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GENETIC DISSECTION OF ROOT ARCHITECTURAL TRAITS AND THEIR ASSOCIATION WITH DROUGHT ADAPTATION IN DURUM WHEAT

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Durum wheat (Triticum durum Desf.) is one of the most important crops of the world but its growth and production are often hampered by limited water availability. Roots play an important role in water acquisition and use. Therefore, a better characterization of the root system architecture is critical to crop improvement and should represent a strategic insight to design new cultivars capable of capturing soil moisture more efficiently. The genetics modulating root system architecture are still not well understood. In the present study, a panel of 100 durum wheat genotypes originating from different countries were investigated for the genetic variability in root architecture and growth traits. Two protocols were used, a 'clear pot' protocol for seminal root characterization and 'pasta strainer' for mature root evaluation. To examine whether genotypes change their root system architecture depending on water availability, the genotypes were assessed for their rooting pattern under water-limited and well-watered treatments in near field conditions. This study revealed that water treatment effect was not significant for root architecture, indicating a strong genetic control of this trait. A significant genetic variability for root angle was found and two main categories of root types were identified: genotypes with (i) superficial and (ii) deep rooting systems. Then, the two classes were tested in the field yield trials with different water regimes to assess impact on yield. A significant advantage for grain yield was shown by deep rooted genotypes in the environments with terminal reduced moisture. The complete set was genotyped and a genome scan using 8173 SNPs markers developed by 35K Axiom array allowed to identify the genomic regions influencing drought adaptation mechanisms and their relationship with yield. The use of this genomic regions could lead to an improved resilience to climate change and increase durum wheat productivity in drought-prone areas.