

# Non-Transgenic Generation of Herbicide Resistance in Soybeans Using CRISPR Base Editing

**Funding:** \$130,000

## Principal Investigator

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## Overview of project objectives

Weeds in the North Central region are increasingly hard to control, primarily due to the spread of weeds resistant to current soybean herbicides. By equipping soybeans with new tolerance traits against current herbicides not currently in use for soybeans, more products with diverse modes of action can be put into play. Two or more herbicides could also be combined to delay emergence and survivability of resistant weeds.

Because susceptibility or tolerance to a herbicide is often determined by one or a very few genomic sequences (bases), CRISPR-based gene editing, especially base editing, allows the creation of new herbicide tolerance traits. This genome editing technology introduces precise changes into the nucleotide base sequences of a select set of soybean genes. Unlike older herbicide tolerance traits, this technology does not introduce non-plant genes and may lessen the regulative burden associated with GMOs.

As part of this multi-state collaborative work, researchers are using the new CRISPR editing technology to modify three soybean genes – ALS, PDS and HPPD – to tolerate the corresponding herbicides that target them – imazapyr, fluridone and mesotrione. All three would be new traits for classes of herbicides considered relatively safe in other crops. Soybean farmers would have more herbicide options to use alone, in combination, or in place of, current herbicides for more effective, sustainable weed control. Specific objectives are:

- Accelerate base editing in soybeans by using germinating soybean seed as the target plant tissue.
- Streamline the base editing protocol in multiple soybean cultivars.
- Generate novel herbicide resistance traits in soybeans using the new base editing approach.

## Key results

Through carefully designed experimental protocols, researchers are experimenting with a new, more efficient base editor and have succeeded in putting the new base editor gene in a plant transformation vector. Scientists are currently trying to use the editor to generate transgenic soybeans. They also are attempting to engineer herbicide tolerance in soybeans using a non-CRISPR approach. Researchers are working to adopt a rice herbicide tolerance gene in soybeans that was recently found to confer tolerance to the HPPD inhibitor class of herbicides. If successful, such a transgenic soybean will serve as an alternative to base editing. The next step will be to transform them into new soybean products.

## Benefit to farmers

If successful, this project will yield soybean seed stocks equipped with three new herbicide tolerance traits. The immediate benefit to farmers would be use of these three novel classes of herbicides presently used only in other crops. Combination of these traits and combinations with existing herbicide tolerance traits will broaden herbicide choices and provide greater flexibility and effectiveness in weed control. The result will be opportunities for farmers to increase soybean production profitability by reducing input use.

## USB National Soybean Checkoff Research Database link

[Non-Transgenic Generation of Herbicide Resistance in Soybeans Using CRISPR Base Editing](#)