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"Filling gaps and removing traps
for sustainable resource management"

Response of Drought-Inducible Proline Accumulation in Barley Genotypes to Seed Set and Filling

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Abstract

Drought as a consequence of climate change is projected to become more prevalent in the future to cause yield decline of about 33 % in barley. In this study we focus on drought response of five different spring barley genotypes; four 2-row types with *Barke* and *Scarlett* as elite German cultivars, two introgression lines *IL143* & *IL141* which bears the ancestral allele *Pyrroline-5-carboxylate synthase1- P5cs1* and one 6-row type *HOR10151.* Plants were grown until booting stage in the greenhouse in pots with peat soil and then subjected to 18 days of well-watered (100 % field capacity) and water-stress (30 % field capacity) treatments. For all genotypes significant reductions due to the treatment were observed for phenotypic, biochemical and physiological traits. Averaged over all genotypes, a significant reduction in plant height (17 %), tiller number (20 %), spike number (56.3 %), grain number (28.8 %), spike length (19 %), grain weight (76.5 %), relative leaf water content (4.4 %), CO_2 assimilation (55.6 %), stomatal conductance (73 %), transpiration rate (63.6 %) and electron transport rate (49.3 %) was recorded due to drought. A positive correlation was found between the treatment effect on spike length and the reduction in grain number (r=0.73, P≤0.01) and grain weight (r=0.37, P≤0.05), respectively. Reduced green leaves area was observed for all genotypes, with the two introgression lines showing milder drought symptoms. The reduction in relative leaf water content was negatively correlated (r=-0.61, P≤0.001) with the reduction in shoot dry weight. Again, the reduction in relative leaf water content positively correlated (r=0.65, 0.53, 0.51, P≤0.01) with reductions in transpiration rate, stomatal conductance and CO_2 assimilation respectively. Across genotypes, the grain filling duration was not affected. However, preliminary MRI scans indicated that there might be differences in floret abortion among drought treated elite cultivars compared to introgression lines. The 6-row barley *HOR10151* was severely affected while *IL143* showed better drought tolerance by staying green, maintaining relative leaf water content and remaining photosynthetically active. These results support and extend recent findings that barley genotypes harboring wild variant of P5cs1 might have an advantage in tolerating low water availability.

Keywords: Barley, drought-inducible proline, filling, seed set

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