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Comparison of the climatic conditions and tomato crop productivity in Mediterranean greenhouses under two different natural ventilation management systems

F. J. Baptista¹ P. E. Abreu² J. F. Meneses² B. J. Bailey³

¹Departamento de Engenharia Rural, Universidade de Évora, Apartado 94, 7002-554 Évora, Portugal; ²Departamento de Engenharia Rural, Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa, Portugal; ³Process Engineering Division, Silsoe Research Institute, Wrest Park, Silsoe, Bedford MK45 4HS, United Kingdom

fb@uevora.pt

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Abstract

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This study was based on experiments with a tomato crop, carried out in two Mediterranean unheated greenhouses, located at the Instituto Superior de Agronomia, Lisbon. The main objective was to compare the behaviour of internal air parameters such as air temperature and relative humidity and the likelihood of condensation on the greenhouse cover in two greenhouses with different management of natural ventilation. The influence of the internal climate on plant development and productivity was also determined by the number of opened flowers and set fruits per truss, and also the harvest rate.

One greenhouse had permanent ventilation (PV) during the day and night while the other had classical ventilation (CV), in which the vents were closed during the night and open during the day.

During the growing season, measurements were made of dry and wet bulb air temperatures, plastic cover temperature, plant temperature, global radiation, PAR radiation, soil temperature and wind speed, and recorded using a data logger. Also, information on the evolution of the crop was recorded.

Internal air temperature, relative humidity and water vapour pressure deficit data were analysed and compared between the two greenhouses. Dew point temperature was computed and compared with the plastic cover temperature to find out if, and when, condensation occurred. Ventilation rates were estimated and related to internal air conditions.

The relative humidity was lower in the PV greenhouse during the night due to the higher ventilation rate. Condensation on the plastic cover was more severe in the CV greenhouse and inversions of the air temperature were also more frequent. Lethally low temperatures did not occur in either of the greenhouses. The PV greenhouse had a higher tomato fruit production but this difference was not statistically significant. On the CV greenhouse the harvest started one week earlier due to heat accumulation after closing the vents in the afternoon.

Keywords: natural ventilation, environmental control, condensation, tomato