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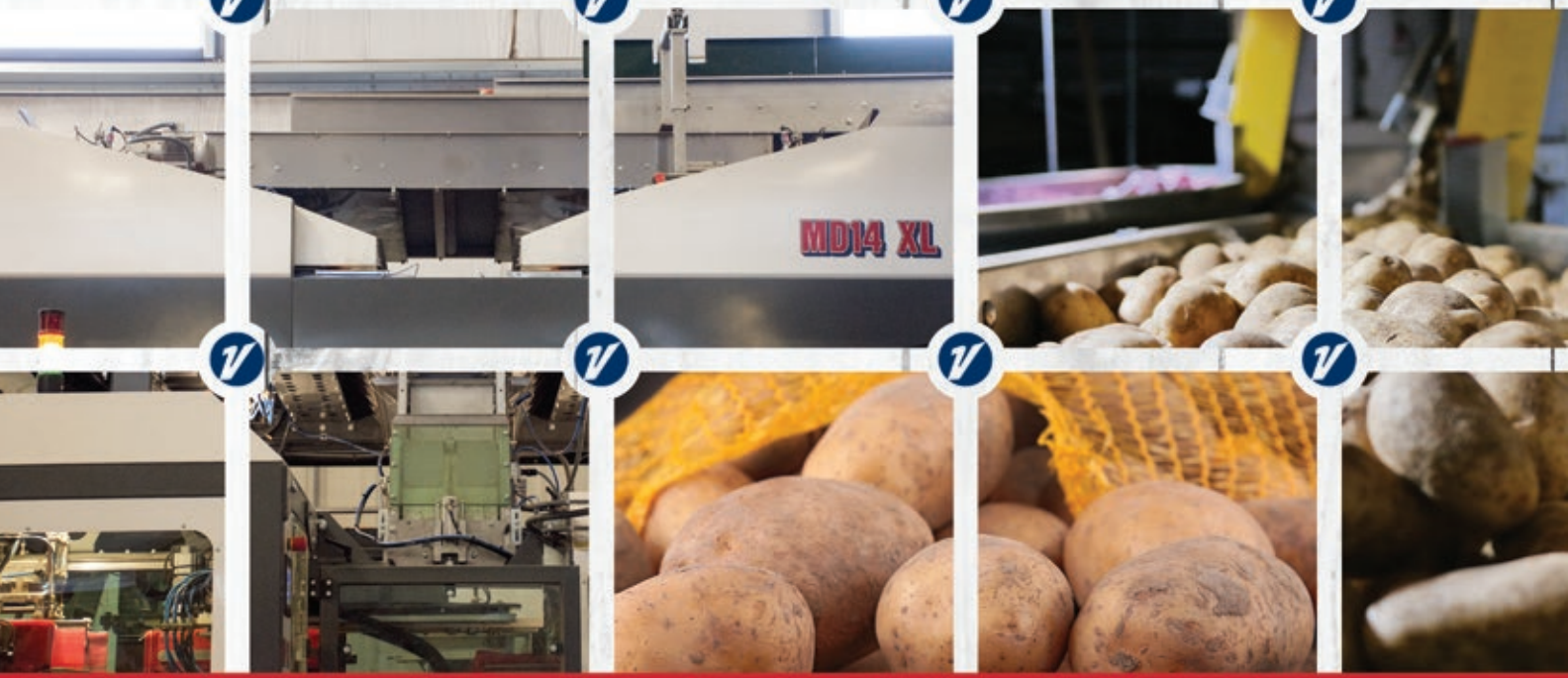

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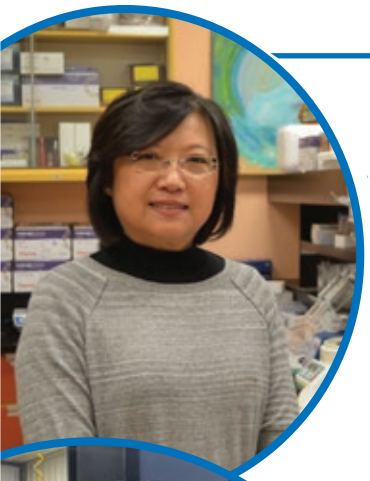

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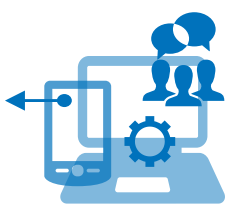

FROM OUR DESK

Kari Belanger

We're All In It Together

HELLO, POTATO PRODUCERS! I'm so happy to be at *Spud Smart*'s helm once again, and to be working with you, Canada's potato industry stakeholders. In many provinces, this past growing season has been challenging, with prevailing hot, dry conditions for some and rains coming too late for others.

Despite these challenging conditions, the September estimate for the average yield of this year's crop is around 302 hundredweight per acre, which is close to the current five-year average (*Market News*, page 18), due to timely end-of-season precipitation in some regions. Meanwhile, the fall U.S. potato crop appears to be smaller than last year's, according to recent estimates.

However, according to Kevin MacIsaac, general manager of the United Potato Growers of Canada, significant reductions in yield and overall production due to hot, dry conditions in major European potato-producing countries could shape things to come in the near future.

"Later in the marketing season we will see reduced competition, reduced pressure from supply coming from that area — it just won't be there," he says. While Canadian producers likely won't notice the effects of reduced competition until late winter or early spring, MacIsaac says some Canadian produce retailers are already receiving requests for business they've not had in the past.

Furthermore, the tight supply situation in Europe is having an immediate effect on the market. "The price is moving up in Europe. That's quite a change from previous years. That tells us supply is not there," says MacIsaac.

At press time, the Netherlands' crop was said to be down 20 per cent and Belgium's by at least 14 per cent. Germany's crop was reported to have decreased by as much as 25 per cent and the United Kingdom by 16 per cent. It was also expected France's production would be reduced.

MacIsaac believes all Canadian potato sectors — fresh, processing and seed — will eventually be affected by the reduced European crop.

For example, there will be less competition from the Netherlands for a piece of the global seed potato market as well as fresh potato exports to the Caribbean.

Belgium is a big player in the processed potato market, and a 14 per cent production loss may mean big changes for the export market.

"Some of Belgium's producers are saying it's their lowest yielding crop they've ever produced. That will be one of the biggest effects on Canada — the parts of North America that export frozen French fries often see competition from Belgium, and they will not have that product to compete with this year," says MacIsaac.

Although Belgium did receive some end-of-season precipitation, it was too late, resulting in yield and quality reductions.

A 25 per cent reduction of Germany's potato crop could also mean shifts in the dehydrated market. Overall, MacIsaac indicates there's going to be a very tight scenario with dehydrated product.

"Germany has large acreage, and a big part of their acreage is for dehydration. Dehydrated product will be in short supply this year, not only from Europe, but also in the United States — they're used to buying off-grade potatoes from the fresh, so they've contracted less," MacIsaac says.

Still to be determined at time of writing is what issues the dry conditions will cause, such as clods, once harvesting begins in Europe.

And with less volume moving into the market, prices will likely increase. "Less supply means we'll all fit into the picture better," says MacIsaac.

Having been through a drought himself, MacIsaac, like other Canadian potato producers, can appreciate the challenges the European growers are up against.

"We're all in the same boat together in the world — and we're in the business of producing potatoes for a global market." ○

EDITOR'S NOTE

Spud Smart is currently creating its editorial line-up. What topics would you like our team to explore? Please send your story ideas to kbelanger@issuesink.com.

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SEEKING A WHAMMY FOR WIREWORMS

A research project is underway to determine if RNAi, an emerging technology for pest control, could work for one of the toughest pest problems P.E.I. potato growers are facing.

BY CAROLYN KING

"WE HAVE ESTIMATED wireworm costs Prince Edward Island's potato industry more than $10 million per year in damaged product, crop protection products, crop insurance claims, and costs associated with rotation crops to battle wireworm," says Ryan Barrett, research coordinator with the P.E.I. Potato Board.

"While research by Agriculture and Agri-Food Canada researchers, such as Dr. Christine Noronha and Dr. Bob Vernon has provided growers with more tools to battle this pest, it is still a serious concern in many parts of the Island," he says.

At the moment, there is no silver bullet, says Barrett, effective at controlling wireworm. "Instead, we need to take an IPM approach, combining in-furrow insecticides with changes to tillage practices, timing of harvesting, click beetle trapping, and use of beneficial rotation crops like brown mustard and buckwheat."

RNAi might become a valuable tool in the wireworm control toolbox. "We are excited about the potential that RNAi technology could hold to control wireworm in an environmentally friendly way," says Barrett.

Many people have recognized RNAi as an environmentally positive approach to controlling insect pests because there isn't the need to spray chemical insecticides, says Gefu Wang-Pruski, a professor and potato researcher at Dalhousie University, and project leader of a study on wireworm RNAi. "RNAi specifically targets specific species and it doesn't affect non-target species," she says.

RNA interference, or RNAi, is a natural gene regulation and defence process. This mechanism is able to switch off a specific gene so the gene doesn't express its function. In many organisms, RNAi is activated by double-stranded RNA (dsRNA).

"RNAi is probably easier to understand if we use another term: double-stranded RNA-mediated gene silencing. That tells you that you need double-stranded RNA, and it is silencing specific genes," says Wang-Pruski. "Genes make products. For instance, our bodies have muscle-making genes that make muscles. If we were to inject our bodies with double-stranded RNA targeting those particular genes, then our bodies wouldn't be able to make muscles."

Similarly, to control an insect pest, you could introduce into the pest's body some dsRNA to silence an important gene in the pest. "If we can identify some of the genes responsible for the survival and development of the insect, and if

we silence those genes — if we knock them down so they don't function — then the insect will not develop or survive," she says.

Using RNAi to control agricultural pests is not new. However, it takes years for the products to be developed and go through the regulatory processes that evaluate their safety for humans and the environment, says Wang-Pruski. For instance, Monsanto has developed a genetically engineered corn trait that produces dsRNA targeting an important gene in the western corn rootworm. If the rootworm feeds on the plant, the gene will be silenced and the rootworm will die. This RNAi trait is expected to be available to corn growers in a few years. As well, Monsanto and Syngenta each have RNAi-based foliar sprays for controlling the Colorado potato beetle in the works.

Wang-Pruski has direct expertise in RNAi for controlling insect pests. "I was involved in an international effort on the diamondback moth, a worldwide pest of Brassica species like cabbage, canola and mustard," she says. "We were able to use feeding experiments to identify some of the genes key for the development of the moth, and we were able to confirm that we can use RNAi technology to control it."

IDENTIFYING TARGET GENES

Wang-Pruski's wireworm RNAi project started in 2016. Her research group is currently identifying some of the genes essential to the survival and development of wireworms. Following that, the group will work on developing a delivery method to get dsRNA into the wireworms.

As a first step, the researchers decided on the project's target species, since RNAi is species-specific and many different wireworm species attack potatoes. AAFC has conducted a multi-year, nationwide survey of wireworm pest species in agricultural areas, and determined Canada has about 20 or more wireworm species of economic importance.

Those species belong to various genera. Some of the species are native to Canada, while others are invasive species from other parts of the world. Three of the most troublesome species — *Agriotes sputator, Agriotes lineatus* and *Agriotes obscurus* — are from Europe.

Prince Edward Island has both invasive and native species. "My lab has surveyed the wireworm population in P.E.I., Nova Scotia and New Brunswick using genetic markers; we have developed a system for identifying the species. P.E.I. has mostly *Agriotes sputator*, so we are focusing on this species," says Wang-Pruski. She thinks the genes they are identifying may work for some of the other wireworm species, although this theory would have to be tested.

Figuring out which gene does what in an organism's DNA is a lot easier if the organism's genome has been sequenced, she adds. Unfortunately, *Agriotes sputator*'s genome hasn't been sequenced.

Despite that, her lab is making progress. "We have already identified several of those key genes, and we are doing in vitro testing to see if those genes truly are essential to wireworm development or survival."

DEVELOPING A DELIVERY MECHANISM

Wang-Pruski says all researchers working on RNAi for insect pest control struggle with developing practical, cost-effective delivery methods. She suspects delivering dsRNA to wireworms could be very challenging. "We can try different delivery methods in the laboratory — feeding tests, soaking tests and many other things — but would those methods be practical in a farm situation?"

Delivering dsRNA through feeding has good potential. Wireworms are the larval stage of click beetles, and feeding is already being used for RNAi control of other types of beetles, either through foliar sprays or genetic engineering of a host plant.

> "If we can identify some of the genes responsible for the survival and development of the insect, and if we silence those genes — if we knock them down so they don't function — then the insect will not develop or survive."
>
> — GEFU WANG-PRUSKI

Researchers are identifying some target genes in wireworm; RNAi would then be used to silence those genes.

"We have estimated wireworm costs Prince Edward Island's potato industry more than $10 million per year."

— RYAN BARRETT

Wang-Pruski's group will be investigating possible feeding delivery methods. One rotation-based idea is to use a cover crop to deliver the dsRNA to the wireworms. The wireworms would feed on the cover crop's roots, and that would result in a decreased wireworm population for the following potato crop.

Another aspect Wang-Pruski would like to explore is the possibility of targeting several different wireworm genes at the same time. "Other researchers are thinking about doing this because it would make the control measure more effective. But it is very difficult to do."

According to Wang-Pruski, the project is making good progress. "We are ahead of schedule; we have made more steps than we originally thought we could. Our major challenge right now is to secure long-term funding." She is hopeful industry and government will provide additional funding so the research can proceed as planned.

The project's work so far has been supported by the P.E.I. Potato Board, Cavendish Farms, the P.E.I. Horticultural Association, Genome Atlantic, and Mitacs through the Applied Research and Innovation Program of the P.E.I. Department of Agriculture and Fisheries.

"The research is at early stages, but the board felt that it was important to support this proof-of-concept research to assess whether RNAi could be used to target wireworms and reduce their populations in a very sustainable fashion," says Barrett. ○

Gefu Wang-Pruski is leading a project to develop RNAi for wireworm control.

PHOTO COURTESY OF GEFU WANG-PRUSKI.

Jyoti Joshi, a postdoctoral fellow, is conducting project-related experiments in Wang-Pruski's lab.

PHOTO COURTESY OF JYOTI JOSHI.

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BAYER

Common Scab Complexities

None of the available control measures for common scab are consistently and completely effective. To help improve control of this bacterial disease, researchers are investigating common scab species and strains in Atlantic Canada. BY CAROLYN KING

YOU NEED TO KNOW your enemy if you want to fight it, says Martin Filion, an associate professor at the Université de Moncton.

"Genetic diversity of a pathogen means differences in functions the pathogen might have," he says. "For instance, different species or strains might have different responses to chemicals or agricultural practices you are using to manage the disease."

Information about which common scab species and strains are present and their particular characteristics is very important to developing more effective control methods for the specific pathogens in growers' fields.

Streptomyces scabies is the main species causing common scab worldwide, but other *Streptomyces* species can also cause the disease. "A dozen or so pathogenic *Streptomyces* species have been reported in the literature, and periodically new ones are discovered. Research also shows there can be regional variations in the species that are present, and there can be multiple pathogenic species within a particular region and even within a single field," says Dawn Bignell, an associate professor at Memorial University of Newfoundland.

"We really need to understand what common scab species and strains are present within a particular region. You can have significant variations in aggressiveness between different species and different strains, meaning some cause more severe disease symptoms than others. Also, some research published in 2009 shows different potato cultivars can respond differently to individual pathogenic species or strains, and this in turn may contribute to regional differences in the disease's severity."

Filion and Bignell are in the vanguard of researchers who are starting to fill the information gaps around common scab species and strains in the different regions of Atlantic Canada.

Different common scab species or strains might have different responses to chemicals or agricultural practices.

PHOTO COURTESY OF MARTIN FILION.

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IMPACTS IN ATLANTIC CANADA

Common scab is a widespread, economically important disease in Atlantic Canada. "The disease is always present in almost every field," says Filion, who has been researching common scab for about 14 years. "Some producers will have more losses than others, but producers will face diseased tubers year after year."

Tubers with common scab lesions are safe to consume. The disease is mainly a quality issue, although Bignell says some studies suggest it can sometimes also cause lower yields or decreased tuber size.

"The major impact of common scab is it reduces the market value of the potato crop. Common scab lesions can be superficial, raised, warty-like, or deep pitted. Potatoes simply aren't worth as much if they are covered with these lesions when compared with blemish-free potatoes," she says. "Fresh market potatoes, seed potatoes and processing potatoes are all affected."

Filion says a large portion of potatoes are produced for the processing market, and potato processors "will usually not buy tubers that have more than seven to 10 per cent lesion coverage on the tuber's surface because the lesions can make processing difficult. Some of the lesions are quite deep and will interfere with peeling of the tubers. Some producers if they have, let's say, lesions in the 15 to 20 per cent range, will lose a significant part of their production to this disease."

Martin Filion is an associate professor at the Université de Moncton.

PHOTO COURTESY OF MARTIN FILION.

Common scab may be increasing in Atlantic Canada. "I'm in close contact with companies involved in potato production, such as Cavendish Agri Services, the Little Potato Company and a few others, and each company tells me they have been seeing an increase in common scab problems for the last couple of years. I am also in contact with potato producers directly, and most producers in the Maritimes are seeing a small increase in the number of tubers with common scab," says Filion.

SURPRISING SPECIES DIVERSITY IN NEWFOUNDLAND

No research had been done on the species causing common scab in Newfoundland until Bignell started her study in 2011. She was interested in this issue because the disease is very common in the province and, as an island, Newfoundland is somewhat biologically isolated, which could be an important factor in the pathogen's genetic diversity.

In her study, Bignell and her research group collected tubers with common scab at three locations in 2011 and 2012, and they isolated *Streptomyces* bacteria from the lesions. "Both pathogenic and non-pathogenic *Streptomyces* species can be present within potato lesions, so we screened our isolates to find the pathogenic ones," says Bignell. "We did a very simple radish seedling bioassay where we treated seedlings with the different isolates, and identified the ones that caused stunting and necrosis of the seedlings." Radish bioassays are faster and easier than potato bioassays for detecting pathogenic isolates.

Out of 52 *Streptomyces* isolates, they found 17 pathogenic ones. Next, the research group did some genetic and phenotypic characterization of the pathogenic isolates. For example, they looked for known virulence genes and for the production of a pathogenicity factor called thaxtomin, a plant toxin that contributes to common scab development. For species identification, they compared key gene sequences to see how closely related the isolates are to each other and to known *Streptomyces* species.

"There were three key findings from our study," says Bignell. "The first was scab lesions on potatoes harvested in Newfoundland are associated with several different pathogenic species."

Eight of the 17 isolates were *Streptomyces europaeiscabiei*, a known common scab pathogen. "This species is commonly found in Europe, and it has been found in different regions in North America, including Canada."

The second key finding was the other nine isolates appear to be previously unknown common scab pathogens. Bignell was surprised to find so many novel isolates, especially given the small sample size.

None of the novel pathogenic strains produce thaxtomin. "We currently don't know what pathogenicity factors they produce, but it is something different than thaxtomin," she says.

"This was particularly exciting because it has long been thought that thaxtomin is the primary pathogenicity factor produced by all common scab pathogens. Some studies have even suggested if we target thaxtomin production, we can control common scab disease. But our study and some other studies are showing some common scab pathogens don't produce thaxtomin, but they produce other virulence factors that are likely contributing to common scab."

Some of the novel isolates appear to be related to each other, while others are distinctly different. Most of these isolates still need to be tested on potatoes. "The radish assay shows the isolates are pathogenic to plants, and the fact that we isolated them from potato lesions strongly suggests they are common scab pathogens, but we need to verify that," says Bignell.

The third key finding was one of the novel isolates is very aggressive. "In all of our plant bioassays, this isolate was much more pathogenic than our control common scab strains."

Another surprise was no *Streptomyces scabies* isolates were found. "*Streptomyces scabies* has a worldwide distribution, and it's quite common in Canada, particularly in Eastern Canada. So we highly expected to find *S. scabies* among our isolates," says Bignell. "One reason why we didn't find it was likely due to our small sample size. I suspect if we were to do a much larger survey, we would find it."

They didn't find any geographical patterns in the distribution of the different common scab species. At some locations, they found more than one species.

Bignell's study was funded by an Agriculture Research Initiative grant from the Newfoundland and Labrador provincial government. She has additionally received funding for infrastructure, equipment and basic operation of her lab from the Natural Sciences and Engineering Research Council of Canada (NSERC), the Canada Foundation for Innovation, and the Newfoundland and Labrador Research and Development Corporation.

Currently, her common scab research includes a detailed study of the very aggressive isolate discovered in her survey. "We sequenced the entire genome of that organism. Based on those results, we are able to confirm it is not one of the known common scab species. We have also confirmed it cannot produce thaxtomin because the genes needed to make that pathogenicity factor are not in the genome."

Bignell and her group are in the process of figuring out what pathogenicity factor is being made by that organism. They know it is a plant toxin, but they still need to determine what the toxin is and what its role is in the disease.

In the future, Bignell hopes to do a broader survey of the common scab pathogens in Newfoundland. "This work could determine if *Streptomyces europaeiscabiei* is the predominant species on the island, what its distribution is across the island, and what other known and novel species are present." She would also be happy to hear from potato growers and others in the potato industry who are interested in partnering with her on common scab initiatives.

HUGE STRAIN DIVERSITY

A few years ago, Filion was involved in the first study to investigate common scab species in New Brunswick, Nova Scotia and Prince Edward Island. In that research, published in 2008, Filion and his colleagues obtained 41 *Streptomyces* isolates from lesions on tubers. Most isolates were *Streptomyces* scabies, but two were *Streptomyces acidiscabies*, the first time this species was identified in the Maritimes.

Using genome fingerprinting, the researchers identified 10 distinct genetic groups among the strains, and they found the geographical distribution of the groups had a regional pattern.

About a year and a half ago, Filion started a three-year study to identify and characterize the *Streptomyces* strains on Prince Edward Island. "At present, P.E.I. is the most important potato-producing province. Also, as an island, P.E.I. is a more isolated region, so we're interested in looking at the geographical distribution of the different strains," he says.

"In the 2008 study, we found only *Streptomyces scabies* on P.E.I. However, keeping in mind we only had a few samples, we did find some genetic diversity within that species on P.E.I. In our current study, we want to get more information on this diversity. We now have access to many, many more samples, so hopefully we will be able to characterize the whole genetic diversity of *Streptomyces scabies* found on P.E.I.," says Filion.

Through Cavendish Agri Services, a key partner in the study, Filion and his research group received about 1,000 tubers with common scab from the western, eastern and central regions of Prince Edward Island. They have isolated close to 800 different isolates of scab-causing agents. They have finished extracting the DNA from the isolates, and they have almost finished the molecular fingerprinting.

"We have found a huge diversity of common scab strains on P.E.I.," says Filion. "And there are some geographic patterns — some strains are only found in certain places in P.E.I. We also sometimes find more than one strain in a particular field, so the diversity within a field is bigger than we originally expected. But what does that diversity mean? Is strain A important and strain B not important? Are both important? Are they both aggressive in the same way? These are the kinds of questions I'll probably be more able to answer in a year from now."

The group will soon be starting on sequencing the genomes of the most important strains they are discovering, and they'll be identifying some key pathogenicity-related genes in those strains.

Filion and his team will also be developing DNA-based tools to specifically detect some of the main strains. These tools will allow diagnostic labs to rapidly identify and quantify the strains in tuber samples and soil samples submitted by producers. Knowing which strains are present, how virulent they are and how abundant they are, will help producers

in managing the disease in their fields. These tools could be available within the next two to four years.

Funding for this common scab strain study is provided by Cavendish Agri Services, Genome Atlantic, Mitacs, New Brunswick Innovation Foundation, and NSERC.

Filion and his group have several other common scab studies on the go. For example, they are testing some cultivars in the lab to determine how they respond to different *Streptomyces* strains. In another project, they are working on biopesticides against common scab. "We are developing inoculants of beneficial bacteria that produce antimicrobial compounds, which can help fight against scab-causing *Streptomyces*."

In addition, Filion will soon be working on a major common scab initiative that will investigate many aspects of the disease and its management. "We recently received more than $1 million from Agriculture and Agri-Food Canada for a five-year research project on common scab. This Canada-wide, collaborative initiative will involve researchers from AAFC and academia."

Bignell's and Filion's studies on *Streptomyces* species and strains in Atlantic Canada are a valuable component in the effort to develop more effective, consistent control methods to combat common scab. ○

Dawn Bignell holds a culture plate with isolates of a common scab pathogen and a potato tissue bioassay for testing the pathogenicity of isolates.

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BREAKING the Fall

There's a new way to ensure gentler handling of spuds, thanks to an innovative product invented by potato growers in P.E.I. BY MARK HALSALL

TWO YEARS AGO, Maritimer Pete Nieuwhof was contemplating ways to speed up packing of his farm's fresh potato harvest. He found his answer with the EZ-Down, an ingenious device invented by a pair of fellow P.E.I. potato growers.

"At the time, we were looking for something to speed up our production a little bit. We had an old homemade machine on the line. It was working well, but we wanted to upgrade so we'd be able to pack more in the day," says Nieuwhof, product manager and co-owner of Blue Bay Farms in Rustico, P.E.I.

"We looked at all the options and it just seemed that the EZ-Down was going to provide the highest production to cost ratio," adds Nieuwhof, who paid a little under $30,000 for his EZ-Down machine.

Nieuwhof, who ships 4,000 to 5,000 tote bags full of yellow potatoes to re-packers in New England and Ontario each year, notes the capacity of his packing line jumped to 30,000 pounds of potatoes per hour with the addition of the EZ-Down.

"It's not even going as fast as it can go, but we can do easily twice as much as what we could before," he says. "This is much better than what we had."

EZ-Down was devised by Randy Visser, general manager of Gerrit Visser and Sons, and Lloyd Martin, a long-time employee at the potato producing and packing operation located in Vernon Bridge, P.E.I.

Visser and Martin developed the first prototype as a way to reduce bruising on a packing line that was dropping potatoes several feet into tote bags and also to eliminate the hassle of having to stop the line every time a tote bag was switched out.

"Lloyd and I came up with the idea. Lloyd has been working for us for quite a few years and he's like our mad scientist — he went back into the workshop and started slapping some things together, and he came up with a model to basically prove the concept," says Visser. "It worked really well, so we got kind of excited about it."

Visser notes that he and Martin have always enjoyed trying to devise better ways of doing things on the farm.

"We're fairly experimental so we've definitely done some different things over the years, but this is really the only one where we've said, 'this could be really valuable, and it'd be nice to have that offered out to the industry at large,'" Visser says.

EZ-Down co-inventors, Randy Visser (left) and Lloyd Martin (right), pictured with one of the machines at the Gerrit Visser & Sons farm. PHOTO CREDIT: GERRIT VISSER & SONS

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"It's a pretty unique concept. There's nothing really like it out there that I've seen."

Here's how the EZ-Down works. The machine has a long chamber that gradually lowers as it fills with spuds from the packing line. When the chute reaches the bottom, exit doors are activated which enables the potatoes to flow gently out into a tote bag or pallet box. The chamber then moves up in small increments, creating a smooth flow of product.

When the tote bag or pallet box becomes full, it signals the bottom doors to close and the chamber retracts upward, and another cycle automatically starts again. In this way, the chamber acts as a buffer hopper, enabling an operator to switch out the tote bag or pallet box without interrupting the in-feed flow. In high volume situations, the EZ-Down automatically stops the in-feed conveyor until a new container is put in place.

Visser says there are other fall-breaking devices on the market that use a type of ladder system to provide some cushioning as spuds are dropped into tote bags, but he maintains they're not as effective for reducing bruising and they also lack the EZ-Down's unique buffer hopper feature.

Visser notes another attractive feature of the EZ-Down is it doesn't require a large footprint in the packing shed because of its vertical alignment. "It doesn't need much floorspace to do the job," he says.

Visser, Martin and a third partner, John Venema, decided five years ago to bet on their machine as a commercial product, forming a company called Ground Level Innovations to develop and market the EZ-Down.

The National Research Council of Canada kicked in seed money for the project, helping fund the process of turning the original proof-of-concept prototype used in Visser's packing shed into a marketable model.

"We spent a lot of time in development and perfecting it," notes Visser, who says there are currently three EZ-Down machines in operation at the Gerrit Visser and Sons farm.

Venema acknowledges the EZ-Down was over-engineered in order to produce a high-quality, durable machine that was 100 per cent reliable.

"We were continually refining it [and] that just took more time than we expected," he says. "The concept was really simple but in order to make it work in all different kinds of conditions and with different kinds of potatoes, what we thought was going to take a year or so to develop the product actually took three years."

Venema points out the EZ-Down system can pack table, processing and seed potatoes and can comfortably handle 40,000 pounds of spuds per hour. "You can fill a 2,500-pound tote bag in a little under three and a half minutes," he says.

Now that Ground Level Innovations is producing commercial EZ-Down units at a manufacturing facility in Charlottetown, Visser says the company is exploring its marketing options and is also looking into possibly partnering with an established farm equipment dealer that could assist with product distribution and servicing.

"It takes some time to build integrity and respect and a reputation in the marketplace, so there might be some advantages to aligning ourselves with a well-known and trusted brand of equipment," Visser says.

At this point, EZ-Down sales have been limited to P.E.I. but Venema and his partners believe there is strong potential for a North American-wide market as word gets out about their innovative product.

Visser states he'd love to see many potato packers as possible adopt the EZ-Down, and not just for business reasons. "We think it's a really impressive tool for the industry to get to another level as far as gentler handling of potatoes," he says.

Nieuwhof says he'd recommend EZ-Down to other potato farmers, particularly those looking to take steps to eliminate bruising on their packing lines.

"Not that we had issues with this before, but there was always that unknown," he says. "You can't really see inside a tote bag as it's being filled, but with EZ-Down we know that every time it goes down the potatoes are falling gently on the bottom," he says.

Two EZ-Down machines, one with its chamber extended (foreground) and the other with its chamber contracted. PHOTO CREDIT: LLOYD MARTIN, GERRIT VISSER & SONS.

"It's just a little bit more peace of mind that you never have to worry about bruising being an issue when our customers receive the product that we pack."

Venema says the EZ-Down's buffer hopper capability, which cuts down on downtime by enabling packing lines to run continuously, has turned out to be an even more attractive feature.

"At first, a key selling piece that was really important to us was the machine's ability to handle the potatoes as gently as possible, but it turns out that for almost every one of our customers the biggest feature they like is that it has this built-in buffer hopper system," Venema says. ○

WHERE ON THE WEB

For more information on the EZ-Down system, go to groundlevelinnovations.com.


PERSPECTIVE
Often the key to innovation is a change of perspective.
SPUDNIK

MARKETNEWS

Despite a very hot and dry summer in many parts of the country, this year's average potato yield in Canada could still top the 300 hundredweight per acre mark.

KEVIN MACISAAC

AFTER THREE STRAIGHT years of record-breaking yields in Canada, the 2018 potato crop appeared headed for a significant drop, thanks to the very hot, dry summer seen in many parts of the country. Some timely end-of-season rains, however, had growers feeling more optimistic heading into harvest.

"Two or three weeks ago, we were looking at a severe crop production reduction because of excessive heat and lack of moisture," Kevin MacIsaac, general manager of the United Potato Growers of Canada (UPGC), told *Spud Smart* in mid-September. "Some areas have rebounded somewhat, which has changed the outlook."

According to MacIsaac, most of P.E.I. received some much-needed precipitation at a crucial time and central Canada was another area that really benefitted from late season rainfall. He cautioned, however, that in Quebec and Ontario, the rains may have come too late to help some potato varieties.

MacIsaac noted that forest fires were another obstacle for potato producers in British Columbia. Extensive smoke from this summer's fires affected sunlight absorption in many fields and may have held the crop back a bit in some areas, he said, but growing conditions generally were much better than in 2017 and B.C.'s potato production went up as a result.

Despite this summer's challenges, MacIsaac said the average potato yield in Canada could surpass the 300 hundredweight per acre mark for the fourth year in a row. Early September guesses from producers indicated Canadian average yield for this year's crop could be around 302 hundredweight per acre, which is close to the current five-year average of 305 hundredweight per acre. MacIsaac stressed this was a preliminary estimate and the final numbers won't be known until November.

MacIsaac noted that potato acreages have been generally rising in the past five years, marking a return to close to 2013 levels, and that trend continued this year.

He maintains the rise in potato acres — driven by the corresponding increase in processing capacity in Canada — is a big reason why overall production in Canada has remained consistently high in recent years.

If 2018 crop production estimates hold true, he added, "it would mean we're going to be a bit tight in terms of supply versus demand. Almost all of that extra production is where it needs to be for processing."

MacIsaac said total Canadian fresh production is expected to be flat or down slightly compared to 2017, and total seed potato production in Canada is projected to be up a bit this year.

MacIsaac indicated the crop is looking good at the beginning of harvest. "There hasn't been a lot of disease outbreaks throughout the country, so at this stage we're looking at a pretty decent quality," he said.

MacIsaac noted it's likely many early potatoes will be able to go straight to market because storage holdings have depleted earlier than normal. "It will give growers a little boost," he said. "There's always some potatoes that processors contract right into September, but this year the other potatoes were cleaned up really early. The pipeline right now is probably emptier than it's been any other year."

SOUTH OF THE BORDER, American potato market analyst Bruce Huffaker is forecasting a smaller fall potato crop in the United States in 2018 from a year ago.

In his Sept. 5 *North American Potato Market News* report, Huffaker stated he expects U.S. growers to produce 395.5 million hundredweight of fall potatoes this year, which is 1.1 per cent less than the current estimate of 2017's fall potato production. That puts the average yield for U.S. fall potatoes at 439 hundredweight per acre, he said. ○ MARK HALSALL

Canadian Potato Crop Production (000 cwt)

Province	2015 Production	2016 Production	2017 Production	2018 Production (Estimates as of Sept. 10, 2018)	% Difference
Nfld. & Labrador	60	74	63	60	-4.8
Prince Edward Island	24,850	25,723	23,664	23,940	1.2
Nova Scotia	330	432	432	375	-13.2
New Brunswick	15,100	14,335	15,159	15,370	1.4
Quebec	12,359	12,233	13,007	12,043	-7.4
Ontario	7,970	6,603	7,830	7,310	-6.6
Manitoba	21,630	22,400	22,200	20,512	-7.6
Saskatchewan	1,675	1,700	1,625	1,560	-4.0
Alberta	19,270	20,012	20,507	21,665	5.6
British Columbia	1,663	2,205	1,824	2,108	15.6
Total Canada	**104,907**	**105,716**	**106,311**	**104,943**	**-1.9**

SOURCE: STATISTICS CANADA AND UNITED POTATO GROWERS OF CANADA

Canadian Potato Crop Yields (cwt/acre)

Province	2014	2015	2016	2017	2018 (Estimates as of Sept. 10, 2018)
Nfld. & Labrador	178	162	175	194	194
Prince Edward Island	298	291	297	284	285
Nova Scotia	282	275	270	270	250
New Brunswick	301	318	305	294	290
Quebec	277	301	295	306	285
Ontario	235	230	190	225	215
Manitoba	308	323	350	354	320
Saskatchewan	245	250	250	250	240
Alberta	361	384	388	391	391
British Columbia	270	274	315	285	310
Total Canada	**299**	**309**	**310**	**311**	**302**

SOURCE: STATISTICS CANADA AND UNITED POTATO GROWERS OF CANADA

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Verticillium and Weeds

Many weed and crop species are susceptible to *Verticillium dahliae*, which causes Verticillium wilt in potatoes. Now a study shows some weed species can make wilt problems even worse for potato crops.

BY CAROLYN KING

VERTICILLIUM WILT IS a major soil-borne disease that can result in yield losses as high as 50 per cent in potatoes. The roots of a potato plant, or other host plant, release compounds that stimulate the germination of *Verticillium dahliae* microsclerotia, the fungus's survival structures in the soil. The fungus then grows, penetrates the plant's roots and spreads up the plant, eventually causing wilting, yellowing and early dying in potatoes.

"As *Verticillium dahliae* completes its life cycle in a plant host, the fungus uses the dying tissue of its host to make more microsclerotia, which are small, darkly pigmented, multicellular and irregularly shaped survival structures," says Zachary Frederick, who was part of the Washington State University (WSU) research group that conducted the study.

"It can take five to 30 microsclerotia per gram of soil to infect a susceptible potato cultivar. A lot of factors are involved with this threshold, including soil properties, environmental conditions, the host's susceptibility, and the properties of the fungus itself. One of those properties for the fungus is its aggressiveness to the potato host," he explains.

"*Verticillium* that is aggressive on potato generally requires fewer microsclerotia per gram of soil to infect a susceptible potato cultivar. Aggressive *Verticillium* also manifests as more severe disease later on in the season, which can catch potato growers by surprise because their soil tests show low counts of the fungus."

This aggressiveness is specific to potato; the fungus acts normally when attacking a wide range of other host species. Frederick notes, "So far, the host-aggressive phenomenon has been well documented in Washington for Verticillium wilt of potato and mint. Isolates that are aggressive on mint are not aggressive on potato, and vice versa." Host-aggressiveness has also been documented in cotton and olive, and possibly exists for other crops.

Scientists are still trying to nail down exactly how such host-aggressive isolates develop. It is thought the fungus gradually adapts to the host — each time it completes its life cycle in that particular host species, it becomes more efficient at killing that host, needing less inoculum to cause increasingly severe Verticillium wilt.

The exact number of potato crops needed to turn an ordinary isolate into a potato-aggressive isolate is not yet known. But if it is a gradual process, then what

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would explain the situations observed by WSU researchers in which a field's potato crop is fine one year, but when the next potato crop in the rotation is planted a few years later, the crop has severe wilt?

The WSU research group wondered if perhaps another crop species or a weed species could be contributing to development of potato-aggressive isolates in such situations. So, Frederick, who was a PhD student at the time, was assigned the weed study, and David Wheeler, another PhD student, was assigned the crop study.

SEARCHING FOR A WEED CONNECTION

Working with WSU plant pathologist and professor Dennis Johnson, who leads the research group, and research technologist Tom Cummings, Frederick carried out a greenhouse study with 16 weed species. The 16 species are all found in Washington's Columbia Basin and also occur in other parts of the United States and Canada.

The study's first objective was to test the weeds for susceptibility to eight isolates of *Verticillium dahliae*. "Some of the 16 weed species have been subject to *Verticillium* research since the late 1960s, so we reconfirmed their susceptibility. Other species did not have a scientific background with *Verticillium* research because we included grasses in our study. *Verticillium* is traditionally thought of as a disease of dicots, not monocots, like grasses," explains Frederick, who is now the applied research agronomist with the Manitoba Horticulture Productivity Enhancement Centre Inc. at Carberry.

The 16 weed species included five nightshades: bittersweet nightshade (*Solanum dulcamara*), black nightshade (*Solanum nigrum*), eastern black nightshade (*Solanum ptycanthum*), hairy nightshade (*Solanum physalifolium*), and litchi tomato (*Solanum sisymbriifolium*). Nightshade weeds are cousins of potato (*Solanum tuberosum*) and are hosts to some other potato pathogens.

The researchers also tested four other broadleaf weeds: annual sowthistle (*Sonchus oleraceus*), common lambsquarters (*Chenopodium album*), Powell pigweed (*Amaranthus powellii*), and tumble pigweed (*Amaranthus albus*). The study's grassy weeds were: annual bluegrass (*Poa annua*), barnyard grass (*Echinochloa crus-galli*), downy brome (*Bromus tectorum*), green foxtail (*Setaria viridis*), large crabgrass (*Digitaria sanguinalis*), rattail fescue (*Vulpia myuros*), and wild oat (*Avena fatua*).

The eight *Verticillium dahliae* isolates included two from mint, two from tomato, and one each from potato, sugar beet, sunflower and watermelon. The potato isolate was aggressive on potato, and the mint isolates were aggressive on mint.

The second objective was to identify any weed hosts where the aggressive isolates created more disease or more microsclerotia, compared with the ordinary isolates.

Frederick inoculated seedlings of the weeds, testing each isolate on its own in each of the weed species. He grew the inoculated plants in a potting mix in the greenhouse.

"Research on *Verticillium* indicates that infection happens prior to flowering for most crops. Once we had as many of the weeds as possible flowering and setting seeds, we held back the water to the plants, allowing them to die slowly over the course of about two weeks. It takes about two weeks for the fungus to form microsclerotia when it senses the host is dying," says Frederick.

He checked the plants for symptoms of the disease, and he compared the aggressiveness of the different isolates by counting the number of living microsclerotia produced by each weed with each *Verticillium* isolate.

SURPRISING FINDINGS

Every single weed species in the study was host to at least one *Verticillium dahliae* isolate, producing at least some microsclerotia after inoculation. Fortunately, many

Zachary Frederick collected this litchi tomato plant and other weed species for his study on *Verticillium dahliae* isolates from different host plants.
PHOTO COURTESY OF ZACHARY FREDERICK.

Verticillium wilt can cause up to 50 per cent yield loss in susceptible potato cultivars. PHOTO COURTESY OF ZACHARY FREDERICK.

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TRINITY

Only black nightshade maintained the aggressiveness of the potato-aggressive isolate. PHOTO COURTESY OF ZACHARY FREDERICK.

of the infected weeds — such as large crabgrass, barnyard grass and rattail fescue — produced only tiny amounts of the microsclerotia.

Initially, the researchers were surprised to find infections in the grassy weeds, so they dug deeper into the scientific literature. "It turns out that since the 1960s, and more so from the 1990s through to about 2015, there have been a fair number of publications where barley, rye, wheat and even corn have all been reported as *Verticillium* hosts, generally without any symptoms of the disease. And in one very unique case, a researcher found a barley plant that actually displayed symptoms of Verticillium wilt," says Frederick.

In Frederick's study, none of the infected weeds — no matter whether they were nightshades, other broadleafs, or grasses — had any visible symptoms of the disease. "There was no stunting, no yellowing, no wilting — none of the hallmarks of the disease," he notes. "[For instance] a six-foot tall wild oat plant [grown in a greenhouse] had a systemic *Verticillium* infection throughout the entire plant, but had no outward signs that the fungus was present."

The infection in that six-foot wild oat plant was caused by an unusual isolate from tomato, which produced a lot more microsclerotia on wild oat than any of the other isolates. That odd isolate also produced infections with significantly greater numbers of microsclerotia in a few of the other weeds in some of the trials.

The study reconfirmed that nightshade weeds are susceptible to *Verticillium*. "The nightshades in general were very susceptible to *Verticillium*, and their infections produced lots of microsclerotia. In the case of species like hairy nightshade and eastern black nightshade, the potato-aggressive isolate didn't produce more microsclerotia than the rest of the isolates, so the aggressiveness wasn't maintained, but these

MORE REASONS TO CONTROL NIGHTSHADES

Nightshade weed control can also be important for managing other potato diseases. Eugenia Banks, a potato consultant for the Ontario Potato Board, explains that nightshades can be hosts to such major diseases as late blight, potato virus Y (PVYo) and a tuber necrotic PVY strain (PVYntn). "When infected with late blight, weeds like hairy nightshade (*Solanum physalifolium*) can serve as a source of spores that can infect surrounding potato fields," she notes. "Also, aphids feeding on hairy nightshade plants infected with PVY can transmit the virus to potatoes."

As well, she points out that nightshades play roles in some emerging disease threats. For instance, research in the U.S. Pacific Northwest shows potato psyllids can overwinter on bittersweet nightshade (*Solanum dulcamara*), a perennial weed, and then move into potato crops. Potato psyllids are a concern because they may transmit zebra chip, a disease that severely reduces yields and makes tubers unmarketable.

A Canadian monitoring program has found small numbers of this psyllid in the three Prairie provinces, and in 2017 the pathogen was detected for the first time in a few of the psyllids collected in Alberta. The pathogen has not yet been found in any potato plant tissues in Canada.

Banks recommends keeping an eye out for hairy nightshade, the most common nightshade growing in and near potato fields, and controlling it with spot sprays.

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weeds were highly susceptible to virtually every *Verticillium* isolate that we tested and returned a great deal of microsclerotia to the soil," says Frederick.

Only black nightshade maintained the aggressiveness of the potato-aggressive isolate. "Like the other nightshades, black nightshade was very susceptible to *Verticillium*, but the potato-aggressive isolate produced more microsclerotia on black nightshade than the other isolates."

TAKE-HOME MESSAGES

"A big take-home message from this study is to tie together your weed management with your Verticillium wilt disease management," says Frederick.

Controlling nightshades is especially important. "Based on this greenhouse study, virtually all nightshades are very good *Verticillium* hosts. If a nightshade weed is infected, microsclerotia will be produced, and where the plant residue breaks down in the field is where you'll most likely see more microsclerotia returned to the soil. So, where you have these nightshades, your *Verticillium* problem could possibly continue to increase." And if you have black nightshade, you might get even greater disease pressure due to potato-aggressive *Verticillium dahliae*.

Another tip from Frederick is to control weeds while they are still small. "Don't give weeds the opportunity to be hosts to *Verticillium* and especially to complete their life cycles. Typically, it takes about two weeks of the weed being in the presence of *Verticillium* in the soil for the fungus to find and infect that weed. When the weed is small there is low potential for microsclerotia. That six-foot wild oat plant had a lot of plant mass to play host to *Verticillium* whereas a three-inch wild oat that is killed off at that stage would return less *Verticillium* to the soil."

Verticillium dahliae uses the dying plant tissue of its host to make microsclerotia, which are the fungus's survival structures. PHOTO COURTESY OF ZACHARY FREDERICK.

Annual sowthistle was one of the weeds tested for susceptibility to the different *Verticillium dahliae* isolates. PHOTO COURTESY OF ZACHARY FREDERICK.

Also, remember that infected weeds will likely have no symptoms even if they have a severe infection that generates lots of microsclerotia.

Frederick recommends making weed control part of an integrated, long-term approach to managing Verticillium wilt in potato. "The fungus takes years if not decades to build up in the soil to the point where it becomes a noticeable problem. So there is a lot of room for proactive treatment ahead of time, and then measures such as chemical fumigation may not be needed. Although weed management isn't a silver bullet for dealing with *Verticillium dahliae*, it fits into this larger picture for *Verticillium* control."

Another important long-term strategy is to avoid very short potato rotations, especially back-to-back potato crops, to reduce the risk of developing potato-aggressive *Verticillium*. More information on cropping options for *Verticillium* management could come from Wheeler's study, which will be completed this fall.

Frederick reminds growers that many other crops are susceptible to *Verticillium dahliae*. "Fungi in the genus *Verticillium* can infect and cause disease in most crops that aren't related to grasses. If you grow alfalfa, sunflower, cherries, strawberries, eggplants, tomatoes, peppers, pumpkins — and the list goes on — Verticillium wilt can eventually become a disease issue. *Verticillium dahliae* is the causal agent for Verticillium wilt on most of those crops." ○


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How to Plan Today to Manage PVY

BY KARI BELANGER

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ANNE MCRAE
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ALTHOUGH THE TRANSMISSION and incidence of Potato virus Y in Canadian potato crops has declined dramatically over the past eight years, new threats to quality and yield are on the horizon in the form of necrosis-causing novel strains. How can Canadian growers manage PVY on their farms today, and how do they fight these latest strains?

For this edition of Roundtable, *Spud Smart* sought input from industry experts Mathuresh Singh, director of Agricultural Certification Services, and Anne McRae, a technical service specialist for insecticides and horticulture products at BASF Canada, on how to manage PVY, what tools are available for growers, the challenges researchers and growers are up against, and new tactics and control products researchers are developing.

PLANT CLEAN SEED

Potato virus Y originates from different sources of inoculum to infect potato crops. Sources of PVY inoculum include potato seed, neighbouring fields, and in-field volunteer plants, weeds, and cull piles. Once PVY is introduced into a field, it multiplies and eventually affects the harvested crop by lowering yield, reducing potato quality due to necrosis, and seed certification failure, says Singh.

Based on studies carried out in New Brunswick on PVY management, certified seed use with low or zero PVY percentages has had a dramatic effect on planted PVY levels over the past eight years. In 2011, only 35 per cent of acres planted had PVY levels between zero and one per cent compared with 92 per cent of acres planted in 2017.

The decline in PVY levels of planted acres can be attributed to the post-harvest testing program and growers' use of extensive management tools, says Singh. "Since growers have been planting clean seed, our post-harvest testing has been offering us very good results," he says.

The decrease of planted PVY levels is a major factor in the decline of potatoes harvested with PVY. Between 500 – 700 seed potato lots have been tested yearly since 2009 to determine the average percentage of PVY in harvested seed potatoes. According to Singh, in 2009, the average percentage of harvested PVY was close to 12 per cent, however in 2016 that figure declined dramatically to 0.43 per cent.

"One of the best management tools is to plant clean seed with a low PVY percentage. This is the most cost-effective way to reduce PVY at harvest," says Singh.

According to his study results, PVY levels are low — less than one per cent — on farms where growers only produce high-quality seed. Growers producing more than 30 per cent seed potatoes but less than 70 per cent table or processing potatoes have higher PVY levels on their farms. Growers producing more than 70 per cent table or processing potatoes and less than 30 per cent for seed have almost twice the PVY levels on their farms compared with those who only grow seed.

"This indicates even though the growers are planting good, clean seed, the PVY is moving within their farms from different fields. Also, the PVY could be coming from infected plants growing in cull piles or from field volunteers. This should be avoided by rotating fields with non-potato crops, which also helps reduce PVY," he says.

Singh also suggests to clean cull piles and get rid of volunteers.

MINERAL OIL AND INSECTICIDE APPLICATIONS

PVY inoculum can originate from seed and from different fields — but how does it move from one field to another, and how is it transmitted from plant to plant? Aphids are one of the main vectors for transmitting PVY, and there are almost 60 different aphid species that can carry PVY.

Singh discovered where tractors were being used for spraying and for cultivation, mechanical transmission of PVY was taking place in the field. PHOTO COURTESY OF MATHURESH SINGH.

Aphids transmit PVY between fields and from plant to plant. Extensive work has been carried out in New Brunswick, says Singh, on managing aphid PVY transmission between potato fields and plants with a horticultural mineral oil and insecticide tank mix, which is sprayed to reduce aphid PVY transmission.

"Insecticide sprayed alone is not very effective for PVY management, however, if we combine mineral oil with insecticide, it's very effective," says Singh.

Studies carried out in 2010 and 2011 indicate aphids can carry PVY early in the season and can infect a potato crop before the majority of the plants are emerged. Growers started their spraying programs after 50 per cent plant emergence with mineral oil or a combination of oil and insecticide.

Six different fields were sprayed with mineral oil and insecticide at two different times — three fields were sprayed on June 15 and three on June 29. The spread of PVY in fields sprayed on June 15 was quite low, says Singh, and those fields contained almost half the PVY levels as fields sprayed on June 29, which also showed a much greater percentage of PVY spread.

Based on the data generated from this study, Singh says he recommends spraying potato crops when they're at 20 to 30 per cent emergence or earlier. "If we spray the fields earlier, we can manage PVY in potato crops better by protecting the majority of plants," he says.

More research was carried out in growers' fields between 2010 and 2014 to determine optimum spraying frequency. The study results indicate moderate spraying frequency (six to eight times in-season) of a mineral oil and insecticide tank mix on potato fields produced higher PVY spread percentages than potato fields sprayed at an intensive spraying frequency (12 to 13 times in-season). The mineral oil used as a tank mix ranged from 1.5 litres to almost three litres per acre, with an average around two litres.

Study results indicate spraying a combination of mineral oil and insecticide is an effective tool for managing PVY, however, spraying insecticide alone is not.
PHOTO COURTESY OF MATHURESH SINGH.

Fields planted with processing potatoes, which were not sprayed, had the highest PVY spread percentages.

Those trials were replicated for three years using two different oil regimes, says Singh. The fields that were not sprayed (and used as a control) had a PVY spread around 10 per cent. Fields sprayed with insecticide weren't far behind that value, indicating insecticide alone doesn't really help manage PVY, says Singh.

However, in those fields where insecticide and mineral oil were combined and sprayed, "there was a huge difference between the control and the insecticide or mineral oil tank mix," he says.

In addition, application of mineral oil alone reduces aphid PVY transmission greatly when compared with the control; however, insecticide combined with mineral oil produced the lowest PVY spread percentages.

Where insecticide and mineral oil were combined, 1.5 litres was sprayed throughout the season in one trial, and three litres was sprayed for five applications and was then reduced to 1.5 litres in another.

Insecticides found to be most effective with the mineral oil tank mix are lambda-cyhalothrin (Silencer) and flonicamid (Beleaf) as well as some other pyrethroids, says Singh.

"The lambda-cyhalothrin is a cost-effective insecticide, and it is very effective for aphid management when combined with mineral oil," he says.

CHALLENGES AHEAD

PVY isn't one virus but several virus strains. There are currently three known groups of strains: the common strain, PVYO, and the novel necrotic strains PVYN:0/N:Wi and PVYNTN. The necrotic strains can cause tuber necrosis, affecting a potato crop's quality and yield. Recently, PVY populations have been shifting from the common strain, PVYO, to the necrotic strains.

Furthermore, the symptoms these novel strains cause vary with the strain type and the potato variety it has infected. For example, when infected with the three different strains, Ranger Russet leaves can exhibit three different symptom sets.

The novel strains are also more cryptic — they're hard to see and rogue from a potato field. Additionally, these novel strains can spread quicker than the common strain, PVYO.

Climate change, the shifting availability and costs of effective insecticides, and the unknown susceptibilities of new potato varieties is making managing these novel strains more complicated, says Singh.

"The new potato varieties released each year respond differently to each strain, and the cost of insecticides can fluctuate. In addition, growing season temperatures are on the rise and winters are

very mild, so aphids are surviving. These factors are complicating PVY management plans," he says.

A single application of mineral oil is roughly $15 per acre, and for insecticides from $5 to $22 per acre. Although mineral oil and insecticide applications could be added to growers' weekly spray programs for late blight management, depending on how many applications are required, growers should expect to pay about $200 (moderate spray frequency) to $335 (intensive spray frequency) per acre for PVY management (mineral oil and insecticide).

NEW TACTICS

Recently, Singh's team finished a project to determine the major PVY strains' symptoms produced in commercially-important varieties. The PVY strains were collected from all over Canada, and the symptoms produced in approximately 30 varieties were catalogued.

"Only four varieties showed symptoms in tubers, the rest did not — which is good news," says Singh.

Cataloguing these symptoms will help growers recognize PVY infection in the field. In addition, measuring how different strains affect potato yield and quality is important information for decision-makers, he notes.

At this time, the researchers also explored mechanical PVY transmission in the field during cultivation. Results from this study indicate the PVY transmission rate between plants — in particular for necrotic strains — was three to four times the rate in rows where tractors were allowed to pass compared with rows where tractor access was restricted.

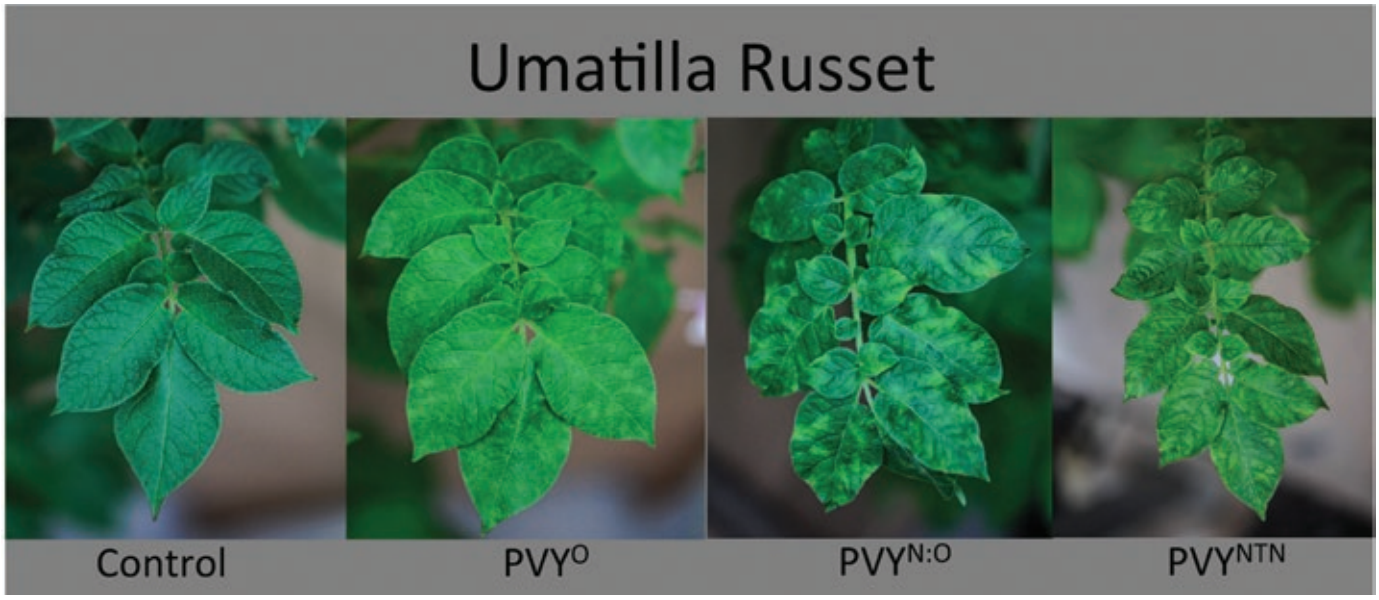
"We found where tractors were being used for spraying and for cultivation, mechanical transmission of PVY was taking place in the field," says Singh. "That explains why, even if you plant low PVY seed, it can still be transmitted by tractors as mechanical transmission."

Other ongoing research efforts include identification of other effective insecticides which are also low in cost and have low environmental impacts. Recently, Singh was involved with a project that developed some of the markers to be used to screen germplasm for breeding programs and the future development of new PVY resistant varieties.

However, at the moment, growers should be focusing on spray applications to reduce aphid transmission to manage PVY in their fields.

"I emphasize most of the work we have done in New Brunswick and also in Manitoba has been on the management of PVY using mineral oil and insecticides. We've found it's very effective in both Eastern and Western Canada," he says.

Cataloguing the symptomologies of PVY strains will help growers recognize infection in the field. Measuring the effects different strains have on potato yields and quality is important information for decision-makers.
PHOTO COURTESY OF MATHURESH SINGH.



The symptoms novel PVY strains cause vary with the strain type and the potato variety the strain has infected. Also, novel strains are more cryptic: they're hard to see and rogue from a potato field. PHOTO COURTESY OF MATHURESH SINGH.

NEW INSECTICIDE TOOL

BASF has created a new insecticide called Sefina which can be used for PVY management. The insecticide has a novel active ingredient (afidopyropen), which BASF has named Inscalis, for the control of piercing and sucking pests, such as aphids. The product is currently being reviewed for registration in Canada, and is on track for the 2019 season for use on potatoes, as well as soybeans.

"Two of Sefina's key characteristics are the quick onset of feeding cessation and its extended duration of control," says McRae.

In addition to vectoring pathogenic viruses, aphids, when present in high numbers, can cause wilting damage by sucking nutrients from foliage and stem tissue.

"By stopping aphid feeding quickly with Sefina, we can reduce the risk of spreading harmful viruses like PVY and limit feeding damage for up to 21 days," says McRae.

One issue with insecticides is the length of time they take to work, allowing aphids more time to feed and spread viruses.

"I heard once, aphids can't walk and chew gum at the same time. A moving aphid is not a feeding aphid, but a stationary aphid is a feeding aphid. Sefina takes effect around the 11-minute mark. When spraying your potatoes, Sefina will be working before you've even left the field. If an aphid cannot pierce the leaf it cannot spread the virus," says McRae.

Sefina controls both green peach and potato aphids, which both carry PVY. Because aphids are affected when they are sprayed with the insecticide as well as when they ingest it from leaf tissue, the product works for up to 21 days.

> In 2009, the average percentage of harvested PVY was close to 12 per cent, however, in 2016 that figure declined dramatically to 0.43 per cent.

The product is translaminar, so it moves from the top of the leaf to the bottom, however, it is not systemic, so it doesn't move through the plant. It's important the whole plant is covered when applying the insecticide, notes McRae.

The first to be classified in subgroup 9D, this pyropene is a neuromuscular disruptor in a new chemical class with a unique mode of action. Thus adding another tool for growers to manage insecticide resistance. "There is no cross-resistance to any other insecticides," says McRae.

As a neuromuscular disruptor, the insecticide is fast-acting, working within the first 24 hours.

Sefina is a chordotonal organ TRP-V channel modulator, says McRae. Basically, chordotonal organs are responsible for sensors in the antenna, legs, mouth, wings and thorax. They provide insects with their senses of hearing, orientation, balance and coordinated movement.

When an aphid is exposed to the insecticide, it locks the TRP-V channels open and chordotonal organ feedback is blocked, she says. Sensory neurons send continuous and misleading signals, so the insect's brain can't detect sound, gravity or body movement. The aphid will make odd sporadic movements, so it appears drunk or as if it's dancing around. It is then unable to pierce the leaf to feed.

The insecticide also has a low impact on predatory and parasitic insects, such as lady beetles. "Which makes it an excellent resource for integrated pest management," says McRae.

"By protecting our predatory insects, they are able to move to other fields, or come back again to help us manage aphid populations later in the season," she says. "Sefina is an excellent resource for growers' integrated pest management programs." ○

If you have ideas for best management practices in potato production or a possible topic for a future Roundtable discussion, we'd love to hear them. Please send your suggestions to managing editor Michelle Clarke at mclarke@issuesink.com.

New Sweet Potato Variety Shines

Hitting the market in 2019, Radiance is a new sweet potato variety developed by Ontario's Vineland Research and Innovation Centre. BY MARC ZIENKIEWICZ

READY FOR COMMERCIAL release in 2019 is Radiance, a new sweet potato variety developed in Canada to suit the country's growing season and conditions. The variety is currently being trialed from coast-to-coast, and should be appearing in Canadian grocery stores next year.

Valerio Primomo, a research scientist and vegetable breeder at Ontario-based Vineland Research and Innovation Centre (Vineland), developed the variety with Canada's unique growing conditions in mind, its shorter growing season being one.

Canadian growers typically cultivate Covington, a sweet potato variety commonly grown in the United States, Primomo says. However, Covington requires a long growing season in order for it to mature. As a result, harvest typically begins in October when the temperature begins to drop in Canada, making it difficult to avoid chilling injury. For this reason, Radiance is a big step forward, he says.

"We know that sweet potato is a Thanksgiving product, at least in the U.S. Now it's a big thing in Canada. Retailers like Loblaws want to hit that market because they'll sell a lot of it at that time of year," says Primomo.

In future, other producers around the world may be growing Radiance, says Vineland's research director of applied genomics, Daryl Somers. Eventually, the variety will be tested in the United States as well as other countries.

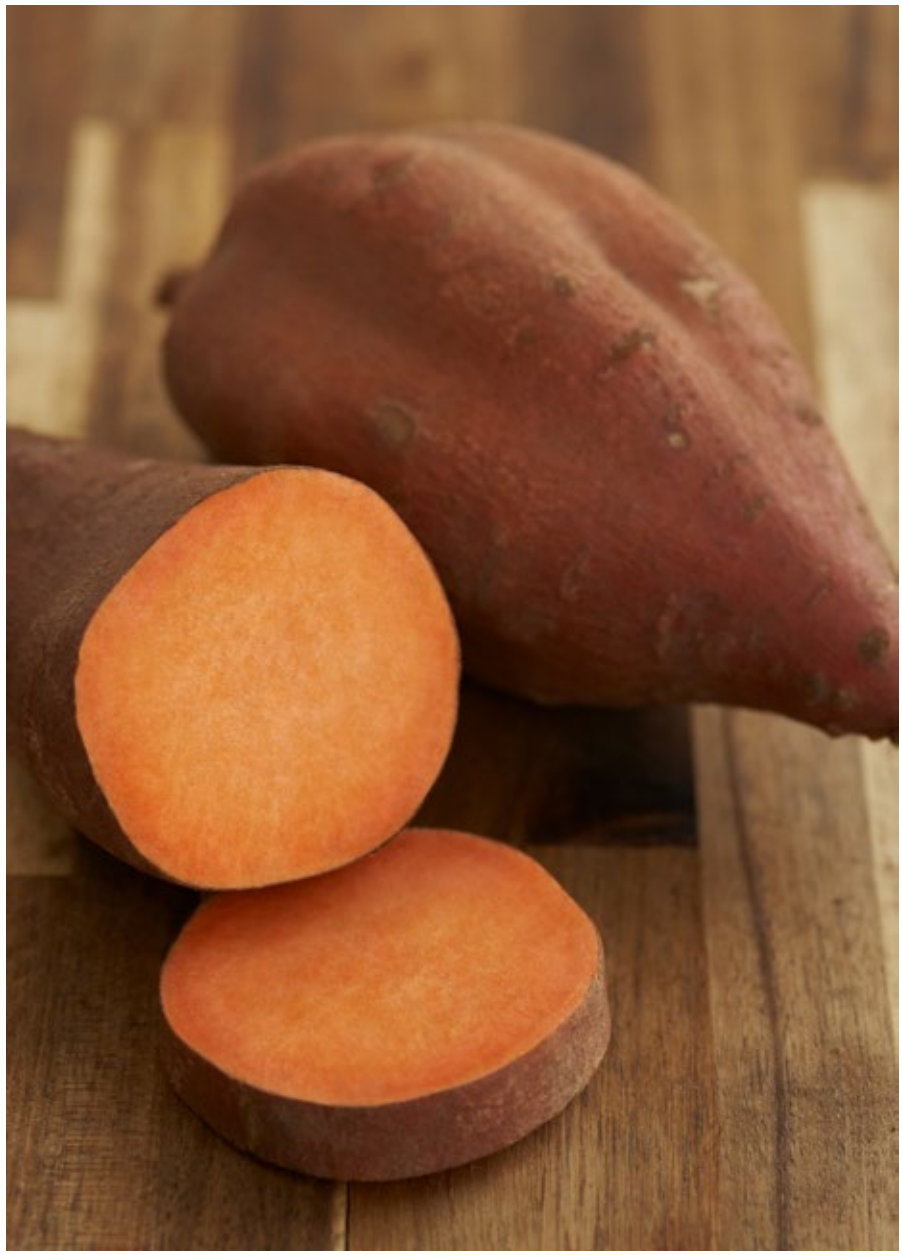
"There are even requests from the EU to test a Canadian-developed sweet potato in their environments," says Somers. Vineland, he says, is Canada's first and only not-for-profit horticultural research centre, and actively seeks out research and business agreements and partnerships.

Located in the town of Lincoln in the Niagara Region, Vineland is a world-class research centre dedicated to horticultural science and innovation. Its researchers in applied genomics, consumer insights, horticultural production systems and robotics and automation work to deliver innovative products and production solutions that address the needs of the horticulture industry and advance Canada's research and commercialization agenda.

Somers says Vineland's influence will continue to grow as the public sees value in the varieties being created there.

"What Vineland really delivers is this ability to look at the different horticultural sectors, the different commodity sectors, and pick which ones are going to be profitable — and it has to be profitable for Vineland. We have to have our own impact. Impact is not always revenue, but impact in the sense that we're changing what we're producing," says Somers.

"We do import a lot of sweet potato into this country, and now farmers are waking up to the idea they can produce Canadian-bred sweet potatoes, get them into the marketplace and into Canadian retail chains. We're pretty optimistic Canadian consumers will recognize these are Canadian products grown in Canada. It makes a big difference to what they purchase." ○



The sweet potato variety Radiance is currently being trialed from coast-to-coast, and should be appearing in Canadian grocery stores next year.
PHOTO COURTESY OF VINELAND.

The SmartSpud travels through potato equipment from harvester to packaging mimicking a real potato and providing real-time feedback.
PHOTO COURTESY OF MASITEK INSTRUMENTS.

New and **Improved** Potato Scanning and Handling Systems

Recent updates on new and established scanning and handling systems including the SmartSpud, chemical imaging and an acrylamide sensor. BY TREENA HEIN

ANY TECHNOLOGY THAT helps maximize profit and minimize waste is welcome in agriculture, and potato farming is no exception. There are some recent updates on new and established scanning and handling systems now available or soon to be marketed.

You have likely heard about the SmartSpud, a revolutionary Canadian device produced by Masitek Instruments of Moncton, N.B., that travels through potato equipment from harvester to packaging, mimicking a real potato. It provides real-time feedback so equipment can be adjusted on the spot, and therefore minimizes losses due to scuffing, bruises and nicks as quickly as possible.

All Masitek systems (its agricultural products also include the CracklessEgg and ProduceQC) received a complete overhaul about 18 months ago. They now have Bluetooth tracking, double the battery life and sampling rate speed as well as improved velocity measurement. The system's app also has an improved interface with new reporting capabilities.

Masitek devices are used in many countries worldwide. Most SmartSpuds have been sold in Canada and the United States, with the majority used in harvesting, storage and processing applications, says Larry Doherty, the company's chief operating officer. The remainder are used by manufacturers of processing and packaging equipment to improve their offerings.

Doherty says potato skin scuffing can occur when potatoes rotate in processing and hit up against a rail or other potatoes. Nicks typically happen in processing as well, and bruising can occur at any drop point from harvest to storage.

"Using the SmartSpud can reduce bruising by up to 10 per cent on first use," Doherty says. "With regular use as part of an overall quality assurance program, even greater reductions will be realized."

Customers include McCain Foods, BASF, Lamb Weston, Cavendish Farms, and J.R. Simplot Company in Manitoba, which has used the SmartSpud on many of its farms over the years.

"This device is a very valuable tool to have for both potato growers and processors, as there is an economic benefit for reducing bruise for the growers, and it makes it easier for the processor to turn the potatoes into a product," says Landon Thomson, J.R. Simplot's manager of trainee operations. "This technology is very beneficial for the potato industry."

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Chemical imaging technology provides an inspection of the potato's surface and up to three millimetres under the surface.

PHOTO COURTESY OF INSORT GMBH OF AUSTRIA.

Thomson says they've run the SmartSpud over grading lines, windrowers, harvesters, bin pilers, trucks and more. "I like to run the SmartSpud over each drop 10 to 15 times to get consistent data," says Thomson. "The data is shown in a graph on the tablet, which is easy to read and updated live as the SmartSpud runs through potential bruising points of the operation."

However, he says it can be challenging to keep sight of the device if it gets dirty. Thomson hasn't heard of any Simplot growers owning their own SmartSpud, but he says they don't hesitate to ask the company to bring the device to their farms and run it through wherever they feel there is a concern for bruise potential.

Schroeder Brothers Farms in Antigo, Wis., has used the SmartSpud for just over two years. "We like the device and are happy we bought it," says co-owner J.D. Schroeder. "It's pretty user-friendly and provides good information." He says Masitek provides threshold baseline numbers for a range of potato varieties related to skin scuffing, small bruises and large bruises.

"We would make sure our equipment and operators stayed under those numbers, and then compare it to our own bruise sampling to see if we agreed," Schroeder says. "Generally, we did. But using the SmartSpud provides data faster because you don't have to wait for bruises to develop like you would on a sample, and it helps you pinpoint where a bruise might be coming from. It's easier than pulling samples from, for instance, every chain or section of a harvester."

Like Simplot, Schroeder Bros. has run the SmartSpud through pretty much everything. "We have buried it in the hill, or set it on top of the hill, and let the windrower pick it up and dump it out," says Schroeder. "We have also let the harvester pick it up and drop it into the truck. It has gone through the grading line, up the bin piler and into the pile."

The device has also run through the operation's grading shed, washing flume and polisher, and at unloading, through stingers and up through the accumulators. The device is run through everything many times to determine what adjustments would cause variations in G-forces, or to cause the device to hit a certain part of the equipment that may occasionally cause bruising.

CHEMICAL IMAGING TECHNOLOGY

Scanning machines using chemical imaging technology are marketed by Insort GmbH of Austria, which has now sold 15 units in North America and about 70 worldwide.

Chemical imaging technology provides an inspection of the potato's surface and up to three millimetres under the surface. Although hollow heart detection isn't possible, glassy potatoes can be discerned.

Lukas Lackner, vice-president of the firm's Canadian division, says the technology can also distinguish between peel and scab and other dark defects with very high accuracy. "Soft rot and acid burn can be detected to some degree, depending on the level of severity of the defect." When it comes to their investment, Lackner says some customers see returns in less than a year.

Last year, Austin and Ramona Roberts, who own P.E.I. Potato Solutions in New Annan, P.E.I., purchased a Sherlock Separator, which is an Insort scanner. "As far as scab goes, the Insort is wonderful. We have had excellent success with this, and it has very high accuracy," says Ramona Roberts.

ACRYLAMIDE SENSOR

New technology is currently being developed in Europe to scan for acrylamide, which is formed from naturally-occurring compounds in certain foods, such as potato chips and French fries, during processing or cooking at high temperatures.

Not all potatoes produce high levels of acrylamide during frying, and Belgium's Vrije Universiteit Brussel scientist, Lien Smeesters, in collaboration with Norway's Tomra Sorting Solutions, has developed a sensor to detect which ones do so. The sensor is being integrated with Tomra's laser-based optical sorting machines this year. Food firms using the technology to exclude potatoes that will produce lots of acrylamide during frying can put those potatoes to other uses. ○

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SEED & POTATO VARIETIES
Navigating the Challenges of New Trucking Regulations

PAUL SAWATZKY Business Development Manager • Parkland Seed Potatoes • parklandseedpotatoes.com

New regulations governing U.S. truckers' driving hours are hitting agriculture hard. Not only are prices for trucking way up (we've seen a spike of 20 per cent or more to some locations), lack of adequate trucking capacity means it sometimes seems nearly impossible to find an available truck. Producers have been calling us since the regulations came into effect looking for suggestions on how to manage the changes. Here's what we know:

Because demand for trucking now outstrips capacity, making life easier for truckers and trucking companies will increase your likelihood of getting a carrier when you need it. Truckers appreciate a flexible loading schedule, since their job can't always be scheduled to the minute. They also appreciate efficiency: with the ELD clock always ticking, any minutes you can shave off by being ready for loading and having paperwork fully organized will make you more popular the next time you call for a truck. And, the bigger you are, the louder your voice: since a small-scale producer's requests might be more likely to be ignored, partnering with other producers when booking transport can carry more weight with carriers.

Transportation changes are costing agricultural companies on both ends: inputs now cost more to truck in; product now costs more to truck out. Where possible (and, admittedly, it's usually not), producers could look at decreasing the distance between their production and their buyer. If producers can spread out their shipments or ship earlier in the season, they may not have to compete as intensely for trucks. Of course, doing so is not always possible given that customers dictate when they need their seed.

Finally, let's all cross our fingers that some of the price shock we've felt this season is a growing pain of the new system. In our industry, producers can't just absorb another increase in freight costs. We're doing our best to help get that message all the way to retailers. This year, the timing of the cost increase meant it hadn't been spread through the value chain by the time shipping happened, so a lot of the added pressure was carried at our and our customers' levels.

Despite all the challenges the new ELD (electronic logging device) regulations bring, the bottom line is they are probably a good thing. Safer roads are something we all support. But, the way the regulations were implemented — both the timing of the roll-out and the immediate jump to full-force implementation — was very difficult for agriculture.

Ultimately, an increase in capacity will resolve the lion's share of concerns for the agriculture industry. Unfortunately, that is out of all of our control. ○

PRECISION FARMING
Set for Success, Part 1: Tips to Get the Most From Yield Monitoring

BILL MENKVELD Vice-President, Sales and Marketing • Greentronics • greentronics.com

I attend a lot of ag expos and field days, a lot of ag-tech conferences and tradeshows. Though those events keep me away from home more than I'd like, I love each opportunity to connect with farmers. I'm always reminded that there's something special about people who commit their lives to this industry: farming might not be the most lucrative or the easiest business to be in, but it sure draws people who are passionately, deeply committed. Getting to know farmers, from small acreages and large and from coast to coast, has changed how I do business. Whereas in the early days, I might have thought my highest priority was innovation and new ideas, now I think a tech company's most important role is helping farmers stay afloat in a world of tightening margins, increasing costs and changeable markets. A big, huge piece of that isn't about selling farmers new technology; it's about giving farmers the information they need to get the most out of their technology.

Monitoring yield can offer incredible insight into what's really happening in different parts of a potato field. It can explain a lot about crops, fields, and production practices, and is a great reference for any important farm decision. Producers often tell me they're concerned about installing and maintaining yield monitoring hardware, gathering and managing data. They're smart to have those thoughts in mind: monitoring isn't hard but it only works if you take several steps to stay on track. Here's what I recommend to maximize a yield monitor's return:

First get familiar with the technology and the information it generates. The technology isn't particularly complicated: at its simplest, the technology is load cells that weigh the crop as it moves along the conveyor, speed sensors that monitor conveyor speed, GPS to link data to location, and a data collection device that passes the information along to you. Still, the technology does require some know-how, so spend some time with the operator's manual and the monitor itself. If you collected yield data in years previous, review that data to look for any misses and inconsistencies. If you can't figure out why any data gaps happened and how you can fix that this season, call your agronomist, equipment dealer or us at Greentronics to gather ideas and answers.

Second, be mindful of wear and damage. Get in the habit of doing an intensive check-over pre-harvest and then regular walk arounds each time you use the machine. Shorts and complete failures can be caused by normal wear and tear or even rodent damage.

Third, calibrate and test. Yield data is only as accurate as the equipment gathering it. Always keep an eye on load weights and do a "reality check" to make sure the data seems in line with what you know about your field. It's also strongly recommended that you run tare calibrations whenever you change fields and whenever conditions change (e.g. wet soil to dry).

Finally, remember: you don't have to figure out your technology on your own. Regardless of what technology you're using, easy-to-talk-to tech support and accessible customer service should be a given. Most technology companies feel the way I do: we love our business, are proud of our technology, and are always happy to make time to help producers! ○

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Where to Start When it's Time to Expand My Spud Storage

CHAD KLEISINGER Business Development and Product Manager • Meridian ArchWall Buildings • www.meridianmfg.com

It happens every harvest – you look at your potato storage capacity and wonder, "Do I have enough – is it time to expand?" When you decide it is time to increase or update your storage facilities, your first question will most likely be, "Where do I start?" Here are some beginning questions to help organize your thoughts as you consider expanding your storage capacity.

- Where is my potato production headed? How much production do I anticipate having in five, 10 years? Is that a realistic goal – what plans do I have to reach my goal?
- How much can I afford to invest now to expand capacity for future production – how far will this take me toward my long-term goals?
- How will my potatoes be used – for processing or for the fresh market? How will this affect the features I need in a new storage facility?
- Do I need state-of-the-art automation that anticipates future technology?
- What are potential building designs, styles and builders? What are their individual strengths and preferences? How do they align with my preferences? Are their designs sufficiently flexible to accommodate my specific requirements?
- What are my companies of choice for storage ventilation systems?
- What is my timeline for completion?

INTERVIEW MULTIPLE BUILDERS

Each new project begins with two plans – your vision of what your ideal facility should be and the builder/supplier's vision of what is most reasonably and economically possible. The finished project will most likely be a healthy meld of those two visions. It is a good plan to visit more than one contractor. Listen to their preferences, understand how their experiences are shaping their preferences. Do they offer good, better, best solutions? Understand the differences. Know how each builder's solution compares to the others.

In the long run, what starts out as least expensive today can become most expensive if it soon becomes outdated and must be replaced with newer, up-to-date equipment. Today's best quality system package, for example, will become a less competitive, good quality product when it is replaced in a few years by a newer and improved best quality package. Think mobile phones and how quickly today's "must have" device becomes tomorrow's cast-off.

In future articles I will present more detailed discussions to help you plan and evaluate options to expand your potato storage capacity. ○

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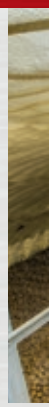

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Disease Alert

A new strain of late blight has been identified in tomato fields in New York State. Here's why potato growers on both sides of the border would be wise to take notice. BY MARK HALSALL

ATTENDING WINTER TRADE shows and meetings are a favoured ritual for many potato growers. Certain topics tend to dominate the conference circuit every year, and one that could have a lot of farmers talking this winter is a brand-new strain of late blight called US-25.

"This is a topic that will be discussed at winter meetings," says Eugenia Banks, a potato specialist with the Ontario Potato Board. "There's not much awareness about US-25 yet, and it's very important to communicate this finding to growers."

Discovered in three commercial tomato fields in upstate New York State in the summer of 2018, US-25 was found to be a novel strain by plant pathologists at Cornell University, an Ivy League research university in Ithaca, New York. So far, it hasn't been reported anywhere else in the United States or Canada.

> "We are learning as much as we can about this particular strain because if it does show up again, we want to be able to give growers the absolute best recommendations to help them mitigate losses."
>
> — CHRISTINE SMART

"It was first identified on June 18," says Christine Smart, a professor of vegetable pathology at Cornell. "We did the standard genotyping … and it was determined to be different than any genotype we had ever seen before."

Smart says the origins of this new strain remain a mystery. Her team is planning to meet with officials from the New York State Department of Agriculture and Markets to try to figure out where US-25 came from.

Smart says although US-25 has been found only in tomatoes thus far, Cornell researchers have shown it can infect potato plants under laboratory conditions. For this reason, she's been keeping potato extension and research pathologists on both sides of border informed of the latest developments around US-25.

Eugenia Banks is a potato specialist with the Ontario Potato Board.
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Smart says there's a chance US-25 could jump species and grow to become a dominant late blight strain like US-23 currently is in potato. US-23 infects both tomatoes and potatoes and is very aggressive on potato tubers.

"It's always possible. Over the years, there'll be one predominant strain and then that gets overtaken by the next one that comes along. We'll have to wait and see if that happens with US-25," Smart says.

"We know that it can survive on potato plants, so there's no reason to believe that it can't move to potato. In the field, we just haven't seen it."

Smart says there's also a chance this new strain could simply disappear.

"In the past, we've had isolates that were only seen for one or perhaps two seasons, and then not again," she says. "But we are learning as much as we can about this particular strain because if it does show up again, we want to be able to give growers the absolute best recommendations to help them mitigate losses."

Smart says the fact that US-25 hasn't turned up in potatoes yet may suggest it may not be as aggressive as other late blight genotypes like US-23 and US-8, which have afflicted potato crops in recent years.

As Smart points out, "hot and dry conditions just don't support late blight" so whether US-25 manages to gain a foothold in tomatoes and then possibly potatoes will depend a lot on the weather.

"We had a very dry summer until mid-July and the environment plays a huge role, so we'll be watching really closely next year to see if we pick up US-25 anywhere else," she says.

Christine Smart, professor of vegetable pathology at Cornell University.
PHOTO COURTESY OF CRAIG CRAMER.

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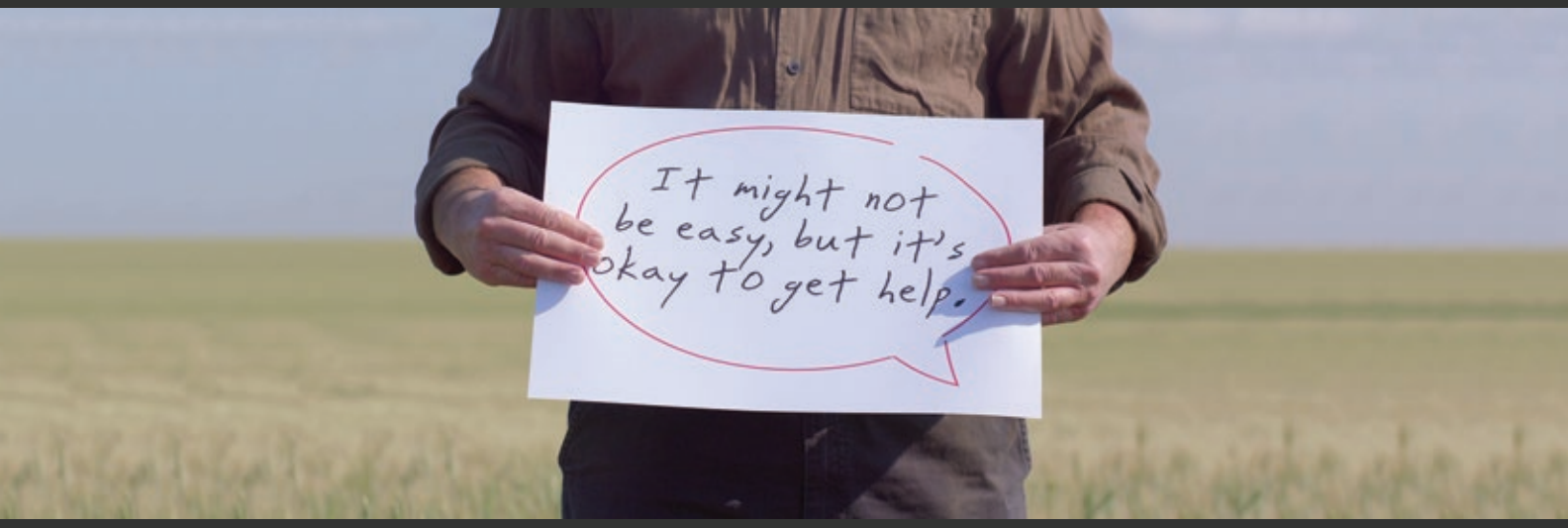

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"If a field is infested with oospores, the late blight threat will be present in that field from planting to harvest for many years."

— EUGENIA BANKS

Banks believes if US-25 ends up becoming a dominant species south of the border, there's little doubt it would eventually turn up in Canada since late blight spores can travel hundreds of kilometres on storm fronts.

Banks says one significant aspect of US-25 is that it's an A2 mating type, unlike the current predominant strain of late blight, US-23, which is an A1 mating type.

According to Banks, if US-25 infects a tomato or potato plant that's also infected with US-23, they can mate with each other and produce sexual spores called oospores, which can result in new strains of late blight.

Another problem, she says, is that oospores can remain viable in the soil for years at a time.

As Banks points out, all late blight strains can overwinter in seed tubers, cull piles or tubers left in the field that do not freeze in the winter — but only oospores produced by A1 and A2 mating are capable of overwintering in the soil itself.

"If a field is infested with oospores, the late blight threat will be present in that field from planting to harvest for many years," says Banks.

Smart agrees that having US-23 and US-25 together would be bad news for potato growers.

"What we don't want is for both of these isolates to end up in the same field and run the risk of sexual reproduction that then produces these long-lived overwintering spores," she says, adding that late blight oospores are currently found in some soils in Mexico but not in Canada or the United States.

Smart says in instances where oospores are present in the field, tomato and potato plants will be at risk for late blight infection sooner than normal. In this scenario, she adds, it would make sense for growers to modify their late blight management strategies and start spraying fungicides earlier in the season.

Smart maintains the best way for growers to protect themselves from new late blight strains like US-25 is to keep on doing what they already do. "All the things they do to prevent late blight in any given season, such as good crop rotations and cultural practices like getting rid of cull piles, are going to be the exact same strategies they'd want to use to make sure US-25 doesn't go anywhere," she says.

One tool that might not be available in the event that US-25 ever becomes a problem for potato growers is metalaxyl, the active ingredient in Ridomil. The popular fungicide has provided good control for US-23 but US-25 has been shown to be metalaxyl resistant.

"Ridomil is an extremely effective fungicide and it's really nice to use Ridomil because of its systemic nature, but there are other effective fungicides on the market as well," says Smart. "I think that taking Ridomil out of the mix to control US-25 with the tools that are available right now might not have a huge impact."

Banks agrees. "US-25 is resistant to metalaxyl but fortunately there are other reliable late blight specific fungicides that when applied timely and in combination with many cultural practices, can reduce the incidence of late blight," she says. ○

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Potato Breeding: A European Approach, Part I

Marcel Bruins, editor of *European Seed*, discusses the challenges and opportunities of breeding new potato varieties with the leaders of Europe's major potato breeding companies. BY MARCEL BRUINS

OF THE TOP 10 food crops in the world, potato comes third, and is the No. 1 non-grain food product. Originally grown in the Andes, the Spanish introduced the potato to Europe in the 16th century, and, after a bumpy start, potatoes have been a very popular food source over the past two centuries.

The potato is a healthy, low-calorie, high-fibre food that offers significant protection from cardiovascular disease and cancer. Additionally, potato tubers are a good source of vitamin B6, potassium, copper, vitamin C, manganese, phosphorus, niacin, dietary fibre, and pantothenic acid. They also contain a variety of phytonutrients which have antioxidant activity. No wonder the potato is such a beloved crop across the globe.

Marcel Bruins, editor of our sister publication *European Seed*, sat down with the leaders of five major potato breeding companies in Europe to learn more about the challenges and opportunities of breeding new potato varieties. Piet Smeenge, director of Kweekbedrijf Smeenge-Research; Vanessa Prigge, Crop Improvement project manager at Solana; Gerard Backx, CEO of HZPC; Jan-Paul Bandsma, product manager at de Nijs Potatoes; and Guus Heselmans, R&D manager of C. Meijer B.V., provided insight on this favoured crop.

POTATO BREEDING: IN IT FOR THE LONG RUN

Potato breeding takes a lot of time, says Smeenge, as only one selection per year can be made. In total, it takes 10 – 12 years before protection and listing. However, European companies are working on ways to shorten that time frame. "In potato, hybrid breeding is still not possible, however, KWS, Solynta, HZPC and Bejo are working on it. So maybe it will be possible in the coming 10 years."

The multiplication rate of a vegetatively propagated crop is much slower when compared with other seed crops, making the selection process slower and

Potato trials in Scotland. PHOTO: SMEENGE RESEARCH.

the introduction phase longer. "Hence, many more years are required," says Backx. Also, in general, vegetatively propagated crops have a more complex genome, which is the biggest hurdle.

"Potato is tetraploid and enormously heterogeneous. Working with diploid plants is possible, but so far this is only done in the research phase. Apart from that, double haploids might be an option, but not an easy route."

Bandsma agrees. "When you have a good variety produced by vegetative methods, you know what kind of variety you will get after multiplication [always the same]. Although potatoes are multiplied vegetatively, it is possible to improve a variety by traditional stem selection. For example, you can improve tuber count, tuber shape or other things."

The main challenges associated with the vegetative nature of potato production are the low multiplication rate and the high risk of tuber-borne disease transmission.

It easily takes beyond the fourth field year to reliably assess tuber yield performance due to the low multiplication rate of less than 15 tubers per plant, which means the first years are dedicated to tuber production for testing purposes, says Prigge.

"This lengthens the breeding cycle and also impacts the selection decisions: at the time of the first yield trials, and out of necessity due to limited storage capacity for this bulky crop, more than 99 per cent of the original material may already have been discarded based on visually assessable traits such as tuber traits and breeder's visual preference," she says.

"In addition, every multiplication cycle bears the risk of infection of tuber-borne diseases, especially viruses, so extensive testing of tuber samples from each selected genotype is performed."

Another major disadvantage of vegetative propagation is the ease of farm-saved seed, which in some market segments in European countries easily amounts to 50 per cent, while in emerging countries it is not uncommon to observe 90 per cent farm-saved seed without compensation. "Considering revenues from seed sales and royalties are breeders' main source of income, much is lost that could otherwise be reinvested in R&D activities," she adds.

> "In potato, hybrid breeding is still not possible, however, KWS, Solynta, HZPC and Bejo are working on it. So maybe it will be possible in the coming 10 years."
>
> PIET SMEENGE

EUROPEAN BREEDING GOALS

The potato market has many sectors, says Backx, which is reflected in breeding programs. For example, potatoes for processing (starch, chips, French fries) require other characteristics than potatoes for fresh consumption. For processing, items like colour, success in processing, efficiency in the factory, taste, length, among others, are important.

"Those words translate into a long list of characteristics one has to search for. Next to that, it's yield, disease resistance and tolerances, et cetera, for the grower. Can you store and handle the variety or not? Can you harvest the variety mechanically? Can you produce seed potatoes of that variety? All those items are important," he says.

"On the other hand, for the fresh market, the taste, skin, colour, and appeal are important. The fresh market is very diverse. Different areas have different preferences, and consumers like to have potatoes for firm cooking, or to make mashed potatoes, or homemade French fries. All those uses require other characteristics. Therefore, we clearly define for what markets we like to create varieties, and what selection criteria we need to score. For every sub-segment of the market, it's a long list of characteristics."

In short, Prigge says, those characteristics include quality, agronomic performance, and disease resistance. "In reality, there are more than 50 traits our potato breeders take into account during the selection process, which means the selection intensity per trait is quite low.

"We develop improved potato varieties for many potato sectors, mainly the crisp [chip] and French fries industries, the starch industry, and the retail sector, all on a global scale. Hence, next to a set of common goals like early maturity or yield capacity for all segments, there are always additional goals specific to the demands of a certain market segment," she adds.

According to Heselmans, yield, stability, resilience and quality in-crop and in processing are the most important factors. Then, in many regions, part of the crop has to be stored for a long time. "To have a reliable result for potato crops within the whole chain, it's a challenge to combine all these factors. Sustainability is the key factor in decision making."

For Bandsma, the most important goals are underwater weight (high dry matter content), early to medium-early maturity, a strong tolerance against heat and drought, and usefulness for French fries, crisps, export varieties and table potatoes (yellow fleshed). "Potato is attacked by several diseases, such as late blight, common scab, silver scurf and Rhizoctonia, and many others, so we need good resistance against those diseases."

Smeenge lists yield, consumer acceptance, resistance to diseases, adaptation to different climates and usefulness for table, crisps and French fries as the most important breeding goals for his company.

GENETIC MATERIAL ACQUISITION

Where do these companies find the genetic material for important characteristics like disease resistance? Having a stake in a breeding company helps.

"We are shareholders of the breeding company FOBEK, and they are making crosses based on our wishes. They have quite a genetic diversity for resistances. They are getting their genetic diversity from their own seed lines and making their own crosses and backcrosses, as well as cooperation with different companies," says Bandsma.

"Secondly, we work with free hobby breeders. They also have genetic diversity for the genes. They get their genetics from their own seed lines, making their own crosses, working with other hobby breeders, and trying to get seed lines from potato companies." Some of his company's goals are potato cyst nematode, wart disease, common scab and late blight.

Potato quality trials for crisps, fries and cooking. PHOTO: SOLANA.

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>
> — GUUS HESELMANS

For Prigge, the anticipated market determines the relevance of a disease for the company's potato breeding program. At the moment, varieties with resistance to the white nematode *Globodera pallida* are in high demand from European farmers, no matter what market segment. New and highly virulent nematode strains have overcome the resistance of popular resistant varieties.

"In this case, we return to the vast collection of potato relatives held in genebank collections to identify genotypes that are resistant to these more virulent *G. pallida* strains, and try to introgress these loci into our improved breeding populations. We did the same for late blight or root knot nematode resistance because little genetic variation for resistance against these diseases was available in European potato varieties."

She says with other diseases, such as blackleg, there is hardly any breeding possible because they lack the prerequisites for breeding progress: genetic variation and an efficient and reliable phenotyping system.

Resistance breeding is an important column in the Meijer breeding program, says Heselmans. In areas with intensive cultivation, soil-borne diseases like wart disease and nematodes create huge problems, whereas late blight is an important threat on a global scale. Besides that, for many other diseases like silver scurf, and common scab and virus disease, there is a minimum level of resistance required.

"To retrieve resistance toward diseases into our commercial potato breeding program, Meijer cooperates with universities and genebanks to introgress new resistance genes from wild species. It is of huge importance that genetic diversity is maintained. For this reason, recently a group of Dutch potato breeders decided to actively support the Dutch genebank to maintain and release new material."

Nematodes, especially the two species *G. rostochiensis* and *G. pallida*, are the most important pests to consider, according to Smeenge. He draws his genetic diversity from starch varieties, from the genebank at Wageningen University, and from his own breeding lines.

After that, late blight is next on his list. He says he gets the genetic diversity from the Louis Bolk Institute through the Bio-Impuls Program, and his

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own breeding material. Third is common scab and virus disease. Here, genetic diversity comes from his own breeding program which has already been in existence for more than 45 years.

When it comes to disease, Backx says the most important ones depend partly on what the variety will be used for and in which area it will be grown. Since late blight is a disease found everywhere, resistance is very important. However, a single resistance is quickly broken. Thus, complex multiple resistances need to be worked on, which is not easy, he says.

"We should not forget that common scab is not an issue for all growers in all areas . Other items like nematode resistance are the most important," says Backx. He finds genetic diversity for resistances in the genebank, but he also uses other *Solanum* types and existing varieties. "That is the common way to create genepools," he says.

LATE BLIGHT, CISGENESIS, AND FURTHER BREEDING

According to Backx, resistance can only be effective if it's a multiple resistance, based on different systems. The fungus is that quick to adapt. Through classic breeding this is hardly possible. With cisgenesis it has been realized.

"Here you get to the question whether a product created through cisgenesis should be allowed on the market. It is considered one of the new breeding technologies. If we could use those techniques, it would help breeders enormously, and with that farmers and the environment. Personally, I would be in favour of allowing a proper cisgenesis product as long as you can prove there is no strange DNA [of a completely other species] in it."

Meijer supports the position of Plantum — the Dutch association for the plant reproduction material sector — on this subject, which indicates cisgenesis is a new plant breeding method that does not result in foreign DNA in the end product, so no species barriers are crossed and should, according to the Dutch government, not be regulated as GMO, says Heselmans.

Bandsma believes there are sufficient genes against late blight. "The only thing which is very important is we need to stack more genes of late blight into a potato variety or seed line. We think it is possible to achieve a good variety, which is very strong against late blight, without cisgenesis," he says.

"It will take some time. We know FOBEK has good genetic diversity for late blight genes. We don't like GMO, but we believe that cisgenesis could be a good addition to potato breeding. Using genes against late blight from another *Solanum* family could be a good opportunity to solve the problem. On the other hand, how quickly will the late blight fungus be able to adjust or break the resistance?"

Potato berries after crossing. PHOTO: A. DE NIJS & ZN B.V.

According to *NBTPlatform.org*, cisgenesis is very similar to conventional breeding, but allows for a more specific transfer of genes between closely related crossable plant species. With this technique, a specific trait, such as disease resistance, is transferred from the same or closely related crossable plant species to another, without altering the plant's overall genetic makeup.

Smeenge says cisgenesis is the transplanting of genes within the species *Solanum* tuberosum. "The benefit of cisgenesis is it can lead to a new variety in a very short time. So, I think it should be released for production and special for further breeding. However, I am against transplantation of genes between different species, for example potato and sugarbeet. I have an ethical problem: we are going to play God."

Several late blight resistant varieties have been commercialized lately, bred by classical methods of recombination and selection, including their own variety Connect, says Prigge.

"These varieties stem from extensive research and pre-breeding efforts in both the public and private potato sectors aimed at exploiting resistance loci from unadapted *Solanum* species for introgression breeding programs in potato," she says.

"Whilst these pre-breeding activities are very time-consuming, sustainable resistance gene stewardship requires stacking of several resistance genes, and that's where we see the great advantage of new breeding techniques, because with cisgenesis, for example, you can develop stable resistances more efficiently." ○

Editor's Note: Part II will be available in Spud Smart's Winter 2019 issue. The second part of this feature will examine breeding for abiotic stress tolerance, improved nutrition and health characteristics, additional European breeding targets, access to germplasm, and the new regulations on access and benefit sharing. Also included are where European breeding companies are focusing their development investments, and future products and innovations in the pipeline.

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L-R: Romain Cools, president, World Potato Congress; Andrew Doyle, Minister of State at Department of Agriculture, Food and Marine; and Michael Hoey, president of the Irish Potato Federation.

Ireland to Host WPC 2021

The Congress will take place from May 24-27, 2021 in Dublin. BY JANET KANTERS

NO OTHER EUROPEAN nation has a more special relationship with the potato than Ireland. So, it is only fitting that the 11th World Potato Congress will be held in Dublin, Ireland, May 24-27, 2021.

The congress will be hosted by the Irish Potato Federation, with the support of the Department of Agriculture, Food and the Marine, Bord Bia (Irish Food Board), Fáilte Ireland (Irish Tourist Board) and Teagasc. It will truly be an all-Ireland event because although the congress proper will be located in the historic venue of the Royal Dublin Society (RDS) in Ballsbridge, a suburb of Dublin, Northern Ireland will also be involved in the congress.

"With a long tradition of involvement in agriculture dating back to the 18th century, the RDS will be a fitting venue for the WPC in 2021," says Romain Cools, president and CEO of World Potato Congress Inc.

The RDS was established in 1731 and is one of world's oldest philanthropic organizations. "The RDS is dedicated to seeing Ireland thrive both culturally and economically, and works to see this happen through science, the arts, agriculture, enterprise and equestrianism."

Liam Glennon is the head of the organizing committee that has already started the preparations of the next congress, which will focus on "the changing world of the potato." The committee will take into consideration the increased attention of issues such as climate change, sustainable production, food security and making use of modern technology.

"This congress will focus on the innovative trends influencing the potato value chain," says Cools. "It will be the global premier network event for the potato professionals, including farmers, traders, processors, suppliers of machinery, equipment and services, scientists, food service and retailers, and professional media.

"And for a lot of potato professionals from the U.S. and Canada who are of Irish descent, this event will also offer a unique opportunity to add a visit to the land of their ancestors to their program."

The Irish Potato Federation has also secured the simultaneous hosting of the Europatat Congress – the annual congress of the European association of the potato trade. Both events will become a week-long focus on the potato, the third most important food crop in terms of global consumption.

Andrew Doyle T.D., Minister of State in the Department of Agriculture, Food and the Marine stated: "I want my Department and Bord Bia to continue to work with the Irish Potato Federation to make this event a great success for the Irish food industry."

The Irish potato sector has always been innovative and wants to illustrate this to the global potato professionals. Michael Hoey, president of the Irish Potato Federation, adds this congress will shine a spotlight on the importance of the potato in Ireland and across the globe, and become a centrepiece of world-class marketing excellence.

Winning the World Potato Congress for Ireland is "the culmination of a lot of hard and creative work by a very dedicated committee," says Hoey. "I know that the 2021 congress will shine a spotlight on the importance of the potato in Ireland, and across the globe, and become a centrepiece of world-class marketing excellence."

Drombeg stone circle (also known as The Druid's Altar), one of the most visited megalithic sites in Ireland, is located about 330 km southwest of Dublin.
PHOTOS COURTESY KEYNOTE PCO

"This congress will focus on the innovative trends influencing the potato value chain."

ROMAIN COOLS

During WPC 2018 in Cusco, an Irish delegation will be presented the WPC flag by the Peruvian hosts of this year's event. From that moment on, the campaign to set up the program and communicate about the event at the most important potato events will start. The website wpc2021.com has already been launched, and people can already subscribe to a newsletter updating them on the event and the program.

WPC 2021 in Ireland aims to gather 1,000 delegates and their partners, and has worked out a number of network events in some of the most interesting locations in Dublin. All hotels will be within walking distance of the congress venue, which will also enable (informal) meetings and gatherings during the congress. A new offer to companies will be the possibility to have business contracts signed on the WPC. ○

Revolutionizing with CRISPR

CRISPR-Cas9 is revolutionizing the way we create novel crops, but why should growers care? BY ALEX MARTIN

THERE ARE PLENTY of buzzwords surrounding the seed industry in 2018 — GMOs, gene-editing, organic and, of course, CRISPR. While we know a lot surrounding the debate of GMOs versus organic and whether or not GMOs and gene-editing overlap, one gene-editing technology still seems a mystery.

So, what exactly is CRISPR-Cas9, and why does it matter to the seed industry?

CRISPR is a genome editing system that could benefit the seed industry by allowing breeders to make minor changes into the genomes of existing high performance cultivars that will result in enhanced yield, ability to withstand stresses such as drought, heat and diseases and give crops the nutritional qualities that consumers are looking for.

"From an academic perspective, I like to think of plants as machines," says Nat Graham, a postdoctoral associate from the Voytas lab at the University of Minnesota. "Everything runs on a code — DNA. What we're focused on from a genome engineering perspective is how can we manipulate DNA for our gain?"

"With traditional transgenics, you would take a genetic sequence and randomly insert it into the DNA, which can disrupt the sequence," Graham explains. "If it disrupts, you just keep trying again until it doesn't cause a problem. If you want to turn a sequence off, you'd need to use mutagenesis. CRISPR-Cas9 is a new tool for genome engineering, and it allows breeders to go through the genome, find a sequence and precisely alter it."

Graham continues by explaining that currently, CRISPR is used to "turn off," sequences through mutation. His current research focuses on how to insert new sequences by using CRISPR-Cas9, but he emphasizes that most products that come from CRISPR currently turn off mutations.

Gijs van Rooijen, chief scientific officer of Genome Alberta.

CRISPR-Cas9 is a protein found in bacteria that were under attack from bacteriophages. It can recognize sequences of invaders and cut the DNA sequences apart. Researchers discovered that the proteins could be programmed to recognize a new sequence and introduce mutations site-specifically into the DNA sequence.

There are a few different ways that CRISPR works to "turn-off," sequences. Graham explains that one way is to alter the sequence, thus the gene no longer makes sense. If the gene sequence doesn't make sense, it wouldn't make the product anymore.

Another way to "turn-off," the sequence is by completely removing it, which would make the sequence no longer functional. It would stop making the product, because it would no longer be there.

Finally, you could alter current genes. In this idea, instead of traditional mutagenesis, where a researcher would create a desirable sequence, find the sequence to be changed and replace it with the new, more desirable sequence, a researcher could find a specific base pair in a sequence and alter it completely. Graham likes to use sentences as examples for this idea: if you had the sentence "the cat was fat," and you wanted to change it to "the rat was fat," CRISPR would allow a researcher to find the sentence and change the "c" to an "r" to create the desired sentence.

Another example he uses is that CRISPR directly edits gene "text," while genetic modification is more like inserting a new chapter into a book.

"Traditional breeding takes advantage of natural mutations to find new traits," Graham says. "The difference is we're causing mutations to happen in the way we choose. We're accelerating the natural process."

"CRISPR is new from an academic perspective — it hit the science journals in 2012," Graham says. "We're still learning about it and how to make it better. There's a lot we still need to learn."

CRISPR is also beneficial to the seed industry because it won't be regulated like GMOs. Gijs van Rooijen, chief scientific officer of Genome Alberta, says that CRISPR regulations are similar to traditional genetics across Canada.

"If you're making minor changes such as deletions or insertions, it isn't different than anything from traditional breeding," says van Rooijen.

In Canada, crops are regulated through plants with novel traits (PNT). Regardless of how the plant was created, be it through traditional breeding or gene-editing, the government must ask questions about whether or not the trait is novel and if it would make the plant more 'weedy' or difficult to control.

"Whether crops are generated through traditional breeding, GMOs, or gene-editing, they will be looking at the risks associated in relation to human health, animal health and environmental health," van Rooijen says.

"The government also takes into account trade risks when dealing with a new cultivar," van Rooijen says. "Right now, if you're growing a GMO variety, chances are it's going to cause more issues with your trading partners, particularly in Europe. However, if you're growing traditional varieties, it's usually okay trade-wise."

Currently, one of the only gene-edited varieties starting to be marketed in Canada is from Cibus's Rapid Trait Development System. Developed in 2015, Cibus has begun trialing a sulfonylura (SU) canola trait, which will be marketed with their Draft herbicide. Together, they can control key weeds such as common buckwheat, common ragweed and redroot pigweed.

"With the advances in CRIPSR and gene-editing technology, the technology and regulations are actually straightforward, so smaller companies are encouraged to begin developing their own products," van Rooijen says. "CRISPR is actually giving smaller companies the ability to compete with larger companies."

Van Rooijen says that currently, CRISPR research in crops is focused around developing varieties similar to GMOs. However, in using CRISPR in North America, these crops can be regulated as non-GMO. In particular, research has been focused on herbicide tolerance.

"You can imagine that a lot of companies are beginning to look at traits that focus on higher nutritional quality, such as high-oleic soybeans or high-fibre wheat," van Rooijen says. "These varieties are likely to be seen in the next couple of years. Since companies can make edits to the existing genome, varieties can be developed much faster, but current research focuses on traits that have already been approved."

Nat Graham is a postdoctoral associate from the Voytas lab at the University of Minnesota.

> "With the advances in CRIPSR and gene-editing technology, the technology and regulations are actually straightforward, so smaller companies are encouraged to begin developing their own products."
>
> — GIJS VAN ROOIJEN

Currently, through traditional breeding, it takes around seven years to create a new desirable variety. With genetic modification, it still takes around 10 to 12 years due to regulatory barriers and high costs. Currently, researchers believe genome editing will only take around three to five years, since gene-editing is more precise than other breeding methods.

However, the best part about CRISPR would be it wouldn't change the way growers have been farming already.

"Growing gene-edited crops won't be much different from growing GMO varieties," van Rooijen says. "By providing the available traits, it means growers can use herbicides only when needed, which is better for the crops and the environment. CRISPR will provide similar benefits that GMOs already bring, however they'll be regulated differently."

CRISPR could provide growers with improved disease resistance, drought tolerance and higher yields, while providing consumers with better food quality, nutrition and a longer shelf life.

Van Rooijen also believes CRISPR has the potential to expand grower's export markets. "Growers have the potential to expand into markets where people are weary of GMOs," he says.

In addition, since CRISPR crops are easier to create than GMOs, van Rooijen says there's a possibility that the seeds might be sold at a reduced rate in comparison to other GMO traits.

However, van Rooijen says the biggest benefit CRISPR will have is an environmental impact.

"There's no question that consumers are concerned about the environmental impact of how we grow our food," van Rooijen says. "We need to grow more efficient crops. With CRISPR, we can grow the amount of food we need to feed the population, but we also increase our efficiency while reducing stress on the environment."

"CRISPR and gene-editing technologies are revolutionizing the way novel traits can be created," says van Rooijen. "The positive effects outweigh the negatives, and we must continue to find the consumer's support so that we can provide the world with better opportunities for growers, consumers and the environment. It's almost irresponsible to not take this opportunity."

We've come a long way in agriculture. From crop domestication to cross breeding to plant breeding based on genetic information to GMOs, it seems the natural way to go from here is target breeding. Whatever may happen with these technologies, it seems one thing is for certain: CRISPR and gene-editing are paving the future of agriculture. ○


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NOV. 13 – 15
Alberta Potato Conference and Trade Show
Enoch, Alta.

JAN. 29 – 31
Manitoba Potato Production Days
Brandon, Man.

DEC. 5
Ontario Potato Board Annual General Meeting
Guelph, Ont.

NOV. 21
P.E.I. Potato Board Annual Business Meeting
Charlottetown, P.E.I.

NOV. 23
CRAAQ Potato Symposium
Lévis, Que.

DEC. 7
Potatoes New Brunswick Annual General Meeting
Grand Falls, N.B.

JAN. 9 – 10
Potato Expo
Austin, Tex.

JAN. 11
National Potato Council Annual Meeting
Austin, Tex.

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eye on the nation

MANITOBA

Dan Sawatzky, General Manager,
Keystone Potato Producers Association

Heat and lack of rainfall highlight the growing conditions for Manitoba this season. Above 30 C days were double the normal, which will have some effect on yield and quality. 2011 was the most recent year where we experienced similar heat, which resulted in significant yield losses.

Dry conditions were carried over from last fall and winter, where little precipitation fell. This summer's rainfall was below normal in all regions ranging from 75 – 85 per cent to below 65 per cent for significant parts of the potato-growing region.

Although the 2011 experience saw additional infrastructure built, we still experienced some reservoirs run short of water in August, and most being completely drawn down. Producers are much better prepared than in the past and continue to add irrigation infrastructure capacity. We will be dependent on snowfall this winter for run-off, or spring rains next season, to refill these holding ponds.

The early harvest of Rangers has resulted in average yields with good quality. Some limited harvest of both Umatilla and Innovator varieties is looking promising. The concern of heat and drought, however, is on the Russet Burbank crop, which has not yet begun to be lifted. Early test digs have shown some evidence of stress reflected in tuber shape and size profile. The effect on yield will not be determined until the main harvest gets underway in mid-September. A positive result of the dry season has been the absence of blight.

The number of farms in the province has decreased by 33 per cent since 2011, and those remaining have continued to make investments to gain efficiency while striving for improved yield and quality. A high degree of management and work has been exerted this season. The 2018 Russet crop will be a test to determine if their efforts will be rewarded.

Plan to mark your calendars to attend our annual Manitoba Potato Production Days Conference and Trade Show. The dates and location are January 29, 30 and 31, 2019, at the Keystone Centre, Brandon, Man. More info is available at www.mbpotatodays.ca

ONTARIO

Kevin Brubacher, General Manager, Ontario Potato Board

The 2018 growing season has been a challenging one. Mother Nature didn't seem to want to cooperate. Most areas of the province received little to no rain; some areas were better off, but still did not receive the rain we needed. Despite some setbacks due to the weather, growers were able to produce a decent crop. Yields on the early crop are down significantly. Marketing of the early crop is beginning to wrap up and harvest of storage potatoes is in full swing. Early indications for the 2018 storage crop are showing average yield with good quality. Dr. Eugenia Banks continued her second year of the late blight management research project using innovative spore trapping technologies. With the dry weather, late blight never emerged as a major issue. The monitoring program gave growers good peace of mind throughout the season however. Thank you, Eugenia! On August 22, Vanessa Currie hosted the Ontario Potato Research Field Day at the Elora Research Station showcasing over 100 potato varieties for the processing and table markets. The next day, August 23, Dr. Eugenia Banks hosted the Ontario Potato Field Day at HJV Equipment in Alliston. This event has grown into one of the largest in the industry! With attendees coming from across Canada, many enjoyed the events which were back to back in order for them to attend both. These are definitely two events you should plan to attend in the future. Thanks again to Vanessa and Eugenia, your hard work and dedication to the potato industry is a benefit to us all!

The Ontario Potato Board will host its Annual General Meeting Wednesday, December 5, 2018, in Guelph, Ont., at the Delta Hotel and Conference Centre. If you are interested in attending, or becoming an exhibitor/sponsor of this event, please contact the Board Office at (519) 846-5553.

ALBERTA

Terence Hochstein, Executive Director,
Potato Growers of Alberta

The effects of our late spring start appear to be behind us. Over the course of the summer most of our crops have caught up, and in some instances, appear to be ahead of an average year. One instance of note is our older, tired fields, which have had 6, 7 or 8 potato rotations over the last 50 years are experiencing a noticeably lower amount of 'early die' this year. The jury is still out about whether the late seeding had anything to do with this occurrence.

Our field run crop appears to be slightly above our long-term average in regard to yield. Quality is excellent so far, with slightly higher than normal gravities. Our chipper yields appear to be excellent as well. As of Sept 15, we are just starting on our Russet Burbank harvest, but all indications are we will have a relatively good crop here as well. It is always difficult at this time of year to accurately predict what we will have for a crop. Two days of freezing, bad weather and all of this can change.

The Potato Growers of Alberta, along with all other potato-growing areas across Canada, continue to engage with PMRA on the many chemistry reviews that are happening. It is through the Canadian Potato Council that we are able to provide a unified voice and represent our industry across Canada.

As the Alberta industry continues to move forward with the Cavendish expansion, set to open in July 2019, many of our growers are undergoing new storage builds on their operations. As in most agricultural expansions, the background work and preparation is often a couple of years ahead of the actual startup date. This also includes our seed industry ramping up their production to meet the future demand.

The PGA AGM and Conference has changed location and venue for 2018. Our event will take place Nov. 13 – 15, 2018, at the River Cree Resort in Edmonton, Alta. For more information please contact the PGA office at 1 (403) 223 2262.

NEW BRUNSWICK

Jean-Maurice Daigle, Director of Market Information, Potatoes New Brunswick

The 2018 New Brunswick potato crop got off to an earlier start than normal this spring due to dry conditions which made it ideal for planting. New Brunswick planted approximately 4,000 more acres for the 2018 crop, and this was to supply an increase in processing demand from McCain and out-of-province processors.

Early growing conditions in June and July saw very little precipitation. Most of the precipitation was in the form of localized thundershowers of varying amounts and concentrated in the southern portion of the Saint John River Valley.

August brought much-needed precipitation to the valley, again with higher amounts being accumulated in the southern areas. September has been cool and soil moisture levels are adequate now. Early indications for the 2018 crop are showing average yields and quality with some variability based on growing area. Harvest activities have started this month with chipping and early processing varieties. Growers will be starting to harvest storage potatoes in the coming weeks.

QUÉBEC

Clément Lalancette, Directeur general, Les Producteurs de pommes de terre du Québec

As you may know, Quebec potato production is pretty well spread in the province, so crop condition could vary quite a bit between areas. For example, the first week of September was hot, but some areas like Saguenay-Lac-St-Jean and Abitibi-Temiscamingue had cold nights with temperatures between 0 – 2 C.

We received good precipitation, but some areas did not receive enough water. One area, Bas-St-Laurent, will ask for AgriRecovery assistance, since they've suffered a drought for the last two years. We think the potato calibre will be on the small side, but with the weather improvement in the past weeks, it could help to regain size for the long varieties.

We expect an average yield of about 285 hundredweight per acre, which is much lower than last year at 306 hundredweight per acre. The Eastern market should be in balance again this year, so we are optimistic about the prices. With no late blight cases, the quality seems to be good, so we expect a good season.

The processing demand is very good. The exchange rate is helping exportation but some U.S. growers put pressure to reduce them, so we will see what's going on. We are pretty happy about our new research consortium starting work with a minimum $300,000 budget per year for the next five years!

BRITISH COLUMBIA

Hugh Reynolds, Reynelda Farms, Delta, B.C.

A good crop is expected, but rain is coming and some fields remain to be dug. May was nice and allowed for a good start, but June was cool and held potatoes back and stunted potential growth. The summer was hot and dry, and hurt non-irrigated fields.

Quality is tops, with most fields getting 120 days compared with last year's 90 days. This year reds and yellows are excellent quality, with lots of count size coming out. The good start allowed for strong summer sales. Early digging was too dry, but this problem was cured mid-September with regular rains, which we wish would now stop. Yield is not tops, but it's very good and much better than last year.

PRINCE EDWARD ISLAND

Darryl Wallace, Chairman, P.E.I. Potato Board

No matter where extreme weather events happen around the world these days, we hear about it in a matter of minutes — from hurricanes and tornadoes to wildfires and typhoons — and we are in awe at the power of Mother Nature. Closer to home we are dealing with the impacts of the 2018 weather season on our farms. The late spring, dry and hot summer and now an early killing frost in many areas of P.E.I. will all affect the yield and quality of the crop we dig. Early harvest is underway and new crop potatoes are going to market.

We are certainly not alone in dealing with weather and environmental factors affecting the crop this year. We hear reports of the impacts of the drought in Europe and overall, *North American Potato Market News* is forecasting a 2.3 per cent reduction in the North American potato crop. We are encouraging our growers to stay up to date with current market reports as we will need to get as much value as we can out of the crop we dig this fall.

The P.E.I. Potato Board is changing the format for its Annual General Meeting this year. Our Annual Business Meeting will be held on November 21, 2018, in Charlottetown. We are pleased to be teaming up with the P.E.I. Department of Agriculture to present a two-day P.E.I. Potato Conference, Trade Show and Industry Banquet on February 19 and 20, 2019. Hope to see you there.

NEW ZEALAND

Biosecurity New Zealand is working with Potatoes New Zealand to respond to a detection of Potato mop-top virus (PMTV) in potato tubers in Canterbury. Incident controller, David Yard, says PMTV is not a food safety issue.

"Potato mop-top virus is a crop disease which, if found to be widespread, could cause some productivity issues for growers. It is a notifiable and unwanted organism in New Zealand under the Biosecurity Act," says Yard.

To date, potato tubers from two properties in the Canterbury region have tested positive for the virus. Further sampling is under way in the region. Yard says this is the first time the virus has been found in New Zealand, however it is common in other countries.

Potatoes New Zealand chief executive, Chris Claridge, says the affected potatoes are from the Innovator variety, which is only used for potato chips.

"The industry is working closely with Biosecurity New Zealand to learn more about the virus, the impact it could have on growers, and to stop any risk of spread," says Claridge. "We will then consider if it is possible to eradicate it, or whether we will need to work with growers to manage its impact over the long term."

The Innovator variety of potato was last imported as germplasm into New Zealand in July 2011. Affected potatoes can display symptoms including distortions to the skin, deep cracking, and rust-coloured arcs, streaks or flecks in the tuber flesh. Biosecurity New Zealand is investigating how the virus may have entered the country.

THE NETHERLANDS

In mid-September, the board of directors and the members council of the Dutch cooperative Avebe held intensive talks on the implications of the extreme drought and high temperatures, which will have a serious impact on the members and the company alike.

The cooperative has decided to increase with immediate effect the current advance payment for potatoes delivered in the 2018 campaign. The advance is 67 euros per tonne with 19 per cent starch. This makes the advance more than 17 per cent higher than last year. Avebe will bear the loading and transport costs as usual.

The cooperative's board of directors indicates that it has looked for ways of supporting its members while maintaining its cooperative principles. "We want to treat all of our members equally without taking any hostages to fortune. We are therefore taking a well-considered approach that does justice to this year's situation and is in line with Avebe's strategic course in which we are working towards a step-by-step increase in the performance price," said chairman of the board, Bert Jansen.

SWEDEN

French fries in Sweden could be about to get shorter, as the hot summer resulted in poor harvests all across Europe. Chips could become over a centimetre shorter as a result of this year's dry weather.

Certainly, the drought has not only affected potato crops in Sweden. Farmers in Belgium, the Netherlands and Germany are now warning of

significantly reduced harvests of the popular dietary staple. That is likely to result in higher prices in supermarkets as well as a reduction in size of harvested produce.

Since Sweden imports the majority of the fried variety of potato from Belgium and the Netherlands, shorter fries are a likelihood in the Scandinavian country. "They could go from six to 4.5 centimetres according to crop estimates and the information we have at the moment," said Anders Huldt, CEO of the industry organisation Svensk Potatis.

A similar Belgian industry organization echoed those sentiments. "Because the potatoes are smaller at the moment, we will all be eating smaller chips," said Pierre Lebrun, head of the Walloon Potato Growers' Association.

SOURCE: FRESH PLAZA AND THE LOCAL SE

UNITED KINGDOM

China's developing taste for chips and crisps will soon be fuelled by British produce, as International Trade Secretary, Liam Fox, secures a deal which enables the United Kingdom to export seed potatoes to China.

The deal is expected to bring major benefits to Scotland, with around 70 per cent of the 100,000 tonnes of seed potatoes exported annually from the United Kingdom coming from Scottish farms. The seed potato export market is already worth an annual £90 million ($152.8 million CAD) to the United Kingdom, with some varieties fetching up to £900 ($1,529 CAD) per tonne.

China is the largest global consumer of potatoes in the world. As the country's demand for potato-based foods increases, the humble spud is now China's fourth staple crop after rice, corn and wheat – with demand increasing at a rapid rate.

EUROPE

Despite significant dissent from some Member States, a recent 'no opinion' position in a Brussels Appeal Committee reviewing proposals for the non-renewal of approval for diquat (Reglone) looks set to result in the loss of this important desiccant next year. In the Appeal Committee, a 'no opinion' position means the European Commission is able to adopt the proposal under its own authority. Proposals can only be rejected in the Appeal Committee if there is a qualified majority vote against.

The National Farmers' Union have recently reported, "It is expected that within the next few weeks the EU will officially publish the regulations banning the active. These regulations usually call on Member States to withdraw authorizations within three months and allow a grace period for use that expires within six months."

This would mean a ban on diquat use is likely to be implemented very early in 2019.

Loss of the active will be a significant blow as it is an effective desiccant which helps achieve skin set (such a key requirement for successful storage) and cuts down the risk of disease spread immediately prior to harvest.

SOURCE: AHDB STORAGE BULLETIN

MEXICO

The National Forestry, Agriculture, and Livestock Research Institute (INIFAP) developed the Citlali potato, an improved variety that is more tolerant to diseases.

This variety, obtained from the production of clones, showed the greatest resistance to the late blight and purple top diseases of the potato, a tuber that in Mexico has a per capita consumption of 14.8 kilograms.

In addition, it meets commercialization standards, researchers said.

The Citlali variety is not completely immune to the purple tip of the potato, but it obtained better results than other commercial varieties, so it will continue to be studied by researchers, the Institute stated.

"The plant, which has small dark green leaflets, stems that have a slight reddish pigmentation, and sparse lilac flowers, develops in temperate climates and has a greater resistance to late blight and purple top diseases; the latter one is a diseases of great importance and complexity in Mexico," they stated.

The experts said that the thin shoots and the internal spots in the tubercle were symptoms of the purple top disease, which decreases the products quality and aesthetics in the fresh market, and affects the producers' economy.

Mexico produces around one 1,716,000 tons of potatoes per year and Sonora, Sinaloa, Veracruz, Nuevo Leon, and Puebla are the leading producing states, according to data from the Agricultural Food and Fisheries Information Service (SIAP).

SOURCE: FRESH PLAZA

PERU

Peru expects to produce 4.77 million tons of potatoes in the 2018/2019 campaign, which goes from August 2018 to July 2019, more than the 4.45 million tons it produced In the previous season (2017/2018), according to the General Agricultural Directorate (DGA) of the Ministry of Agriculture and Irrigation (Minagri).

According to the entity, there will be 576 thousand tons of potato seeds available for the current campaign (2018/2019). They also estimated a loss of 716 thousand tons (15% of the total) and an excess of 260 thousand tons for the national supply (79,800 tons of which will be an excess of commercial offer).

The DGA of the Minagri stated that 99.8% of the 4.45 million tons produced in the 2017/2018 campaign was consumed in the domestic market while 0.2% (700 tons) was exported as processed potato.

They also stated that 19 regions of the country cultivated potatoes in the last campaign. The average productive yield amounted to 15.4 tons per hectare.

156 countries in the world sow potatoes. The main producers are China with 99.1 million tons, India with 43.8 million tons, Russia with 30.2 million tons, Ukraine with 21.8 million tons, and the United States with 19.9 million tons. Peru ranked 14th with 4.45 million tons.

SOURCE: FRESH PLAZA

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BUSINESS NEWS

McCain Foods Appoints New President of Canadian Division

McCain Foods announced the appointment of Danielle Barran to country president, McCain Foods (Canada), a division of McCain Foods Ltd. Barran assumed full responsibility for the Canadian commercial business effective August 20, 2018. Reporting to Jeff DeLapp, North America president, Barran will lead McCain Foods Canada's next stage of strategic development.

"We are pleased to welcome Danielle to McCain. She will be a tremendous asset to both our Canadian business and our North American senior leadership team," said DeLapp. "Under Danielle's leadership, the Canadian team will continue to foster strong customer relationships and drive innovation, further enabling the leadership position of the company and our commitment to bringing joy to families across Canada."

Barran joins McCain with more than 20 years' leadership experience in the consumer-packaged goods industry, including a record of accomplishment for delivering exceptional results that focuses on sustainable top and bottom line growth driving market segment share, sales and profitability.

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New Label Expansion for Frontier Max Herbicide

In September, BASF Canada Inc. was granted a new label expansion for Frontier Max herbicide, for control of annual grasses and key broadleaf weeds in potatoes. In addition to its expanded label on potatoes, Frontier Max is also registered for use on corn, soybeans, dry beans, onions, cabbage and grapes.

"Potato growers continue to look for new solutions for their weed control challenges, and we believe Frontier Max will help our customers to address many of these needs," said Scott Hodgins, BASF horticulture crop manager. "At the same time, the addition of potatoes to the Frontier Max label will help our retail customers to more effectively manage their inventories." With the addition of potatoes to the Frontier Max label, BASF will phase out Outlook herbicide from the marketplace.

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McCain Foods Recognizes Carl Crandlemire as Champion Grower

Carl Crandlemire was named the 2017 – 2018 McCain Champion Potato Grower for Florenceville-Bristol during the 45th annual McCain Growers' Banquet on August 23. This year, approximately 200 guests gathered at the Northern Carleton Civic Centre to celebrate the top growers and their hard work over the past year.

Carl Crandlemire and his wife, Judy, were excited to be announced as the Champion Grower. Crandlemire has been contracting with McCain for 28 years, has held the top 10 position five times, and this was their second time earning the Champion Grower title.

"I'm quite excited to win, and this is the second time it's happened. The last time was almost a decade ago," said Crandlemire. He explained that growing a crop requires "a lot of hard work and careful planning, but sometimes it comes down to luck. The way I always look at it, manage what you can manage, don't worry about what you can't. Mother Nature — we have nothing to do with that."

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McCain Foods Recognizes Les Fermes FC Daigle as Champion Grower

Les Fermes FC Daigle Inc. of Drummond was named the 2017 – 2018 McCain Champion Potato Grower for Grand Falls during the 44th annual McCain Growers' Banquet on August 21. This year, more than 200 guests gathered at Centre E&P Sénéchal to celebrate the top growers and their hard work over the past year.

Fabien Daigle, his wife, Carole, and son, Tobie, were shocked to be announced as the Champion Grower. The Daigle family has been contracting with McCain for 42 years, have held the top 10 position 10 times, and this was their second time earning the Champion Grower title.

"We were very surprised to win because the competition is fierce in this area and we are a smaller family farm," said Carole. Fabien added, "We can't grow as much as others with more land, so we really focus on quality. We ensure the quality of our organic matter to grow the best potatoes."

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Barcelona: Fresh Market Variety

The variety Barcelona looks promising for Ontario, says Eugenia Banks, a potato specialist with the Ontario Potato Board. While at a variety trial at Brenn-B Farms, and in a field without irrigation, Banks noted the potato variety Barcelona performed very well. Out of a number of varieties that fared well this past summer, Barcelona was the highest yielding at 550 hundredweight per acre, says Banks.

Barcelona is a yellow-fleshed variety with smooth skin. The previous year, the variety also yielded well in the areas of Waterdown and Shelburne, Ont. The variety's maturity is medium late and it is moderately susceptible to scab, "similar to Colomba," says Banks. "I saw very little second growth, a surprise in a hot, dry summer with infrequent rain."

USDA Potatoes 2017 Summary Released

The United States Department of Agriculture (USDA) released its Potatoes 2017 Summary (September 2018). According to the report, 2017 potato production is up slightly. All potato production in 2017 totaled 442 million hundredweight, up slightly from the 2016 crop. Harvested area, at 1.02 million acres, was up 1 per cent from 2016. The average yield of 431 cwt per acre was down 2 cwt from the previous year.

The value of all potatoes sold in 2017, at $3.77 billion, increased 1 per cent from the previous year. The average price, at $9.10 per cwt, was up $0.02 from 2016. The quantity of potatoes sold from the 2017 crop totaled 413 million cwt, up 1 per cent from 2016. Quantity sold accounted for 93 per cent of 2017 production, unchanged from the previous year.

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McCain Foods Recognizes Leavitt Farms Inc.

The McCain Top 10 Potato Growers were recognized at the annual McCain Grower Barbecue at the Presque Isle Inn and Convention Center in Presque Isle, Maine, on August 24. Almost 300 guests gathered to celebrate the 2017 growing season and recognize the top ten growers and their achievements.

Champion grower selection is based on the highest standing quality of the following three delivery categories: field direct delivery, winter storage delivery and refrigerated storage. Leavitt Farms LLC placed first in field direct category and second in the refrigerated storage category to receive the position of Champion Grower.

Randy Leavitt, owner of Leavitt Farms LLC, said it was a great honour to receive the Champion Grower award. “It’s something we have always strived for and it was an honor to receive it this year with my dad and my oldest son present. I credit the farms’ success to my hard working and dedicated crew and the knowledge passed down to me from my dad. I am proud of his legacy and we all work hard to make the farm look good, be good and do good every day. It was a great surprise this year.”

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Medium Term Outlook Projects Continued Growth For The Canadian Agricultural Sector

In September, Agriculture and Agri-Food Canada (AAFC) released its Medium Term Outlook (MTO), an economic projection of the domestic and international agricultural markets from 2017 to 2027. This year’s projections show continued growth for the agricultural sector and put Canada within reach of its $75 billion target in agriculture, agri-food and seafood exports annually by 2025.

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Expansion Key for Success for New Brunswick Potato Grower

MICHEL LEVESQUE, who grew up on a farm in New Brunswick's fertile potato belt, was only 24 when he began his own potato operation in Saint-Andre, N.B.

"I started by myself in 1991. My father had a farm and he sold it to my two brothers. I wanted to still continue farming, so I bought a farm a couple of miles away from the homestead farm," says Levesque, who's 52.

Levesque admits the first few years after he struck out on his own were a bit of a struggle.

"I farmed there for two or three years, but there wasn't much I could do with the crop rotation and I couldn't do much expansion on the farm because I only bought about 250 acres," he says.

Levesque started looking further afield to add to his acreage, and he found what he was looking for about 50 kilometres away in the Saint-Quentin area of New Brunswick.

"I rented about 200 acres of land for the first year and it went really well, so I thought, 'I really need to buy some more land,'" Levesque says. Shortly afterwards, he purchased 900 acres that was close to the farmland he was renting in Saint-Quentin, and he's been gradually expanding his farm operation ever since.

Today, Levesque's farm totals approximately 2,100 acres, of which 900 acres are planted in Russet Burbank, Shepody and Prospect potatoes each year to fulfill processing contracts for McCain Foods and Cavendish Farms. In addition to potatoes, Levesque grows barley and oats, as well as a bit of canola in some years. He also grows clover as a rotation crop.

Last year, Levesque's farm was chosen as a top 10 grower for the McCain Foods potato processing plant in Grand Falls, N.B. Levesque says it's the fourth time in the last seven years his farm has received this honour.

Levesque notes that most of his potatoes are grown in a one in three year rotation, which he believes is instrumental in helping to maintain a healthy crop. Typically, he follows potatoes with a grain crop and then clover is grown in the third year of the rotation.

LOVE FOR FARM EQUIPMENT

Levesque recently bought a brand-new planter and he tries to keep up with new technologies, such as GPS, that enable him to increase productivity on his farm.

Michel and Lise Levesque (centre), flanked by son, Marc, and daughter, Veronik.
PHOTO COURTESY OF JAMIE BARD PHOTOGRAPHY.

> "It's been nine years I've been using the GPS now, and every year there's something a little different on it that helps."
>
> MICHEL LEVESQUE

"It's been nine years I've been using the GPS now, and every year there's something a little different on it that helps," he says. "It's been great."

Levesque says he relished learning how to operate farm equipment when he was growing up on his father's farm.

"I liked getting out of school to go harvest potatoes," he says. "That was my big thing, running the harvester."

Levesque still loves equipment, but these days his opportunities to get behind the wheel of a farm machine are few and far between.

"I really enjoy it, but I can't really do it anymore," he says. "Operating the equipment is much harder for me now because I've got to take care of all the rest of the farm business."

Levesque, who still lives in Saint-Andre, says his wife, Lise, helps run the farm operation, which is called Northwest Potato Farms. Their son, 22-year-old Marc, also works on the farm and their daughter, 20-year-old Veronik, helps out as well.

Levesque says he doesn't have any more expansion plans at the moment.

"I think I'm going to try to keep it the way it is now. I have one harvester and one planter, and I can't really grow more with the equipment that I have," he says. "The acres I have now are enough."

○ MARK HALSALL

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