



PHOTOS COURTESY OF BILL GIBBONS, SDSU

Compelling New Crop

Carinata offers potential for crop diversity, livestock feed and jet fuel.

by **KINDRA GORDON**, *field editor*

“High hopes” is how South Dakota State University (SDSU) professor Bill Gibbons describes carinata, a new crop being researched for its promising potential in the Dakotas and Montana, and as a winter crop in the southeastern United States.

The oil from carinata seeds can be used to make biobased fuels, such as diesel and jet fuel. However, there’s also excitement for this new crop because it offers a new option for crop rotations, and it has potential for livestock feed.

What is carinata?

The yellow-flowered carinata plant is a brassica, which is a genus of plants in the mustard family. Carinata

is sometimes called Ethiopian mustard. A more familiar brassica crop is canola, which is commonly grown in Canada, Montana and North Dakota. Many farmers in these regions who are familiar with growing canola have also started to grow carinata. It is estimated North Dakota and Montana farmers planted about 6,000 acres of carinata in 2015.

Although carinata is best suited to semi-arid conditions like that of the Dakotas, it is also being grown in Alabama, Georgia and Florida as a winter crop that is planted in November and harvested in April.

SDSU’s Bill Gibbons shares that carinata was chosen for biofuel production, not only for its high oil content, but also because it does not compete as a crop for human consumption.

“It tastes terrible to humans, but

is perfect for biofuel production,” he shares.

The primary oil from carinata is a 22-carbon-long fatty-acid chain (erucic acid), which can be split to create two 11-carbon chains, Gibbons explains. “This is perfect for jet fuel. With carinata you get two fuel molecules out of one. With shorter-chain-length oils (such as soybeans) you just get one 11-carbon fuel molecule.”

Moreover, the especially good news about the fuel produced from this crop is that it can be used without modifications to existing engines, and can be dispensed through the current petroleum fuel infrastructure. Biofuels with these characteristics are called “drop-in” fuels.

Gibbons, who specializes in industrial microbiology, says there is

growing interest — and demand — in this type of “green” biofuel.

Naval quest

The Navy reached out to SDSU and other universities about four years ago to express interest in developing more sustainable and distributed sources of diesel and jet fuels.

“They are seeking ways that the United States can move away from a high level of dependence on petroleum fuels and the limited geographic area (Gulf Coast) in which most petroleum is refined. Hurricane Katrina demonstrated to the military that our petrochemical refining industry is susceptible to supply disruptions. ... It can be a tenable situation,” Gibbons notes.

To that end, the Navy has set a

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goal of deploying the “Great Green Fleet” in 2016, in which ships and aircraft from a carrier strike group will operate on a 50:50 blend of petroleum and biofuels (see “Fueling the Navy’s Great Green Fleet” on page 168). Research efforts are focused on ensuring that biofuels created from carinata will be included.

As an additional market, European airlines have committed to purchasing carinata seed from the 2016 crop, and will ship it to Europe for crushing and conversion into jet fuel. As the crop becomes more available in the future, Gibbons anticipates domestic American airlines will also provide a market, and

eventually, carinata-derived diesel could be offered for use by everyday consumers.

Gibbons says, “The technology for extracting the oil from carinata is known, and the technology to convert the oil to fuel exists.” Additionally, the market exists. Now, the final hurdle is to learn more about the agronomic production

of carinata to help farmers successfully grow the crop.

Expanding crop acres

During the past four years, South Dakota researchers have been collaborating with Canadian company Agrisoma Biosciences Inc. to explore carinata as a new biofuels crop in the region. “This is a new crop, so we are conducting variety evaluations and analyzing what is necessary to optimize the agronomic conditions for carinata,” Gibbons explains.

Factors being evaluated include timing to plant, row width, nitrogen recommendations, herbicide tolerance, insects and crop rotations. Crop production costs and returns are being assessed by economists, while engineers are performing life-cycle analysis to assess environmental sustainability.

Gibbons calls carinata, which is suited to a drier climate and marginal lands, “the perfect fit for western South Dakota.” He reports that it works well in rotation with wheat, sunflowers, milo or sorghum. Yields have produced 2,000 pounds per acre in test plots at Dakota Lakes Research Farm near Pierre, S.D.

Additionally, research indicates that the carinata plant produces an allelopathic compound that kills nematodes in the soil, which, in turn, appears to boost wheat yields on those acres the following year.

For 2016, Gibbons anticipates a significant expansion in growing the crop in the Northern Plains region will be pursued.

Cattle-feeding opportunities

Perhaps most exciting for cattlemen is that a co-product of the carinata refining process is a high-protein meal that can be a feed source. Currently, SDSU researchers are conducting meal-utilization trials to evaluate its use in the beef, dairy and swine industries. Fish trials are also being conducted to determine opportunities for aquaculture. Technologies to improve qualities of the carinata meal coproduct are being looked at, as well.

All total, Gibbons says nearly 20 researchers across the state are collaborating on carinata research and have optimism for the crop’s future.

He states, “We look at this as a new rotational crop. If we can get producer buy-in and carinata acreage expands, I see it [having an impact] like ethanol in Eastern South Dakota. It has the potential to buffer the economy because producers have two markets for their crop — feed and fuel.”

Gibbons believes in the future the opportunity to build a carinata extraction and processing facility in the state may even exist.

He concludes, “Western South Dakota has never had this kind of opportunity for diversity of agriculture. ... And, with a high-protein feed source, it could boost their cattle industry.”