Ancestral QTL alleles from wild emmer wheat improve drought resistance and productivity of modern wheat

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ABSTRACT:

The potential of wild emmer wheat (*Triticumturgidum* ssp. *dicoccoides*) to enhance drought resistance of its domesticated progenies, durum wheat (*T. turgidum* ssp. *durum*) and bread wheat (*T. aestivum*) was studied. Wild emmer wheat exhibited wide diversity of drought responses and a considerable advantage in drought resistance over cultivated durum wheat genotypes. A Recombinant inbred line population derived from a cross between durum wheat (cv. Langdon) and wild emmer wheat (acc. G18-16) was used to construct a genetic map and to identify quantitative trait loci (QTLs) conferring drought resistance and related morph-physiological traits. Marker assisted selection (MAS) was used to introgress major QTL alleles from wild emmer wheat into four modern durum and bread wheat cultivars. The resultant near isogenic lines (NILs) were examined across two years in a rain protected screen house and one year under field conditions. Two QTL alleles from wild emmer wheat, on chromosome 7AS and chromosome 2BS, conferred significantly enhanced drought resistance and productivity in the respective NILs, compared to their recurrent parents. Detailed physiological analyses of the NIL introgressed with the 7AS QTL, revealed that the improved productivity of the NIL was associated with enhanced photosynthetic capacity coupled with greater root branching and biomass. The results provide first evidence that introgression of wild emmer QTL alleles can enhance productivity and yield stability across environments in domesticated wheat, thereby enriching the modern gene pool with essential diversity for the improvement of drought resistance.