



Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute) (490g)

# Effects of Day and Night Temperature on Rice Photosynthesis

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## Introduction

Daily minimum night temperatures have increased faster than daily maximum temperatures. In rice (*Oryza sativa*), higher night temperatures have been shown to increase



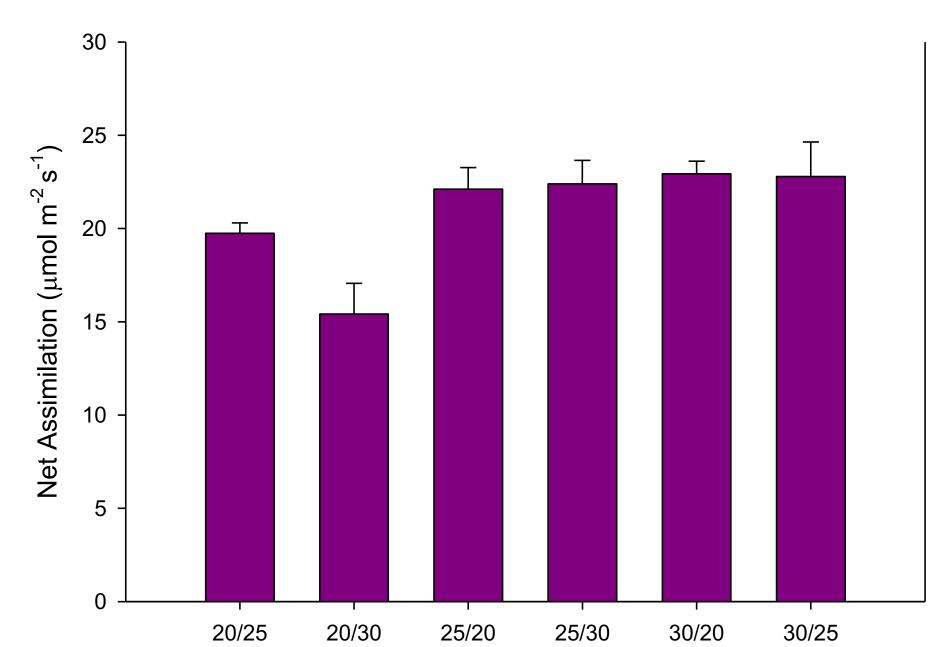
## **Conclusions and Outlook**

- Higher night temperatures:
  - Shift sucrose export and utilisation to the night-time
  - Increase photosynthetic efficiency by reducing photorespiration

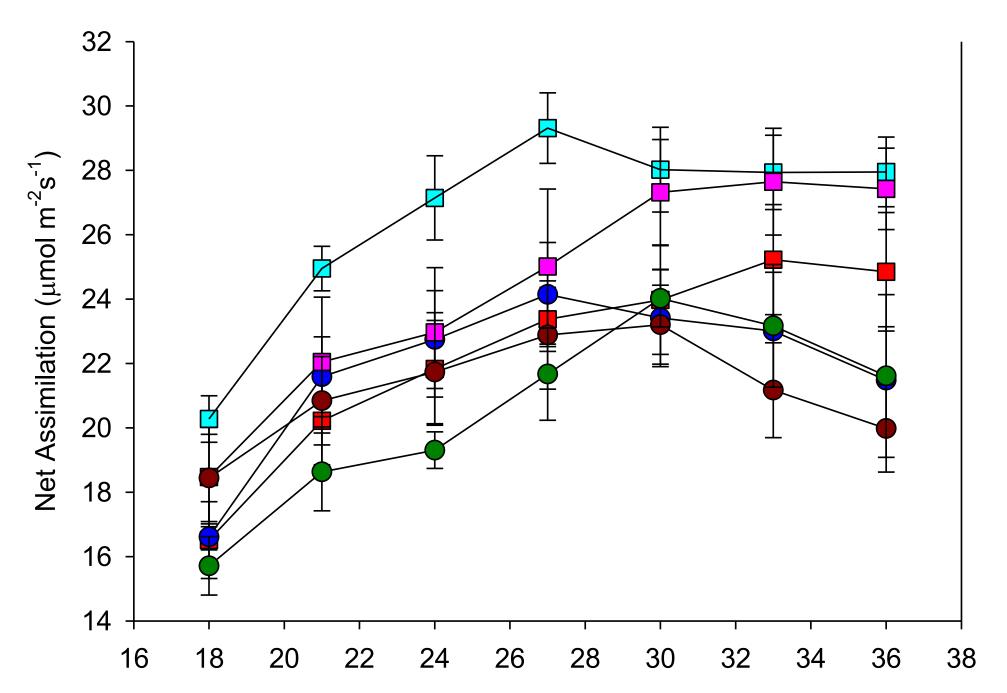
respiration, without increasing biomass accumulation, but decrease spikelet fertility and yield. How rice acclimates its sink-source relationships to moderate shifts in night temperature is not entirely clear, but is fundamental to understanding the potential impacts of a changing climate on a staple half the world depends on.

- Increases photosynthetic tolerance at higher temperatures
- Further refinement of the curve-fitting algorithm for determining mesophyll conductance and photorespiration

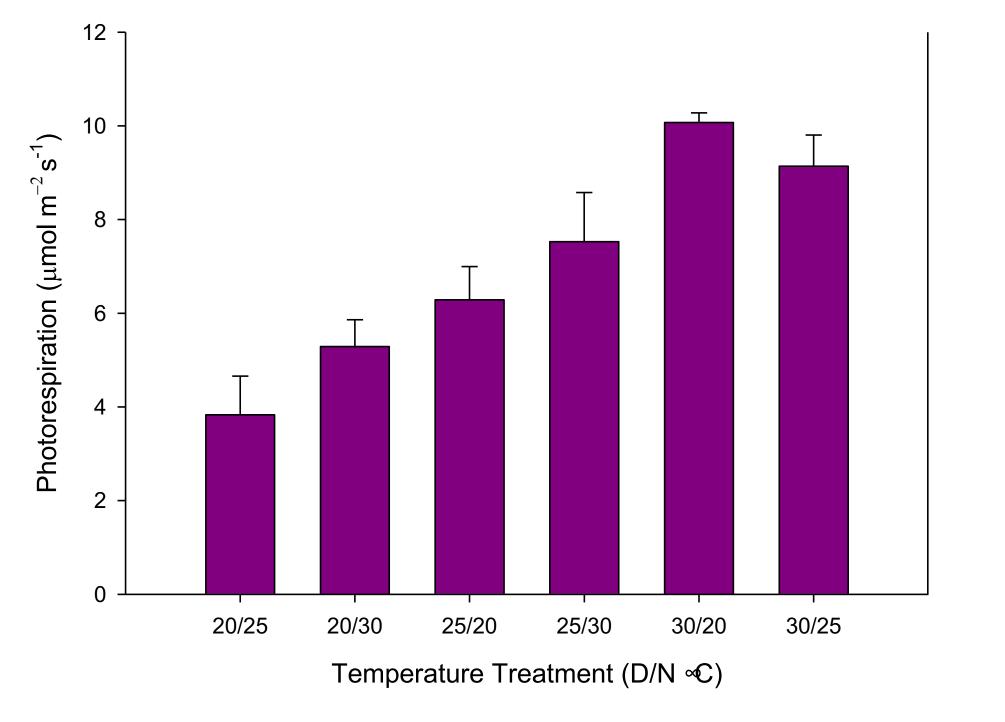
## **Results and Discussion**

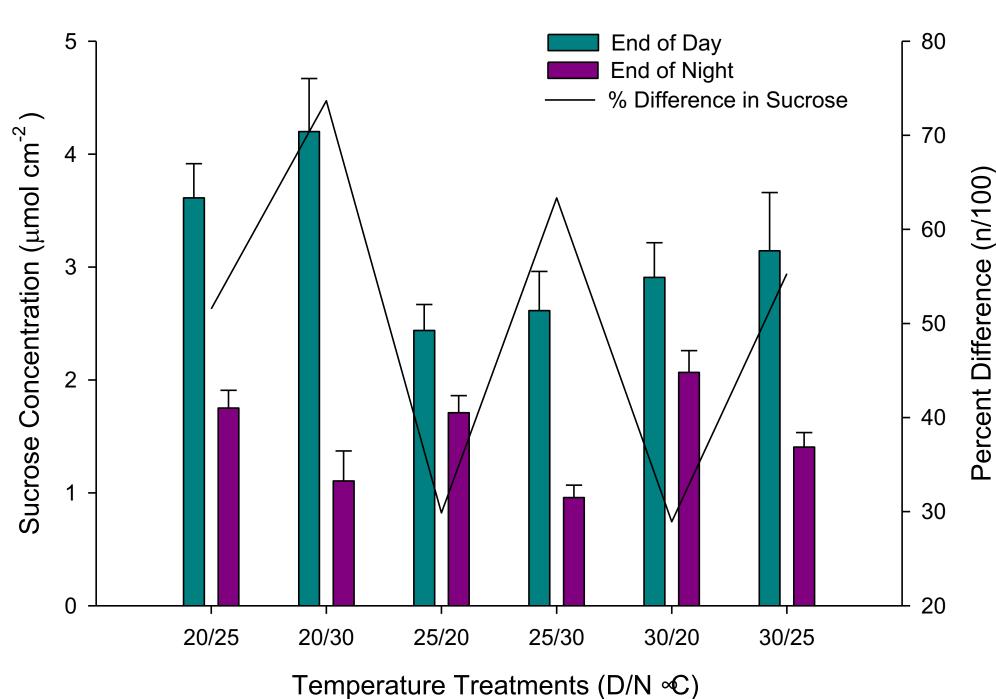


- Assimilation rates were lower at low day temperature.
- Higher temperature likely leads to increased assimilation rate due to an increase in enzyme activity.



#### Temperature Treatment (D/N ∞C)

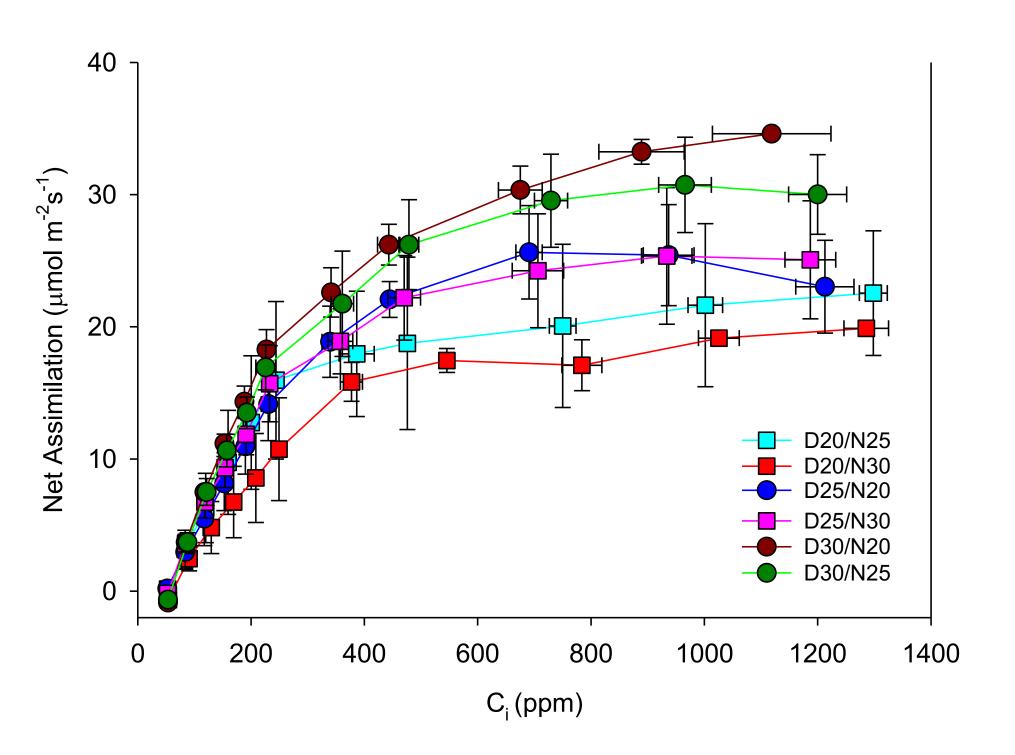




- Photorespiration was highest at higher day temperatures.
- However, it was lowest at higher night temperatures.
- Night temperature positively influences photosynthetic efficiency.
- Higher night temperatures led to higher sucrose levels at 'end of day'
- The difference between sucrose levels was greatest at higher night temperatures.
- The larger differences in sucrose indicate a shift

Temperature (∞C)

- Assimilation decreased above 30°C in plants grown at higher day than night temperatures.
- Higher night temperatures increase photosynthetic tolerance to higher temperatures.



Assimilation rates across C<sub>i</sub> levels were highest

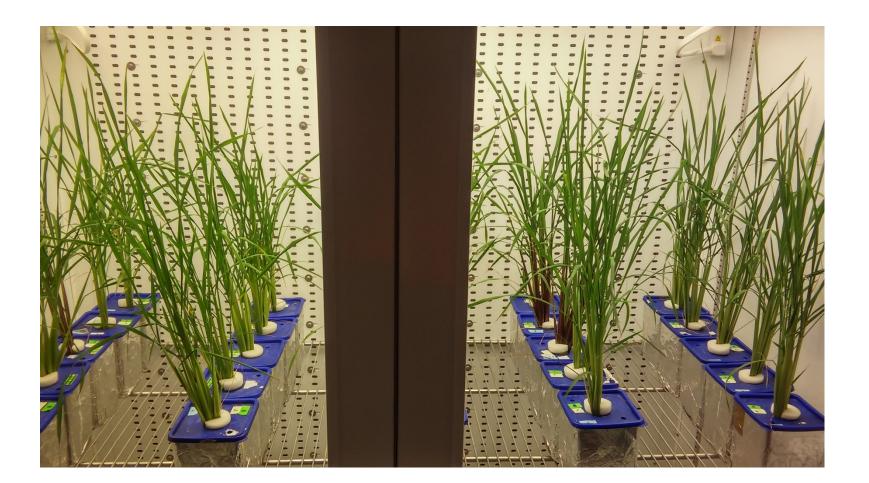
towards growth during the night in higher temperature nights.

## during higher day temperatures.

Assimilation rate is predominantly driven by enzymatic efficiency, which increases with temperature.

## **Materials and Methods**

5-week-old IR64 rice plants in hydroponic solution were exposed to 6 different temperature treatments for two weeks in a growth chamber. After 7 days of acclimation, photosynthetic parameters were measured, A-C<sub>i</sub> curves, and assimilation, as well as temperature curves at 3°C steps. Photorespiration was measured as the difference between 0 and 21% O<sub>2</sub>, at CO<sub>2</sub> 300 (ppm). Leaf samples for carbohydrate and chlorophyll were taken at end of day, end of night, as well as a leaf shaded for 48 hrs.



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