



# Monitoring Spatial Distribution of Temperature and Relative Humidity using Wireless Sensors

Wageningen UR Greenhouse Horticulture

## Cold and wet spots

A homogeneous greenhouse climate has economic advantages due to a more homogeneous crop, lesser diseases and possibilities to save energy. Therefore, growers try to avoid having cold or wet spots in their greenhouse. Horizontal distribution of temperature and humidity, obtained with a dense grid of low-cost wireless sensors, opens ways to control homogeneity, either by adapting the greenhouse infra structure, or by more precisely operating greenhouse heating and ventilation.

## Experiments

During the autumn-winter period of 2008-2009, trials were performed with 100 wireless sensors for temperature and relative humidity (AgriSensys®) in four commercial greenhouses (tomato, cucumber, matriacria and gerbera), to evaluate their practical use, observe climate variability and determine amount of sensors needed for an accurate estimate of the spatial and temporal climate distribution.

## Results

We observed long-term averaged spatial differences for temperature and humidity of respectively 1.0 – 3.4 °C and 10 – 40 %, and short-term actual spatial differences are larger. The greenhouses investigated showed that at least 9 sensors per hectare ( $\pm 33$  m apart) were needed to detect long term cold or wet spots.

## Benefits for growers

Using a large set of wireless RH-T-sensors temporarily, growers may obtain an indication about the homogeneity of their greenhouse climate. They may adapt the greenhouse infra structure if needed to make it more homogeneous. When permanently installed, they may set their climate computer in real-time to maintain a minimum vapour deficit, and at the same time prevent cold or wet spots. They can minimize their energy use and prevent a wet crop especially during the nights in autumn-winter periods.

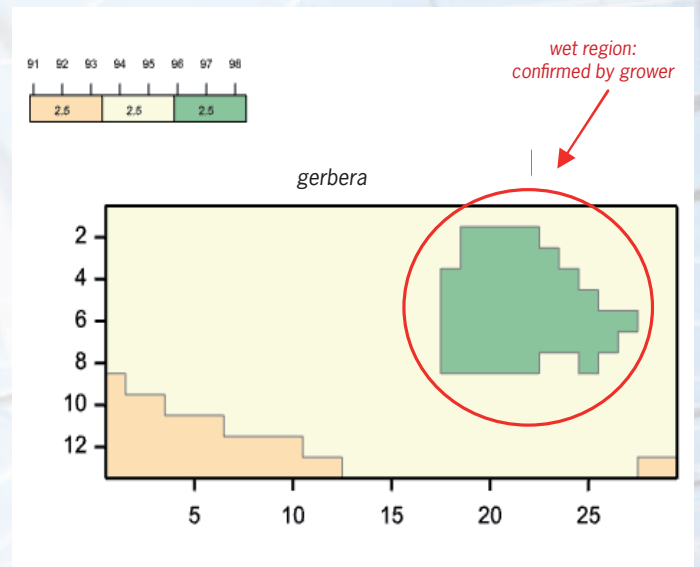
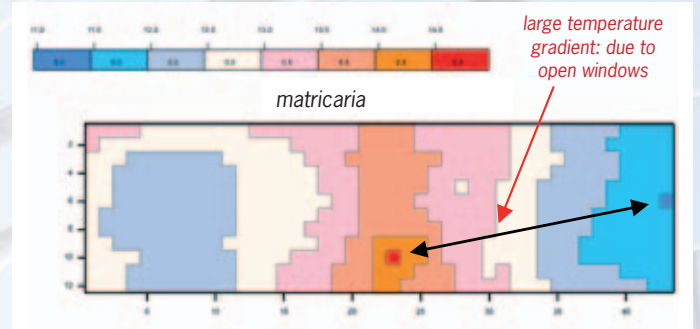
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Advanced crop production systems



Small, wireless sensors for temperature and relative humidity, attached to a steel wire of the heating system in a matricaria crop



Large temperature and humidity gradients observed in practical greenhouses (matricaria and gerbera). 2-Dimensional plots obtained as average over a 10 day trial

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