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Nitrogen Dynamics and Physiological N Use Efficiency in High-Biomass Sorghum

Background/Objective

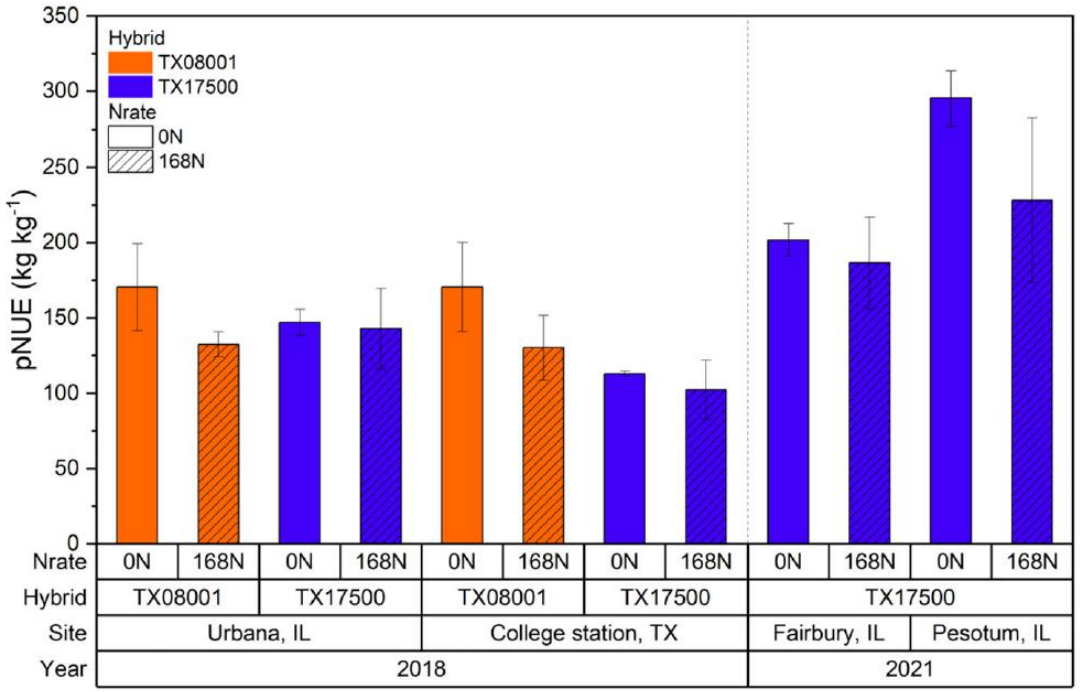
High-biomass sorghum (i.e., photoperiod-sensitive (PS) sorghum) is a promising energy crop for biofuel production due to its high yield potential. In PS sorghum, extended foliar greenness is associated with higher leaf N content and improved yields, emphasizing the importance of N remobilization and partitioning for enhancing physiological N use efficiency (pNUE). Therefore, the objective was to assess N remobilization from the lower to upper canopy in two PS sorghum hybrids and evaluate the effects of hybrid, N rate, and environment on N remobilization and pNUE.

Approach

Researchers evaluated leaf and stem N dynamics, canopy N remobilization, and pNUE in two PS sorghum hybrids (TX08001 and TX17500) under two N rates (0 and 168 kg-N·ha^{-1}) across four site-years: Urbana, IL (2018), College Station, TX (2018), Fairbury, IL (2021), and Pesotum, IL (2021).

Results

Leaf N concentration increased with plant height in the canopy, with steeper gradients under low-N conditions (3.1-16.3 g·kg^{-1}), indicating enhanced N remobilization when N is limited. Stem tissue showed less variation (1.2-7.6 g·kg^{-1}) in N concentration across canopy nodal positions. While pNUE was generally higher under unfertilized conditions, it varied with site-specific conditions. However, genotypic differences were minimal within a given year.



Variation in pNUE among two hybrids across two N fertilization levels and four site-years.

Significance/Impacts

This work highlights the importance of integrating environmental and management factors into breeding and fertilization strategies to enhance N efficiency in high-biomass sorghum.

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