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Barley stem reserves and yield maintenance under terminal drought: molecular dissection of fructan biosynthesis and remobilization

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Drought is one of the main constraints limiting plant production. Barley is an important crop in many developing countries, where it is often exposed to severe drought stress. Barley is also known as a proper model species for abiotic stress related studies. The current research sheds light on the role of stem fructan remobilization on yield maintenance of barley under terminal drought conditions, while current photosynthesis is very limited during grain filling stage. Morocco and Yousef as drought susceptible and tolerant cultivars of barley were grown under well-watered conditions until anthesis; when the drought treatment was started by withholding water. Then, peduncle, penultimate and lower internodes were sampled from well-watered and drought-stressed plants at 7-days intervals. Yousef had significantly higher stomatal conductance, relative water content, leaf temperature, osmotic adjustment and grain yield. Maximum accumulation and remobilization of reserves was found in penultimate followed by lower internodes and peduncle. Total carbohydrate, fructan, sucrose, glucose and fructose concentration was higher significantly in the penultimate of Yousef plants under both drought and well-water conditions than Morocco genotype. Drought stress increased the fructan accumulation and remobilization rate in the penultimate internode of Yousef. A strong correlation was observed between the relative expression of fructan biosynthesis genes (1-SST and 6-SFT) with the fructan content and, expression of fructan exohydrolase (1-FEH) and sucrose transporter (SUT1) genes with fructan remobilization in the tolerant cultivar during grain filling under drought stress. Based on the achieved results, enhanced fructan accumulation and its induced remobilization under drought condition can play an important role in yield stability of Yousef under stress and current photosynthesis limitations. The genetic variation among barley cultivars in terms of the accumulation and remobilization mechanisms of stem carbon reserves indicated the possibility of improvement in these traits in plant breeding programs.

Biography

Zahra Sadat Shobbar is working as a lecturer in Agriculture Biotechnology Research Institute of Iran, Iran

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