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Evolution of water repellency of organic growing media used in Horticulture and consequences on hysteretic behaviours of the water retention curve

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Most of growing media used in horticulture (particularly peat substrates) shows hysteresis phenomena during desiccation and rehydration cycles, which greatly affects their hydraulic properties. The origins of these properties have often been related to one or several of the specific mechanisms such as the non-geometrical uniformity of the pores (also called 'ink bottle' effect), presence of trapped air, shrinkage-swelling phenomena, and changes in water repellency. However, recent results showed that changes in wettability during desiccation and rehydration could be considered as one of the main factors leading to hysteretic behaviour in these materials with high organic matter contents (Naasz et al., 2008).
The general objective was to estimate the evolutions of changes in water repellency on the water retention properties and associated hysteresis phenomena in relation to the intensity and the number of drying/wetting cycles.

For this, simultaneous shrinkage/swelling and water retention curves were obtained using method previously developed for soil shrinkage analysis by Boivin (2006) that we have adapted for growing media and to their physical behaviours during rewetting. The experiment was performed in a climatic chamber at 20°C. A cylinder with the growing medium tested was placed on a porous ceramic disk which is used to control the pressure and to full/empty water of the sample. The whole of the device was then placed on a balance to record the water loss/storage with time; whereas linear displacement transducers were used to measure the changes in sample height and diameter upon drying and wetting in the axial and radial directions. Ceramic cups (2 cm long and 0.21 cm diameter) connected to pressure transducers were inserted in the middle of the samples to record the water pressure head.
In parallell, contact angles were measured by direct droplet method at different steps during the drying/rewetting cycles.

First results obtained on weakly decomposed peat samples with or without surfactants showed isotropic shrinkage and swelling, and highlighted hysteresis phenomena in relation to the intensity of drying/wetting cycle. Contact angle measurements are in progress. Other measurements on highly decomposed peat (more repellent than weakly decomposed), composted pine bark (without volume change during dryin/wetting cycles), and coco fiber (expected as non repellent organic growing media) are also in progress.