Field-grown miR156 cisgenic switchgrass allows a method for bioconfinement due to delayed flowering

Background

- Switchgrass biofuel production has been improved through genetic engineering of cell wall traits.
- A specified level of expression of microRNA156 (miR156) reduces, delays or eliminates flowering, which could be useful to 'bioconfine' cisgenes.

Approach

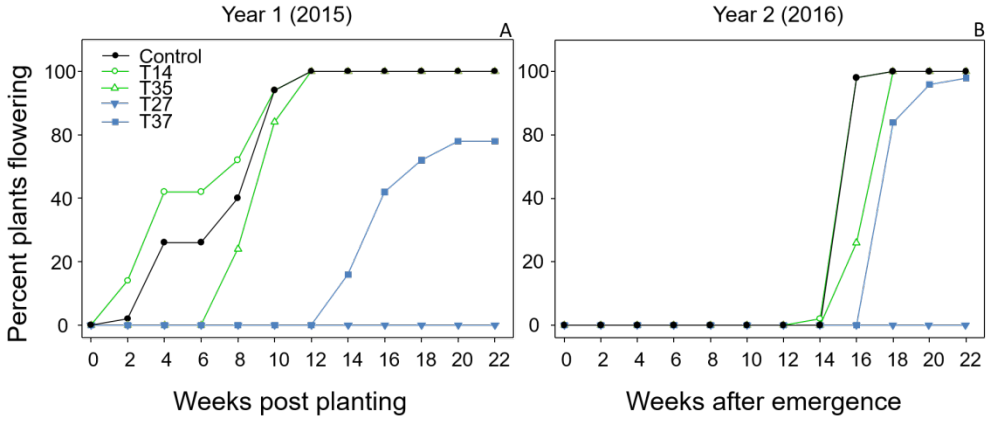
- Two low (T14 and T35) and two medium (T27 and T37) miR156 overexpressing switchgrass lines and a non-transgenic control were grown in eastern Tennessee over two seasons to assess flowering and biomass.

Outcome

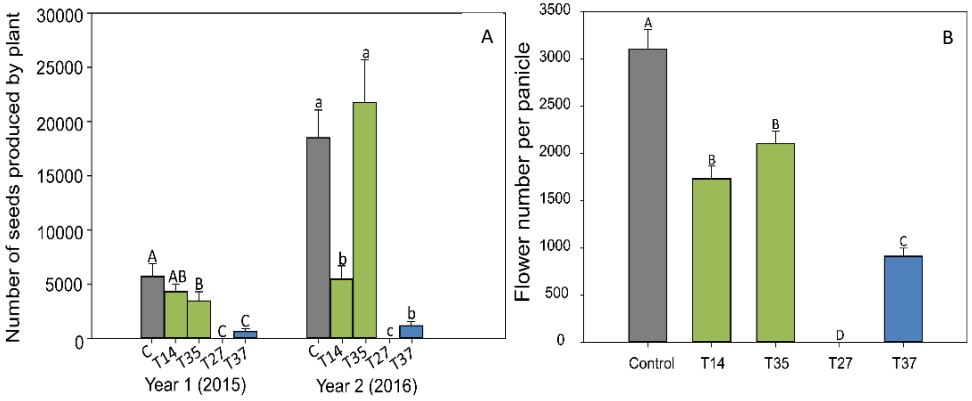
- miR156 expression was positively associated with decreased and delayed flowering at moderate levels.
- During the second season, line T37 produced 70.6% fewer flowers than controls with commensurate decreased seed yield.
- Line T37 produced equivalent biomass as the controls.

Significance

- Appropriate cisgenics can allow potential bioconfinement while achieving other yield and conversion goals.
- This study was the first instance of any genetically engineered trait in switchgrass where experimental plants were allowed to flower in the field in the eastern U.S.; USDA-APHIS-BRS regulators allowed open-flowering.



Time to first flower for field grown miR156 transgenic switchgrass and wild-type control. A) Year one weeks after transplanting on June 5, 2015 (Wk 0). B) Year two after plant vegetative growth began on March 30, 2016 (Wk 0).



Average number of seeds produced per plant (Panel A) and average flower number per panicle (Panel B) for miR156 transgenic switchgrass and nontransgenic controls observed in the second field season.

Johnson, C.R., Millwood, R.J., Tang, Y., Gou, J., Sykes, R.W., Turner, G.B., Davis, M.F., Sang, Y., Wang, Z-Y., Stewart, C.N., Jr. Field-grown miR156 transgenic switchgrass reproduction, yield, global gene expression analysis and bioconfinement. *Biotechnology for Biofuels* (2017) in press.

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