MACQUARIE University

Improved heat tolerance in plants for enhanced crop yields under heat stress

BACKGROUND

Climate change models project as much as a ~ 1-5°C increase in the average temperature within 100 years, and suggest that yields for staple crops could decrease by anything from 2-25% in the next 10-30 years. Photosynthesis is a core factor in crop productivity. Photosynthesis is temperature sensitive, and every species has an optimum temperature range above which photosynthesis and yield is reduced. Rubisco and the enzyme which activates it — Rubisco activase (RCA) — constitute the critical first step in photosynthesis. The reduction in photosynthesis at above-optimal temperatures has been linked specifically to the inhibition of RCA. If greater activity of RCA could be engineered at elevated temperatures, photosynthetic performance would increase and crops would become more productive in hotter regimes.

OUR SOLUTION

Our invention is a novel variant of RCA with greater activity at elevated temperatures. The RCA variant was identified in wild Australian rice (*Oryza australiensis*), in which we have shown that it produces more thermally stable complexes up to 42°C, contrasting with RCA from common commercial rice, *O. sativa*, which forms unstable complexes above 36°C. Photosynthetic activity in *O. sativa* is *halved* at 45°C (cf. 28°C), whereas photosynthesis rates in plants with our heat-tolerant variant of RCA remains stable.

This technology could be applied to many crops to maintain current yields in traditional growing areas into the future, despite predicted increasing average temperatures from climate change. The technology could also be used to expand the current growing areas of heat-sensitive crops into hotter and more arid zones traditionally considered unsuitable for temperate crops.

APPLICATIONS

- ✓ Maintaining current crop yields in traditional growing areas despite climate change.
- ✓ Expanding potential growing areas of heat-sensitive crops into warmer zones.
- ✓ Can potentially be incorporated through conventional breeding techniques in rice crops (*Oryza* sp.).
- ✓ Can be incorporated through standard recombinant techniques into plants other than *Oryza* sp.

INVENTORS

Dr. Andrew Scafaro and Prof. Brian Atwell

INTELLECTUAL PROPERTY POSITION

WO2016115594A1: “Thermostable rubisco activase complexes”

WOULD YOU LIKE TO KNOW MORE?

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