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Physiological processes affected by low night temperatures in sweet pepper plants

E. Gorbe Sánchez[a,b,*], E. Heuvelink[b], C.Stanghellini[a]

[a]*Wageningen UR Greenhouse Horticulture, Wageningen University and Research Centre, Droevendaalsesteeg 1, Building 107,6708 PB, Wageningen, The Netherlands*

[b]*Horticulture & Product Physiology Group, Wageningen University, Droevendaalsesteeg 1, Building 107,6708 PB, Wageningen, The Netherlands*

Abstract

Extreme temperatures may be frequent in the coming decades as result of climate change. However, we need to keep crop yield high by means of breeding and improving crop management. And first we need to understand the physiological processes affected. Little is known about how cold affects plants during the night (when the incidence is higher), so that was the objective of our work. The response of sweet pepper seedlings to different doses of low night temperature (LNT) (1/4/7 nights at 6/18°C) was evaluated by measuring changes in potentially sensitive physiological parameters.

LNT reduced water uptake and relative water content (RWC) of plant tissues probably due to a decrease of hydraulic conductivity but not to an increase of transpiration. The reduced RWC resulted in loss of turgor, which reduced stem elongation and leaf expansion, and therefore light interception. LNT enhanced the accumulation of sucrose and starch in the leaves during the night. Starch accumulation did not affect photosynthesis due to feedback inhibition. Although photo-inhibition was observed, CO2 uptake was not affected and neither was total dry weight production after 7 cold nights. Specific leaf area decreased with LNT. However, that was not correlated with starch accumulation so it may be due to accumulation of other compounds involved in cold hardiness, such as sucrose. LNT didn't stop the clock that regulates these plant processes, but affected them by modifying their physical properties.

In conclusion, the occurrence of LNT leaded to shorter plants with thicker but smaller leaves. The decrease of cell elongation was due to the reduced water uptake capacity. Although biomass was not affected after 7 days because photosynthetic rate was kept high during the day, the reduced light interception may affect it eventually if stress doses are extended.

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