

# C<sub>4</sub> Grasses Employ Various Strategies to Acclimate Rubisco Activase to Heat Stress.

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## Abstract

C<sub>4</sub> crops such as *Zea mays* (maize) and *Sorghum bicolor* (sorghum) are important in both food and bioenergy systems. In these crops, carbon assimilation is limited at high heat by the thermolabile protein rubisco activase (RCA). We present a comparative study of assimilation and RCA function in the C<sub>4</sub> grasses maize, sorghum, and the C<sub>4</sub> model grass *Setaria viridis* (setaria) during a 48 hour heat stress acclimation. Western blots and biochemical assays show that each species uses a different strategy to acclimate to heat. All grasses shift the predominant proteoform of RCA from a 41kD to a 43kD form. In addition, sorghum expresses the [?] isoform, while all three grasses transiently increase expression of the ? isoform. The response of RCA to magnesium ions and to ADP is also altered. After heat treatment, maize RCA is more sensitive to inhibition by magnesium but loses sensitivity to ADP. Different cultivars of maize show differences in assimilation and protein expression. Because each grass expressed and regulated RCA differently, we recommend that future study of RCA should examine each grass individually rather than relying on a model organism.

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