Quantitative analysis of root responses to multiple physical constraints: effects of soil pore structure

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Introduction
Climate change may result in significant changes in rainfall patterns. The physical structure of soil affects both drainage and water retention. This reduces root elongation rates and can potentially affect crop yield.

Objectives
• Assess the physical status of agricultural soils
• Investigate the effects of soil physical properties on root growth

Methods
• Sampling area: North East Scotland (left)
• 3 intact soil cores collected from 59 fields
• Matric potential adjusted to -20kPa
• Barley seedling root elongation assay

Conclusions
• Soil physical properties in field are likely to be slowing root elongation.
• Root elongation rates are closely related to the volume of air filled pores in field cores (particularly the 60-300μm diameter range), in contrast to sieved repacked cores suggesting soil structure is important.

Future analysis of physical contraints to root growth

RNA expression analysis
• RNA expression analysis in roots extracted from soil cores: e.g. response of aquaporins in barley roots to changes in water availability in two different cultivation systems (right)

Image analysis
• PlantVis is an image analysis tool being used to analyse root elongation and growth strategies in artificial systems with different pore structures (Roberts et al. 2010, Wuyts et al. 2010)

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References: