Engineering rice to perform better under dynamic light regimes

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Abstract

Light levels change throughout the day, are affected by climate and weather, and are filtered by the local environment. Switching between low and high levels of light over varying periods of time experienced by an organism in its environment shapes the tempo and mode of its light detection system. Plants must respond to dynamic environmental conditions and thus switch between efficient photosynthesis and photoprotection. Receptors on the plasma membrane perceive extracellular signals, such as photosynthetically-fixed sugars, are coupled to cytoplasmic G proteins to transduce information to cytoplasmic proteins and to amplify that signal to bring about changes like photosynthetic efficiency in both short (e.g. enzymatic reactions) and long (e.g. plant development) time scales. While G proteins have been shown to be important in regulating various aspects of stomata and photosynthesis, their role has yet to be fully understood. A regulator of G signaling (RGS) has been shown to sense sugars fixed in photosynthesis. Thus, we hypothesize that RGS mediates responses to dynamic light. The sequenced genomes within the grass family are the only genomes throughout Plantae known to lack RGS. By contrast, *Setaria* retains the RGS gene. Thus, the RGS gene from *Setaria* was expressed in rice to better understand the function of RGS. In this study, multiple transgenic events were grown to investigate their phenotypic response. We identified lines with altered stomatal patterning and rates of stomatal closure in response to changing light levels that will be used in future experiments.

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