Advancing Field Pennycress as a New Oilseed Biofuels Feedstock that does not Require New Land Commitments

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http://www.wiu.edu/pennycress/ http://cbs.umn.edu/marks-lab/home
https://about.illinoisstate.edu/jcsedbr/Pages/Research.aspx

Project Goals: This project aims to genetically improve the agronomic traits of Field Pennycress (*Thlaspi arvense* L.; pennycress) for its use as a profitable oilseed winter cover crop grown throughout the U.S. Midwest. We have identified large numbers of EMS-induced pennycress mutant lines exhibiting a variety of improved agronomic traits. We are also successfully and routinely employing CRISPR genome editing to generate pennycress mutants to test hypotheses about mutational effects on agronomic traits and to identify alleles to be used commercially. The traits on which we are focused for this funding are 1) Harvestable seed yields of at least 1,500 lbs/acre; 2) Reduced sinigrin (glucosinolate) to below the regulatory limit; 3) Reduced seed coat fiber to improve the seed meal nutritional value 4) Shortened time to maturity to consistently allow pennycress harvest in time to plant full-season soybeans.

Pennycress (*Thlapsi arvense* L.) is an emerging oilseed crop closely related to rapeseed canola and Arabidopsis that holds considerable agronomic and economic potential in producing seed oil to be used as a liquid biofuels feedstock. Pennycress possesses a unique combination of attributes including extreme cold tolerance, rapid growth, over-wintering growth habit, and a natural ability to produce economically-relevant amounts of seeds high in oil and protein. Pennycress could generate billions of liters of oil annually throughout the U.S. Midwest without displacing food crops or requiring land use changes. For example, pennycress can be grown on the ~35 million acres of U.S. Midwest farmland rotating each year between corn and soybeans. Much of this land otherwise lays fallow, resulting in nutrients loss into streams and soil erosion – two urgent problems which pennycress can help mitigate as a winter cover crop. This poster will highlight our efforts to 1) reduce seed glucosinolate content to make the oil and meal edible/palatable (we are characterizing multiple mutations in 15 glucosinolate biosynthetic and related regulatory genes), 2) reduce seed coat fiber content to allocate more metabolite to oil and to improve the nutritional value of the meal for use in animal feeds (mutations in 11genes controlling seed coat condensed tannins and acid detergent fiber (ADF) production have been identified and are being characterized), and 3) develop earlier maturing lines to avoid delays in planting soybeans, thereby enhancing farmer adoption (19 early flowering mutants have been confirmed for inheritance of earliness traits; we are focusing our efforts on three lines that produce seedpods 7-10 days earlier than wild type).

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