

Though farmers consider pennycress (*Thlaspi arvense*) nothing more than a weed, Illinois State Professor of Genetics Dr. John Sedbrook is working to change their perspective—and the plant itself. Sedbrook and his student researchers in the School of Biological Sciences are genetically modifying pennycress as part of a multistate, multi-institutional effort funded by a five-year, \$10 million USDA grant and a \$13 million Department of Energy grant.

The researchers are attempting to transform the plant into a commercially grown cover crop that would be a boon to farmers and the environment. The harvested plant would be processed into biofuel, jet fuel, animal feed, and other products.

“This would not only help the environment, but also produce oilseeds that farmers can sell in these economically challenging times,” Sedbrook said. “Plants like pennycress take carbon dioxide out of the atmosphere to grow. Instead of adding to carbon in the atmosphere by digging for fossil fuels, you’re taking carbon that’s already there. So it’s a zero-sum game.”

Domesticated pennycress could be grown as a cold-resistant, high-yield oilseed crop across the central United States, where nearly 80 million acres of land devoted to corn and soybeans sit dormant in the winter months. Sedbrook said the same process was used in the 1960s to convert rapeseed into canola oil, a relative of pennycress that is in widespread use today.

Illinois State researchers—Professor of Water Ecology Dr. Bill Perry, Assistant Professor of Crop Science Dr. Nicholas Heller, and Professor of Soil Science Dr. Rob Rhykerd—are investigating how planting pennycress on otherwise fallow fields could also help farmers reduce soil erosion and nutrient loss, two factors that are imperiling water quality and aquatic life locally and as far downstream as the Gulf of Mexico.

This research has been ongoing for 10 years with the latest grant awarded in 2020. Illinois State researchers are currently working under the umbrella of the Integrated Pennycress Research Enabling Farm and Energy Resilience (IPREFER) program with colleagues at Western Illinois University, the University of Minnesota, The Ohio State University, the University of Wisconsin-Platteville, and the St. Louis-based crop development company CoverCress Inc.

POWERFUL PENNYCRESS

DR. JOHN SEDBROOK

Illinois State Professor Dr. John Sedbrook completed a doctorate in genetics at the University of Wisconsin in Madison and undertook postdoctoral study at Stanford University. He has received the Illinois State University Research Initiative and the College of Arts and Sciences Outstanding College Researcher awards.

Sedbrook’s research focuses on identifying molecular genetic mechanisms in plants that can be exploited to improve crops for human use without compromising the plant’s health. A founding member of the Great Lakes Bioenergy Research Center funded by the U.S. Department of Energy, his lab identified beneficial mutations in grasses for their use in generating biofuels.

The text has been adapted from articles written by Rachel Hatch for News.IllinoisState.edu and Illinois State alumni magazine. Additional sources: *Nature Food*, *The Pantagraph*, and WGLT.

DOMESTICATING A WEED

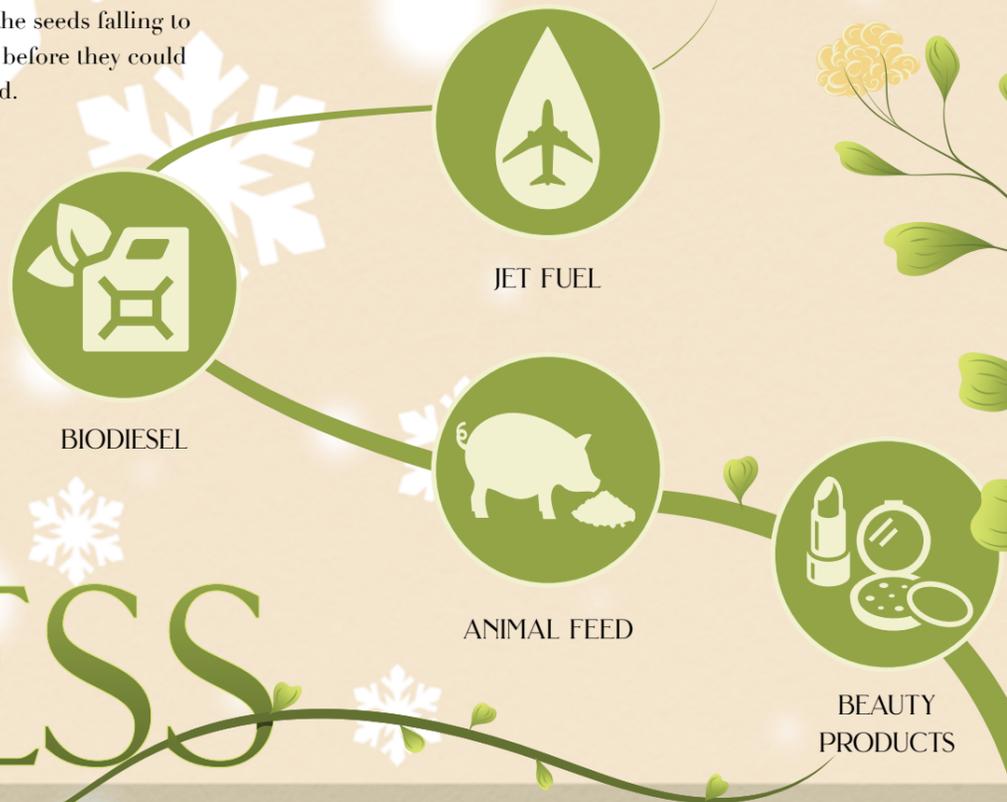
Researchers are using plant breeding and the CRISPR gene editing tool to modify pennycress seeds to make them edible, more nutritious, and resilient to climate change. Sedbrook’s team has also worked to improve seed germination and crop establishment and has genetically fixed pennycress’ “pod shatter” problem, which resulted in about 20 percent of the seeds falling to the ground before they could be harvested.

SCALING UP AND SPREADING THE WORD

Researchers plan to move from research trials to field trials over the next couple of years. Grant funds are also supporting outreach to farmers and the agricultural community to educate them on the plant’s commercial and environmental benefits.

BUILDING INFRASTRUCTURE

IPREFER members are planning to establish an infrastructure within five years that will enable farmers to not only plant and harvest domesticated pennycress, but also deliver the seeds to processing plants that will convert them to fuel and feed. Companies will need to be identified to crush and process the crop.



NOTHING WASTED

Studies suggest that pennycress could produce 2,000 pounds of seeds per acre and yield 80 gallons of oil per acre. That oil has the potential to produce 3 billion gallons of biodiesel and jet fuel per year, helping to offset a reliance on fossil fuels. The seeds could also be converted into industrial products such as soaps and cosmetics. Furthermore, domesticated pennycress seed remnants can be added to meal to feed animals.

FOR MORE INFORMATION, VISIT IPREFERCAP.ORG.