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Identifying the Best High-Biomass Sorghum Hybrids Based on Biomass Yield Potential and Feedstock Quality Affected by Nitrogen Fertility Management Under Various Environments

Background/Objective

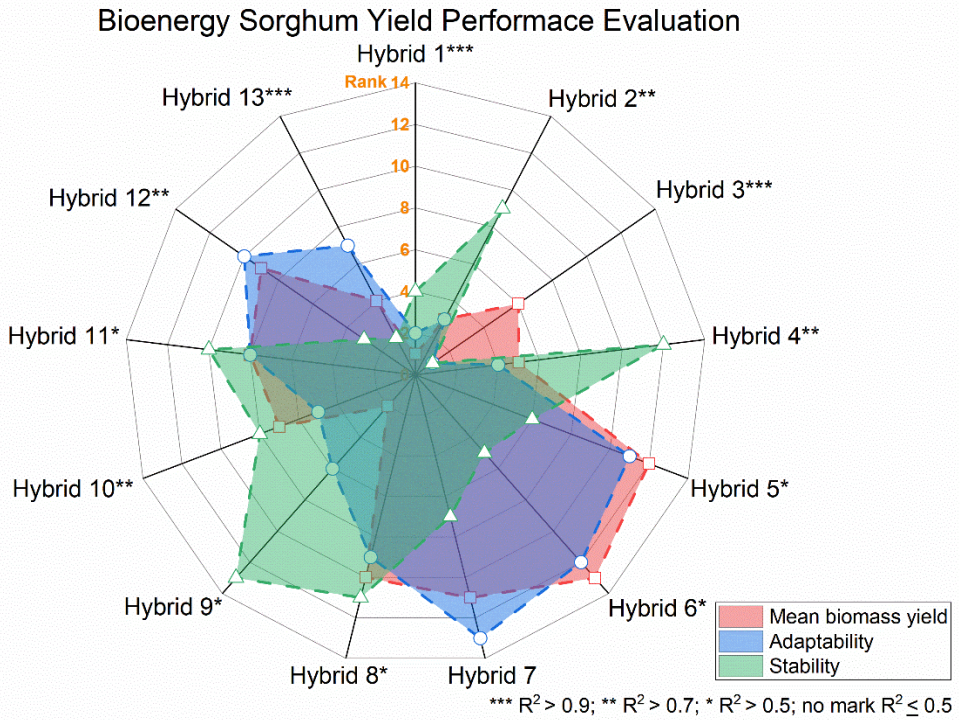
There is growing interest in high-biomass sorghum (*Sorghum bicolor* L. Moench) as a bioenergy feedstock, but more information is needed to determine the most suitable varieties for the U.S. Midwest. This work evaluates and compares the yield potential of 13 sorghum hybrids.

Approach

13 sorghum hybrids (H1-H13) were grown for two seasons (2022-2023) in two locations (Urbana, IL and Ewing, IL) over two nitrogen (N) application rates (0 and 112 kg-N ha^{-1}) and evaluated for biomass yield potential, N fertilization impact on yield, and nutrient and feedstock composition.

Results

The best hybrids at both sites were H1 and H13, both of which were very photoperiod sensitive (PS) and exhibited superior biomass yield, less nutrient removal, and high energy-rich feedstock composition. Low-yielding hybrids were short-stature (H5 and H6) and recessive at the *Dw3* locus. Moderate PS hybrids (H7, H8, H11, and H12) that produced grain panicles showed high yield plasticity and excessive nutrient removal due to accumulation of potassium in biomass tissue and N and phosphorus in grain panicles.



High-biomass sorghum yield performance evaluation across 13 hybrids, based on three key metrics: dry biomass yield, adaptability, and stability.

Significance/Impacts

This work documents relationships and tradeoffs between compositional and agronomic traits which can be harnessed to maximize regional productivity and optimize conversion for end-users. More work is needed to optimize N fertilization and assess ecosystem service benefits of these new sorghum hybrids.

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