STEM WATER SOLUBLE CARBOHYDRATE REMOBILIZATION IN WHEAT UNDER WATER LIMITED CONDITIONS

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The most common factor affecting wheat production and grain quality in Australia is water deficit – “drought.” In the WA wheatbelt, water deficit intensifies from anthesis, and severe drought usually occurs from a month after anthesis to maturity. Thus, terminal drought is a major problem for wheat production in WA and drought tolerance in wheat is a priority for research. A major limitation in this field is the lack of efficient approaches of drought tolerance screening and availability of drought tolerant germplasm.

Our study has found that stem water soluble carbohydrate (WSC) mobilization has great significance for converting biomass into the grain under terminal water-deficit. However, stem WSC level is not, on its own, a reliable criterion for drought tolerance as no significant positive correlation has been detected between the grain weight per spike and the maximum levels of stem WSC concentration or the maximum total WSC content in the MEF project “remobilization of stem WSC to grains by 1-FEH under water limited condition” using Westonia, Kauz and their 24 DH lines with large genetic diversity background in Merredin, WA. The results indicated that the genes involved in the mobilization of stem WSC, 1-FEHs, and the gene expression data, as a potential drought tolerant marker, define their crucial role in contributing to water deficit tolerance. In irrigated and naturally drought plants, the stem WSC level in the Kauz type decreased seven and four days earlier compared with the Westonia type, respectively. The grain weight per spike (GW) of the Westonia type was similar between the drought and irrigated treatments while there was a drop in GW in the drought treatment in the Kauz type. These results suggest that the Westonia type had higher osmotic potential and greater tolerance to drought than the Kauz type. Shoot analysis revealed that the WSC concentrations were highest in the penultimate peduncle stem segment, followed by the lower parts of the stem, the peduncle and sheath in both drought and irrigated plants. At the end of stem WSC pattern, the levels of stem WSC of all different segments were below 15 and 21% in line 307 in drought and irrigated plants, respectively. In contrast, levels of stem WSC showed sharper reductions in peduncle and sheath compared with the penultimate peduncle and lower parts of stem in line 338 in both drought and irrigated treatments. The result indicated variation in stem WSC remobilization between different genotypes. Recently discovered QTL provide some evidence for the possible gene function of the contribution to the grain yield components. This and other markers of grain yield components may be useful for wheat breeding in the future.