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Nitrogen Fertilization Effects on Aged Miscanthus x giganteus Stands: Exploring Biomass Yield, Yield Components, and Biomass Prediction Using In-Season Morphological Traits

Background/Objective

Nitrogen (N) management is essential to the sustainable production of miscanthus, a perennial bioenergy grass. However, the precise role of N in biomass yield optimization remains uncertain. This study investigates the impact of N fertilization on biomass yield in aging miscanthus stands and additionally explores the use of in-season morphological traits for yield prediction and of yield components as direct indicators end-of-season yield.

Approach

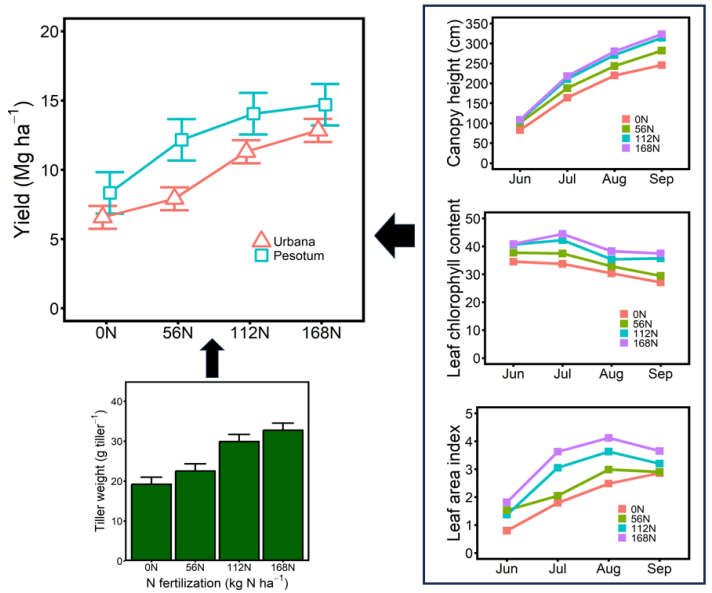
A previously unfertilized 10-year-old miscanthus stand (Urbana, IL) and 16-year-old stand with history of 56 kg N ha^{-1} N application (Pesotum, IL) were split into N treatments (0, 56, 112, and 168 kg N ha^{-1}) during 2018-2021 and 2020-2021, respectively. Morphological traits were measured every 2-3 weeks while yield components (tiller height, weight and density) and end-of-season biomass yield were determined at harvest.

Results

- Optimum N rates for maximizing yield differed by location were 112N at Urbana and 56N or less at Pesotum.
- End-of-season tiller weight correlated with biomass yield.
- Canopy height (August-September) was the best predictor of biomass yield, followed by LCC (leaf chlorophyll content, August-September) and LAI (leaf area index, late July).

Significance/Impacts

This work shows that aged miscanthus biomass yield responds to N fertilization but that response magnitude depends on environmental and management conditions. Additionally, this work highlights utility of plant trait data for yield prediction, and of yield components for monitoring yield changes over time.



Within-season (canopy height, LCC, LAI) traits for predicting miscanthus yield, and end-of-season traits (tiller weight) for monitoring yield changes over time were evaluated at two field sites under four N application rates.

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