Definition of a Porous Media Model Simulating the Presence of a Small Canopy Crops in a Greenhouse

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**Abstract.** Controlling the indoor microclimate condition in a greenhouse is very important in order to ensure the best conditions for both crop growth and crop production. Therefore, to properly assess the indoor microclimate conditions in a protected environment with presence of crops, it is necessary to also consider the plant effects and the possible exchanges between plants and indoor air. To this regard, the present paper provides the results of a study aiming to define a porous media model simulating the crop presence and to evaluate the thermal energy exchange between crops and greenhouse environment.

As first, an experimental campaign has been carried out to evaluate temperature and air velocity distributions in a naturally ventilated greenhouse building with sweet pepper plants cultivated in pots. Then, the main aspects of energy balance, in terms of mass transfer and heat exchange, and both indoor and outdoor climate conditions have been combined to set up a computational fluid dynamics model. In the model, to simulate the crops presence and effect, an isotropic porous medium following Darcy’s law has been defined based on the physical characteristics of the plants. The outcomes of the numerical simulations were then compared with the experimental one. The results show that the porous medium model could accurately simulate the heat and mass transfer between the crops, the indoor air, and the soil. Moreover, the adoption of this model helps to clarify the mechanism of thermal exchanges between crop and indoor microclimate and allows to assess in more realistic way the microclimate conditions close to the crops.

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