Abstract:

A respiration-diffusion model was constructed to study the development of core breakdown in 'Conference' pears as a function of the applied controlled atmosphere conditions. Magnetic resonance images and X-ray CT scans were taken to study the spatial distribution and the time course of this pear disorder. To obtain reliable parameter estimates for respiration and diffusion, both phenomena were uncoupled. The influence of gas diffusion on the respiration parameters of the modified Michaelis-Menten kinetics, was eliminated by measuring respiration of pear cell protoplasts in suspension instead of on intact pears. These 'diffusion-free' respiration parameters were included, together with the gas diffusivities of pear skin and tissue, in the respiration-diffusion model. Based on this model, three-dimensional O_2 and CO_2 profiles were simulated for intact pears, depending on the storage conditions. It was observed that the contours of the simulated CO_2 and O_2 profiles corresponded very well with the MRI and CT scans of the pears. On the MR images the process of brown discoloration and cavity development was followed non-destructively in time. The X-ray CT scans were used to reconstruct the cavities in the geometrical model and to validate the model.