Abstract:

Resistance to airflow of horticultural products in boxes is important for the design of the cooling process. Correlations have been determined experimentally to determine the effect of particle shape and size, box design, and air penetration slots on overall pressure drop. While useful in practice for process calculations, the aerodynamic design of the box and of the stacking of the products is difficult by means of such correlation equations. In this paper, a numerical modelling methodology is presented to account for geometrical factors, such as box design and product stacking, explicitly in the model formulation of the air flow through vented boxes with horticultural products. Thereto, two numerical techniques, the discrete element method and computational fluid dynamics, were combined and the simulated airflow pattern compared to measurements and a porous medium approach. Preferential air flow paths inside the box were revealed, which will have consequences for the uniformity of cooling of horticultural products in boxes. The proposed procedure will provide a means to develop more accurate porous medium models to predict cooling on a larger scale.