Dynamic response of Crassulacean Acid Metabolism in *Phalaenopsis* to a warm day/cool night temperature regime

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Abstract

The recommended average daily temperature for production of *Phalaenopsis* is between 25°C and 30°C. Therefore, growing *Phalaenopsis* demands a large energy input. Greenhouse heating strategies that maximise the contribution of solar radiation during the day and minimise heat production during cold nights have shown their effectiveness in reducing energy costs. However, such greenhouse strategies (e.g. temperature integration) are based on empiricism and lack physiological background. During this study, *Phalaenopsis* 'Isis' and *Phalaenopsis* 'Hercules' were subjected to a warm day/cool night temperature regime (32.5/17.5°C) for 32 days while maintaining the average daily temperature at the same level of a control treatment (26/25°C). Leaf net CO_2-exchange was continuously monitored and PS II photochemistry and thermal energy dissipation was assessed. Exposing *Phalaenopsis* to the warm day/cool night temperature regime resulted in a stronger expression of CAM. As a consequence, daily carbon gain was enhanced for the first days of the experiment. This short term increase of daily carbon gain was also reflected in PS II photochemistry and thermal energy dissipation. However, the maximum quantum efficiency of PS II suggested an increased susceptibility to photoinhibition. At the same time, monthly carbon gain was reduced. Nevertheless, daily carbon gain of *P.* 'Isis' rose above the one of the control treatment after 32 days, indicating adaptation and the start of recovery. From the dynamic response of *Phalaenopsis* to a combination of warm days and cool nights, it can be concluded that temperature integration, and its energy saving properties, has opportunities for commercial production of *Phalaenopsis*.