Manipulating Wheat’s ‘Hidden Half’

For more than 100 years, plant breeders have focussed on optimization of the aboveground characteristics of cereal crops, such as plant height and flowering time, which has led to dramatic gains in productivity worldwide. However, the plants’ hidden half, the roots, have largely been ignored even though their architecture can significantly impact plant performance, particularly under water-limited conditions.

In an article recently published in The Plant Genome, researchers report the first direct phenotypic selection for root architecture in spring wheat. They performed two generations of bi-directional selection for both wide and narrow root growth angle by combining the “clear pot” root phenotyping method with speed breeding for rapid generation advance. This innovative approach enabled crossing and development of BC1F4-derived lines with extreme root systems within only 18 months. The phenotypic selection successfully shifted the means of the divergent populations, and analyses revealed genomic “hot spots” associated with root architecture.

Greater knowledge of the molecular pathways involved in shaping root system architecture, development of elite germplasm incorporating desirable alleles for root architecture, and validation of the yield benefits will empower plant breeders to assemble more robust crop varieties for a hotter and drier world.

Adapted from Richard, C., J. Christopher, K. Chenu, A. Borrell, M. Christopher, and L. Hickey. 2018. Selection in early generations to shift allele frequency for seminal root angle in wheat. Plant Genome 11. View the full open access article online at http://dx.doi.org/doi:10.3835/plantgenome2017.08.0071

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Fast Methods for Predicting the Soil-Water Retention Curve

The soil water retention curve is essential for understanding and modeling water and solute transport in the vadose zone and water availability for plants. However, it is highly time consuming to measure, and so a fast and accurate method to predict it is needed.

In a recent article in Vadose Zone Journal, researchers from Aarhus University and Aalborg University report on models they developed to predict the soil water retention curve using visible–near infrared spectroscopy and a pedotransfer function based on soil fines (soil clay-size fraction and organic matter), covering a wide range of soil texture, from sandy to loamy soils, and organic matter contents.

They found that the soil water retention curve can be predicted equally well using either visible–near infrared spectroscopy or a classical soil pedotransfer function since both methods compared closely to the measured data. However, the soil water retention curve was slightly better predicted for across-field variations using visible–near infrared spectroscopy and for individual soil samples using pedotransfer function based on soil fines.

Both models can be applied as a faster and indirect method to predict the soil water retention curve across-field variations or for individual soil samples. This study comprises soils with volumetric content of fines (clay plus organic matter) up to 20%. In future studies, the research group will include soils with higher clay and organic contents along with soils from different geographical and climate regions.


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Cecile Richard and the “clear pot” root phenotyping system that was used in combination with speed breeding to perform rapid selection for root architecture in spring wheat.

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