Research may lessen frost risk for canola

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News

The research team lead by Marcus Samuel, associate professor of integrative cell biology in the department of biological sciences, has figured out a way to allow seeds to continue de-greening after a frost. | File photo

Researchers at the University of Calgary have developed a canola trait that reduces green seed count.

The research team lead by Marcus Samuel, associate professor of integrative cell biology in the department of biological sciences, has figured out a way to allow seeds to continue de-greening after a frost.

Seeds from his genetically modified lines of canola contained 50 to 60 percent less chlorophyll than control varieties after being exposed to non-lethal -4 C temperatures for six hours.

Green seed costs growers an estimated $150 million annually, said Samuel.

He hopes the trait will be on the market in the next four or five years if everything goes as planned.

That is music to the ears of Bernie McClean, president of the Canadian Canola Growers Association and a grower from Glaslyn, Sask.

“That excites me a lot,” he said. “I farm in an area in the northwest part of Saskatchewan here that has a very short growing season. That’s one of my holdbacks in agriculture.”

McClean believes the potential new trait could simplify planting decisions on his farm.

“If I’ve got something that can withstand fall frosts maybe instead of having to force myself to get (canola) seeded, I concentrate on malt barley or I concentrate on oats that have a little longer growing seasons,” he said.

Samuel said the first step in the over-decade-long scientific journey was identifying the “master regulator” gene in Arabidopsis plants responsible for chlorophyll breakdown and seed maturity.

Arabidopsis is a cousin of canola that is used as a model plant system for research purposes.

The researchers found the gene, which is called the abscisic acid insensitive 3 (ABI3) protein, and used genetic modification to overexpress that gene in the Arabidopsis plants.

Those plants continued the de-greening process after being exposed to frost.

“That was so exciting,” said Samuel.

The research findings were published in a scientific journal in 2013, which is where projects like this typically come to a halt.

“Most of this big data work just stops with Arabidopsis. No one really translates it, so we’re really happy to see it getting translated into canola,” he said.

Samuel’s team isolated the exact same gene in canola plants and overexpressed it in the same manner.

“As predicted, it was able to confer frost-tolerant de-greening in the seeds,” he said.

But there were also some unpredicted enhancements in the experimental lines of canola.

The researchers discovered that the petiole that connects pods to the stem of the canola plants became stronger.

“We believe this is going to help with pod drop,” said Samuel.

They also noticed there was a higher concentration of omega 9 high oleic oil. It increased to 65 or 70 percent from about 60 percent.

And there was a 20 percent surge in nervonic aid to 0.18 percent from 0.15 percent. It is a long-chain omega 9 oil that is important for brain maintenance.

“We didn’t expect these things to happen,” said Samuel. “We were mainly going for the green seed tolerance. These were like bonus, added benefits.”

McClean worries the trait could also have negative consequences such as decreased yield or oil content, the loss of disease resistance or reduced maturity.

However, Samuel said the gene only impacts the functions of seeds and pods. There have been no negative impacts on other parts of the plant.

“Get me signed up. I’m ready,” said McClean with a laugh.

Samuel's research has caught the attention of Nutrien, but the company doesn't want to contend with the headaches of trying to commercialize a genetically modified crop.

So it is helping fund a new project to introduce the same trait in canola through gene editing breeding techniques.

Samuel said that requires a different approach. Instead of overexpressing the ABI3 master regulator gene, they are attempting to neutralize a negative regulator gene, which will have the same effect on the de-greening process.

The researchers have proven the new technique works in a laboratory setting and are now trying to introduce it into Nutrien's elite breeding lines.

Samuel anticipates it will take two years to have the trait bred into Nutrien's genetic material and then it will be up to the company to bring it to market.