

# Inflection point on water retention curve of sandy soils indicates onset of plant hydraulic stress

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Water availability in drying sands relies on the abilities of soil to release water and to deliver it roots. To calculate plant available water in sandy soils Grant and Groenevelt (2015) proposed the inflection point on the water retention curve as well suited to apply hydraulic weighting functions to restrict the water capacity. There is no a priori reason why plants should experience water stress immediately beyond the inflection point but the rate of water release per unit suction decreases thereafter. Thus, the question arises whether plants respond predictably when grown at water contents surrounding the inflection point. This study grew wheat plants (drought tolerant and intolerant varieties) in sandy soils at constant water contents at the inflection point, above it, or below it. Water retention data were collected and fitted to water retention models,  $\theta(h)$ , then differentiated to produce water capacities,  $C(h)$ , the peaks of which marked the inflection points ( $\theta_{infl}$ ,  $h_{infl}$ ). Two water contents close to the inflection point but just above or below it (i.e.  $\theta_{wet}$  or  $\theta_{dry}$ ), were identified from the two matric heads corresponding to 90% of the maximum water capacity either side to ensure no overlap among water contents.

Pots of different sandy soils were packed, brought to one of the three water contents, and planted to two wheat varieties with different drought tolerance (*Triticum aestivum* L, Kukri and Excalibur). Pots were weighed twice daily to maintain constant water content as the plants grew. After 3 weeks the shoots and roots were harvested and weighed as a plant response. In most soils, root growth was greater at or above the inflection point than below it, although this depended on variety. It appears the inflection point does indeed mark an initial point of hydraulic stress and can be used to weight the water capacity as postulated but probably only for relatively coarse sands.