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Water deficit directly impacts the ability of plants to intercept and convert light into biomass. Because leaf growth is one of the first processes affected by water deficit, many physiological studies concentrated in short-term responses and associated mechanisms. They demonstrated the roles of cellular and metabolic processes such as changes in cell turgor, hydraulic conductance and cell wall plasticity. However, our understanding of how water deficit impacts the cell wall biosynthesis and dynamics is still fragmentary. Here, we report that ZmMYB31, a subgroup 4 R2R3-MYB transcription factor that acts as a repressor of the lignin pathway in Arabidopsis [1-2], is induced by water deficit in the leaf growing zone and colocates with QTLs for lignin content and growth responses to water deficit in maize. To assess the role of ZmMYB31 in maize upon water limitation, we generated maize transgenic lines overexpressing *ZmMYB31*. We showed, in preliminary experiments, that the leaf growing zone of T1 *ZmMYB31* overexpression plants had a higher content of β-O-4-linked lignin units than that of wild-type sister plants grown in the greenhouse under well-watered conditions. A comparative analysis by quantitative RT-PCR revealed significant differences for six lignin biosynthetic genes in the leaf growing zone of T1 *ZmMYB31* overexpression plants compared with that of wild-type plants, consistent with the observed changes in β-O-4-linked lignin unit content. To obtain additional clues with regard to ZmMYB31 function in maize under water-limited conditions, we are currently combining RNA-seq analysis and shotgun proteomics of the leaf growing zone of homozygous *ZmMYB31* overexpression plants and their wild-type siblings grown in the PhenoArch platform under well-watered and moderate water deficit conditions. Integrative statistical approaches shall allow us to infer a ZmMYB31-regulated network and identify variables underpinning maize responses to water deficit.

Keywords: maize, water deficit, ZmMYB31, lignin biosynthesis, omics

[1] Fornalé S, Sonbol FM, Maes T, Capellades M, Puigdomenech P, Rigau J, Caparros-Ruiz D (2006) *Plant Mol. Biol.* 62: 809-823.

[2] Fornalé S, Shi X, Chai C, Encina A, Irar S, Capellades M, Fuguet E, Torres JL, Rovira P, Puigdomenech P, Rigau J, Grotewold E, Gray J, Caparrós-Ruiz D (2010) *Plant J.* 64: 633-644.