

Effects of a temperature drop (DROP) on growth and development of tomato plants

Anja Dieleman and Esther Meinen

Introduction

Aim of this research is to establish the time of the day that plants are most sensitive to a temperature drop (DROP) and to determine the effects of a DROP on plant growth. Energy consumption can be reduced by allowing lower greenhouse temperatures in the morning.



Figure 1. Tomato plants without DROP (left) and with DROP at the start of the light period (right).

Young plants

Young tomato plants cv. Cedrico (11 DAS) were placed in climate chambers during 4 weeks. Temperature treatments were:

1. Control (day (8:00-20:00)/night 22.9/20.9 °C)
2. 5 °C DROP at start of light period (8:30-12:30)
3. 5 °C DROP at middle of light period (12:00-16:00)
4. 5 °C DROP at end of light period (15:30-19:30)
5. 5 °C DROP at start of dark period (20:30-00:30)

Average 24 h temperatures did not differ between treatments (21.9 °C).

Applying a DROP in the morning reduced shoot length significantly (Figure 2). The later the DROP was applied, the smaller the effect on shoot length.

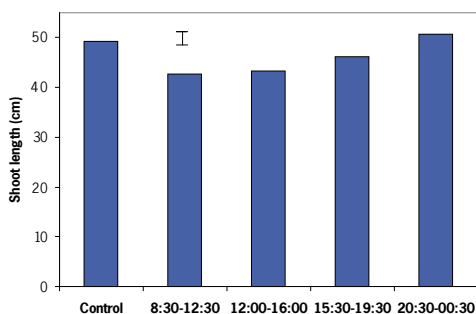


Figure 2. Shoot length of tomato plants as affected by the different temperature treatments. Vertical bar indicates LSD ($P < 0.05$)

Fruit bearing crop

Tomato plants cv. Cedrico were planted in 4 glasshouses. When plants had a LAI of 2.9, temperature treatments were applied for 2 months. The control treatment was a temperature strategy as applied in practice. In the DROP treatment, temperature was lowered to 14.5 °C during 1 h and gradually increased thereafter (Figure 3). Average 24 h temperatures did not differ between treatments.

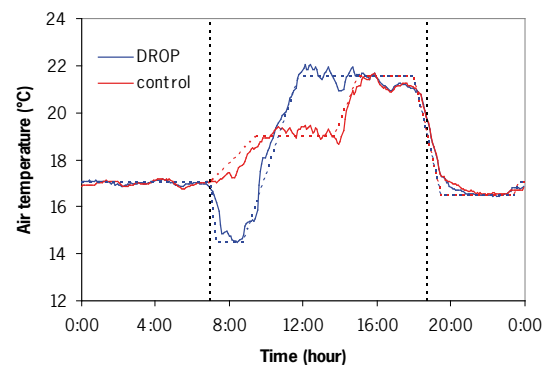


Figure 3. Diurnal pattern of air temperature of the control treatment and DROP treatment. Dotted lines indicate temperature setpoints, straight lines indicate the realised temperatures. Vertical lines indicate sunrise and sunset.

The temperature treatments did not affect plant length, internode length, leaf length and width, number of internodes, weights of leaves, stems and fruits, leaf area and fruit diameter.



Figure 4. Overview of the tomato crop in the greenhouse.

Conclusions and implications

- A DROP affects elongation of young tomato plants primarily at the beginning of the light period, and to a lesser extent later during the day
- Applying a DROP of 2.5 °C at a fruit bearing crop for 2 months does not affect plant growth and development.
- Energy use can be reduced by allowing a DROP in the morning.