

Visualising and quantifying rhizosphere processes: root-soil contact



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Close root-particle contact is essential for water and nutrient transport to roots via liquid films. X-ray microtomography is a new and developing technique to investigate the root-soil interface.

Aims

Development of a method to determine root-soil contact from 3D volumetric images to investigate the effect of particle size distribution on root-soil contact.



Root-soil contact

We took scans of pre-germinated maize seeds grown in soil sieved to 4-2mm, 2-1mm, 1-0.5mm and <0.5mm and at a matric potential of -0.03 MPa (growth period 24h) at 20°C in darkness. Sample size: 10 cm high, 3 cm high, Resolution 35 µm.

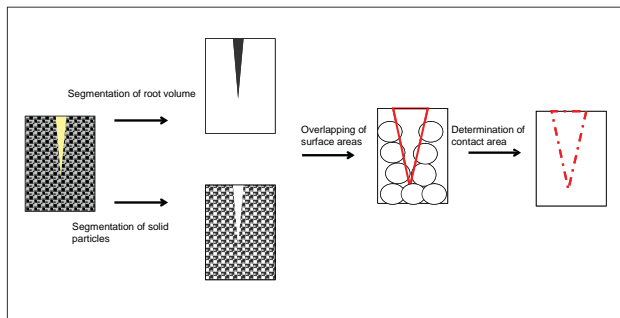


Figure 1

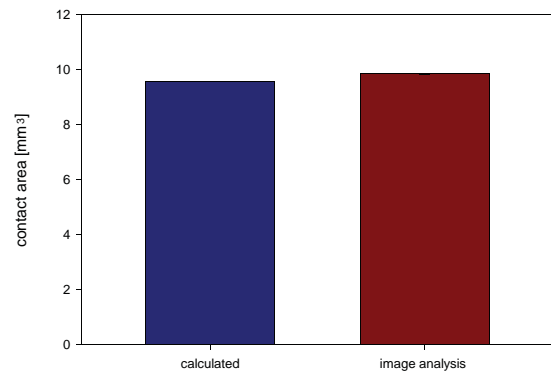
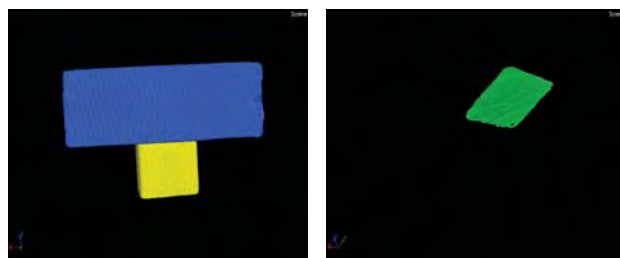
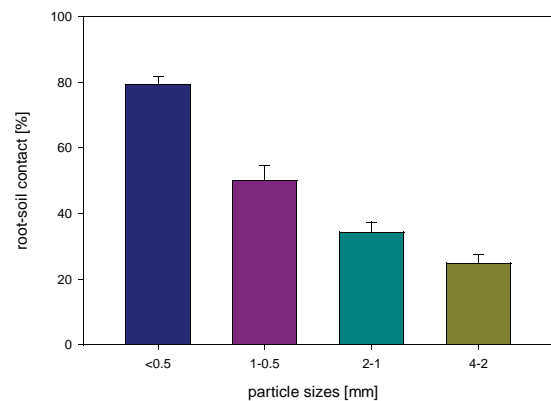
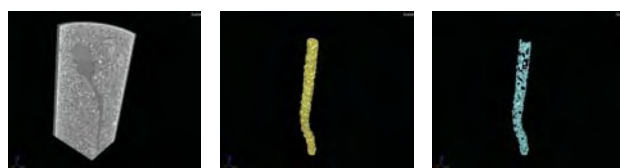


Figure 2



A model system of root-soil contact with known dimensions was built to calculate the systematic error of this methodology.

Differences between calculated values and values determined with image analysis were less than 3% (Figure 1).



Maize in sieved soil of particle size 1-0.5 mm, segmented root volume and area of root-soil contact of maize root.

Root soil contact decreased with increasing particle size (Figure 2).

Conclusions

The model system to test estimation of root-soil contact demonstrated high accuracy.

Soil with finer particle sizes facilitated greater root-soil contact.

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