

HI-Edit: Disrupting crop breeding via simultaneous haploid induction and genome editing

Genome editing using CRISPR-Cas9 works efficiently in plant cells, but delivery of genome editing machinery into the vast majority of crop varieties is not possible using established methods. We co-opted the aberrant reproductive process of haploid induction (HI) to induce edits in nascent seeds of diverse monocot and dicot species. Our method, named “HI-Edit”, enables direct genomic modification of commercial crop varieties. HI-edit was tested in field and sweet corn using a native haploid inducer line, and extended to dicots using an engineered CENH3 HI system. We also recovered edited wheat embryos using Cas9 delivered by maize pollen. Our data indicate that a transient hybrid state precedes uniparental chromosome elimination in maize HI. Edited haploid plants lack both the haploid inducer parental DNA and the editing machinery. Therefore, edited plants could be used in trait testing and directly integrated into commercial variety development.