CABBI
CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

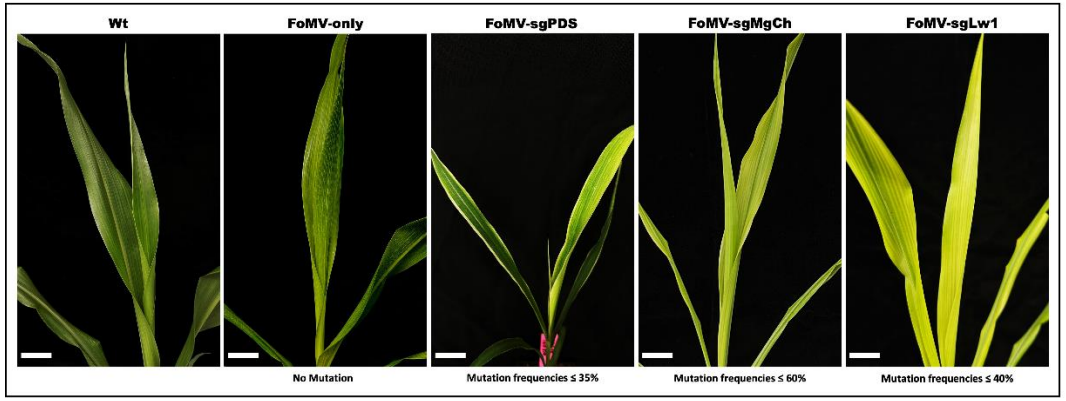
Rapid and Efficient *in planta* Genome Editing in Sorghum Using Foxtail Mosaic Virus-mediated sgRNA Delivery

Background/Objective

- The requirement of *in vitro* tissue culture for the delivery of gene editing reagents limits the application of gene editing to commercially relevant varieties of many crop species. To overcome this bottleneck, plant RNA viruses have been deployed as versatile tools for *in planta* delivery of recombinant RNA.
- The characteristics exhibited by both barley stripe mosaic virus (BSMV) and foxtail mosaic virus (FoMV) provided an opportunity to evaluate their effectiveness in targeted genome editing in sorghum.

Approach

We engineered a set of BSMV and FoMV vectors to deliver fluorescent protein AmCyan and sgRNAs, respectively, to transgenic sorghum lines overexpressing Cas9. We then used these viruses to deliver and express sgRNAs to Cas9 and GFP expressing transgenic sorghum lines, targeting a variety of genes.



FoMV-induced mutation analysis in sorghum via viral sap rub inoculation.

Results

The recombinant BSMV did not infect sorghum nor deliver or express AmCyan and sgRNAs. In contrast, the recombinant FoMV systemically spread throughout sorghum plants and induced somatic mutations with frequencies reaching up to 60%.

Significance/Impacts

Our work demonstrates FoMV-mediated *in planta* genome editing in sorghum and highlights opportunities to refine this method for generating progeny plants with targeted modifications, bypassing the need for tissue culture or recurrent transformation. This innovation could significantly advance breeding programs and the development of superior sorghum varieties with enhanced traits for human food, livestock feed, industrial applications, and bioenergy crops for renewable fuel.

Baysal et al. 2024. "Rapid and efficient *in planta* genome editing in sorghum using foxtail mosaic virus-mediated sgRNA delivery." *The Plant Journal*. DOI: 10.1111/tpj.17196