



# Climate in greenhouse horticulture: From climate management to cultivation control

## Wageningen UR Greenhouse Horticulture

Wageningen UR Greenhouse Horticulture is an authority in the field of knowledge concerning the relationship between climate factors and plant growth, production and quality. We support the international glasshouse horticulture industry with new equipment, sensors and materials, as well as developments regarding cultivation in conditioned greenhouses.

### On-time quality

In naturally ventilated greenhouses, the possibilities to control light, temperature, humidity and CO<sub>2</sub> independently are limited. Fortunately, the development of (semi) conditioned greenhouses has considerably enhanced these possibilities. Climate management is now a powerful tool for realising the desired quantity and product quality at a specific time at minimum cost.

In its new greenhouse facilities in Bleiswijk, Wageningen UR Greenhouse Horticulture has the capacity to examine virtually all combinations of climactic conditions. These includes:

- effects of climactic factors on production
- optimal microclimate around the plant
- possibilities for local climate and plant control



### The greenhouse climate: A complex equation

Greenhouse climate is the result of a complex combination of processes in and around the greenhouse structure and in and around the individual plants. Wageningen UR Greenhouse Horticulture has extensive knowledge about these processes. Based on this knowledge we can provide an accurate image of the climate distribution in the entire greenhouse as well as on the microclimate level around the plants, translated in a three-dimensional distribution of temperature, humidity, CO<sub>2</sub> and light. Based on this information the design of climate equipment and the use inside the greenhouse can be optimised. For example, it is possible to determine the right cooling capacity and the right ventilation capacity including size and place of ventilation openings. Companies can now determine their return on investment when they are planning on installing climate control.

### Biology and technology for intelligent equipment

Wageningen UR Greenhouse Horticulture is developing new and innovative equipment for sensors, climate regulators in cooperation with the industry. The equipment including new covering materials; devices for heating, cooling, dehumidification and artificial light; and regulators for temperature integration, CO<sub>2</sub> optimisation, crop evaporation and air humidity, is tested for greenhouse conditions.

### Soft sensors for the future

Wageningen UR is currently working on a new generation of intelligent sensors. These so-called soft sensors combine physical and physiological measuring methods with model calculations. These developments contribute to reduce the energy consumption and to optimize plant production, and help growers to optimize climate management.

#### For more information:

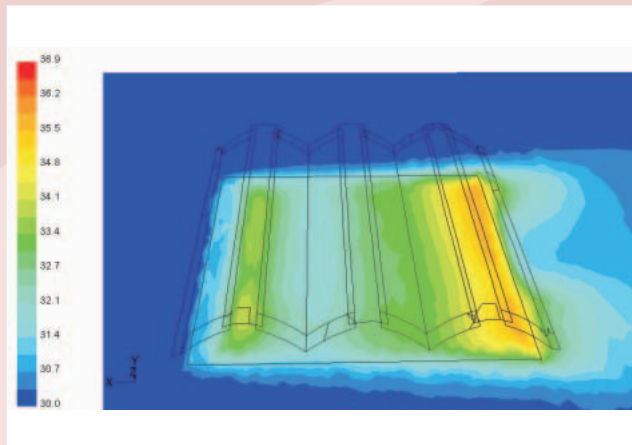
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### Climate analysis and innovative equipment

The climate in the greenhouse, the microclimate around the plant and the spatial distribution of temperature, humidity, CO<sub>2</sub> and light are determined accurately through the development and implementation of advanced measuring techniques and model calculations.

In addition, Wageningen UR is developing innovative equipment and techniques for climate control together with its partners. Current projects include heat exchangers (FiWiHex, among others), dehumidification systems and low-temperature heating.

Customers include suppliers, construction companies and the Dutch Product Board for Horticulture.



### From climate management to on-time quality

Wageningen UR Greenhouse Horticulture utilises its combined knowledge of climate management, equipment and plant processes for the development of new concepts, regulations and cultivation systems in order to realise the desired quantity and quality at a given moment and at minimal expense. Recent examples include:

- Plant temperature as a control parameter for growth and production
- Synchronised phasic development of rose cuttings
- Influencing the harvest cycle of pepper cultivation through adapted climate regulation
- Regulating the flowering moment of potted plants

### Crop responses in new greenhouse systems

New greenhouse covering materials and conditioned greenhouses result in a different greenhouse climate and possibilities for new combinations of light, CO<sub>2</sub>, temperature and humidity. The influence of these factors on various crops is examined in the framework of various projects:

- Influence of forced air movement on photosynthesis and plant growth
- Effect of LED lighting
- Plant responses on high CO<sub>2</sub> and high levels of solar radiation
- Plant response to reversed temperature distribution in conditioned greenhouses
- Benefits of diffuse radiation

Customers: Suppliers, the Dutch Product Board for Horticulture, crop committees, the Dutch Ministry of Agriculture, Nature Management and Fisheries

