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The Importance of Juvenile Root Traits for Crop Yields

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Genetic variation in root system architecture (RSA) is an under-exploited breeding resource. This is partly a consequence of difficulties in the rapid and accurate assessment of subterranean root systems. However, although the characterisation of root systems of large plants in the field are both time-consuming and labour-intensive, high-throughput (HTP) screens of root systems of juvenile plants can be performed in the field, glasshouse or laboratory. It is hypothesised that improving the root systems of juvenile plants can accelerate access to water and essential mineral elements, leading to rapid crop establishment and, consequently, greater yields. This presentation will illustrate how aspects of the juvenile root systems of potato (Solanum tuberosum L.) and oilseed rape (OSR; Brassica napus L.) correlate with crop yields and examine the reasons for such correlations. It will first describe the significant positive relationships between early root system development, phosphorus acquisition, canopy establishment and eventual yield among potato genotypes. It will report the development of a glasshouse assay for root system architecture (RSA) of juvenile potato plants, the correlations between root system architectures measured in the glasshouse and field, and the relationships between aspects of the juvenile root system and crop yields under drought conditions. It will then describe the development of HTP systems for assaying RSA of OSR seedlings, the identification of genetic loci affecting RSA in OSR, the development of mathematical models describing resource acquisition by OSR, and the correlations between root traits recorded in the HTP systems and yields of OSR in the field.