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March 24th | 2:30-3:30 PM | LILY 2-425

Leveraging Genome Editing for Pre-Breeding of Physalis Species

Abstract:

The *Physalis* genus includes underutilized species such as groundcherry (*Physalis grisea*) and goldenberry (*Physalis peruviana*), which are valued for their highly nutritious fruit. However, their widespread adoption by farmers is hindered because very little if any improvement has been done. Therefore, their growth is similar to wild species, making production management challenging. To address this, we are using genome editing to correct undesirable traits, such as the wild, unmanageable growth in both species and fruit drop of groundcherry that occurs at all ripening stages due to abscission at a joint region in the pedicel. For plant growth modification we used CRISPR/Cas9-mediated mutagenesis of three different genes: SELF-PRUINING, BRACHYTIC, and ERECTA. The edited lines exhibited a compact growth habit, varying by gene and species. To prevent groundcherry fruit abscission, we targeted the JOINTLESS gene and eliminated the pedicel joint allowing the fruit to fully ripen on the plant. All edited lines will be evaluated for fruit sugar content, yield, and other agronomically-relevant traits. Additionally, we are exploring tissue culture-free genome editing using groundcherry as a model. To date, we have successfully edited the PHYTOENE DESATURASE gene, recovering progeny with the expected bleached phenotype. Overall, our work serves as a model for bringing underutilized species to the level of agronomically viable crops.

