

Wind driven ventilation of a mono-span greenhouse with a rose crop and continuous screened side vents and its effect on flow patterns and microclimate

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Although high greenhouse tunnels are often used by growers in the Mediterranean basin, the data on the distributed microclimate within such structures is limited. Experiments were carried out in a naturally ventilated mono-span greenhouse with continuous screened side vents to determine the ventilation rate, temperature, humidity and air velocity distributions and the energy partitioning of the incoming radiation. Results indicate that the ventilation rate increases linearly with wind speed. When the wind blows perpendicularly to the greenhouse opening plane there is a cross-flow between the windward and leeward openings that results in gradients in the air and crop temperatures between windward and leeward sides. Gradients in temperature, humidity and air velocity are observed in the vertical direction as well. The temperature and humidity ratio were larger near the roof than near the crop while the air velocity was higher near the crop than near the roof. The gradients in the vertical direction were larger than those encountered in a horizontal plane in a direction parallel to the mean flow (from windward to leeward opening). The root mean square (RMS) values of the air velocity in all three components, the RMS of temperature normalised by the temperature difference between inside and outside and the turbulent fluxes were generally higher near the windward opening than near the leeward one. Nearly 75% of the net radiation in the greenhouse was consumed as latent heat by plant transpiration while only about 14% was converted to sensible heat.