Heart-Friendly Corn Oil?

New High-Oleic Corn Varieties Make It Possible

New corn varieties bred by scientists at the Agricultural Research Service and Iowa State University (ISU) may just do one's heart some good.

In fact, the 14 new lines may lead to a slew of desirable corn-based products, like cooking oils and margarine that keep blood cholesterol levels down or salad dressings that last longer. They may even lead to less-expensive animal feed.

ARS geneticist Linda Pollak and plant biologist Susan Duvick, along with ISU food science professor Pamela White, have crossed traditional Corn Belt inbred lines with varieties cultivated during past independent studies that contain genes from eastern gamagrass, *Tripsacum dactyloides*.

Pollak works at the ARS Corn Insects and Crops Genetics Research Unit, while Duvick works at the ARS North Central Regional Plant Introduction Station, both on the ISU campus in Ames.

"One of the great things about these lines," says Duvick, "is that they were developed through traditional plant breeding. As a result, they can have a lot of applications in markets that are resistant to biotechnology."

The most promising of these "*Tripsacum*-introgressed lines," as the researchers call them, are ones with high percentages of oleic acid. This monounsaturated fatty acid may be the key to "heart-friendlier" corn products.

Duvick says high percentages of oleic acid "give corn oil stability with regard to flavor and deterioration and have also been linked to lowering blood cholesterol levels in people." High levels of cholesterol in the blood can lead to coronary heart disease, heart attacks, and stroke.

There are three basic fatty acid types. "Saturated fatty acids have great stability. Thus oils and products made with a high percentage of them have long shelf lives and can endure the heat of deep-fat frying without breaking down," says White. Their main drawback? They raise blood cholesterol levels.

The second type, polyunsaturated fatty acids, have been linked to lower incidences of heart disease. But they lack strong stability traits. They are also prone to oxidation and development of unstable molecules called free radicals, which are associated with a higher risk of cancer. Free radicals can be very destructive to human tissue.

Says White, "As a monounsaturated fatty acid, the third type, oleic acid has higher stability than the polyunsaturated acids. And it has good characteristics, similar to those of the polyunsaturated fatty acids, when it comes to prevention of cholesterol and heart disease."

These features may be a boon to producers of corn-based cooking oils, who have lost customers to high-oleic alternatives such as olive oil and canola oil.

"A high-oleic oil contains a lower percentage of the other types of fatty acids," says White. "That means you get fewer negative effects of either polyunsaturated or saturated fatty acids

PEGGY GREB (K10615-1)

Geneticist Linda Pollak (left) and plant biologist Susan Duvick inspect seed characteristics of *Tripsacum*-introgressed corn, which has high levels of oleic acid.

while maintaining their many good properties."

What's So Special About High-Oleics?

"A high-oleic oil may also help reduce plasma levels of low-density lipoproteins—or 'bad' cholesterol—without reducing the high-density lipoproteins—or 'good' cholesterol," adds White.

High-oleic corn oil also provides good starting material for making margarine. That's because replacing polyunsaturated fatty acids with oleic acid could mean that less processing is needed to create the hardened but spreadable product.

Most margarine is made of highly polyunsaturated fats. They gain stability and consistency through hydrogenation, a process during which hydrogen atoms are forced into unsaturated fatty acids. This process creates trans fatty acids, which many consider to be cholesterol-raising compounds.

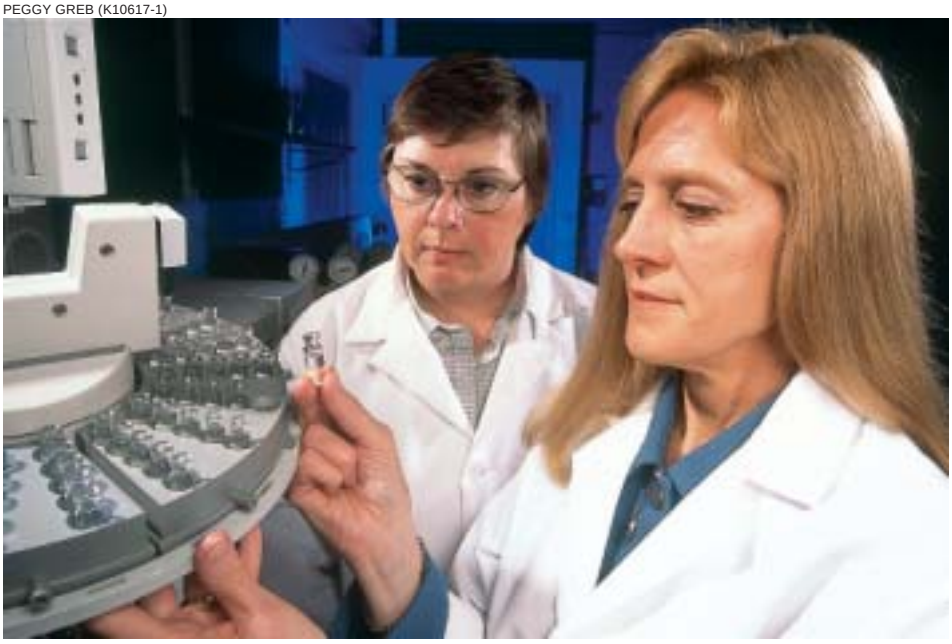
But Pollak warns that high percentages of oleic acid will not eliminate margarine-related heart health issues, adding, "This is still a high-fat food that must be consumed in moderation."

Oleic acid's stability, which makes for longer storage and refrigerator shelf life, may also prove attractive to makers of salad dressing. "Many salad dressings today use very polyunsaturated soybean or canola oils, which don't have high stability and thus can become rancid relatively quickly," says White.

She adds that some salad dressing makers use oils that have been partially, or lightly hydrogenated, a process that can be sidestepped by using oil high in oleic acid.

Pollak says some *Tripsacum* lines that have high protein and oil content can lead to cost-effective animal feeds, which could enable ranchers to reduce or bypass expensive soybean meal.

PEGGY GREB (K10617-1)



Susan Duvick (left) and ISU food science professor Pamela White examine a vial of oil extracted from *Tripsacum*-introgressed corn before loading it into the autosampler for analysis by gas chromatography.

A Long Time Evolving

The new varieties can be traced to corn evolution studies during the 1970s at the University of Illinois. They produced corn populations that were infused with genes from eastern gamagrass, a wild, native grass species distantly related to corn. Gamagrass was used because it resists cold and insects and tolerates both drought and flooding. These traits would be desirable in corn hybrids.

Duvick became interested in the hybrids while conducting research during the early 1990s at ARS' Southern Plains Research Station in Woodward, Oklahoma, and brought samples back to her lab to experiment with. The Oklahoma researchers were using them in forage-improvement studies.

Duvick, Pollak, and White have submitted a patent application (No. 09/285,368) for the *Tripsacum*-introgressed corn lines, and they currently seek commercial partners. "Seed companies and firms developing new corn breeding lines could use this technology, as could companies in the food or feed industries," says Pollak.

Duvick says some of the new lines yield oils containing 60 to 70 percent oleic acid, compared to the 20 to 30 percent rate found in commercially available corn oils. She adds that varieties have been developed that have oils with total saturated fatty acid composition as low as 6.5 percent—compared to the 13 percent found in corn oils currently available.

Pollak says future research on the subject will focus on two areas: examining the types of products that can use the high-oleic lines and crossing the new lines with existing corn varieties.—By **Luis Pons,** ARS.

This research is part of Plant, Microbial, and Insect Genetic Research, Genomics, and Genetic Improvement, an ARS National Program (#301) described on the World Wide Web at www.nps.ars.usda.gov.

Linda M. Pollak is in the USDA-ARS Corn Insects and Crops Genetics Research Unit, and Susan A. Duvick is with the USDA-ARS North Central Regional Plant Introduction Station, Agronomy Building, Iowa State University, Ames, IA 50011-0000; [Pollak] phone (515) 294-7831, fax (515) 294-9359, e-mail lmpollak@iastate.edu, [Duvick] phone (515) 294-9375, fax (515) 294-4880, e-mail sduvick@iastate.edu. ★