UNIVERSITY of GUELPH

Focus on
Plant Agriculture
Research

A smart choice for soybeans

High-oil varieties to replace petroleum-based oil

By Arthur Churchyard

From the food we eat to the fork we eat with, life is full of products made with oil. But as petroleum prices rise, manufacturers of items made from petroleum-based chemicals such as plastic forks and foam seats, are looking at oil from soybeans as the better choice. To support this switch, researchers from the University of Guelph are trying to find ways to increase the amount of oil contained in soybean seeds.

Prof. Istvan Rajcan, Department of Plant Agriculture, is leading the team that's developing high-oil soybeans. Together with researchers from the universities of Waterloo and Toronto, the group is exploring new opportunities to convert soybean oil into everyday commercial products.

"Theoretically, any petroleum-based product can be made using soybean oil instead," says Guelph professor Gary Ablett, who's part of the project.

So what's stopping industries from going the soybean way? A key reason is economics. Manufacturers switching from petroleum to soy oil would have to develop new production methods and machinery. But one way to make this investment pay off is to make it more productive, by using high-oil soybeans – particularly if the oil can be designed to make it more suitable for a particular production system and product.

The challenge: To increase oil content by up to 15 per cent

Soybeans are a good industrial choice because of their sustainability. Unlike petroleum, soy oils are renewable. Products based on soybean oil are environmentally friendly, too – many of them are biodegradable, and biodiesel fuel produces 30 per cent fewer harmful emissions.

Until now, soybeans have been researched mostly for their healthy fatty acids and unique proteins. The research team is one of the first to focus on increasing soy-oil yield. Their goal is to increase oil content by 10 to 15 per cent over standard varieties.

To develop high-oil beans, the researchers are combining adapted varieties with high oil levels to produce progeny with higher oil levels, while maintaining excellent yield and agronomic characteristics. Ablett says they will not sacrifice performance for a few more percentage points of additional oil.

Besides being excellent oil producers, soybeans are also nutritious. Soy oil contains no cholesterol, and provides several fatty acids which are essential for nutrient absorption. The Guelph project is breeding plants with these desirable traits. They also hope to produce unique soybean varieties that have less saturated fat and more omega-3 fatty acids.

This project is funded by the Ontario Ministry of Agriculture, Food and Rural Affairs, the Ontario Soybean Growers and through contributions by Canada and the Province of Ontario under the Canada-Ontario Research and Development (CORD) Program, an initiative of the federal-provincial-territorial Agricultural Policy Framework designed to position Canada's agri-food sector as a world leader. The Agricultural Adaptation Council administers the CORD Program on behalf of the federal and provincial governments. •

Martin Schwalbe

Soybean oil could be used to make everyday commercial products, say Profs. Gary Ablett and Istvan Rajcan. They're part of a team breeding high-oil soybeans that are suitable to replace petroleum-based oils in manufacturing.

INSIDE

Fighting disease, the Ontario way

Research has led to a healthy combination of local fruit with antioxidant benefits

By Kaitlyn Little

Juicy peaches, sweet cherries and fresh plums are all stone fruits which have become a familiar taste of Ontario summers. They also happen to be brimming with powerful antioxidants. And many of these fruits would be imported, without the work of University of Guelph researchers. Through various techniques – genetics, selective breeding and biotechnology – researchers have been developing healthier fruit varieties that will flourish in the Canadian climate and markets.

Tree fruit expert Jayasankar Subramanian, based at the Vineland research station, is one of the researchers involved. He's focused his efforts on breeding stone fruits that mature earlier and have increased antioxidant properties to tap into growing consumer demand for local foods with health benefits.

"Being able to grow these fruits locally is important to take advantage of the health-promoting compounds that are more readily available in the fresh product," says Subramanian.

Antioxidants have been touted for their effect on reducing diseases such as some cancers, Alzheimer's and heart disease. As awareness of antioxidants grows, consumers are looking more to foods to obtain their benefits.

Specifically, Subramanian is leading a research team that has been breeding cherries that can be harvested earlier to help meet demands for local markets and compete with imported U.S. varieties. The researchers are beginning to notice there's a connection between disease resistance and higher antioxidant levels in cherries.

This connection is also being explored in other stone fruits. Some of the new varieties under development (including a blue plum called Violette) which show high levels of disease resistance also contain two to three times more antioxidants than the standard varieties, Subramanian says.

Fruit breeding is a labour of love, he says, because many successful varieties take at least 15 to 20 years to develop.

"It takes a lot of fine tuning. The researchers have to look for and find the varieties that have desirable traits and then keep breeding them together until finally a tree is developed with all the traits together."

Support for this project is provided by the Ontario Ministry of Agriculture, Food and Rural Affairs and the Ontario Tender Fruit Producers' Marketing Board. •

Martin Schwalbe

New stone fruit varieties such as these cherries are brimming with powerful antioxidants that could improve consumer health.

Canadian flowers, born and raised

By Alicia Roberts

Kyle Rodriquez

Most flowers in Canadian gardens are varieties derived from other countries. But a new native plant breeding program is being developed by Prof. Al Sullivan (above), an ornamental plant breeding specialist, to help put more Canadian foliage on the domestic horticultural market. Through the program, he seeks out indigenous plants in nature, then breeds and adapts the varieties to be best suited to local growing conditions. Detailed information on plant growth needs is gathered through the program, which can be passed onto local gardeners and horticulturalists. Ultimately, having more Canadian plants on the market will help preserve local varieties and give the horticultural market another competitive edge. This research is sponsored by Flowers Canada, the Ontario Ministry of Agriculture, Food and Rural Affairs and the Canadian Ornamental Plant Foundation. •

Turf's up

New grass variety could save golf courses time, money

By Katharine Found

Summer is here, the weather is perfect and the courses are open, so that can only mean one thing – long days grooming the golf courses to keep them looking great. A new type of turf being tested at the University of Guelph may make grooming easier, and stay greener longer into the season.

Prof. Katerina Jordan, turf grass specialist, is researching the claims behind a low-input species of turf called velvet bentgrass. She says compared to the conventional creeping bentgrass, the velvet turf is supposed to use 20 to 40 per cent less nitrogen. As well, it has increased disease resistance, and is drought tolerant. She says these advantages could save considerable time for golf course managers, and make environmentalists happy.

"Golfers can continue to enjoy the beauty of the course, but fewer inputs and money have to go into keeping it that way," says Jordan.

Velvet bentgrass is an introduced species. It was brought to North America from Europe in the early 1900s, and became well adapted in areas such as New England and the Maritime provinces. The grass is only just making headway in Ontario, having cropped up on a few courses in recent years. But local golf course keepers aren't yet convinced of its performance.

Jordan believes the label claims for this turf are probably accurate. But there isn't enough research data to give course managers specific details and instructions for its use and care, such as fertility, ideal mowing height and its watering needs.

"We ask a lot of our turf grasses," says Jordan. "They're cut shorter, walked on, driven on, and hit with balls and clubs all day long, so the inputs we use must be ideal for each specific turf."

That's why Jordan's study is putting the turf to the test at the Guelph Turfgrass Institute and Environmental Research Centre. Along with her graduate student John Watson, she's investigating the amount and type of nitrogen that allows velvet bentgrass to grow best. Her goal is to complete the field study by fall 2008 and is confident that she will see a reduction in nitrogen needs.

This is a joint study involving collaborators from the Department of Environmental Biology and other institutions across North America and in Norway.

Other researchers involved with this study include Prof. Eric Lyons of the Department of Plant Agriculture. Funding for this research was provided by the Natural Sciences and Engineering Research Council and the Ontario Turfgrass Research Foundation. •

Olivia Brown

Prof. Katerina Jordan lines up a putt on turf grass that may require less nitrogen and have better disease and drought tolerance, with Prof. Eric Lyons (centre) and graduate student John Watson looking on.

Jürgen Mayer

Eyeing edible vaccines for the cattle industry

By Kaitlyn Little

Edible vaccines made using alfalfa could help farmers tackle shipping fever (also known as *Pneumonic pasteurellosis*), a common respiratory disease estimated to cost the North American cattle industry more than $1 billion annually. Prof. Judith Strommer, a University of Guelph molecular geneticist, and her research team have spent the past decade developing the plant-based vaccine. Now, they're studying the vaccine's use with large-scale feeding tests.

To make the edible vaccine, the researchers took the DNA encoding proteins from *Mannheimia haemolytica*, the primary pathogen responsible for the disease, and transferred them to alfalfa, where the proteins are produced in leaves and stems.

Alfalfa works well for a number of reasons, says Strommer. It's ruminated for a relatively long time, which should enhance its effectiveness. It can consistently produce high quality feed in the greenhouse. And the proteins are stable in dried feed.

Strommer says the edible vaccines can offer advantages over the currently available injectable vaccine. The injectable vaccine requires refrigeration, is injected at feedlots (too late for maximal effectiveness) and requires restraining the calves, which can be stressful and requires veterinarian assistance.

The alfalfa carrying the vaccine can be harvested, dried and made into feed cubes that can be easily fed to calves for protection from the disease.

Funding for this project was provided by the Ontario Ministry of Agriculture, Food and Rural Affairs, the Natural Sciences and Engineering Research Council, the Ontario Cattlemen's Association and Dow AgroSciences. •

A greener way to drive away

Researchers are developing plastic composites that include agricultural materials

By Lindsay Brown

Every car on the road contains more than 200 kilograms of plastic. But it's typically made with raw materials and energy from petroleum or natural gas, and it's not biodegradable. This has enormous environmental implications. Now, a new initiative involving four top universities could see car parts take on a bio-based composition, by integrating plant materials into plastic.

Prof. Larry Erickson, plant geneticist, says this "biocar" initiative is the first time Ontario's top two sectors – automotive and agriculture – have worked together on a grand scale. He says the pairing could usher in a new era of building materials that will lessen dependence on petroleum-based plastics.

"No car in Ontario is yet made from plastic composites that include plant material," says Erickson, "but there's great potential to use local crops in Ontario-made cars."

He, along with many plant breeders, processing and chemical engineers, and design analysts, is studying how to produce car parts made from plastic composites – plastic made using two or more plant materials. Currently, researchers have successfully used plastic composites to make residential siding and lumber for fences, decks and bridges.

The biocar initiative is a joint research program involving the University of Guelph, the University of Toronto, the University of Waterloo and the University of Windsor. The starting steps for this research are being made at Guelph – the agri-partner in the group.

Erickson says the initiative will be a huge opportunity for the Ontario agricultural industry to gain profile and make a bigger mark on the economy. Local farmers will have more outlets for their commodities, enhancing crop value.

"This bioproduct research will ensure a stable supply of renewable, more reliable plastics made from local crop sources that will be very valuable compared to the use of plastics from petroleum, which must be imported and can make the economy vulnerable during shortages," says Erickson.

Other University of Guelph researchers involved in this project are Profs. Istvan Rajcan, Liz Lee and Peter Pauls of the Department of Plant Agriculture; Prof. Gary Ablett of the Ridgetown Campus; Prof. Ian Tetlow of the Department of Molecular and Cellular Biology; and Prof. Michael Emes of the College of Biological Sciences.

The research is funded by Agriculture and Agri-Food Canada, the Natural Sciences and Engineering Research Council, the Ontario Ministry of Agriculture, Food and Rural Affairs and the Ontario Ministry of Research and Innovation. •

Martin Schwalbe

Fibres from agricultural crops are being integrated into car parts by (left-right) Prof. Larry Erickson, graduate students Zena Ng, Andrew Yeh and Paula Kruger, and Prof. Leonardo Simon.

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