kaolin (7.5%), which was at par with salicylic acid (1000 ppm) and liquid paraffin (1.5%). Fruit yield was significantly increased with kaolin (7.5%) and salicylic acid (1000 ppm).

**Key words :** Antitranspirants, brinjal, kaolin, transpiration.

In view of the damage caused by excessive transpiration, there has been much interest in finding ways to reduce the rate of water loss and improve the water use efficiency. The possibility of reducing plant transpiration to alleviate the adverse effect of water imbalance on plant growth holds great promise for water starving situation (Gale and Hagan 1966). Methods of reducing transpiration have been aimed without affecting the growth adversely. Among the various methods of reducing rate of transpiration, use of antitranspirants is one of the practice to reduce the transpiration in the agricultural ecosystem. A wide range of materials have been tried as antitranspirants (Solarova *et al.* 1981). Use of antitranspirants were reported in apple (Weller and Ferre 1978), oleander (Davenport *et al.* 1974) and sapota (Reddy and Khan 2000). However, field scale use of antitranspirants in vegetables were limited. Brinjal is considered as one of the important vegetables. Though brinjal is a hardy plant for its vegetative growth, its productivity is controlled by its heterostyly flowering behaviour which is highly influenced by its RWC. The present study documents the effect of antitranspirants on growth, photosynthesis and yield characters of brinjal.

A field experiment was carried out at the Department of Horticulture, Annamalai University, Annamalainagar in brinjal cv. Annamalai. There were ten treatments viz., phenyl mercuric acetate (10<sup>-4</sup>M and 10<sup>-5</sup>M), kaolin (5 and 7.5%), salicylic acid (1000 and 1500 ppm), liquid paraffin (1 and 1.5%) along with water spray and no spray as control. The trail was laid out in RBD with three replications. The antitranspirants were sprayed at 45 and 90 days after transplanting (DAT) using teepol as surfactant. A standard water deficit situation was maintained for all the treatments. Vegetative parameters such as plant biomass, number of branches, plant height and leaf area were recorded at 100 days after transplanting (DAT) and yield parameters viz., total number of flowers plant<sup>-1</sup>, number of productive flowers plant<sup>-1</sup>, number of fruits plant<sup>-1</sup> and yield ha<sup>-1</sup> were recorded continuously upto the cropping period and added at the end. Relative water content of leaves was recorded using the Dew Point Microvoltmeter and the photosynthetic characters such as net photosynthetic rate, stomatal conductance, transpiration and intercellular CO<sub>2</sub> concentration were recorded at 100 days after transplanting using infra red

\* Corresponding author

glass analyser (Analytical Development Company, London, LCA2 Model).

The plant growth characters were found to be significantly affected by different antitranspirants (Table 1). Among the various treatments, kaolin 7.5% ( $T_6$ ) recorded the maximum biomass production (74.53 g plant<sup>-1</sup>), number of branches (13 branches plant<sup>-1</sup>) and plant height (90.03 cm). However, its effect on leaf area was insignificant. Reduction in plant growth characters were also observed in treatments ( $T_3$ ), PMA ( $10^{-4}$  M) and

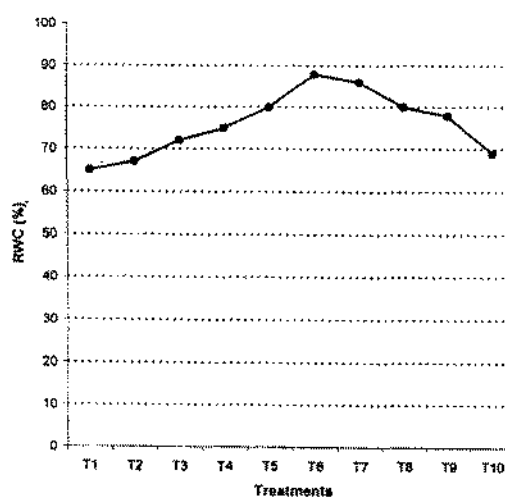
results of increased water status by antitranspirants which may be due to reduced transpiration and increased stomatal resistance.

Regarding the influence of antitranspirants on the photosynthetic characters of plants, different responses were noticed with different antitranspirants (Table 2). Among the treatments, ( $T_5$ ) kaolin (5%) and ( $T_6$ ) kaolin (7.5%) and ( $T_7$ ) salicylic acid (1000 ppm) and ( $T_8$ ) salicylic acid (1500 ppm) significantly increased the net photosynthetic rate while other treatments recorded

**Table 1.** Effect of antitranspirants on growth characters of Brinjal

| Treatments                        | Biomass (g plant <sup>-1</sup> ) | Number of branches | Plant height (cm) | Leaf area (cm <sup>2</sup> plant <sup>-1</sup> ) |
|-----------------------------------|----------------------------------|--------------------|-------------------|--|
| $T_1$ - Control (No spray)        | 65.32                            | 11.19              | 80.82             | 64.95  |
| $T_2$ - Control (Water spray)     | 68.95                            | 11.80              | 82.42             | 65.38  |
| $T_3$ - PMA $10^{-4}$ M           | 53.10                            | 10.23              | 65.22             | 58.43  |
| $T_4$ - PMA $10^{-5}$ M           | 50.08                            | 9.49               | 71.08             | 55.89  |
| $T_5$ - Kaolin 5.0%               | 72.17                            | 12.43              | 85.38             | 57.16  |
| $T_6$ - Kaolin 7.5%               | 74.53                            | 13.00              | 90.03             | 61.13  |
| $T_7$ - SA - 1000 ppm             | 73.29                            | 12.71              | 87.15             | 62.78  |
| $T_8$ - SA - 1500 ppm             | 70.98                            | 12.14              | 84.19             | 59.65  |
| $T_9$ - Liquid paraffin (1.0%)    | 56.13                            | 10.90              | 77.41             | 52.08  |
| $T_{10}$ - Liquid paraffin (1.5%) | 62.82                            | 11.49              | 74.39             | 61.93  |
| C.D. 5%                           | 1.03                             | 0.26               | 1.28              | NS   |
| SED                               | 0.53                             | 0.13               | 0.64              | NS   |

( $T_4$ ) PMA ( $10^{-5}$  M) and ( $T_9$ ) liquid paraffin (1%) and ( $T_{10}$ ) liquid paraffin (1.5%) over control. But, Weller and Ferre (1978) observed no effect of antitranspirants on apple shoot growth. In pomegranate and ber, non-significant difference were observed among the different antitranspirants (Anon 1991 and 1993). Reddy and Khan (2000) observed increased growth characters with kaolin as antitranspirants. The increased growth of plants with kaolin may be attributed due to the increased relative water content of the plants. Antitranspirants significantly affected the RWC of leaves (Fig. 1). Among the different antitranspirants, kaolin (7.5%) spray was recorded the maximum RWC whereas control recorded the minimum RWC. Increased RWC might be due to the reduced transpiration and stomatal conductance. Goode *et al.* (1978) and Reddy and Khan (2000) reported similar



**Fig. 1.** Influence of Antitranspirants on RWC (%) of Brinjal

## EFFECT OF ANTITRANSPIRANTS ON BRINJAL

significant reduction over control (Table 2). However, stomatal conductance, transpiration rate and intercellular CO<sub>2</sub> concentration were significantly reduced by T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub> and T<sub>8</sub>. The increased net photosynthetic rate in kaolin and salicylic acid treatments might be due to the reduction in transpiration rate, stomatal conductance and intercellular CO<sub>2</sub> concentration (Gale and Hagan 1966).

Antitranspirants also significantly influenced the yield characters of brinjal (Table 3). Among the different antitranspirants, kaolin 7.5% was superior to all other

treatments followed by salicylic acid 1000 ppm. The yield increase mainly because of the increased production of productive flowers.

In general, water deficit in brinjal leads the production of unproductive flowers. In this experiment, since, kaolin 7.5% was maintaining high RWC of the plants, the plant favoured the production of productive flowers which may be the reason for the higher productivity of the plants under water stress conditions.

**Table 2.** Influence of antitranspirants on Brinjal photosynthetic characters

| Treatments                               | Net photosynthetic rate ( $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ sec}^{-1}$ ) | Stomatal conductance ( $\mu\text{mol m}^{-2} \text{ s}^{-1}$ ) | Transpiration rate ( $\mu\text{mol H}_2\text{O mol}^{-1}$ ) | Intercellular CO <sub>2</sub> concentration ( $\mu\text{mol mol}^{-1}$ ) |
|--|--|--|---|--|
| T <sub>1</sub> - Control (No spray)      | 37.32  | 0.64   | 8.52  | 690  |
| T <sub>2</sub> - Control (Water spray)   | 38.69  | 0.67   | 8.50  | 663  |
| T <sub>3</sub> - PMA 10 <sup>-4</sup> M  | 34.82  | 0.47   | 7.29  | 739  |
| T <sub>4</sub> - PMA 10 <sup>-5</sup> M  | 32.18  | 0.42   | 7.99  | 762  |
| T <sub>5</sub> - Kaolin 5.0%             | 39.36  | 0.62   | 7.23  | 632  |
| T <sub>6</sub> - Kaolin 7.5%             | 42.51  | 0.60   | 7.02  | 610  |
| T <sub>7</sub> - SA - 1000 ppm           | 40.93  | 0.63   | 7.42  | 631  |
| T <sub>8</sub> - SA - 1500 ppm           | 39.52  | 0.58   | 7.78  | 652  |
| T <sub>9</sub> - Liquid paraffin (1.0%)  | 35.09  | 0.51   | 8.25  | 712  |
| T <sub>10</sub> - Liquid paraffin (1.5%) | 38.02  | 0.54   | 8.31  | 672  |
| C.D. 5%                                  | 0.64   | 0.03   | 0.09  | 21.78  |
| SED                                      | 0.31   | 0.01   | 0.04  | 10.07  |

**Table 3.** Influence of antitranspirants on yield characters of Brinjal

| Treatments                               | No. of flowers per plant | Number of productive flower per plant | No. of fruits per plant | Yield (t ha <sup>-1</sup> ) |
|--|--------------------------|---------------------------------------|-------------------------|-----------------------------|
| T <sub>1</sub> - Control (No spray)      | 40.93                    | 14.20                                 | 12.24                   | 16.53                       |
| T <sub>2</sub> - Control (Water spray)   | 43.92                    | 17.12                                 | 13.65                   | 22.00                       |
| T <sub>3</sub> - PMA 10 <sup>-4</sup> M  | 40.00                    | 12.56                                 | 10.32                   | 12.36                       |
| T <sub>4</sub> - PMA 10 <sup>-5</sup> M  | 36.19                    | 11.28                                 | 9.26                    | 10.78                       |
| T <sub>5</sub> - Kaolin 5.0%             | 46.60                    | 18.65                                 | 16.31                   | 25.11                       |
| T <sub>6</sub> - Kaolin 7.5%             | 48.68                    | 20.68                                 | 18.25                   | 28.15                       |
| T <sub>7</sub> - SA - 1000 ppm           | 47.90                    | 20.10                                 | 17.15                   | 26.52                       |
| T <sub>8</sub> - SA - 1500 ppm           | 45.19                    | 17.58                                 | 14.92                   | 23.27                       |
| T <sub>9</sub> - Liquid paraffin (1.0%)  | 40.00                    | 13.34                                 | 11.50                   | 14.12                       |
| T <sub>10</sub> - Liquid paraffin (1.5%) | 42.75                    | 15.65                                 | 13.00                   | 18.75                       |
| C.D. 5%                                  | 0.80                     | 0.34                                  | 0.61                    | 1.16                        |
| SED                                      | 0.40                     | 0.17                                  | 0.29                    | 0.59                        |

## REFERENCES

- Anonymous (1991). Proceedings of research workers group meeting on Arid Zone Fruits, Bangalore.
- Anonymous (1993). Report of research workers group meeting on Arid Zone Fruit, N.D. University of Agriculture and Technology, Faizabad.
- Davenport, D.C., K. Uriu and R.M. Hagan (1974). Effect of film forming antitranspirants on growth J. Expt. Bot. **25**: 410-419.
- Gale, J. and R.M. Hagan. (1966). Plant antitranspirants. Ann. Rev. Plant Physiol. **17**: 269-282.
- Goode, J.E., K.H. Higgs and Hyryez (1978). Abscisic acid applied to orchard tree of Golden Delicious apple to control water stress. J. Hort. Sci. **53**: 99-103.
- Reddy, Y.T.N. and M.M. Khan (2000). Effect of antitranspirants on growth, water relationships and fruit yield of rainfed sapota. Indian J. Hort. **57**: 125-129.
- Solarova, J.J., Paspisilova and B. Slavik. (1981). Gas exchange regulation by changing epidermal conductance with antitranspirants. Photosynthetica **15**: 365-400.
- Weller, S.C. and D.C. Ferre. (1978). Effect of pinolene based antitranspirants on fruit growth, net photosynthesis, transpiration and shoot growth of "Golden Delicious" apple trees. J. Amer. Soc. Hort. Sci. **103**: 17-19.