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ADAPTIVE TRAITS TO IMPROVE DURUM WHEAT YIELD IN DROUGHT AND CROWN ROT ENVIRONMENTS

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Durum wheat (*Triticum turgidum L. ssp. durum*) production can experience significant yield losses and grain quality reduction due to crown rot (CR) disease, caused by a complex of fungal pathogen *Fusarium spp*. Losses due to CR are exacerbated when disease infection coincides with terminal drought. Durum wheat is very susceptible to CR and resistant germplasm is not currently available in elite breeding pools. Deploying physiological traits for drought adaption such as enhanced root system architecture, to reduce water stress, could minimise losses due to CR infection.

Australian cultivars and ICARDA elite breeding lines pre-selected for drought adaptation in Syria and Morocco, were used to rapidly develop a nested association mapping (NAM) population using the rapid generation advance technology, 'speed breeding'. NAM populations were evaluated in the field and under controlled conditions for root architecture, stay-green traits and CR disease. Field experiments were conducted in Queensland (Australia) to investigate the value of root architectural traits to improve adaptation to each of the stresses. Weekly measurements of NDVI enabled modelling of the senescence pattern and calculation of stay-green traits for each genotype. Genome-wide association studies using 2,541 high quality polymorphic DArTseq markers identified a major QTL on 6A (*qSRA-6A*) and 6B (*qCR-6B*) underpinning seminal root angle growth and CR tolerance, respectively. Haplotype analyses identified allelic variants with favourable impact on yield under drought and CR conditions. Results highlighted the value of combining above- and below-ground physiological traits to boost yield.

The study provides new insights into the genetic controls of these adaptive traits. We anticipate this will assist breeders to design improved durum varieties to mitigate production losses due to water deficit and CR.