Geophysical Research Abstracts
Vol. 17, EGU2015-7390, 2015
EGU General Assembly 2015

Rhizogenesis: Exploring the physical development of the emerging root:soil interface

Sacha Mooney (1), Jon Helliwell (1), Craig Sturrock (1), Richard Whalley (2), and Tony Miller (3)
(1) School of Biosciences, University of Nottingham, Nottingham, UK, (2) Rothamsted Research, Harpenden, UK, (3) John Innes Centre, Norwich, UK

The rhizosphere is a distinct zone of soil directly influenced by a plant root, with all below ground resources passing through this dynamic zone prior to capture by plants. Therefore the physical nature of the interface between the rhizosphere and the bulk soil is crucial for plant development. It is well known that the soil microbial community play a significant role in the evolution of the rhizosphere and some studies have shown that it is structurally a very different environment to the surrounding bulk soil. However how this evolution or genesis is influenced by the underlying soil physical properties and how this interacts with different plant species is less well understood. Actually examining the undisturbed rhizosphere has represented a major obstacle to research, due to its microscopic size and often fragile nature. Here we have employed high resolution X-ray Computed Tomography (CT) to successfully map the physical architecture of the developing rhizosphere in natural soils for the first time. We compared the temporal changes to the intact porous structure of the rhizosphere during the emergence of a developing root system, by assessing changes to the soil porous architecture across a range of soil textures and plant species. Our results indicate the physical zone of influence of a root at an early stage is more localised than previously thought possible (at the μm rather than mm scale). Soil porosity increases at the immediate root surface due to localised crack formation in both fine and coarse textured soils. As such the soil porous architecture at the root interface is enhanced and not compacted as previously considered. Subsequent densification of the soil system in response to an expanding root diameter was still observed, however this at some distance away from the root, and is primarily governed by soil particle size, soil bulk density and root diameter. This 'rhizosphere structure' and associated dynamics have important consequences for several important root-soil processes including water uptake efficiency and gaseous exchange pathways between individual aggregates and subsequently our efforts to model their behaviour.