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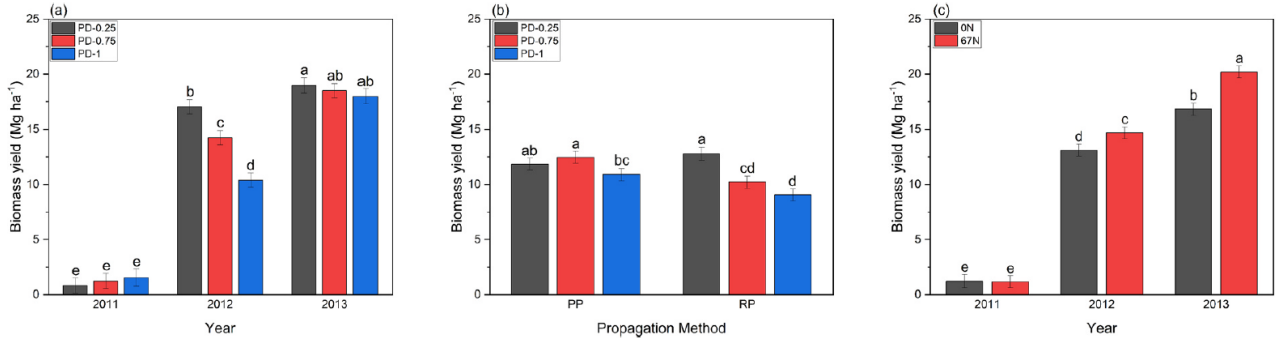
Propagation Method and Planting Density Influence Canopy Developmental Transition and Biomass Productivity in *Miscanthus x giganteus*

Background/Objective

Reliable annual production of renewable biomass feedstocks will be critical for achieving the sustainable aviation fuel (SAF) grand challenge aim of 132 bn L of annual SAF production by 2050. However, optimal long-term management strategies for perennial biomass feedstocks such as *Miscanthus x giganteus* (miscanthus) remain underdeveloped. This work seeks to understand how establishment practices influence the mechanisms underlying long-term miscanthus productivity and canopy development.

Approach

Data collected during the juvenile (2011-2013) and mature (2024) phases of a long-term miscanthus field experiment established in Urbana, IL were used to evaluate effects of propagation method (plug propagation [PP], rhizome propagation [RP]), planting density (1.0, 0.75, and 0.25 plants m^{-2}), and nitrogen (N) application (0 and 67 kg N ha^{-1}) on end-of-season biomass yield, tiller mass, tiller density, and tiller height.



Impact of year, planting density, propagation method, and N fertilization on biomass yield of juvenile miscanthus. (PP = plug, RP = rhizome, PD = planting density)

Results

Juvenile phase biomass yield was driven by tiller density while mature phase yield was driven by tiller mass. PP plots produced higher tiller density than RP plots, resulting in faster canopy closure and higher juvenile-phase yields. In mature miscanthus stands once the canopy reached equilibrium, PP and RP yields were similar because greater RP tiller mass compensated for its lower tiller density. In the juvenile phase, N application increased yield by 1.6-3.5 Mg ha^{-1}.

Significance/Impacts

Higher planting density, the PP method, and N fertilization accelerated canopy density equilibration, resulting in higher juvenile phase yields, but did not affect mature-phase productivity. An economic analysis is needed to determine whether higher early juvenile productivity justifies the higher establishment cost of these methods.

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