Managing Flowering Time in Miscanthus and Sugarcane to Facilitate Intra- and Intergeneric Crosses

Background
The C4 perennial grass Miscanthus is a bioenergy biomass crop widely available for commercial production. As a close relative of Saccharum, Miscanthus is a potentially valuable genetic resource to improve sugarcane, another important bioenergy crop. However, differences in flowering time within and between the two species hinders hybridizations. This study explored the feasibility of synchronizing flowering time of Saccharum and Miscanthus by understanding the impacts of day length and other environmental factors.

Approach
- In greenhouse experiments over three years, Miscanthus and sugarcane were grown under a photoperiod conducive to flowering sugarcane, and treatments were applied to Miscanthus to determine how to synchronize its flowering with sugarcane.
- In a growth chamber, 33 Miscanthus genotypes from 20.9° S to 44.9° N were evaluated for response to three day lengths (10 h, 12.5 h, and 15 h).

Results
- Flowering for more than half of the sugarcane genotypes was achieved in a greenhouse at Urbana, IL (40.1° N) by providing a declining photoperiod of 1 min d⁻¹ from 12.5 h to 11 h.
- To flower high-latitude accessions of M. sinensis synchronously with sugarcane, M. sinensis requires >12.5 h day lengths, whereas sugarcane needs <12.5 h day lengths.

Significance
This study identified methods to circumvent barriers of synchronizing flowering time of sugarcane and Miscanthus, such as staggered plantings or growing each under different day lengths. These methods will help plant breeders improve these two bioenergy crops by introgressing desirable genes (e.g., cold-tolerance and disease-resistance) via intra- and intergeneric crosses.

Effects of day length on days to first flag and days to first flower for 33 Miscanthus and two Sorghum bicolor genotypes grown in controlled environment chambers at constant 23 °C.