

Engineering greater WUE in sorghum through tissue-specific manipulation of epidermal patterning factors to reduce stomatal density

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Abstract

Globally, water supply is the major limiting factor for crop productivity. Water use efficiency (WUE) is defined as the ratio of photosynthetic carbon gain relative to water vapor loss from the leaf through the stomata to the atmosphere. Improving WUE would slow crop water use and delay the onset of drought stress when water supply does not meet crop demand. Stomatal density is an important factor that influences plant gas exchange efficiency. We have proof-of-concept that reducing stomatal density in sorghum by ubiquitously expressing a synthetic EPF2_{core} gene can increase WUE without any decrease in photosynthetic carbon gain. However, ubiquitous expression of the synthetic EPF gene has unwanted pleiotropic effects on stem development and seed set. In this study, we test whether tissue-specific promoters can be used to isolate the desired leaf phenotypes without causing unwanted side effects. This provides an important step towards engineering stomatal density to improving WUE and protecting C4 crop yields from drought-induced losses today and in a future, warmer climate.