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THE INNOVATION ISSUE
WHAT FARMERS SAID
Autonomous vehicles not on the radar for most farmers

ON OUR COVER: ILLUSTRATION BY MICHELLE HOULDEN

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WHAT'S IN THIS ISSUE

A revolution is coming

What is the future of agriculture? Disruption and chaos. There's a revolution coming, according to agricultural innovation experts, but it will come with opportunities. **BY BARB GLEN, LETHBRIDGE BUREAU**

"FARMERS OF THE FUTURE will be innovators," said Aidan Connolly, chief innovation officer at Alltech, a U.S.-based company with interests in animal nutrition, meat and distilling.

"In the future, my recommendation to farmers would be, buy yourself a passport, go travel the world, read as much as you can, learn as much as you can, and when you see innovations, within reason, embrace them as quickly as possible because I think innovators are the ones that are going to be successful, the ones that are going to survive and thrive.

"That's the farming of the future for me. Innovation."

Connolly and three other experts discussed the future of farming via a webinar held this fall. The role of consumers, use of so-called big data, autonomous vehicles, nutrigenomics and the attributes of future farmers were part of the conversation.

Expanded role of consumers

Mary Shelman, former director of the Harvard Business School's agribusiness program, said farmers of the future will be expected to grow what the market is interested in buying rather than what they prefer to grow and sell.

It sounds obvious, and of course that already occurs to a degree, but Shelman said it's going to extend to deeper levels.

That is in part due to non-traditional players entering the business. Bill Gates is investing millions in agricultural development. Google is investing in tissue-cultured meat. Jeff Bezos bought Whole Foods with intentions to change traditional food retailing.

"Think about the implications of the supply chain for that, and that differentiation," said Shelman.

Producers will be increasingly required to differentiate their product and meet specific consumer needs. Technology will help them provide the desired traceability and transparency that consumers increasingly demand, but the economics of doing that aren't moving in lockstep.

"We need new talent to come in. They can only come in if there's attractive returns in the sector."

Shelman emphasized the importance of millennials in shaping the food production system. Those born between 1980 and 2000 are having families and increasing their income. They're used to getting information in different ways and intent on buying food that reflects their values.

"Food actually reflects their values and this is the thing that perhaps poses the biggest challenge to the traditional food industry, because not only do they want products that meet a certain price point and a certain safety point, they want products that have a purpose. They want products from an industry that has the same values that they do.

"I think it's putting a very interesting twist on the system right now."

Big data

The data that can be collected via farm equipment, drones, satellites and other technologies will play a big role in agriculture's future, the experts agreed.

"You have a tool here to look at millions and billions of observations, whether it's productivity... the way we grow our crops, how much rain you get, all of this can be integrated into very precise models and that's going to be the big change in agriculture," said Karl Dawson, chief science officer at Alltech.

"We're talking about moving to armchair farming. We're going to be making our decisions from a site, sitting in front of the computer, looking to see what we can predict in the future. That's a tremendous tool that we've never had before."

Michael Boehlje of Purdue University says big data can be used not only at the farm level, but by every part of the agricultural production chain. It can allow the sector to trace and evaluate processes as never before.

Autonomous vehicles

They're already here, said Connolly. Self-driving farm equipment is a logical development in a world where self-driving cars

Big data can be used not only at the farm level, but by every part of the agricultural production chain. It can allow the sector to trace and evaluate processes as never before. | GETTY IMAGE




MEET THE EXPERTS: Aidan Connolly is chief innovation officer at U.S.-based Alltech, Mary Shelman is former director of the Harvard Business School's agribusiness program, Michael Boehlje is a researcher specializing in farm and agribusiness management at Purdue University and Karl Dawson is chief science officer at Alltech. | SUPPLIED PHOTOS

and trucks are already being tested on our roads.

They will also address labour and safety issues, he added.

"I think it is difficult to find labour on farm. When you find labour, you want labour to be well trained and well prepared. You have safety opportunities also. I think there's just going to be a lot of factors that are going to drive for these autonomously driven tractors and harvesters to become part of our future."

Boehlje agreed.

"It's going to be coming much more rapidly than we realize and it has the opportunity to profoundly change the agricultural sector, so it's a really, really important development.

"My belief is we'll see this in the fields in five years, not 10 years, and rapidly adopted."

Nutrigenomics

In simplest terms, nutrigenomics is the study of food nutrients on gene expression in the body that consumes them — "you are what you eat" at the genetic level.

Dawson sees major potential in the technology, which can reveal the effect of food and various ingredients on basic livestock physiology.

"We are starting to narrow in … on the gap between genetic potential and what the animal can do," he said.

"We have a tool that allows us to actually measure what happens when we make a nutritional change. It's a very powerful thing."

He sees a future where animals can be selected for the specific nutrition they can provide, as has long been done in plant breeding.

Through nutrigenomics, producers can potentially measure animal productivity as well as immunity and disease resistance, and alter livestock diets to improve expression of those traits.

He said it could also reduce nutrient needs through more efficient use and lower the effect on the environment.

Who's your farmer & what does he do?

Farmer demographics are likely to change in coming years, the experts say.

"I think what we're looking at now is again a fundamental change in what that person's going to look like," Connolly said.

"They won't necessarily grow up on a farm. They might grow up in a city. They won't necessarily have the skills of maybe understanding animals or understanding plants. They'll understand data. They'll understand analytics. They'll understand equipment. They'll understand decision making between all of the various technologies of what a person should buy and what they shouldn't invest in.

"So those are dramatically different skills than we used in the last thousand years, you might say hundred years … to decide who is it that's a farmer."

It's also going to require keen abilities in data management.

"Some farmers abhor record-keeping," said Boehlje. "We are going to increasingly have to develop that skill and feel comfortable with that skill of looking at numbers, looking at information, trying to understand what they say, the story they tell."

Besides those attributes, Shelman said the next generation of farmers will have to pay close attention to consumer desires and figure out how to deliver on them.

"It's not just about producing at the lowest price, but producing what the market wants … and being able to sell into those channels, connect with those channels. So, this is a very big basket now, a very big ask," she said.

Boehlje also said farmers will have to forego their desire to be completely independent, and instead forge relationships with others in the supply chain.

Connolly summarized it thus: "If anybody thinks that agriculture is going to be the same way in 20 or 30 years' time, they've got their head in the sand."

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Nanotechnology to alter animal health, food systems

Networked biosensors could offer a key advantage during disease outbreaks

BY ROBIN BOOKER
SASKATOON NEWSROOM

BIOLOGICAL SENSORS based on nanotechnology are being developed by Canadian researchers and may soon be commonplace on Canadian farms.

A biosensor device relies on a biological element such as an enzyme or bacterium to react with a target substance such as a spore or virus. This reaction is monitored by a transducer that converts the biological response into an electrical signal.

For instance, research scientist Susie Li is developing a biosensor that can differentiate sclerotinia spores from other spores in the air.

Li, who works at Alberta Innovates Technology Futures, developed the biosensor's chip with gold nanoparticles bonded to it. These nanoparticles are also attached to antibodies that only attach to sclerotinia spores.

When the antibodies attach to a sclerotinia spore, the gold nanoparticle sends a signal to a transducer connected to wireless technology.

"You transmit that signal to a little box, like Bluetooth technology, and then that can transfer to an electronic device like a cellphone. You just need to download an app and then you can use it," Li said.

This sensor can send farmers text messages when a specific threshold of sclerotinia spores has been reached in their fields.

"I hope it could be a revolution because right now, you have to go to the field to find out and it's time consuming. It's also because you have to pick up a diseased leaf or petals and then you send that back to a lab," Li said.

It currently takes days to get results back from a laboratory when testing for sclerotinia, and the spraying window for the disease is very short in canola.

The sclerotinia detector Li built can detect as few as five sclerotinia spores.

She is currently miniaturizing the detector and expects a field-ready model to be on the market within five years.

Nanotechnology-based biosensors being developed at Ontario's University of Guelph are currently being licensed and they are expected to be available within a few years, said Suresh Neethirajan, director of the Bio Nano Laboratory at the university.

He said biosensors based on nanotechnology are set to revolutionize the farm and food sector.

The mandate of the Bio Nano Laboratory is to enhance animal health and food safety through nanotechnology approaches.

University researchers have developed a hand-held nanobiosensor that uses paper-based test strips similar to home-based glucometers. Users put a droplet of material, such as food, oral swabs from poultry, or blood solution from the dairy cow or swine, in the cartridge. Users know immediately if the specific substance or disease they are testing for is present.

Depending on which paper-based biosensor has been installed in the hand-held device, a whole hosts of pathogens and diseases can be detected — from numerous flu diseases in poultry and swine to ketosis or metabolic diseases in dairy cattle, or many kinds of food that can give allergic reactions.

Currently, when there's an avian flu outbreak in a Canadian poultry barn it takes days to know exactly which disease is present because samples have to be shipped to a centralized animal health laboratory.

"These biosensors enable the farmers to know the results by bringing down the time for the results from several days to a few minutes, so that's one of the key advantages," Neethirajan said.

The biosensors offer another key advantage when it comes to infectious disease outbreaks because they can be linked in a network.

The sensors are also much easier on animals when it comes to testing because only a droplet of blood or saliva is needed.

The biosensors can also be integrated into existing monitoring systems in barns.

"That will enable the farmers to basically download an app and then periodically or in a specific frequency, it can record data in a noninvasive way.

"For example, when a bird pecks to take water, or pecks to take a grain or a seed, based on the interaction of the beak to a particular zone, we have some trace of the oral swab in fluids left over that is good enough to be able to call up in terms of screening for specific pathogenic micro-organisms," Neethirajan said.

Biosensors are also being integrated into robot milkers in dairy barns, and can be installed on wearables such as a dairy cow's collar.

The hand-held device developed by the Bio Nano Laboratory has biosensor cartridges that can screen for a variety of allergens such as peanut, shrimp, and gluten in food, which is particularly useful in areas with limited resources, such as remote communities.

The Bio Nano Laboratory has also developed paper-based biosensors that children with food allergies can use.

"They can dip the paper in the food solution, based on the colour change they can decide whether to eat or not to eat," Neethirajan said.

Food processors can integrate these nano-biosensors into production lines to look for specific materials, which could dramatically change how food manufacturers test, he said.

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Suresh Neethirajan, director of the Bio Nano Laboratory at the University of Guelph, holds a device he helped develop that uses nanobiosensors on paper test strips to detect multiple kinds of virus, bacteria and food allergens. | PHOTO SUPPLIED BY SURESH NEETHIRAJAN

A SCLEROTINIA SENSOR BUILT AT AITF CAN DETECT AS FEW AS

FIVE SPORES

GM POLLEN: IT GETS AROUND

BY SEAN PRATT
SASKATOON NEWSROOM

REBECCA TYSON has developed a mathematical model to determine the appropriate isolation distance between genetically modified and conventional crops.

"Numbers tend to get thrown around and until our paper came out there wasn't a lot of very good research saying what that distance should be," said the associate professor of mathematics at the University of British Columbia.

Tyson was challenged by W. David Lane, an Agriculture Canada biologist working at Summerland, B.C., to see if she could devise a way to scientifically determine how far GM pollen from apple trees travels.

Her light bulb moment occurred when Lane's son mentioned that GM pollen and regular pollen were like hot and cold.

"You model movement of heat by the diffusion equation and I knew how to do that," said Tyson.

She knew the pollen drift study would be similar to determining how far embers travel from a fire.

What she needed was data to plug into the model and Lane supplied her with all she required.

For two years, he had conducted an experiment where he had a row of GM apple trees planted in an orchard. He harvested seeds from the surrounding trees and figured out how many of them carried the transgene.

Tyson plugged the data into her fractional diffusion model and was able to calculate a safe distance to plant a conventional orchard next to a GM apple orchard with a cross-pollination rate of less than 0.9 percent.

It depends on the relative size of the crops. If the conventional crop is two times the size of the GM crop, the ideal distance is 51 metres. Crops of identical size should be separated by 72 metres and if the GM crop is twice as big as the conventional crop the safe distance is 88 metres.

"Our results suggest that separation distances of several hundred metres proposed by some European countries is unnecessarily large but separation by 40 metres is not sufficient," she said.

Lucy Sharratt, co-ordinator with the Canadian Biotechnology Action Network (CBAN), said it's great to have a new tool for establishing buffer zones but she thinks there is a missing ingredient.

"Certainly, we would hope that if there's to be a discussion of appropriate buffer zones for the GM apple, for example, that local farmers would also be consulted," she said.

Growers have unique knowledge of things like the density and types of orchards, as well as bird and bee populations in the area. The model should also take into account unpredictable things like human behaviour and equipment use.

"It's tempting to think that we could map out biodiversity in an area and predict behaviour but our experience shows us that contamination is particularly an issue because of unpredictable events," said Sharratt.

She said the Canadian Food Inspection Agency has established buffer zones for field testing various types of GM crops, but there are no buffer zones required once the crop is commercialized.

Tyson's model also provided a mathematical answer to a conundrum that had previously puzzled biologists.

Put a GM plant in the midst of a lot of conventional plants and see how far the pollen travels and the answer is not very far at all.

But put a GM plant all by itself and place a conventional trap plant a long distance away and, lo and behold, the pollen spreads all the way to the trap plant.

"Mathematically, we were able to show that these are consistent," said Tyson.

That's because pollen spread is like a bell curve. There is very little pollen at the tail end of the curve and when that tail is in the midst of a field full of conventional plants the GM pollen can't be detected because there is so much conventional pollen around.

But once outside the conventional plot the conventional pollen drops off quickly as well and suddenly the amount of GM pollen goes up proportionally and can be detected.

So far, the model has been used only for GM apple orchards.

The Arctic apple, non-browning Golden Delicious and Granny Smith apples developed by Okanagan Specialty Fruits, received Health Canada approval in 2015.

Groups like CBAN and some British Columbia orchardists protested the field-testing of the Arctic apple in Canada.

So, the company established orchards in the U.S. and began test-marketing its sliced apples in U.S. grocery stores this year.

Tyson said her mathematical model could be adapted to determine isolation distances for other GM crops such as canola and alfalfa but the model would have to be tweaked because apple trees rely strictly on bees for pollination, while canola pollen can be spread by wind as well.

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Put a GM plant in the midst of a lot of conventional plants and see how far the pollen travels. The answer is not very far at all. But put a GM plant all by itself and place a conventional trap plant a long distance away and, lo and behold, the pollen spreads all the way to the trap plant.

Farm wi-fi connectivity opens

BY BRIAN CROSS
SASKATOON NEWSROOM

A TECHNOLOGY company based in the United Kingdom has developed a new product that monitors temperature and moisture levels in stored grain and sends wireless data to a smartphone, laptop or home computer.

BeanIOT is a bean-sized remote sensing device that can monitor conditions in stored grain and warn the user of potential spoilage inside the bin.

The sensors are roughly the size of a kidney bean and are capable of monitoring grain temperatures, humidity levels, insect movements and other conditions that could affect the value of stored grain.

Digital data generated by the beans is sent wirelessly and can be displayed graphically for quick and easy assessment.

The rechargeable units can be deployed throughout stored grain masses and have a battery life of up to 14 months.

The beans are reusable and can be put to use quickly with limited set-up time. They are currently being tested commercially in the United Kingdom.

Developers say they should be suitable for North American storage systems, although it remains to be seen how beans that have been deployed in large storage facilities would be recovered for reuse.

Mechanical damage caused by augers and grain conveyors is another potential pitfall.

Andrew Holland, founder and chief operating officer of RF Module and Optical Design Limited, the Cambridge-based company that developed the Bean IOT system, said the beans can be deposited throughout stored grain, providing information from numerous points within the storage area.

"Density of deployment is key," said Holland.

"Our system provides lots of physical locations across the grain stack, so the farmer is not going to miss any untoward activity like hot spots, mould growth, insect infestation and so forth."

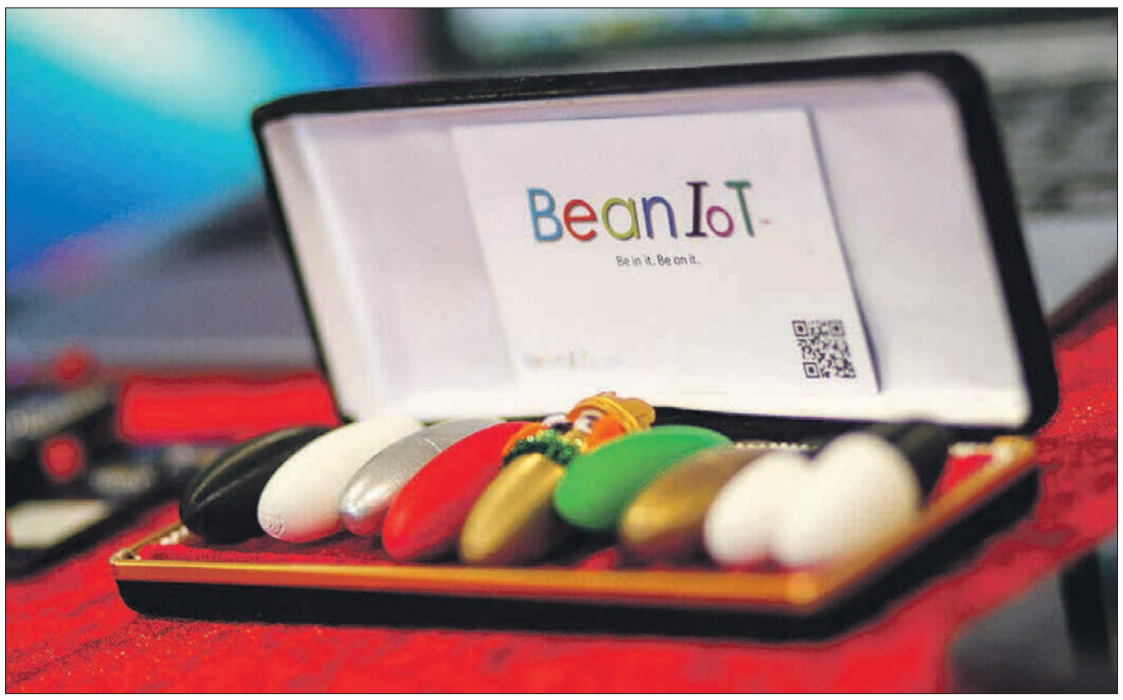
Although BeanIOT has yet to prove its value in the North American marketplace, the technology is an example of how remote data collection systems with wi-fi connectivity can be used to make informed farm management decisions.

Developers say data collected by the beans is displayed in a user-friendly visual format that allow managers to identify problems quickly and take preventive action before spoilage occurs.

For example, grain temperature data collected at various points in a stored grain mass can be displayed as a thermal map that shows hot spots where spoilage is most likely to occur.

Additional data generated by the beans can be overlaid, providing additional insights about potential trouble spots.

Users decide what type of data to collect, and the display interface is customizable, depending on the user's preferences.



BeanIOT is a bean-sized remote sensing device that can monitor grain temperatures, humidity levels, insect movements and other conditions that could affect the value of stored grain. | RF MODULE AND OPTICAL DESIGN LTD. PHOTO

Data collected is transferred wirelessly to a local hub, eliminating issues that could potentially be caused by poor cellular or internet coverage in rural or remote areas.

Users can also receive alerts via Twitter or email, informing them that problems are arising and may need to addressed.

"The system provides a compound image of what's going on, and the farmer can tell which sensor is pinpointing the actual point where there is an issue with the grain," Holland said.

"We're putting all of the information anybody would ever need to know up in front of them.... It's those high level decisions that we're trying to assist with."

Data collection devices with wi-fi connectivity are already being used on many Canadian farms to boost productivity and manage production risks.

In the near future, wireless data collection and transmission systems will continue to expand, giving producers access to a wide variety of products that simplify farm management.

CONTINUED ON NEXT PAGE »

INTELLICON COMMUNICATIONS SOLUTIONS PHOTO

new world of possibilities

Ken Jackson, a Saskatchewan entrepreneur and founder of Intelliconn Communication Solutions, said the ability to monitor farm operations and make management decisions remotely is critically important for today's large farm operators.

"Most rural business and residents have some access to the internet, but there's also a growing need for enhanced wireless access ... on farms (that allows farm managers) to connect to grain bins, to monitor tanks and to be able to turn pumps and fans and lights on and off," Jackson said.

"With agricultural operations growing larger, the management of those operations (through a smartphone or remotely) is becoming increasingly more important."

> ***We're putting all of the information anybody would ever need to know up in front of them.... It's those high level decisions that we're trying to assist with.***
>
> **ANDREW HOLLAND**
> RF MODULE AND OPTICAL DESIGN LIMITED

Intelliconn, based in Saskatoon, offers a wide range of wireless monitoring and control products that are connected under a wireless ethernet dome.

The dome allows for the establishment of numerous wi-fi hot spots, providing connectivity to numerous devices across the largest farmyards and bin sites.

Intelliconn's systems are fully customizable and can be tailored to the specific needs of the farmer, Jackson said.

Systems typically include cameras that monitor activity within the farmyard, but they can also include devices such as temperature sensors, motion detectors and infrared sensors.

The company has already installed more than 30 farm-based systems in Western Canada.

It is also close to rolling out a new grain monitoring and sampling system that automatically collects representative samples for binned grain and tests the samples for moisture.

Jackson said all of Intelliconn's products are designed to increase farm productivity, profitability, safety and security.

Intelliconn starter kits will be available through selected farm retail outlets beginning this year with prices beginning at around $2,500 plus installation fees.

"When you're not on the farm, there's lots of things that you'd like to keep track of," he said.

"When you see something that you need to deal with, it's so convenient to just scroll down in an app or on your cellphone and hit a button instead of having to be there physically to turn on a fan or a pump or a light."

For more information on Intelliconn's products, visit www.intelliconn.com.

A video of Intelliconn's Ingrain grain monitoring and sampling product can be viewed at bit.ly/2j3IaMu.

— With files from Angela Lovell

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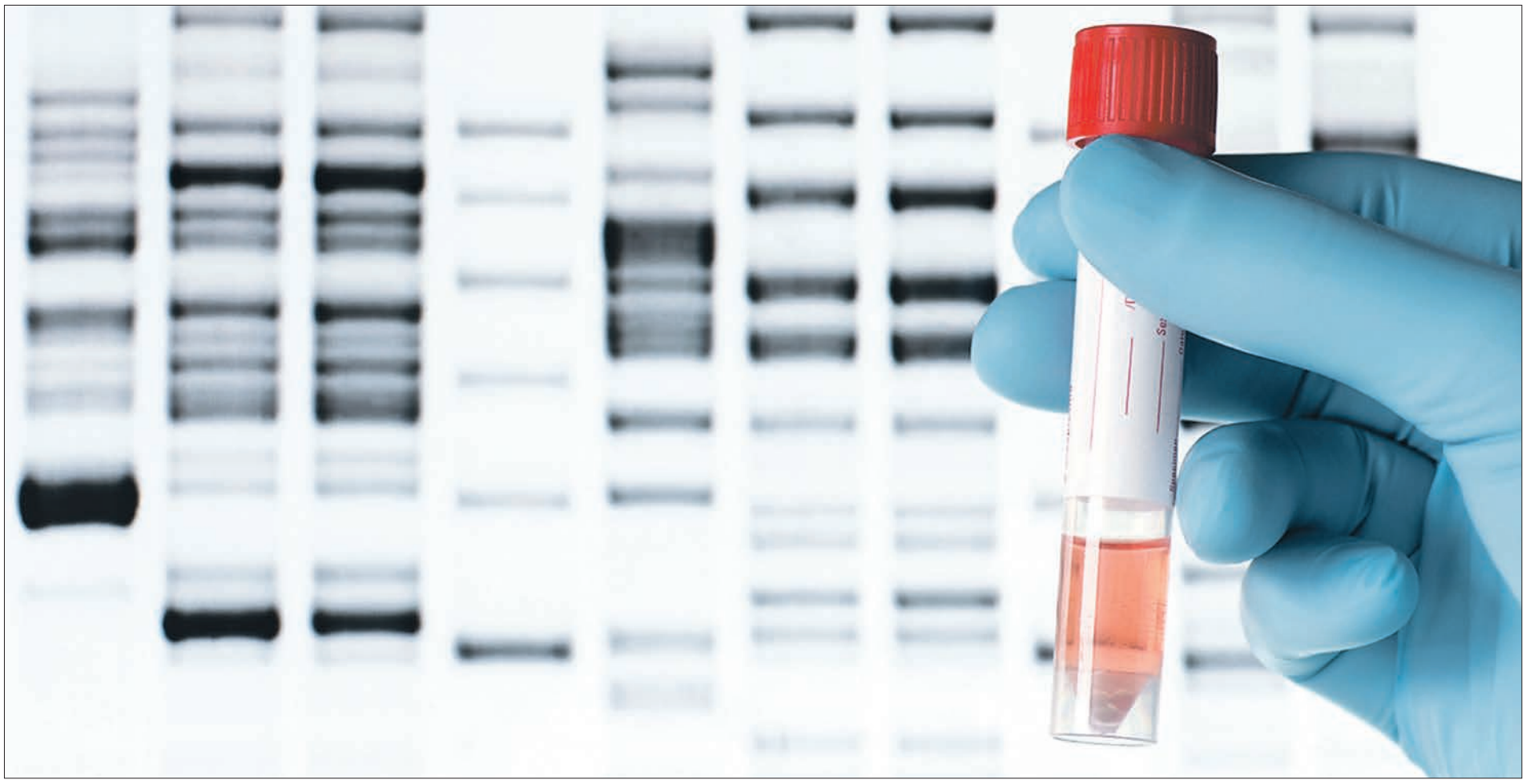

Genomics testing can determine breed composition and new tools can also show where to make improvements. One area for improvement is hybrid vigour. | FILE PHOTO

New genetic tools offer way to restore cattle vigour

Beef genomics information can help producers with strategic crossbreeding programs

BY BARBARA DUCKWORTH
CALGARY BUREAU

DOUG WRAY assumed he had a Red Angus-Simmental cow herd on his Alberta ranch but DNA testing revealed an interesting mix.

Similar to the concept of ancestry.com where people can trace their ethnic heritage, DNA breed analysis of Wray's commercial cows showed they were Angus, Simmental, Charolais, Limousin, Hereford and Gelbvieh. Included in the mix was a cow with a smattering of Galloway even though that breed has not been on the ranch for more than 10 years.

Wray tries to match cows to the appropriate bulls that produce calves capable of thriving in his intensive grazing program and produce quality beef.

He agreed to DNA testing and also adopted an intensive record-keeping system called HerdTrax.

He can record birthdates, breed of sire, identification of the mother, weaning and yearling weights, calving, performance of offspring, health treatments, carcass data and any other pertinent information.

The challenge is converting data into information.

"When you get in this game you really need someone who is number savvy and computer savvy and who likes to do it. That is probably our Achilles heel," he said.

Scientists like John Basarab of Alberta Agriculture have been looking at beef genomics for a long time. The next step is to transfer what has been learned about purebreds into something useful for commercial producers.

Genomics can determine breed composition and new tools can also show where to make improvements. One area for improvement is hybrid vigour.

More strategic crossbreeding could produce calves with more vigour, something Basarab said is diminishing across North America.

"In the last 20 to 30 years, we have seen a continual erosion of the amount of heterozygosity, hybrid vigour in the North American cow herd. We have moved from a systematic crossbreeding program now to nonsystematic crossbreeding where we really are not sure what that cow herd is from a breeding composition view," he said.

Finding the right genetic mix is not clear cut.

If a purebred Hereford cow is bred to a purebred Angus there is a 50-50 split. If a Simmental bull is added, a three-way combination is created but the genetic makeup is not always clear.

DNA is not transferred evenly but moves in chunks.

It is expected a three-way cross cow would be 50-25-25 but the animal could end up being 50 percent Simmental, 15 percent Angus and 35 percent Hereford depending on how genetic recombination occurs.

Still, crossbreeding is a good way to produce greater hybrid vigour in animals, which affects how well they grow and thrive.

People also want to build a uniform herd, but that may not be happening.

"We go towards a more uniform cow herd and do get uniformity of type but mostly it is uniformity of colour," he said. "Our herd has migrated over those 20 years to be a herd of red and black animals."

This could affect sustainability and profitability of the western Canadian beef population.

In 1990, about 6,200 herds were surveyed in Alberta.

Included in the study was calf crop percentage. This is the number of calves weaned per 100 cows exposed to breeding. At that time, 84 percent of the calves survived to weaning. Subsequent studies showed no real improvement in calving percentages have been made.

"We are not doing anything about the fertility of our cow herd," he said.

People often think they can check the pedigree to check background composition but the vast majority of commercial producers do not maintain pedigrees or records.

Knowing the breed composition with DNA tests can lead to better mating decisions when cross breeding to boost performance and fertility.

Fertility is more important than the other traits like carcass merit and growth because a calf needs to be born every year.

A two percent improvement in the calving rate means two extra calves out of a herd of 100. That means more income without getting more cows.

Survival to the second calving means the young female was not removed for a variety of reasons like bad attitude, poor body structure or failure to get pregnant.

Herds with lots of hybrid vigour tend to have a low culling rate.

"Over 30 years, nutrition technology has improved, vaccination, health and grazing management has all improved but we haven't done a damn thing about our calving rate," said Basarab.

Producers want vigorous cows but as herds grow larger, they cannot take on too much risk. They do not want to take on a new breed that could introduce vigour but may also cause calving difficulty that a large herd cannot cope with.

The right combination can make a cow herd more productive.

"These animals with more heterozygosity (hybrid vigour) have more resilience, they can handle changes in climate, changes in diet, changes in management and they stay in the herd longer," he said.

A new tool to measure the genetic makeup and hybrid vigour is called EnVigour HX, offered by Delta Genomics. It can generate a hybrid vigour score to help producers develop a more strategic breeding plan. It does not recommend specific breeds.

Armed with this information, a producer can decide to use an Angus bull, for example, on the cows that have the least amount of Angus in their background to improve hybrid vigour.

Besides improved fertility, the cattle could become more feed efficient.

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Technology can help breed better cattle

BY BARBARA DUCKWORTH
CALGARY BUREAU

REGINA — Keeping up with technology could be the biggest challenge facing purebred cattle breeders.

Genomically enhanced expected progeny differences, genetic databases and new algorithms are complicated and hard to understand but all are necessary to improve cattle and make better selection decisions, said Bob Weaber, cow-calf extension scientist at Kansas State University.

"There is getting to be a wider gap in knowledge between the seedstock producer, particularly the nucleus seedstock producers and the average commercial cattleman than there has ever been," he said at the Simmental Federation of Americas conference held in Regina Nov. 21.

"The complexities of explaining what we do to our commercial customers is getting more difficult and probably more important," he said.

"If we don't keep up with technology and progress in terms of genetic improvement, what happens to the status quo? Status quo is not standing still but actually backing up and the longer you wait to adopt or change or implement, the further behind you are," he said.

Commercial producers need to be convinced of the value of the new science, he said.

Producers can improve commercial herds by knowing the sires of calves and their ancestries, but they have to see value in it, said geneticist John Crowley, based at the University of Alberta.

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Crowley works with the Canadian Beef Breeds Council, which represents 16 cattle breeds.

"They don't see the merit in spending $20 on doing a parentage test on a commercial animal when his profit margin may only be $20 to$30 depending on the year," Crowley said.

Knowing the breed composition at the commercial level helps determine the level of hybrid vigour.

Commercial producers may think they know what breeds are present in their herd, but DNA does not lie.

DNA from each parent is not transferred evenly and desired traits can sometimes disappear or diminish.

"We have known for a long time in using genomics that every relationship between grandparents and progeny differ a lot from what you expect it to be," Crowley said.

The rate seedstock producers are adopting these new genetic technologies also varies.

Not everyone is comfortable in using EPD information or selection indexes, said Weaber.

The concept of genomically enhanced EPDs where genomic information is blended with traditional EPDS is fast-moving technology and can be complicated.

Genomic information adds to the knowledge collected on individuals sooner rather than measuring merit later in life.

"The definition of the tool hasn't changed; the implementation hasn't changed, but the data that goes into it is changing rapidly," said Weaber.

When following EPDs, there is an expectation of what the average progeny should look like. The progeny is never average so more information is needed to develop the true genetic merit of an individual and better predict what the offspring might do.

Producers can improve commercial herds by knowing the sires of calves and their ancestries, but they have to see value in it. | FILE PHOTO

When genomes were first sequenced, there was high expectations the technology was going to work out where specific genes might be connected to valuable traits. Now researchers know there are interactions among thousands of genes that can affect a single trait.

However, the technology continues to improve and significant changes are expected over the next four or five years in the seedstock business.

"If we don't figure out how to make better critters, then we are asleep at the wheel," Weaber said.

Genomic data accumulation offers a chance to better document common traits for factors such as fertility, longevity, feed efficiency and beef quality.

A further advantage is selecting younger animals of high genetic merit.

Using standard tests, it takes a long time to collect information on bulls. A DNA test could speed that up.

"Increasing accuracy early in an animal's life shortens the generation interval on the bull side," he said.

"If you are a nucleus beef breeder and you do not adopt the technology, you will not be able to keep up."

Those selling bulls may argue they are not going to get paid enough to cover the cost of the testing and results. It is going to come down to the progressive and informed commercial producers. They understand the value of reducing error in decision making, said Weaber.

Besides tracking the bulls, more information is needed on cows.

A DNA test could provide a better prediction of the cow's potential through the genotype than lifetime production records.

Selection of replacement heifers could be also easier if they were genotyped before they were put into breeding programs. Producers could also make more informed decisions about which bulls to use.

Traditional EPDs versus genomically enhanced EPDs can improve heifer selection by about 50 percent by using more precise information.

"If I can put a group of heifers together where I know their genetic potential when they are weaned, I should do that," said Weaber.

The dairy industry is already doing this and since 2009, it has quadrupled genetic change with higher fertility, lower somatic cell counts, calving ease, conformation and a longer productive life.

"A gap is growing between those who adopted the technology and those who did not in the dairy industry," he said.

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Indigo, a Massachusetts-based biotech company, is using gene sequencing tools and artificial intelligence platforms to study endophytes and the role they play in plant development. | SASKATCHEWAN RESEARCH COUNCIL PHOTOS

Biotech companies prospecting for microscopic gold mines

BY BRIAN CROSS
SASKATOON NEWSROOM

CAN A microscopic endophyte increase crop yields on your farm?

Indigo, a Massachusetts-based biotech company, thinks so and is investing tens of millions of dollars in research and development to prove that claim.

Indigo specializes in the identification, isolation and commercial production of beneficial endophytes.

An endophyte is a microbial life form — often bacterial or fungal — that lives in the tissues of a plant.

Until recently, the relationship between endophytes and the plants in which they live was not well understood.

But with the assistance of new gene sequencing tools and artificial intelligence platforms, interest in endophytes and the role they play in plant development has expanded, along with the development of new commercial products.

Indigo, for example, has already developed a number of commercial products, which according to the company have the ability to boost yields in winter wheat, cotton, corn and soybeans.

It is also working on a product for rice.

Indigo's concentrated endophyte products are applied as a seed coating and have shown significant yield-boosting potential, particularly under stressful growing conditions.

"In the example of winter wheat, we're using a bacterial endophyte ... that clearly enhances seedling growth," said Kevin Kephart, head of industry relations with Indigo.

"We see faster coleoptile growth in wheat, faster root growth and after just a few days of germination, we'll see a larger root mass ... that allows the plants to capture resources out of the soil, whether that's water or phosphorus or potassium or nitrogen.

"We're also seeing a greater number of ... head bearing tillers in wheat and we see a greater number of spikelets per head as well."

Indigo products that have been field tested in Kansas under stressful conditions such as excess heat and drought have demonstrated a yield increase of eight to 16 percent relative to winter wheat crops that were not treated.

In corn, certain hybrid varieties that were treated with Indigo growth promotants produced yields 70 percent higher than those of untreated corn fields sown with the same seed variety, again under drought conditions.

"We don't see as much of a benefit under irrigation," Kephart said.

The process of identifying beneficial endophytes, isolating them and increasing them to a commercial scale does not occur quickly or easily.

To identify commercially viable microbes, Indigo visits areas that are affected by drought or heat stress and looks for plants that appear to be thriving under adverse conditions.

Communities of microbes contained in those plants are then analyzed to determine which endophytes are most beneficial to the plant's health.

Potentially beneficial bacteria are isolated and multiplied in commercial fermentation facilities and field tested before commercialization.

The end result is a concentrated product that can be applied as a seed coating along with other crop inputs such as insecticides or fertilizers.

Indigo's products for corn, winter wheat, cotton and soybeans are already being used in the United States.

Kephart said additional products are likely to be developed in the future for growers in Western Canada.

In Saskatoon, the Saskatchewan Research Council works with private sector clients such as Indigo to scale up plant inoculants and endophyte-derived growth promotants.

Meghan Gervais, manager of SRC's Biotechnology Laboratories, said researchers who identify beneficial bacteria or fungi will bring their products to the NRC-SRC Fermentation Facility in Saskatoon to have their products scaled up or multiplied to the point where it can be field tested and taken to the next stage of commercialization.

"We're really here to be the middle ground, where clients can take a product that they've developed in a lab and scale it up to commercial quantities," Gervais said.

SRC is currently working with Indigo to scale up beneficial microbes, some of which may have commercial applications in Saskatchewan.

"The project team, using bioprospecting ... has identified potentially beneficial microbes for different crops — some of them pertinent to Saskatchewan, like wheat, for instance — and they're looking at how those microbes, working as endophytes ... can optimize plant growth," Gervais said.

"It (commercializing endophytes) is about finding the right microbe ... and then figuring out how to grow or multiply that microbe in a way that will be cost effective enough to apply it back as an input into agriculture."

In many ways, endophytes are similar to rhizobia-based inoculants that are widely used by pea producers in Western Canada.

The main difference is that rhizobia-based inoculants are derived from soil-borne organisms, whereas endophytes exist within plants themselves.

Gervais said endophytes can promote plant growth in a variety of ways, such as conferring disease resistance, improving water use efficiency or enhancing tolerance to abiotic stresses.

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A St. Louis, Mo., research team plans to develop an app that would work in conjunction with acoustic listening systems that producers could use to track pollinator activity in their fields. | NICOLE MILLER-STRUTTMANN PHOTOS

Bee buzzes critical to calculating crop pollination

Researchers in Missouri use small microphones to measure the quantity of bee noises

BY JEREMY SIMES
EDMONTON BUREAU

FARMERS MAY soon have a better idea on how well their crops are being pollinated, thanks to new research into the buzzes of bees.

In 2014 and 2015, researchers in Missouri were monitoring bee noises in the Colorado Rocky Mountains by using small microphones called acoustic listening systems.

In findings published last June, they found that if the acoustic systems were picking up more bees buzzing, the bees were doing a lot more pollinating.

"It's not rocket science, but it is informative," said Nicole Miller-Struttmann, who was part of the research team and currently teaches at Webster University in St. Louis, Mo.

"The more bees there are, the better the pollination services."

Knowing this buzzing activity would be extremely helpful for farmers, she said, because many rely on bees or other pollinators to grow successful crops.

For instance, if buzzes are low, farmers would know they need to bring in more honey bees. If buzzes are high, they might not need to bring in any.

"If wild populations are doing enough pollinating, farmers might not need to spend lots of money and time," Miller-Struttmann explained. "On the flip side, it can be an early warning signal, where they can take action and bring in more bees if they need to."

So, to get this technology in the hands of farmers, the research team plans to develop an app that would work in conjunction with acoustic listening systems, which would be available for purchase.

"These microphones are a pretty inexpensive way to track these bees," Miller-Struttmann said, "and therefore they help farmers with how they manage their farm."

Kevin Serfas, a director with the Alberta Canola Producers who farms near Turin, Alta., said this technology would be particularly helpful for canola seed producers who buy pollinating services from beekeepers.

'If you're able to tell what the activity is like on the field, you'll be able to be more efficient," he said. "If one field needs more bees, while the other has more than enough, you would be able to shift them around."

Jake Berg, a beekeeper and vice-president of the Saskatchewan Beekeepers Development Commission, also thought the technology would be useful.

"The more information the producer has, whether it's for wild bees or imported ones, would be great," he said.

Miller-Struttmann added the technology could help build relationships between farmers and conservation workers.

"There's a lot of ways we can support native and local bee populations," she said. "So, a little bit can go a long way in terms of things like planting hedgerows. If people could see the numbers in their own fields that would be really meaningful."

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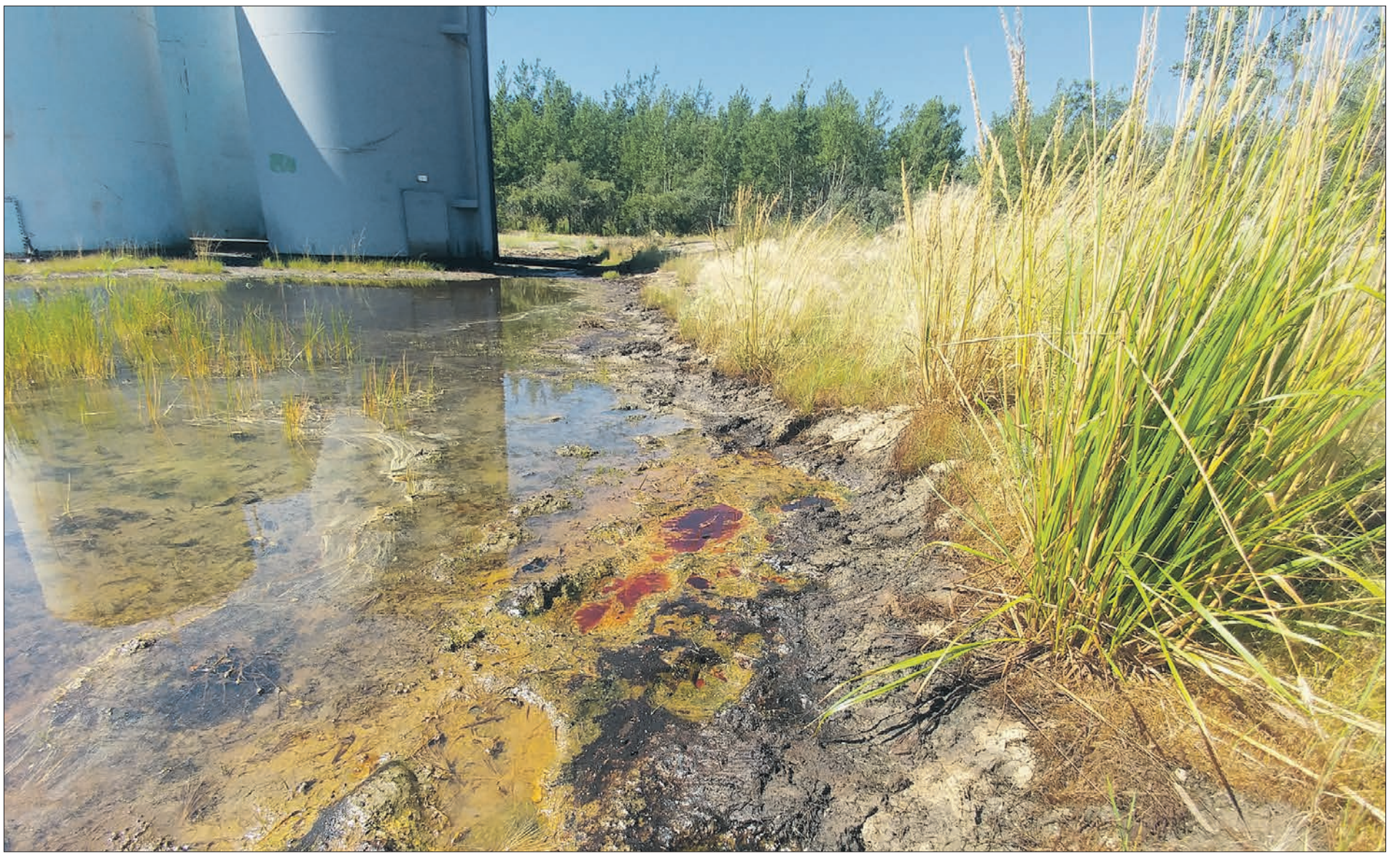
A look at the equipment researchers in Missouri used to measure bee buzzes.



Plants growing on historically contaminated sites, such as this oil production facility in northeastern B.C., have been collected for the isolation of new endophytes that may help in site remediation and reclamation. | TIMOTHY REPAS PHOTO

Fungus could aid plant growth, reclaim oil sites

BY WILLIAM DEKAY
SASKATOON NEWSROOM

A NATURAL FUNGUS is showing remarkable abilities to promote plant growth under stressful conditions while nursing polluted soils back to health.

Researchers are finding the multi-talented fungus called TSTh20-1 (TSTh), short for Trichoderma harzianum 20-1, could increase agricultural yields and decontaminate some of the most polluted petrochemical places on the planet.

"I think this is a huge innovation at this point.... This is a game changer," said Tim Repas, one of several University of Saskatchewan researchers involved in finding plausible mechanisms for how the fungus functions.

SUSAN KAMINSKYJ
RESEARCHER, UNIVERSITY OF SASKATCHEWAN

"TSTh does everything at once. It saves a lot of steps and a lot of work," he said.

"I think once we get the field trials completed, we'll be able to show that this is the way forward."

The inspiration for the innovation was a humble dandelion growing by itself in some coarse tailings in Fort McMurray's oilsands region.

"It just happened to be this plant surviving somewhere where it shouldn't have been, and the thought occurred to check it for this," said Repas.

"If that plant can do it, can we transfer that tolerance mouldability to anything else?"

Susan Kaminskyj at the University of Saskatchewan College of Arts and Science led the research team that discovered the innovation.

The group isolated an entophyte fungus from the roots of the plant in the tailings.

When its spores are applied to plants, those plants grow and thrive on the material that lacks detectable levels of plant nutrients and is also water-repellant.

"Plants that TSTh colonizes grow vigorously on coarse tailings as well as on oil-contaminated soil without additional fertilizer or extra water," said Kaminskyj.

Repas said when they added the endophyte fungus to places where seeds were not germinating or poorly germinating, they suddenly saw 90 percent germination, comparable to potting soil.

That's when researchers found the plants were degrading hydrocarbons.

This means that while remediating a site of hydrocarbons, researchers were getting plants to establish as well, said Repas.

"That's what intrigued us so much about this. It's cutting down the number of steps to get from a problem site back to something functional."

In Kaminskyj's laboratory, tomato seedlings treated with the fungus flourished on tailings without fertilizer.

The fungi are not transmitted through seed so each seed must be individually colonized.

"It turns out that it doesn't have to be just dandelions. It can be tomatoes, squash, wheat, flax, lots of different things," Kaminskyj said.

Repas said researchers favour agricultural species because they tend to be more sensitive, so if a tomato can survive in the harsh environment of a contaminated oil spill, then larger agronomic species should be better because of their larger rooting systems and greater resilience.

Researchers now hope to learn whether harvested plants from the

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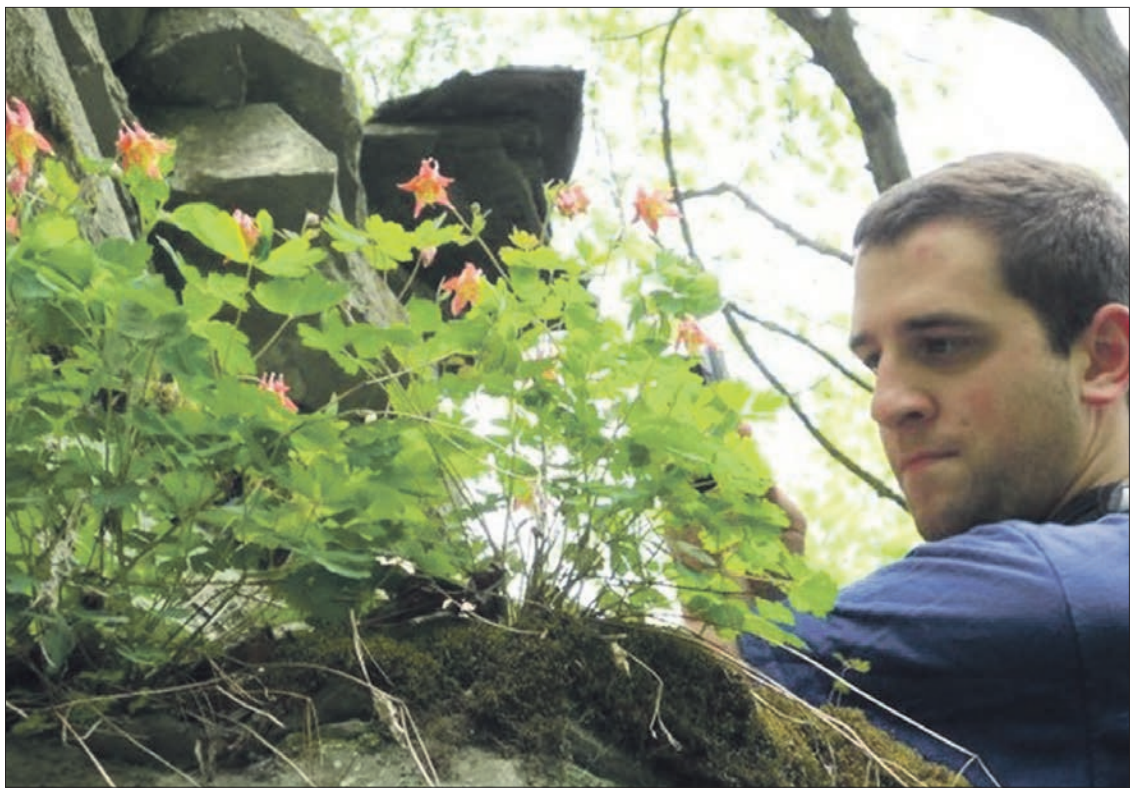
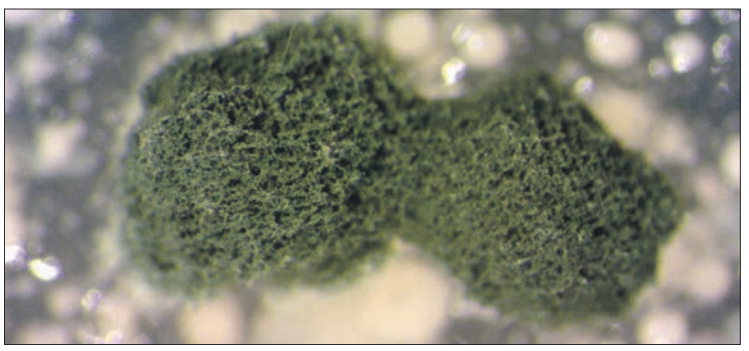
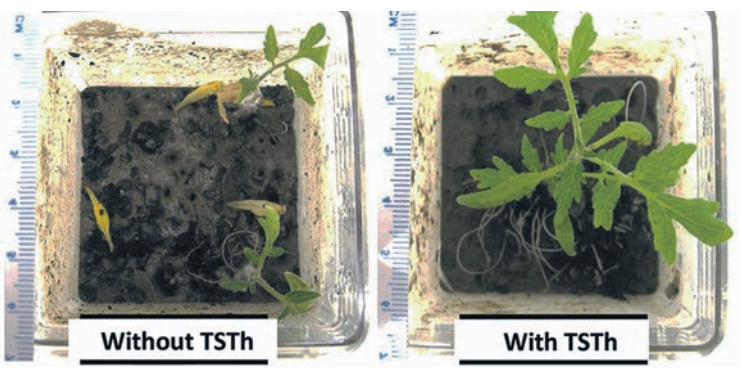
IN HIGH-STRESS FIELD TESTS, SEEDS TREATED WITH TSTh INCREASED CROP YIELDS BY

10-50 PERCENT



Researcher Timothy Repas explores the Beatton River Valley near Fort St. John, B.C. | AARON MACKAY PHOTO





A fungus called TSTh20-1 could increase agricultural yields and decontaminate some of the most polluted petrochemical places on the planet. | TIM REPAS PHOTOS

oilsand sites are safe to consume when produced under real world conditions.

"If you're growing tomatoes, for example, on a reclaimed well site, are they just as safe to consume and nutritious as the ones in the field?" asked Repas.

In terms of oilfield reclamation, scientists are most interested in establishing a cover crop on coarse tailings and other petrochemical-containing soils. It's hoped that could help reduce erosion, increase petrochemical mobilization and degradation, and begin to create a healthy soil.

Future research will likely explore growing perennial forages such as alfalfa, which is deep rooting and increases soil nitrogen.

"It would also be interesting to test the honey compared to other alfalfa honey," said Kaminskyj.

However, future tests would need to determine if feeding these remediation crops to animals is safe.

Researchers at Adaptive Symbiotic Technologies in the United States have conducted field trials around the world to enhance crop yields using TSTh and a proprietary mixture of microbes and fungi.

After five years of testing, they have documented success at growing plants exposed to stresses such as drought, salinity and temperature.

They have reported that after high-stress growing seasons, their treated seeds increased crop yields an average of 10 to 50 percent.

"They are growing a wide range of things including wheat, corn and leafy greens. One of the nice things having grown these crops is they've found the fungus doesn't cause problems for consumption," said Kaminskyj.

These innovative uses for TSTh could have far reaching impacts on large scale farming operations across Western Canada for growing food and feed, as well as the bioremediation of plants on dry, low-nutrient, hydrocarbon-contaminated soils.

"We grow a lot of wheat and imagine if we could increase wheat yields by 50 percent on the same amount of land.

"Wheat could potentially be grown on contaminated soils. The next question, of course, is could you eat that wheat?" Kaminskyj said.

Added Repas: "When you're talking huge agricultural scales, even a yield increase of five to 10 percent is, of course, massive."

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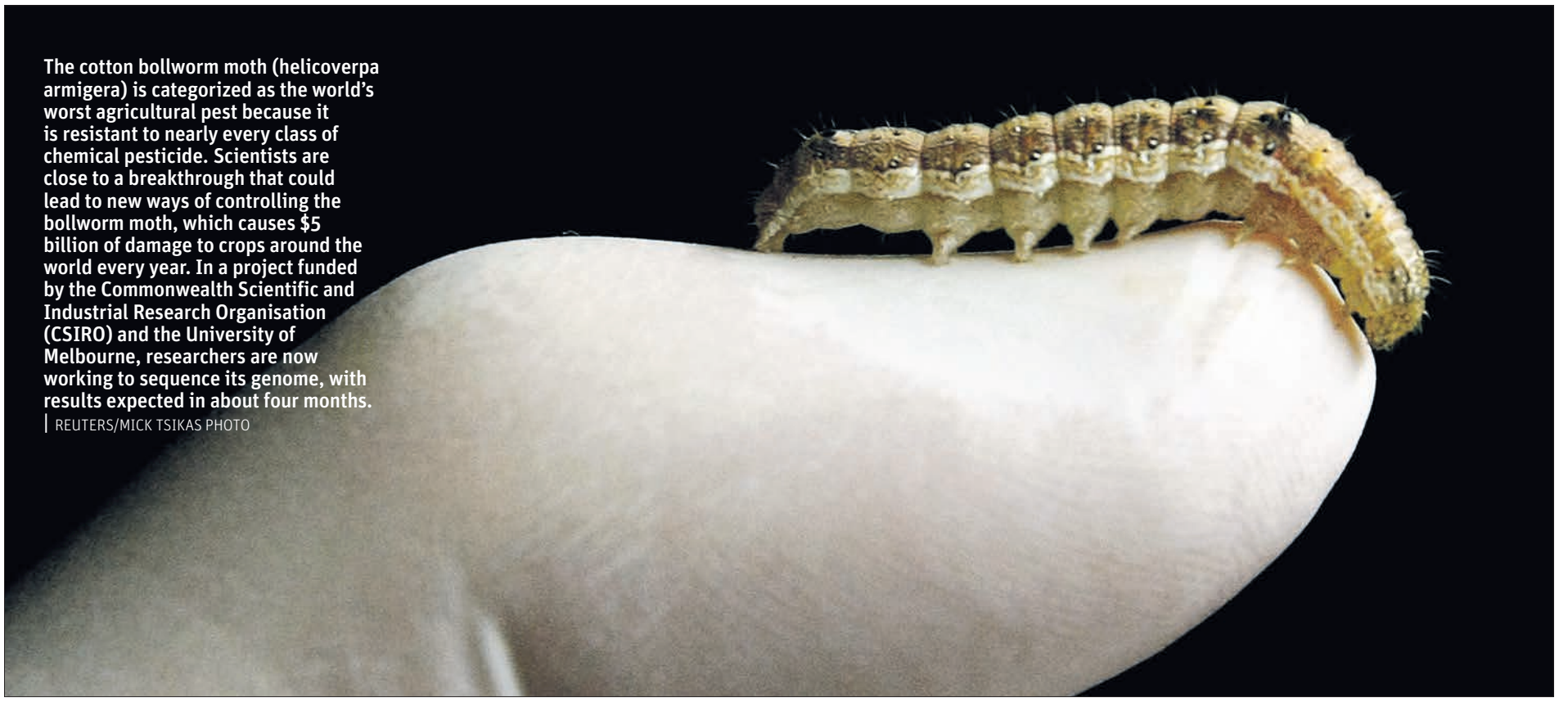

The cotton bollworm moth (helicoverpa armigera) is categorized as the world's worst agricultural pest because it is resistant to nearly every class of chemical pesticide. Scientists are close to a breakthrough that could lead to new ways of controlling the bollworm moth, which causes $5 billion of damage to crops around the world every year. In a project funded by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the University of Melbourne, researchers are now working to sequence its genome, with results expected in about four months. | REUTERS/MICK TSIKAS PHOTO

Cracking the megapest genetic code

Knowing the total genetic makeup of an insect allows scientists to design plants that repel the bad bugs

BY RON LYSENG
WINNIPEG BUREAU

AUSTRALIAN researchers have spearheaded an international effort to decipher and map the entire genome makeup of two major megapests threatening crops around the world.

The Commonwealth Scientific and Industrial Research Organization announced in a recent news release that it had identified more than 17,000 protein coding genes in two closely related pests considered to be the world's greatest caterpillar enemies of broad acre crops.

It's estimated that the cotton bollworm (Helicoverpa armigera) and the corn earworm (Helicoverpa zea) cost the world's farmers $5 billion a year in North America, Australia, Africa, Asia and Europe.

As part of the research, CSIRO updated a distribution model to highlight the global invasion threat with emphasis on the risks to North American crops.

Researchers also documented how these insect genetics have changed over the years. Understanding how insects adapt to become resistant to chemicals is the key to keeping one step ahead of crop-killing pests. Armed with these genetic codes, plant breeders can continue developing new B.t. varieties that the insects don't eat.

The CSIRO release said that genetic mapping has the potential to significantly reduce insecticide use worldwide, thus saving the agricultural community billions of dollars a year and reducing the volume of chemicals escaping into the environment. At the same time, this innovative technology can provide better protection for crops.

"The bollworm is the single most important pest of agriculture in the world, making it humanity's greatest competitor for food and fibre," said CSIRO scientist John Oakeshott, adding that it attacks more crops and develops better pesticide resistance than its cousin the earworm.

"Its genomic arsenal has allowed it to outgun all our known insecticides through the development of resistance, reflecting its name — armigera, which means armed and warlike."

According to the release, the bollworm has been spreading rapidly in Brazil and there are cases of it hybridizing with the earworm. This poses a real threat because the "new and improved superbug" could migrate up the continent to North America.

CSIRO and Australian cotton breeders incorporated B.t. insect resistance genes in their varieties in the mid-1990s to try tackling the bollworm. The B.t. cotton plants emit a natural insecticide that's toxic to the caterpillar.

The use of chemical pesticides that were previously required to control bollworms dropped by 80 percent within a decade of introducing B.t. varieties.

But the bollworm fought back. A small percentage developed resistance to B.t. cotton, forcing scientists to develop newer and stronger chemical insecticides to manage the problem.

Karl Gordon, another CSIRO researcher, said a combination of B.t. and some chemical products was working well in Australia, but it's costly. It's important to study the pest itself if producers expect to manage the problem worldwide, he added.

"We need the full range of agricultural science," said Gordon.

"Our recent analyses and mapping of the complete genome is a huge step forward in combatting these megapests."

Identifying pest origins and the countries of origin is important in developing a global resistance management strategy. Gordon said the strategy must include risk analysis at biosecurity hot spots such as national seaports and airports.

Partners in the genome mapping project include the University of Melbourne, Baylor College of Medicine in Texas, the French National Institute for Agricultural Research, Max Plank Institute of Chemical Ecology in Germany and the U.S. Department of Agriculture's Agricultural Research Service.

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It once took two to three years for researchers to map even tiny genomes, but it can now can be done in 24 hours with new optical mapping techniques. | GETTY IMAGE

Genetic mapping vs. genome sequencing

'i5K Initiative' seeks to sequence 5,000 insect pests

BY RON LYSENG
WINNIPEG BUREAU

PEOPLE MISTAKENLY USE "genetic mapping" and "genome sequencing" interchangeably without a second thought. However, the two technologies are as different as planting wheat with a stick and planting wheat with a SeedMaster.

True, both technologies will yield some sort of a final product, but that's where the similarity stops, says James Schnable, a geneticist at Berkeley College.

"For basic science, a genome sequence is generally more useful than a genetic map. On the other hand, from a breeding or crop improvement perspective, a genetic map is probably more important than an actual sequenced genome, especially from a cost-benefit perspective," Schnable said.

"Genetic maps describe the order of markers along the chromosomes of a genome. In the oldest maps, these markers would be whole genes. Modern genetic maps use smaller markers, but the principle is the same. It's a map of the order of landmarks on a chromosome along with some kind of information that can be used to tell them apart."

A massive global project is currently underway, aimed at sequencing the genomes of 5,000 insects. The project is titled the "i5k Initiative" and it's been called the Manhattan Project of entomology. It seeks to sequence the genomes of potentially damaging insects, thus improving our lives by contributing to a better understanding of insect biology. This information will enhance our ability to manage arthropods that threaten our health, food supply and economic security.

Susan Brown, a geonomics researcher at Kansas State University and one of the founders of i5k, said sequencing is the highest resolution map that can be created.

"Today, we can look at places where enzymes cut, for instance," she said. "It used to take teams of researchers and two or three years of work to do that for even a tiny genome. Now, for example, we can sequence a human gene in 24 hours with these new optical mapping techniques."

The Genome News Network, an online magazine that covers important developments in genomics research, said a genome map is less detailed than a genome sequence.

"A sequence spells out the order of every DNA base in the genome, while a map simply identifies a series of landmarks in the genome," it said.

"Sometimes mapping and sequencing are completely separate processes. For example, it's possible to determine the location of a gene — to 'map' the gene — without sequencing it. Thus, a map may tell you nothing about the sequence of the genome and a sequence may tell you nothing about the map."

Schnable said there's nothing new about mapping. The real breakthrough was the technology to closely examine genomes and sequence them. The first sequencing research began in 1979, and by 2000 most research organizations around the world were using it.

"Barbara McClintock published a map of the order of three genes and the fact they were genetically linked to a physically observable feature on one of the maize chromosomes back in 1931, more than 20 years before the structure of DNA was discovered," he said.

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Like a fox in the henhouse, Spoutnic keeps chickens on their toes. Preventing chickens from becoming lethargic means broilers put on weight quicker and layers have fewer floor eggs. | TIBOT TECHNOLOGIES

French robot prowls the chicken coop so you don't have to

BY RON LYSENG
WINNIPEG BUREAU

THE TIBOT SPOUTNIC prowls chicken coop floors all day, every day, keeping chickens on their toes and at the peak of efficiency.

Spoutnic, a small autonomous robot, debuted this fall at SPACE, an annual French livestock show that focuses on new technologies.

Spoutnic is designed to take the place of people who monitor chickens, regularly walking the coops to keep hens moving so they lay their eggs in nest boxes instead of on the floors.

In coops dedicated to raising broilers for the table, operators try to prevent the birds from staying dormant for too long for similar productivity reasons. Broilers experience greater weight gains when they're more active.

Employing a robot for this drudgery has obvious health benefits for the chickens and for the people, although displaced chicken coop walkers may not see it that way.

Spoutnic is the brainchild of Tibot Technologies, a French company founded by a pair of poultry farmers who did not like walking coops and bending over hundreds of times a day to pick up eggs in an environment of dust and ammonia. Tibot says that a 24-7 Spoutnic reduces floor eggs by 23 percent. Floor eggs that aren't gathered by human workers right away end up wasted because of food safety protocols.

Globalization has forced biosecurity into a priority issue. An animal raised in Canada may end up on a table in China or Europe. Even in developing nations where food takes a larger cut of families' budgets, consumers are concerned about the safety of imported food. Keeping boots out of the coops goes a long way toward protecting chicken health by reducing potential exposure to outside pathogens.

Spoutnic programmers have to strike a delicate balance when it comes to keeping the chickens moving. They need to gently rile the birds to prevent lethargy, but they don't want to cause panic. If they can get them to do the chicken dance, all the better.

> ***If this robot can make a real-time map of where the birds are, it can tell us if they're congregating in one spot. It can tell us how they're interacting. It can provide our birds with the extra engagement the animal rights activists are searching for.***
>
> **LISA BISHOP**
> CHICKEN FARMERS OF CANADA

The robot never stops moving. To prevent the chickens from becoming accustomed to a certain routine, Spoutnic is programmed to constantly change its playlist of music, lights, sounds and dance steps.

The machine also performs more serious tasks, such as spraying vaccinations, spraying disinfectants, monitoring chicken performance and marking locations of dead chickens. It produces a map depicting where it has worked and what it accomplished during each shift.

"The potential for this technology is tremendous," says Lisa Bishop, spokesperson for the Chicken Farmers of Canada. "Farmers are always innovating and looking for new ways to take care of their birds, so this robot is a tremendous tool."

Bishop says Chicken Farmers of Canada has a mandatory on-farm food safety program plus a mandatory animal-care program, that requires farmers to walk their barns three times a day.

"People check on the birds, check on mortalities and report on everything they see. We currently monitor ammonia levels, oxygen levels and temperature throughout the barns. This robot can give farmers even more information to help better manage their birds.

"If this robot can make a real-time map of where the birds are, it can tell us if they're congregating in one spot. It can tell us how they're interacting. It can provide our birds with the extra engagement the animal rights activists are searching for."

Spoutnic is about the size of an automated round Roomba vacuum cleaner. It weighs 20 pounds, has four-wheel drive, six speeds and an eight-hour battery life. It's expected to cost about $1,300.

Leonard and Kim Klassen have one barn full of layers and a second barn full of broilers at their farm near Grunthal, Man. They do a lot of barn walking. Kim thinks Spoutnic might be a good idea, but she's skeptical.

"A thousand dollars (U.S.)? Is there a money back guarantee?" asks Kim.

"I'd like to see how it runs over straw and how it reacts with all that high humidity and corrosive manure. I'm doubtful."

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Alternatives to livestock antibiotics are difficult to assess

Natural antimicrobials such as garlic may prevent infection in some animals, but some other 'natural' antibiotics do not

BY ROBERT ARNASON
BRANDON BUREAU

IN OCTOBER, a sales representative for an American company sent an email to reporters at *The Western Producer*. The email touted a new product that could replace or reduce the use of antibiotics in livestock production.

The product was made from compounds found in the allium family of plants, which includes onions and garlic, that may have natural antimicrobial properties.

The founder of the company used extracts from garlic to create a feed additive that he said controls pathogenic bacteria and increases the population of beneficial bacteria in livestock.

That means the product could potentially replace antibiotics and prevent infection in herds of cattle, pigs and poultry.

Natural antimicrobials like this garlic product may actually work, but some other "natural" antibiotics definitely do not.

"The problem is that some of them do have a level of credibility and others have absolutely no credibility," said Tim McAllister, a ruminant nutrition and microbiology expert with Agriculture Canada in Lethbridge.

"(But) it's very difficult to differentiate between the two ends of (that) spectrum."

Farmers around the world are under pressure to reduce the amount of antibiotics they give to livestock to prevent and treat disease.

In November, the World Health Organization delivered a direct message to the livestock trade, saying farmers are overusing antibiotics and contributing to the growing threat of antibiotic resistance.

"WHO strongly recommends an overall reduction in the use of all classes of medically important antibiotics in food-producing animals, including complete restriction of these antibiotics for growth promotion and disease prevention without diagnosis."

The strongly worded WHO recommendation is part of a broader trend in the livestock sector, McAllister said.

"The most recent stuff I've seen suggests the pressure on the use of antimicrobials in livestock production is only going to increase, even at more rapid rate then it has," he said. "A lot of the pressure is coming from the McDonald's, the Burger Kings. Those guys are the ones driving the change."

If Canadian livestock producers are forced to minimize or eliminate the preventive use of antibiotics, it's certain that new players will step in to fill the void with alternative treatments.

A quick internet search shows that many companies have already entered the natural therapy market for livestock.

One site promoted using winter savory and thyme to treat mastitis, an udder infection common in dairy cows. Another website hyped essential oils as a way to treat intestinal parasites in sheep.

"You're talking health food store for cattle," McAllister said.

Some companies are trying to adapt natural human remedies and sell them into the livestock market, but other firms are devising novel alternatives to antibiotics.

ZIVO Bioscience, for example, is developing products from strains of algae. The Michigan biotech firm has been testing its compounds to see if they can prevent mastitis in dairy cows.

A number of the natural and innovative products entering the market might be effective, but how can a producer distinguish the good from the snake oil?

That's not easy, partly because Canada has loose rules around marketing natural therapies.

"If the company wants to make a claim for disease treatment or disease prevention, then it is (regulated as) a drug," McAllister said.

"It's not the Wild West from a regulatory perspective, but it is from a marketing perspective."

If a firm sells its product as a feed additive it can talk to potential buyers about the antimicrobial properties.

However, it can't put those claims on the label, in brochures or on its website, which means the companies with skilled sales reps who can build trust with livestock producers will likely have the most success.

McAllister said he and his Agriculture Canada colleagues are interested in alternatives to antibiotics.

But being scientists, they want to know how a compound works and see evidence that it does work.

Their attitude to such products can be summed up with a quote that's familiar to most scientists.

"In God we trust, all others bring data."

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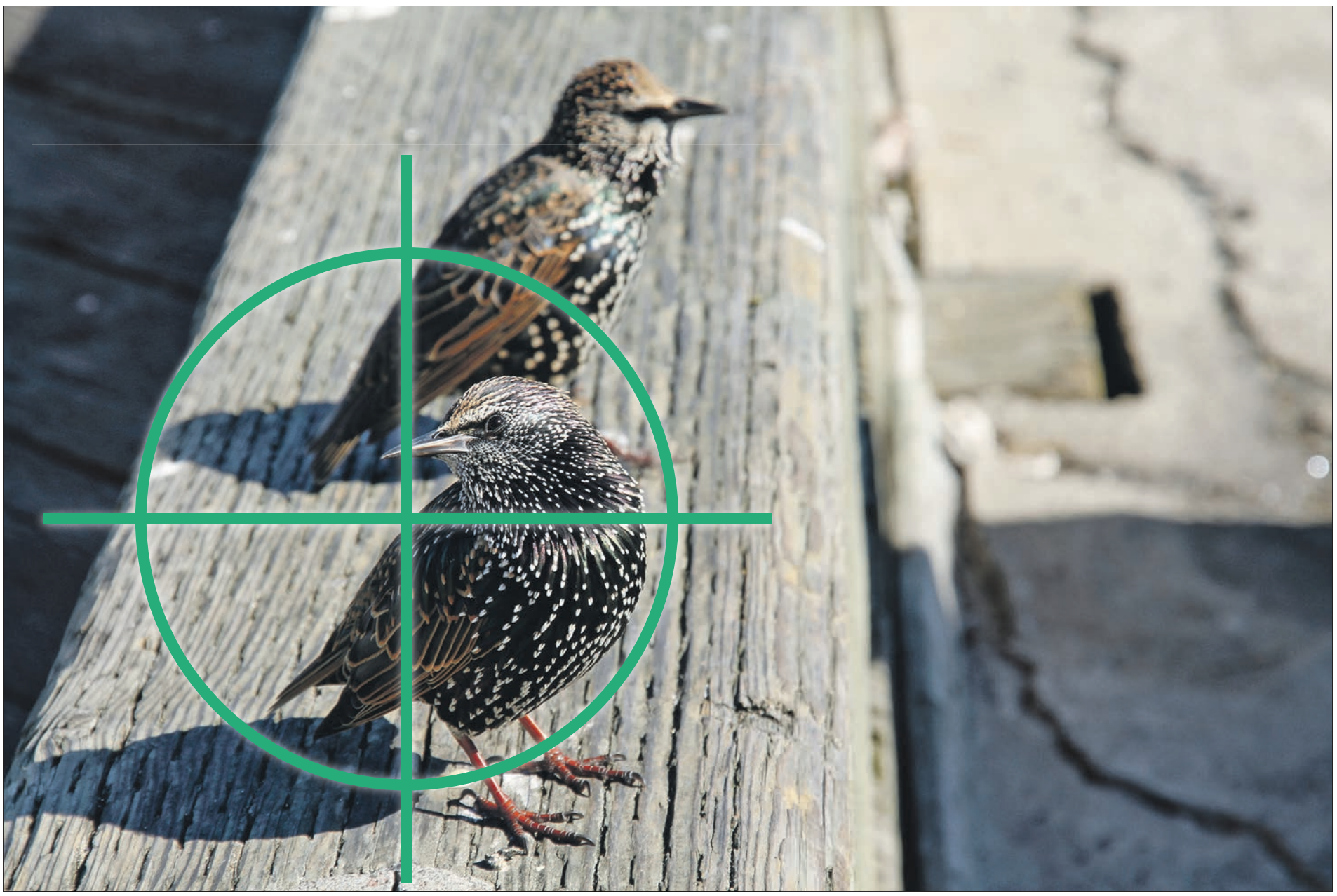
HOMEOPATHY FOR LIVESTOCK?

Alternative treatments for pets and livestock have become commonplace in the United Kingdom. So common, in fact, that in November, the Royal College of Veterinary Surgeons issued a statement on these alternative treatments.

The Royal College in particular targeted homeopathy, a type of treatment where pets or livestock are treated with a highly diluted dose of a substance that causes disease.

"Homeopathy exists without a recognized body of evidence for its use. Furthermore, it is not based on sound scientific principles," the Royal College said in its statement. "In order to protect animal welfare, we regard such treatments as being complementary rather than alternative to treatments for which there is a recognized evidence base or which are based in sound scientific principles."



European starlings are known varmints in British Columbia. They can decimate cherry crops if not managed. | INVESTMENT AGRICULTURE FOUNDATION OF BRITISH COLUMBIA PHOTOS

New laser technology proves successful for B.C. orchard

Orchard uses the laser as a way to prevent birds from eating cherries

BY JEREMY SIMES
EDMONTON BUREAU

GROWERS AT a British Columbia orchard are using new laser technology to deter birds from eating their cherry crops, an effort they say has so far paid off.

"It's been very successful," said Gayle Krahn, the horticulture manager with Coral Beach Farms in Lake Country, B.C.

The device called an Agrilaser projects green beams just above the orchard canopy when activated. The laser isn't harmful, but when birds see it, they view it as a barrier.

"They see it as a danger zone," Krahn said. "They would stay sitting on the post and watch it. When they did come in, they were confused and would fly just above the ground because they didn't know how to get out."

The Agrilaser is a solar-powered device that shoots green beams over an orchard to deter birds from entering and eating fruit crops. | GAYLE KRAHN PHOTO

Coral Beach growers have been using the lasers for about three years as part of a pilot project with the Investment Agriculture Foundation of British Columbia.

In their first year of testing, Krahn said the laser worked great. But in year two, growers noticed the birds became used to it.

"We realized we had to double-up in our bird control that year," she said. "There really is no single silver bullet."

In year three, however, growers programmed the lasers so that they would beam in different directions every few hours. This way the birds couldn't get used to the beams being in one spot, Krahn said.

"That worked a lot better for us because there was a lot less birds coming through."

Even with the lasers beaming, Krahn and her team had to control the birds by other means as well. Some were patrolling the posts and shooting the pests, while others set up bird guards.

"What I want to make 100 percent clear is that you have to double up; you can't just use a laser," she said. "It's when we doubled up that we found we were successful."

But she still stands by the product, which costs about $8,000 and requires solar power to operate.

She said the orchard that was equipped with the lasers lost only about two percent of its cherry crop, while the orchard that didn't have them lost about 25 percent.

"It's not cheap but it was worth it," she said. "Losses can be very devastating so cherry growers have to do something."

As well, other growers have taken an interest in the product.

Glen Lucas, general manager of the B.C. Fruit Growers Association, said more growers are becoming interested because the current method of solely trapping or scaring birds doesn't work too well. "The starlings are still causing damage, despite the fact that we trap and humanely euthanize about 50,000 per year," he said. "Damage hasn't gone down, so it seems like growers are interested in adding something like this (lasers) to what they currently do."

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Researchers are developing safe light and noise-based deterrents to keep unwanted animals such as elephants from devastating crops. | GETTY PHOTO

High-tech deterrent devices protect crops from ... intruding elephants?

Devices used in Gabon, Africa, where elephants can destroy a crop overnight

BY JEREMY SIMES
EDMONTON BUREAU

LASERS TO DETER birds in Canadian orchards are one innovative way to handle beasts that can damage crops.

But birds are small. You know what's large?

Elephants.

True, elephants on the Prairies aren't a problem. But elephants in Africa are — and they're without a doubt the largest pest farmers have to deal with.

In fact, elephants are capable of destroying an entire crop in one night if they manage to break into a plantation and gorge on bananas or nuts. It can be devastating for African farming communities.

Enter a different type of innovation to deter animals that can damage crops.

The Commonwealth Scientific Industrial Research Organization (CSIRO), an Australian research agency, learned of this problem and realized there wasn't much out there to stop the massive creatures from munching.

To find a solution, CSIRO partnered with Olam International to develop a deterrent that would protect crops but not harm the animals, which have seen their numbers sharply decline due to poaching and habitat destruction.

The deterrent they developed is called Vertebrate Pest Detect-and-Deter, or VPDaD for short. It's a motion sensor device equipped with cameras that can take regular photos and heat images.

When the device realizes an elephant is nearby, it emits light and makes noises, which are things elephants don't like, according to CSIRO's website.

But the VPDaD goes one step further. If an elephant gets used to the noise that the device is making, it will sound off another noise, and keep sounding off different noises until the elephant is truly scared. The device then remembers to use that same noise again if an elephant returns.

After doing tests in Gabon, Africa, researchers determined the VPDaD was a success.

Now, they're going to see if the devices can work in Australia to deal with pests there by conducting trials with businesses and farms.

If it works, animals like rabbits, feral pigs, wallabies, foxes, and dingoes may no longer be taking massive bites out of farmers' fields and pocketbooks.

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Diamondback moths focus of Cornell study

New gene altering technology may one day help control these destructive pests

BY ROBERT ARNASON
BRANDON BUREAU

THE DIAMONDBACK moth project at Cornell University isn't a normal research project.

Cornell has created a detailed website for the project, the university has a media contact person specifically for the research and there is a Frequently Asked Questions link on the website.

Cornell entomologist Tony Shelton is testing a novel approach to control diamondback moths, a major pest of brassica crops including cabbage, broccoli and canola.

The caterpillars of diamondback moths feed on the leaves of brassica crops, stunting growth or killing plants.

Shelton and his team are working with a British company called Oxitec. Scientists at Oxitec discovered a method to alter the genetics of a male diamondback moth so that it passes on a "self-limiting gene" when it mates. Cornell is evaluating the effectiveness and safety of the technology.

The self-limiting gene in the genetically modified moths produces a toxin in their female offspring. That kills the females before they reach adulthood and reduces the number of female moths that can reproduce.

The idea is to release genetically modified moths on cropland and with repeated releases, the population of diamondback moths in the area shrinks to nothing.

Diamondback moths are well suited for this approach because they breed rapidly and there is a short time between generations. As well, they are becoming resistant to a long list of insecticides.

"(It) is one of world's most damaging insect pests," Shelton said, noting that diamondback moths cause about $4.5 billion worth of damage to crops every year.

That may be true but research on moths normally doesn't warrant a dedicated website or detailed videos explaining the science.

Cornell has gone the extra mile because changing the genetics of moths in the state of New York has generated a media frenzy in New York City.

The Atlantic magazine, *Wired*, *Forbes, Bloomberg* and the *New York Times* have all reported on the Cornell project.

Environmental groups and the public have raised alarms about the research. A comment on a United States government website, regulations.gov, summarizes their position:

"Future ramifications are unknown and could be dangerous to the entire world."

Many have questioned the safety of releasing a genetically modified moth into the wild because it could pass the altered gene to other species.

Cornell, on its website for the project, said that scenario won't happen.

"The released GE diamondback moths will only mate with their own species, producing offspring which carry the self-limiting gene."

In 2015, Oxitec and Cornell tested the concept of GM moths in cages within a greenhouse. The tests showed that the Oxitec moths caused the diamondback moth population to crash.

A Cornell researcher is testing a novel approach to control diamondback moths, a major pest of brassica crops including cabbage, broccoli and canola. | FILE PHOTO

In July of 2017, after more than a year of review, the U.S. Department of Agriculture granted Cornell permission to test the moths in a field setting.

Shelton and his team selected an eight-acre cabbage field near Geneva, New York.

"As of mid-October the field studies for the year have been completed," the Cornell website stated. "We will analyze the data during the fall and winter and plan to submit a manuscript to a peer-reviewed journal soon after in 2018."

Oxitec hopes the field study supports the technology because it may be safer than insecticides.

"The approach ... is specific to the diamondback moth so does not affect beneficial insects," the Oxitec website noted. "Additionally, the insects die out so the released insects and their genes do not persist in the environment."

Diamondback moth larvae are a major pest for canola growers in Canada.

Most infestations occur when southerly winds carry the moths into the Prairies. The severity of the infestation depends on the population size in the spring and how early the moths arrive.

The Western Producer contacted Oxitec to see if the technology could be used on canola crops.

It didn't respond by press time.

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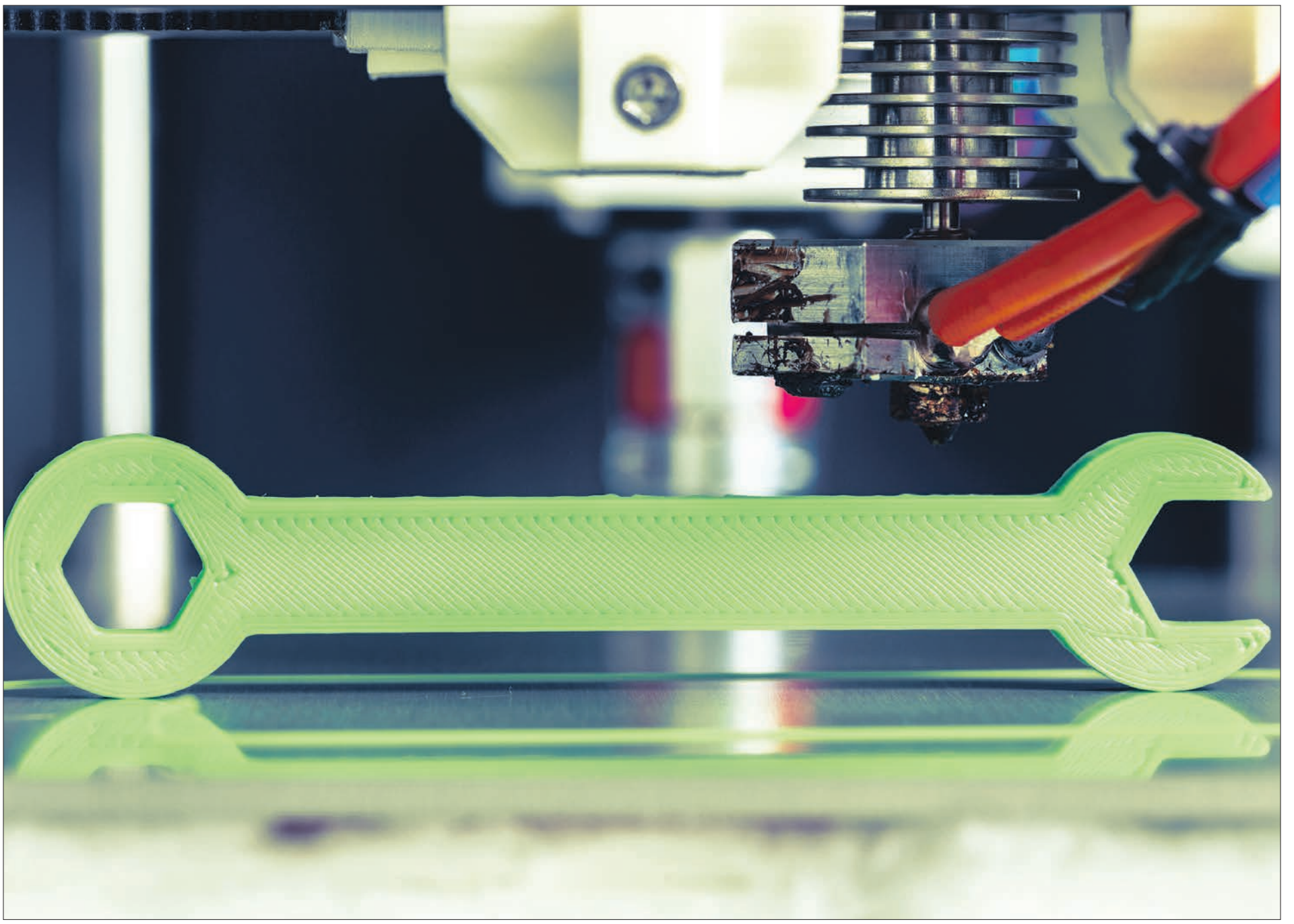


Many 3-D printers on the market produce results made of resin materials. The printed copy can take anywhere from two to five days to be completed. | GETTY IMAGE

Print your own parts?

New 3D printing centre may make it possible to replicate parts from old machinery

BY ROBIN BOOKER
SASKATOON NEWSROOM

SOURCING PARTS for older farm machinery can be a hair-pulling experience. Farmers often find parts are no longer available or the price is unreasonable.

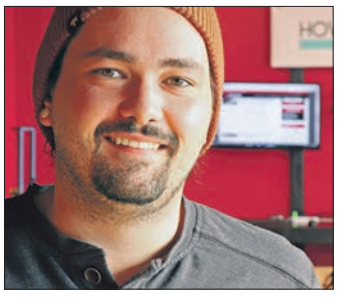
But there may soon be another option for replacement parts.

A 3D printing centre called Create Cafe has opened in Saskatoon, where anyone can walk in, talk to a designer, and order a part and coffee all at the same time.

Dustin Maki, chief executive officer of Create Cafe, said the centre is modelled after the style of an internet cafe.

"3D printing is slightly expensive and inaccessible currently, so having a cafe space where you can educate people on the applications of it and provide them access to printers, like we do in the front of our cafe, lets them try it out before spending $1,000 or $5,000 on their own," Maki said.

Beyond the educational and barista side of the business, Maki said their 3D printing service has worked with multiple industries, including agriculture, medical, aviation, and manufacturing.



DUSTIN MAKI
CEO, CREATE CAFE

There are companies trying to reduce the cost of metal 3D printers, but they still cost around $100,000.

So far, Create Cafe prints only with resin-based material.

Maki said there are more than 100 different resins available but the primary material they use is a polylactic acid (PLA) plastic.

"It's called polylactic plastic. It's actually made from cornstarch, which is interesting because it's sustainable. We can keep using that plastic and we can keep growing corn," Maki said.

Acrylonitrile-Butadiene-Styrene (ABS) plastic is also commonly printed, as is rubber.

"We have a selection of rubbers in a few different parameters, so that's good because you can do custom gaskets and anything with bushings in the middle where you need a little impact resistance. It's extremely strong and very tear resistant," Maki said.

Replacement parts that need to be impact resistant are often printed in nylon.

"Nylon does absorb moisture, so normally what we do is we'll actually put the moisture in it right away and then it won't take on additional moisture after that. It is one of the strongest materials that we've found," he said.

When a replacement part is needed, it's best if the customer brings the old part into the café. This makes it easier for designers to recreate it in the software.

"Replacement parts are really nice to work with especially if we have one of the pieces. Even if it's broken it can be glued together so that we can take measurements from," Maki said.

Three designers help draft a customer's replacement part in CAD software, that's often the most expensive part of the procedure.

"Once we have that model we put it in the slicer and we can determine how much it will cost to print off," Maki said.

The turn-around time for replacement parts is between two to five days, but once a part is designed its parameters remain in Create Cafe's files and subsequent pieces can be produced more quickly.

"After the design is done, the cost stays static, so you will know how much pieces will cost," Maki said.

The design team at Create Café can also help improve parts by eliminating weak points in the original design.

The biggest job Create Café has done to date was a batch of hopper extensions for a seeder because canola seed wasn't feeding uniformly with the original system.

"We were contacted by KMK Sales to create an extension that would basically make that five-pound hopper a 25 lb. hopper. And that increase in weight somehow fixed the issue with it seeding more than it needed to, and then it would only seed one at a time," Maki said.

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> ***Replacement parts are really nice to work with especially if we have one of the pieces. Even if it's broken it can be glued together so that we can take measurements from.***
>
> **DUSTIN MAKI**
> CREATE CAFE

Bees may be serving up humanity's next big food ... and it isn't honey

BY ED WHITE
WINNIPEG BUREAU

SOMETIMES an idea is just too delicious to ignore.

That's how thousands, probably millions of people around the world have reacted to the notion of turning bee brood into human food.

Yup, bee brood. That's the larvae of bees that live inside the thousands of hexagonal chambers that collectively make up a beehive's nursery. They're white, maggot-like things.

Yummy.

For clarification, people in countries like Canada aren't necessarily eating a lot of bee brood, at least not yet. What's caught a lot of interest in the last couple years in the developed world is the idea of eating bee brood, rather than people actually doing it.

However, bee brood has long been eaten in developing nations and among indigenous peoples. The world's poor have proven canny at discovering sources of available protein and other nutrients in their local environments.

But among the privileged classes, bug-munching has gone distinctly out of fashion. It's hard to find a restaurant that offers insect delicacies.

However, a restaurant in Copenhagen, Denmark, has pioneered much bee-based cuisine, including appetizers and brood beer. That has grown out of the work of a Danish scientist who has been laying out the opportunities and issues around the potential of using bee babies as food.

Bee brood has long been eaten in developing nations and among indigenous peoples. | GETTY PHOTOS

Annette Bruun Jensen is a noted international bee researcher. Along with a team of researchers, she released a report in October 2016 that caught fire around the world.

It not only discussed with considerable detail the technical challenges of brood extraction, handling, storage and preparation, but ventured into the realm of the culinary with example recipes, such as:

- Thai bee larvae and weaver ant eggs, with sour fermented bamboo shoots
- fresh pea and bee larvae soup
- honey bee larvae granola
- bee larvae ceviche

Apparently the possibilities are endless when you give a chef a bowl of larvae. According to Bruun Jensen's 2016 study, bee larvae can taste like "raw nuts," "avocado," "vegetal," and "meaty," depending on the taster and brood treatment.

While the study attracted a lot of interest because of the unusual and exotic nature of the topic, it wasn't prompted by frivolous concerns.

Harvesting bee brood could have serious practical value for beekeepers and society.

For beekeepers, much bee brood is literally thrown away every year as a way of controlling the spread of the varroa mite.

Yet the brood are proven to have high nutritional value, and the human race is expected to have a growing demand for protein and other high-value nutrition in coming decades.

The combination of the beekeeper's need to dispose of brood and humans' need for food has taken the idea beyond momentary online interest. It is still being talked about more than a year after being published.

It's actually not a new idea, and certainly not unheard of in Canada.

In the May 1960 edition of *Bee World*, two Canadian researchers discussed the idea in the article Bee Brood as Food.

B. Hocking and F. Matsumara examined references from the 1950s to humans eating bee brood, and noted the same desire to reduce biological waste and produce food that Bruun Jensen's team acknowledged.

"At the time of killing, colonies may contain half (a pound) to five lb. of mature capped brood," Hocking and Matsumara write.

"The world balance, or imbalance, of human food and human population suggested that its utilization should be investigated."

They mention that Japanese canned bee brood was available in Canada.

The researchers suggest that harvesting bee brood could produce a foodstuff worth more than $4 million in 1960 dollars, which was almost as much as the value of the honey crop.

Very little bee brood harvesting has occurred in Canada but the idea is back in the public eye and Bruun Jensen's paper provides all the basics for farmers or cooks interested in exploring this bold new culinary frontier.

ed.white@producer.com

Researchers say bee brood has great potential as a protein food source. | FILE PHOTO

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SASKATOON TRUCK PARTS CENTRE Ltd. North Corman Industrial Park. New and used parts available for 3 ton trucks all the way up to highway tractors, for every make and model, no part too big or small. Our shop specializes in custom rebuilt differentials/transmissions and clutch installations. Engines are available, both gas and diesel. Re-sale units are on the lot ready to go. We buy wrecks for parts, and sell for wrecks! For more info. call 306-668-5675 or 1-800-667-3023. www.saskatoontruckparts.ca DL #914394

WRECKING SEMI-TRUCKS, lots of parts. Call Yellowhead Traders. 306-896-2882, Churchbridge, SK.

WRECKING LATE MODEL TRUCKS: 1/2, 3/4, 1 tons, 4x4's, vans, SUV's. Cummins, Chev and Ford diesel motors. Jasper Auto Parts, 1-800-294-4784 or 1-800-294-0687.

TRUCK BONEYARD INC. Specializing in obsolete parts, all makes. Trucks bought for wrecking. 306-771-2295, Balgonie, SK.

WRECKING TRUCKS: All makes all models. Need parts? Call 306-821-0260 or email: junkman.2010@hotmail.com Wrecking Dodge, Chev, GMC, Ford and others. Lots of 4x4 stuff, 1/2 ton - 3 ton, buses etc. and some cars. We ship by bus, mail, Loomis, Purolator. Lloydminster, SK.

WRECKING VOLVO TRUCKS: Misc. axles and parts. Also tandem trailer suspension axles. Call 306-539-4642, Regina, SK.

BUSES 1300

SCHOOL BUSES: 20 to 66 passenger, 1998 to 2007, $2700 and up. 14 buses in stock! Call Phoenix Auto, Lucky Lake, SK. 1-877-585-2300. DL #320074.

CARS 1400

2016 SUBARU IMPREZA consumer reports as best small call starting at $23,360! Call for best price!! 1-877-373-2662 or www.subaruofsaskatoon.ca DL #914077.

SPECIAL PURCHASE OF new and near-new 2014-2015 Crosstrek XVs. Save up to $5000. Come in quickly!! 1-877-373-2662. www.subaruofsaskatoon.ca DL #914077.

TRAILERS

GRAIN TRAILERS 1505

PRAIRIE SANDBLASTING & PAINTING. Trailer overhauls and repairs, alum. slopes and trailer repairs, tarps, insurance claims, and trailer sales. Epoxy paint. Agriculture and commercial. Satisfaction guaranteed. 306-744-7930, Saltcoats, SK.

Look Here

NORMS SANDBLASTING & PAINT, 40 years body and paint experience. We do metal and fiberglass repairs and integral to daycab conversions. Sandblasting and paint to trailers, trucks and heavy equip. Endura primers and topcoats. A one stop shop. Norm 306-272-4407, Foam Lake SK.

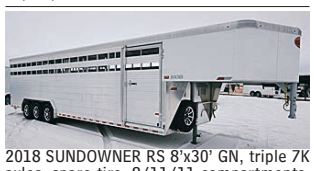
ALL ALUMINUM GRAIN TRAILERS: Tandems, tridems and Super B Timpte grain trailers. Call Maxim Truck & Trailer, 1-888-986-2946 or www.Maximinc.Com

LIVESTOCK TRAILERS 1510

2016 EXISS 28' Stock Combo Trailer, (2) 8000 lb. torsion axles, 8 yr. struct. & 3 yr. BTB warranty, $29,149. Call 780-974-9700, Tofield, AB., www.heritagetrailers.ca

2017 EXISS 20' Stock Trailer, (2) 7000 lb. torsion axles, 8 yr. struct. & 3 yr. BTB warranty, $21,750. Tofield, AB. Call 780-974-9700 www.heritagetrailers.ca

DELIVERY AVAILABLE ON ALL TRAILERS. Full line-up of Wilson Trailers also available in BC! Call for more info on getting a trailer delivered to you! With almost 2 decades of Sales & Service, we will not be undersold! Call 1-888-641-4508, Bassano, AB., www.desertsales.ca



2018 SUNDOWNER RS 8'x30' GN, triple 7K axles, spare tire, 8/11/11 compartments, #J1KB6153, $34,500. 1-866-346-3148 or shop online 24/7 at: allandale.com

CALL GRASSLAND TRAILERS for your best deal on quality livestock trailers by Titan, Duralite (all aluminum riveted) and Circle D. Fall Special in stock- 25' Duralite, $23,500; 20' Titan smooth wall classic steel stock, $14,500. 306-640-8034 cell, 306-266-2016, Wood Mountain, SK. Email gm93@sasktel.net

20' TANDEM AXLE cattle trailer, lift-off top (converts to open trailer), $4500 OBO. Call 306-862-8460, 306-277-4503, Gronlid, SK.

MISC. TRAILERS 1515

24' GOOSENECK 3-8,000 lb. axles, $7890; Bumper pull tandem lowboys: 18', 16,000 lbs., $4750; 16', 10,000 lbs., $3390; 16', 7000 lbs., $2975, 8000 lb Skidsteer, $1990 Factory direct. 1-888-792-6283. www.monarchtrailers.com

1981 NEIL'S 61' double drop flat deck, snap-off neck, 36' working deck, $7000; 1998 Trailtech tandem 12' sprayer trailer, $8000. Call 780-221-3980, Leduc, AB.

TRAILTECH TRAILER: 22', two 7000 lb axles, bumper hitch, hi boy, low boy, beaver tails & tilt, elec. over hyds., winch & picker, bolt rims. 403-346-7178, Red Deer, AB.

HEATED SNOWMOBILE TRAILERS, starting at $14,995! Call 1-866-346-3148 or shop online 24/7 at: allandale.com

130 MISC. SEMI TRAILERS, flatdecks, lowbeds, dump trailers, jeeps, tankers, etc. Check **www.trailerguy.ca** for pictures and prices. 306-222-2413, Saskatoon, SK.

ALL ALUMINUM TRAILERS: tridems and Super B Timpte grain trailers. Call Maxim Truck & Trailer, 1-888-986-2946 or see www.maximinc.com

1995 DOEPKER 48', 102", tandem machinery trailer, single drop, hyd. tail/flip, alum. outriggers, 12,000 lb. winch, good cond., $30,000. A.E. Chicoine Farm Equipment, 306-449-2255, Storthoaks, SK.

HI-BOY TRAILER, w/2-2500 gal. tanks, 3" Banjo ball valves & hoses. Tires good, $12,000 OBO. 306-834-7810, Dodsland, SK

KNIGHT SCISSOR NECK lowbed, 24.5 tires; Tridem belly dump. $22,000/ea. Call Danny Spence, 306-246-4632. Speers, SK.

COMPONENTS FOR TRAILERS. Shipping daily across the prairies. Free freight. See "The Book 2013" page 195. DL Parts For Trailers, 1-877-529-2239, www.dlparts.ca

MISC. TRAILERS 1515

PRECISION TRAILERS: Gooseneck and bumper hitch. You've seen the rest, now own the best. Hoffart Services, Odessa, SK. 306-957-2033 www.precisiontrailers.ca

BEHNKE DROP DECK semi style and pintle hitch sprayer trailers. Air ride, tandem and tridems. Contact SK: 306-398-8000; AB: 403-350-0336.

TRUCKS

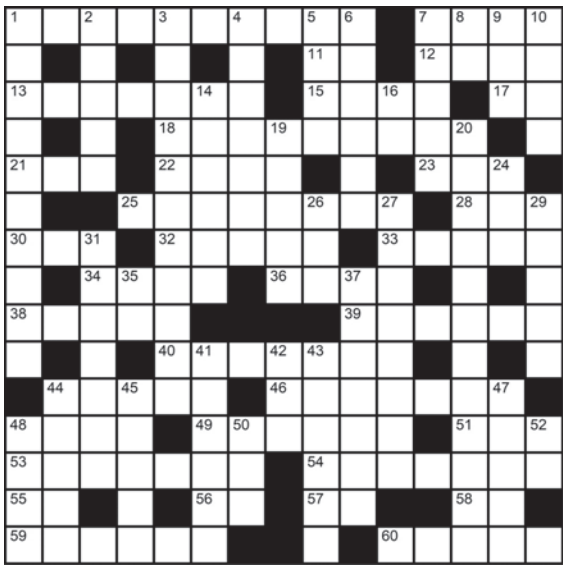
NEWEST TO OLDEST 1595

2015 FORD F250 XLT, Super Duty 4x4 crew cab, 6.7L Diesel, auto., trailer tow package, backup camera, tailgate steps, bronze fire exterior, tan cloth interior. 6 1/2' box with cover and chrome tube rails. 23,900 kms, balance of all factory warranties, $47,500 firm plus GST. Call Bill 306-726-7977, Southey, SK.

2015 F-150 XLT 4x4, w/3.5 V6, super cab, 51,000 kms., balance warranty to 100,000 kms, remote start, $28,900. Cam-Don Motors Ltd., 306-237-4212, Perdue, SK.

2013 RAM 3500 SLT, crew cab, 6.7L, auto, 4x4, dually, 99,900 kms., Sask tax paid, one owner, local trade, $41,995. Hendry's Chrysler, 306-528-2171, Nokomis, SK. DL#907140

Entertainment Crossword
by Walter D. Feener



Last Weeks Answers

ACROSS
1. She played handmaiden Lola on *Reign* (seasons 1-3)
7. She played Ma Petite, who was the smallest of the group on *American Horror Story: Freak Show*
11. Initials of the actor who played NSA Agent Alex Torres on *Knight Rider* (2008 TV series)
12. She plays Nancy Wheeler on *Stranger Things* on Netflix
13. He played Money in *Don't Breathe* (2016)
15. Katz of *Dallas*
17. *Coming ___ America* (1988)
18. 2006 French film starring François Cluzet (3 words)
21. *I Witness* co-writer (2003)
22. *___ Land* (2016) (2 words)
23. *___ Wednesday* (1973)
25. "___ now" (What Frank Constanza was advised to say every time he gets angry in order to keep his blood pressure down)
28. 1984 Irish film starring John Lynch and Helen Mirren
30. ___-Nicole Sanger
32. *Radio* ___ (1992)
33. Israeli actress Eden
34. *The Man with One Red* ___ (1985)
36. She played Melissa Walker in *Timecop* (1994)
38. *Burying* ___ (2014) (2 words)
39. Ethel Merman's last husband
40. *___ Sunshine of the Spotless Mind* (2004)
44. *___ House* (2012)
46. Director of the French film *Rust and Bone* (2012)
48. School James Bond was kicked out of
49. *Ouija: ___ of Evil* (2016)
51. 2015 miniseries Ben Kingsley starred in
53. Pet detective
54. *The ___ Patient* (1996)
55. Initials of the actress who played Madame Emery in *The Umbrellas of Cherbourg* (1964)
56. *___ Good Deed* (2014)
57. He starred in *Birth of the Dragon* (2016)
58. Jill ___ John
59. *___ on a Wet Afternoon* (1964 British film)
60. Michelle's character in *The Russia house* (1990)

DOWN
1. Creator of *True Detective* on HBO
2. She played Rosa Delle Rose in *The Rose Tattoo* (1955)
3. 1941 Bette Davis film (with *The*) (2 words)
4. He was affectionately known as "The Beard"
5. She played Lolita in *Lolita* (1962)
6. Fred Sanford's son
7. Actress Porter
8. *___ Favorite Year* (1982)
9. *___ a Job* (2016)
10. English actor Vlahos
14. Conway of silent films
16. Initials of the actor who played Nick Szalinski in *Honey, I Shrunk the Kids* (1989)
19. *Changing* ___ (2002)
20. 1982 Griffin O'Neal film (with *The*) (2 words)
24. *Star Wars* pilot Solo
26. *Married Life* director Sachs
27. 1946 film about a boy and his adopted deer (with *The*)
29. She starred in *Swing Shift* (1984)
31. She plays David's sister, Amy, on *Legion*
35. *Drive, ___ Said* (1971)
37. *Burn After* ___ (2008)
41. Emily's last name on *Revenge*
42. Actress of the black and white era of Hindi cinema
43. *The Cat and the Canary* director (1939)
44. Most popular character on *Family Matters*
45. Actress who was Miss California in 1969
47. ___ Crophopper (plane in *Planes* (2013)
48. Longoria and Gabor
50. He starred in *Drag Me to Hell* (2009)
52. Initials of the actor who played Bane in *The Dark Knight Rises*

NEWEST TO OLDEST 1595

2004 F-150 HERITAGE, 5.4 auto., 2WD, only 80,000 kms., uses clean burning natural gas, economical to run! $3900. Cam-Don Motors Ltd, 306-237-4212, Perdue, SK

GRAIN TRUCKS 1675

1979 MACK TANDEM, R600 21' grain box, 300 HP, 10 speed, 3rd axle air lift, safetied, $20,000. 204-324-9300 or 204-324-7622, Altona, MB. E-mail: gpwiebe@sdnet.ca

2007 MACK, 10 speed Eaton auto., new 20' CIM B&H, 940,000 kms., fresh Sask. safeties. Call 306-270-6399, Saskatoon, SK. **www.78truxsales.com** DL #316542.

AUTOSHIFT TRUCKS AVAILABLE: Boxed tandems and tractor units. Contact David 306-887-2094, 306-864-7055, Kinistino, SK. DL #327784. www.davidstrucks.com

CAB AND CHASSIS: 2010 Chev 3500 1 ton dually, will take 10'-12' deck, 6L gas, 195,000 kms, fresh Sask. safety, $8900; 2010 Chev 3500 1 ton dually, 2 WD, 6.6L Duramax, 330,000 mi., $6900; Mechanic's Special: 2001 Sterling L8500, will take 20' box, C12 Cat eng., 13 spd. Eaton, 454,000 kms, needs motor work, $12,900 OBO. Call **K&L Equipment**, 306-795-7779, Ituna, SK. DL #910885. ladimer@sasktel.net

REMOTE CONTROL ENDGATE AND hoist systems can save you time, energy and keep you safe this seeding season. Give **Kramble Industries** a call at 306-933-2655, Saskatoon, SK. or visit us online at: **www.kramble.net**

TANDEM AXLE GRAIN trucks in inventory. New and used, large inventory across Western Canada at www.Maximinc.Com or call Maxim Truck & Trailer 1-888-986-2946

YEAR END GRAIN TRUCK CLEARANCE! 2007 Mack 400 HP, Mack eng., AutoShift, A/T/C, new 20' BH&T, new RR tires, 716,000 kms., exc shape, **was** $67,500, **NOW** $63,500; **2007** IH 9200 ISX Cummins, 430 HP, AutoShift, alum. wheels, new 20' BH&T, fully loaded, 1M kms., real nice shape, **was** $67,500, **NOW** $63,500; **2009** Mack CH613, 430HP Mack, 10 spd., 3 pedal AutoShift, new 20' BH&T, alum. wheels, 1.4M kms. has eng. bearing roll done, nice shape, **was** $69,500, **NOW** $65,500; **2007** Kenworth T600, C13 Cat 425 HP, 13 spd., AutoShift, new 20' BH&T, alum. wheels, new paint, 1.0M kms., excellent truck, **was** $71,500, **NOW** $67,500; **2005** IH 4400 tandem, w/570 IH eng., 320 HP, 10 spd., new 20' BH&T, alum. wheels., 423,000 kms., very clean truck, excellent tires, **was** $54,500, **NOW** $51,500; **1996** Midland 24' tandem grain pup, stiff pole, completely rebuilt, new paint, new brakes, excellent tries, **was** $18,500, **NOW** $16,500; **1999** IH 4700 S/A w/17' steel flat deck, 230,000 kms., IH 7.3 diesel, 10 spd., good tires, **was** $19,500, **NOW** $18,000; **2005** IH 9200 tractor, ISX 430 HP Cummins, 13 spd., alum. wheels, flat top sleeper, good rubber, **was** $22,500, **NOW** $19,500. All trucks SK. safetied. Trades considered. Arborfield SK., Phone Merv at 306-276-7518 res., 306-767-2616 cell. DL #906768.

GRAVEL TRUCKS 1676

TANDEM AXLE GRAVEL trucks in inventory. New and used, large inventory across Western Canada at www.Maximinc.Com or call Maxim Truck & Trailer 1-888-986-2946

SEMI TRUCKS 1677

1995 VOLVO, 350,000 original kms., 9500 hrs., wet kit, 370 HP, 14 spd., one owner, farmer owned, exc. cond., 780-206-1234.

2004 IH 7600 tandem truck, 670,000 kms, 13 spd., 425/65R22.5 front (20,000 lbs.), 11R22.5 rear (46,000 lbs.), $55,000. 204-743-2324, Cypress River, MB.

2008 PETERBILT 386, yellow, daycab, 18 spd., 850,000 kms., 46k rears full locks, vg cond., $24,900. 780-206-1234, Barrhead.

2010 IHC PROSTAR day cab, heavy spec., 800,000 kms., 46R double locks, 18 spd., 485 Cummins, (0 hrs. on factory rebuilt c/w warranty), new clutch (warranty), 10 new 24.5's, nice clean heavy spec Western truck, $69,900. Will consider farm tractors or trucks on trade. Cam-Don Motors Ltd., 306-237-4212, Perdue, SK.

SEMI TRUCKS 1677

2011 FREIGHTLINER DAY-CAB, Detroit DD15, 455 HP, 13 spd., 12 front, 40 rear, 175" WB, 715,800 kms., $44,900. DL# 1679. Norm 204-761-7797, Brandon, MB.

2012 MACK CXU613 day-cab, Mack MP8, 455HP, Eaton 13 spd., $39,900. DL#1679. Norm 204-761-7797, Brandon, MB.

2013 VOLVO VN630, D13 engine, 13 spd. Eaton trans., new tires, 660,000, 4-way lockers, safetied in June 2017, $55,000. Call 306-280-9571, Saskatoon, SK.

FREIGHTLINER CASCADIA, 530 HP Detroit deleted eng., 46,000 lb. diff., 18 spd., full fenders, new tires and beacon, $80,000. 306-642-8551, Assiniboia, SK.

SANDBLASTING AND PAINTING of heavy trucks, trailers and equipment. Please call for details. Can-Am Truck Export Ltd., 1-800-938-3323, Delisle, SK.

SLEEPERS AND DAY CABS. New and used. Huge inventory across Western Canada at www.Maximinc.Com or call Maxim Truck & Trailer, 1-888-986-2946.

SPECIALIZED TRUCKS 1680

1986 DODGE 1 TON, duals, good 360 motor, rebuilt tranny (300 KM), rebuilt carburetor. New battery, newer fenders, cab floor, w/Haul-All packer/dump box, $4,900. Call 204-889-1697, Winnipeg, MB.

DECKS, DRY VANS, reefers and storage trailers at: www.Maximinc.Com or call Maxim Truck & Trailer, 1-888-986-2946.

VACUUM SEPTIC TRUCK: 2006 M2 Freightliner, S/A, Cat 10 spd., 1800 gal. tank and pump (4 yrs. old), exc. cond., $48,000. 306-547-7612, Preeceville, SK.

VACUUM SEPTIC TRUCK: 1996 Mack tandem, 3000 gal. tank, hoist, rear open door, 1200 Fruitland pump, new tires, ready to work! $38,000. 306-961-8070.

SPORT UTILITIES 1682

2016 SUBARU FORESTER name top pick for 2016. Starting from $29,360. Great selection to choose from!! 1-877-373-2662, www.subaruofsaskatoon.ca DL #914077.

SPECIAL PURCHASE OF new and near-new 2014-2015 Crosstrek XVs. Save up to $5000. Come in quickly!! 1-877-373-2662. www.subaruofsaskatoon.ca DL #914077.

VARIOUS 1685

SLEEPERS AND DAY CABS. New and used. Huge inventory across Western Canada at www.Maximinc.Com or call Maxim Truck & Trailer, 1-888-986-2946.

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VARIOUS 1685

VANS 1700

DECKS, DRY VANS, reefers and storage trailers at: www.Maximinc.Com or call Maxim Truck & Trailer, 1-888-986-2946.

VEHICLES WANTED 1705

INTERNATIONAL single axle, hyd. brakes, 466 or 530 motor, auto or std., cab and chassis. 306-291-9658, Vanscoy, SK.

BUILDING/RENOVATIONS

LUMBER 2520

ROUGH LUMBER: 2x6, 2x8, 2x10, 1" boards, windbreak slabs, 4x4, 6x6, 8x8, all in stock. Custom sizes and log siding on order. Call V&R Sawing 306-232-5488, Rosthern, SK.

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CONTINUOUS METAL ROOFING, no exposed screws to leak or metal overlaps. Ideal for lower slope roofs, rinks, churches, pig barns, commercial, arch rib building and residential roofing; also available in Snap Lock. 306-435-8008, Wapella, SK.

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PRIME LOCATION - Industrial Shop and Yard: Endless opportunities and excellent location for commercial, agricultural & industrial use. Located on Railway Avenue of Nipawin, SK., directly across from the future Hanfood site. Featuring easy access for vehicles and heavy trucks, 12" thick concrete floor and a 4 point car hoist. Other upgrades within past 5 yrs include radiant tube heaters, 3 phase power, upgraded shop lighting, spray foam insulation and a new shop door large enough for heavy trucks & equipment. This spacious 6000 sq. ft. shop and +/- 0.74 acre lot offer endless opportunities for large or small businesses. Expand your business with the use of the newly renovated office space available for lease (conveniently located right next door), excellent condition, $325,000 OBO. 306-276-6840, 306-812-6841, Nipawin, SK. tc.accumark@outlook.com

BUSINESS OPPORTUNITIES 2800

FARM LAND INVESTORS WANTED for east central Alberta and west central Sask, Looking for investors to partner with or directly invest in good land. Land to be managed by a proven top producing 3rd generation farm business in a prime area for expansion. Area has multiple wind farms in the planning stages to be constructed in the next few years as well as oil and gas. Farmland is a safe place to invest with good returns and the time is now. **Email: farmland@netago.ca**

BUSINESS FOR SALE, $120,000. Offers great growth opportunity in consumer and pet industry. Saskatoon, SK. Call Bert 306-664-BERT(2378).

SMALL BUSINESSES FOR SALE: $50,000 to $500,000. Land and buildings not included. SUITE Business Services. Ph/txt Bert 306-664-BERT(2378).

PROVEN FARMING SKILLS but need land? Operator with growth to ownership opportunities available; May require relocation. Call 403-775-0536.

SUITE Business Services: Helping small businesses to grow, start and sell their business. Ph/txt Bert 306-664-BERT(2378)

BUSINESS SERVICES

FINANCIAL/LEGAL 2902

DEBTS, BILLS AND charge accounts too high? Need to resolve prior to spring? Call us to develop a professional mediation plan, resolution plan or restructuring plan. Call toll free 1-888-577-2020.

FARM/CORPORATE PROJECTS. Call A.L. Management Group for all your borrowing and lease requirements. 306-790-2020, Regina, SK.

NEED A LOAN? Own farmland? Bank says no? If yes to above three, call 1-866-405-1228, Calgary, AB.

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CUSTOM SEEDING 3527

GRAIN CLEANING SERVICES: Fully portable grain cleaning and crop upgrading services, c/w air and screen machine, 3 roll indents & gravity table. Lloydminster, SK. Please call 306-821-2380 or 780-205-5526. https://mckenziemobileseedcleaning.com Email: mckseed@outlook.com

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COMBINED POWER AND REACH visit **farmzilla.com** for over 35,000 ag-only listings. follow us on twitter and facebook!

CUSTOM TRUCKING 3550

LONG LAKE TRUCKING, two units, custom hay hauling. 306-567-7100, Imperial, SK.

CUSTOM TUB GRINDING 3555

JIM'S TUB GRINDING, H-1100 Haybuster with 400 HP, serving Saskatchewan. Call 306-334-2232, 306-332-7332, Balcarres.

CUSTOM WORK 3560

REGULATION DUGOUTS: 120x60x14', $2000; 160x60x14', $2950; 180x60x14', $3450; 200x60x14', $3950. Larger sizes avail. Travel incl. in SK. See us at on FB at saskdugouts. 306-222-8054, Saskatoon SK

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BRUSH MULCHING. The fast, effective way to clear land. Four season service, competitive rates, 275 HP unit, also avail. trackhoe with thumb, multiple bucket attachments. Bury rock and brush piles and fence line clearing. Borysiuk Contracting Inc., www.bcisk.ca Prince Albert, SK., **306-960-3804**.

CONSTRUCTION EQUIPMENT 3600

CAT D8-14A WET deck angle dozer, not running; Hoover 12' V-Cutter; Hoover 14' Piler. 306-747-3674, Shellbrook, SK.

KELLO/ ROME/ TOWNER/ KEWANEE disc blades and bearings: 22" to 36" Ingersoll notched. Oilbath, regreaseable and ball bearings to service all makes of construction and ag. discs. 1-888-500-2646, Red Deer, AB. www.kelloughs.com

EXCAVATOR **BUCKETS,** various shapes and sizes for different excavators. Call 204-871-0925, MacGregor, MB.

CLIFF'S USED CRAWLER PARTS. Some older Cats, IH and Allis Chalmers. 780-755-2295, Edgerton, AB.

2014 L10 TAKEUCHI Skid Steer, 3500 hrs., good condition, comes with tooth bucket. 306-441-1684, Cut Knife, SK.

SKIDSTEER ATTACHMENTS: Buckets, rock buckets, grapples, weld-on plates, hyd. augers, brush cutters and more large stock. Top quality equipment, quality welding and sales. Call Darcy at 306-731-3009, 306-731-8195, Craven, SK.

2006 KOMATSU D65 EX-15. Approx. 5950 org. hrs., 24" pads, straight tilt blade, 3 tooth ripper, excellent working cond., very good UC, $139.500. Bush canopy available. Trades considered (warranty). Can deliver. Call 204-743-2324, Cypress River, MB.

MOVE YOUR DIRT real cheap! Low prices! (3) Cat 641 motor 28 yard scrapers; Cat 235 excavator w/digging bucket, not used in 5 yrs.; Cat D9-G hyd. dozer w/tow winch; (2) Cat 980B loaders w/bucket; Cat 977-K loader. Equipment of all types. New & used parts. 2 yards over 50 acres. Cambrian Equipment Sales, Winnipeg, MB. (Ph) 204-667-2867 or (Fax) 204-667-2932.

CONSTRUCTION EQUIPMENT 3600

2008 G940 TANDEM drive articulated, Volvo D7E eng., net 165 HP, HTE 1160, shuttle auto shift trans. (11 fwd, 6 rvs), 14' mold board, 5688 hrs., $74,800. DL#1679. Norm 204-761-7797, Brandon, MB.

ROAD GRADERS CONVERTED to pull behind large 4 WD tractors, 14' and 16' blade widths avail. 306-682-3367, CWK Ent. Humboldt, SK. www.cwenterprises.ca

INTERNATIONAL CLOSED DOOR baler, model NA1450; 2 hydraulic pin presses; 1 portable hydraulic track press; 3 Goodman battery locomotive carts w/hundreds of feet of track. Cambrian Equipment Sales, Winnipeg, MB. (Ph) 204-667-2867 or (Fax) 204-667-2932.

2006 HITACHI ZX200-LC excavator c/w hyd. thumb quick change bucket, approx. 10,050 hrs., excellent working condition, warranty. Machine can be viewed in Kamsack, SK. on job site. Call deliver, $89,000. Call 204-743-2324, anytime.

HYDRAULIC SCRAPERS: LEVER 60, 70, 80, and 435, 4 to 30 yd. available. Rebuilt for years of trouble-free service. Lever Holdings Inc. 306-682-3332 Muenster, SK.

1986 CASE 450C dozer crawler, 6-way blade $9500. www.waltersequipment.com 204-525-4521. Minitonas, MB.

2011 KOMATSU TC308 excavator, hyd. thumb, guarding, very clean, 5300 hrs., $145,000. Randy 780-983-0936, Camrose

2002 JCB 214 SLP backhoe; Case 2870 w/Degelman dozer; Fassi hyd. arm & 10' 1-ton steel deck. Call 306-240-8086.

HYDRAULIC PULL SCRAPERS 10 to 25 yds., exc. cond.; Loader and scraper tires, custom conversions available. Looking for Cat cable scrapers. Quick Drain Sales Ltd., 306-231-7318, 306-682-4520 Muenster SK

1980 D6D DOZER, wide pad, winch; 1993 D37 P6 6-way dozer, cab. 306-304-1959. Goodsoil, SK.

CONSTRUCTION EQUIPMENT 3600

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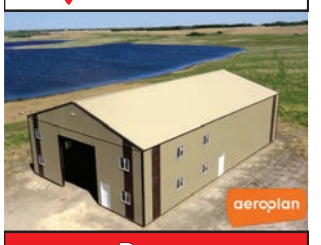

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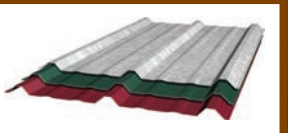

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SNOWBLOWERS/ SNOWPLOWS 4226

FARM-KING MODELS: 96", $3900; 84", $3450; 74", $3200; 50", $1900. 306-682-0738, Humboldt, SK.

SCHULTE 9600FM SNOWBLOWER front mount, orig. cutting blade, JD mount, low hrs. $8900 firm. 780-853-4888, Vermilion.

6 1/2" ALLIED 3 PTH snowblower, push or pull, 180 rotating chute. $500 OBO, Call Paul 306-233-7921, Wakaw, SK.

2016 DEGELMAN speed blade, top screens c/w skid steer bracket, only used 10 hrs., $11,500. 306-495-7721, Kipling, SK.

SPRAYING EQUIPMENT

PT SPRAYERS 4238

2014 NH SP240F 120', 1200 gal. SS tank, IntelliView IV , AccuBoom, AutoBoom, Stk 024111, $299,000. 1-888-905-7010, Lloydminster. www.redheadequipment.ca

SP SPRAYERS 4241

2011 ROGATOR 1396, 132' alum. recirculating boom, 1300 SS tank, Raven Viper Pro, Raven SmarTrax steering w/slingshot, AccuBoom sec. control, AutoBoom height control, HID lighting, DeKoning air lift crop dividers, both sets of Michelin tires, one owner. Call 204-937-3429, 204-937-7047. Roblin, MB.

1998 CASE/IH SPX3185 90', 2 sets tires Stk: 017817, $79,000. 1-888-905-7010, Saskatoon, SK. www.redheadequipment.ca

SP SPRAYERS 4241

2013 JD 4940, 120', 1500 eng, 380 tires & duals on rear, 1200 gal. stainless, all options, $219,000. 306-948-7223, Biggar, SK

HEAVY DUTY WHEEL DOLLY. Change your sprayer tires in less than an hour! Over 250 units sold. Perfect tool for safely and quickly moving or changing large wheels and tires, $1499. Phone 403-892-3303, Carmangay, AB., www.hdwheeldolly.com

2010 JD 4830, 100' booms, 1000 gal. tank, AutoSteer, Swath Pro, AutoBoom St: 021520, $215,000. 1-888-905-7010, Saskatoon, SK. www.redheadequipment.ca

2011 ROGATOR 1194, 2085 hrs., 2 sets of tires, Raven Viper Pro, newer style wheel motors, $170,000 OBO. 204-723-0236, Rathwell, MB.

2013 JD 4940 120', BoomTrac, sect. control, AutoSteer, 2630 monitor, Stk: 02415, $240,000. 1-888-905-7010, Prince Albert, SK. www.redheadequipment.ca

2011 CASE PATRIOT 3330, AccuGuide, AccuBoom, AutoBoom, Pro 600, 650 floaters, 5-way nozzle bodies, 1940 eng. hrs., always shedded, exc. cond., $180,000 OBO 306-338-8231, 306-327-4550, Kelvington.

$340,000 2014 CIH 4430, Stk#82674, 1625 hrs., 120' boom, Air Command Pro, 1200 gal., float/skinny tires, crop dividers. 403-280-2200, Calgary, AB.

2013 RG 1100, Viper Pro, height ctrl., AccuBoom, BCO, deluxe cab, HID lights, remote section ctrl., 2 sets of tires, 2160 hrs., $255,000. 403-994-7754, Olds, AB.

$145,500 2009 APACHE AS1010, Stk# 87261, 737 hrs., 100'/boom leveling, SS tank, 20" spacing, Triekon crop dividers, GPS. 403-823-8484, Drumheller, AB.

2015 CASE/IH 4440 120', AIM, AutoBoom, AccuBoom, Pro 700 Stk: 023153 $475,000. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

$254,000 2013 JD 4830, Stk#83194, 100'/boom leveling, 20" spacing, SS tank, 420/80R46 float tires, SF3000, AMS activation. 403-641-3813, Bassano, AB.

$209,000 2011 JD 4830, Stk#82768, 2142 hrs., 100' boom, 20" spacing, 1000 gal. SS tank, 380R46 skinny/600R38 floaters. 403-854-3334, Hanna, AB.

SPRAYING VARIOUS 4244

SKINNY TIRES: Four (4) High Clearance sprayer tires off Patriot 4- 12.4x42, $3800. Call 306-563-8765, Canora, SK.

FLOATER TIRES: Factory rims & tires: JD 4045, 710/60R46, $20,500; 800/55R46, $22,500; JD 4038, Case 4420, 650/65R38 Michelin tires and rims. Sprayer duals available. 306-697-2856, Grenfell, SK.

SET OF FOUR 320/90R50 Michelin Agribib sprayer tires w/rims, fit Rogator 1084, 10 bolt, $6800. 403-994-7754, Olds, AB.

2009 1286C Rogator parts, 830 hrs, C9 Cat engine w/radiator, hydros, wheel motors, plenty of other parts. 403-994-7754, Olds.

TILLAGE/SEEDING

AIR DRILLS 4250

2012 BOURGAULT 3320 QDA 66', 10" sp., c/w L6550 tank, MRB, NH3 kit, duals Stk: 02317, $295,000. Call 1-888-905-7010, Saskatoon, SK. www.redheadequipment.ca

2013 SEED HAWK 60-12 60', twin wing, semi pneumatic packers, DD, SH 800 TBH, Stk 017840, $335,000. Prince Albert, SK., 1-888-905-7010. redheadequipment.ca

2012 PILLAR OPENERS on Salford frame, floatation tires 10" spacing, blockage monitors, 2 sets of packer tires, Case 3380 DS variable rate TBT air cart, good cond., $119,000. 204-534-7920, Boissevain, MB. Darren.e.peters@gmail.com

2015 SEED HAWK 84-12 84' 12" spacing, steel seed and fertilizer knives, Stk: 022334, $352,000. 1-888-905-7010, Saskatoon, SK. www.redheadequipment.ca

2006 BOURGAULT 5710 40' 9.8" spacing, steel packers, 6200 Stk: 020500, Cart $60,000. www.redheadequipment.ca or 1-888-905-7010, Swift Current, SK.

2010 NH/FLEXI-COIL 5500, 70', 10" spacing, 3" paired row carbide atom jet knives, DS, full blockage; 2010 Flexi-Coil 430 bu. TBT cart, 3 tanks, var. rate metering, 20.8x38 duals, 10" deluxe load-in auger. Both units shedded since new and in excellent cond., $85,000. 306-675-6136, Kelliher, SK

2013 SEED HAWK 60-12 60', twin wing, semi pneumatic packers, DD, SH 800 TBH, Stk 017840, $335,000. Prince Albert, SK., 1-888-905-7010. redheadequipment.ca

2010 BOURGAULT 3310 66' 12" spacing W/MRB, 6550 cart w/liquid kit. $190,000 OBO. 306-552-4905, Eyebrow, SK.

FLEXI-COIL 5000 51', 9", w/2320, 4" rubber packers, in-row liquid phos. $18,500. 306-690-8105, Moose Jaw, SK.

2010 JD 1830 drill, 61' 10" spacing, w/430 bu. 1910 grain cart, duals, double shoot, $79,000 OBO. 306-552-4905, Eyebrow, SK.

2007 SEEDMASTER TXB 66-12, 66', 12" spacing, double shoot, all new manifold and new hoses, mint cond., w/wo JD 1910 air tank. 306-861-4592, Fillmore, SK.

2009 SEED HAWK 66-12 66', 12" sp., single knife, pneum. pkrs, 30.8 rear tires, Stk: 021475, $205,000. 888-905-7010, Prince Albert, SK. www.redheadequipment.ca

FLEXI-COIL 5000, 57.5', 7.5" spacing, 4" rubber press, 2320 tank, deluxe monitor, $14,000. 204-476-6907, Neepawa, MB.

AIR DRILLS 4250

2010 CASE/IH ATX700 70', rubber packers, high float tires, double shoot, Stk: 020407, $94,000. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

2010 SEEDMASTER 72-12 72', 12" space, JD 1910 air cart, 3-tank metering, Stk: 020958, $132,000. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

2009 SEED HAWK 72-12 72', 12" sp., twin wing, pneum. packers, 600 TBT cart, stk: 021477, $205,000. 888-905-7010, Prince Albert, SK. www.redheadequipment.ca

2010 JOHN DEERE 1830 61', 10" sp, DS dry, Poirier openers, Alpine liquid kit Stk: 023964, $67,500. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

2010 BOURGAULT 3310, 74', MRB's with granular and liquid kits., 2" carbide tips, 4" round air filled packers. No frame cracks, $75,000 OBO. 204-526-0575, Regina, SK. marcelrejean@hotmail.com

2010 JOHN DEERE 1830 61', 10" sp, DS dry, Poirier openers, Alpine liquid kit Stk: 023964, $67,500. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

2012 BOURGAULT 3320 QDA 66', 10" sp., c/w L6550 tank, MRB, NH3 kit, duals Stk: 02317, $295,000. Call 1-888-905-7010, Saskatoon, SK. www.redheadequipment.ca

MOON HEAVY HAUL pulling air drills/ air seeders, packer bars, Alberta and Sask. 30 years experience. Call Bob Davidson, Drumheller, AB. 403-823-0746.

2010 CASE/IH ATX700 70', rubber packers, high float tires, double shoot, Stk: 020407, $94,000. 1-888-905-7010, Swift Current, SK. www.redheadequipment.ca

WANTED: JOHN DEERE 1910 air cart, in decent shape. Call 306-862-8518, Choiceland, SK.

2009 SEED HAWK 66-12 66', 12" sp., single knife, pneum. pkrs, 30.8 rear tires, Stk: 021475, $205,000. 888-905-7010, Prince Albert, SK. www.redheadequipment.ca

2008 SEEDMASTER 8012, **2004** NH 430 tank, 3 compartments with 5 rollers, Raven NH3, $89,000 OBO. 306-272-7225, Foam Lake, SK.

2010 BOURGAULT 3310 65', Paralink, 12" spacing, mid row shank banding, double shoot, rear hitch, tandem axles, low acres, $135,000. A.E. Chicoine Farm Equipment, 306-449-2255, Storthoaks, SK.

2010 SEED HAWK 60' Toolbar, 12" sp., w/Seed Hawk 400 cart, 2 fans, seed & fertilizer distributing kit auger. Also NH kit & winch $175,000. 306-449-2255, A.E. Chicoine Farm Equipment Ltd., Storthoaks SK.

2014 55' K-HART drill, Paralink 4612 openers, Quick depth changing, Bg MRB, high floatation, 3" V-packers, great shape. Awesome for high speed fertilizer banding or seeding. Seed in tall stubble, $70,000 OBO. Del. possible. 204-526-0575, Swift Current, SK. marcelrejean@hotmail.com

2012 BOURGAULT 3320, 76', 10" space, 2" tips, 4.5" packers, DS dry, MRB #3's; 2014 Bourgault 7950 air tank, 5 tank meter, saddle, conveyor, scale, rear hitch. $340,000 for both. 204-648-7085. Grandview, MB.

2006 BOURGAULT 5710 40' 9.8" spacing, steel packers, 6200 Stk: 020500, Cart $60,000. www.redheadequipment.ca or 1-888-905-7010, Swift Current, SK.

CIH ATX700, 60', 12" sp., 5.5" rubber packers, Raven NH3, closers and single bar harrow. $28,000. 204-648-7085, Grandview.

AIR SEEDERS 4253

2009 SEEDMASTER 6912, expandable to 80', 300 bu. on frame w/tracks; Bourgault 6550 tank, many extras, CTF ready. 780-206-1234, Barrhead, AB.

WANTED: 42' - 45' air seeder with 7.5" spacing and 330+ lb. trips. Prefer 8810 Bourgault but will consider other makes with 7.5" spacing. Call 306-867-8477 or 306-867-7381, Outlook, SK.

WANTED: CONTROL BOX for 6180 Morris air cart, part #N21062. 306-753-2667, or 306-753-7244, Macklin, SK.

HARROWS /PACKERS 4256

2012 BOURGAULT 70' 6000 mid harrow & 72' 7200 heavy harrow, vg cond., $22,000 OBO. 204-734-0144, Minitonas, MB.

TILLAGE EQUIPMENT 4262

2009 BOURGAULT 9400, 60', 1/2" harrows, tow hitch, 600 lb. trip, quick adapters, $69,500 OBO. 204-734-0144, Minitonas, MB

BREAKING DISCS: KEWANEE, 15' and 12'; Rome 12'; Towner 16-18'; Wishek 18' and 30'. 1-866-938-8537.

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2017 DEGELMAN 40' Pro Till, 21 1/2" blades; 2017 DEGELMAN 33' Pro-Till, done 1000 acres; 2017 DEGELMAN 26' Pro-Till 500 acres. 306-441-1684, Cut Knife, SK.

42' BOURGAULT 9800 chisel plow, HD double spring, w/4-bar heavy harrow, $29,500 Cdn OBO. 218-779-1710 Delivery available

TILLAGE/SEEDING VARIOUS 4265

2010 MORRIS 8370 TBT variable rate air cart, vg cond., ran through shop, $75,900. Cam-Don Motors 306-237-4212 Perdue SK

TRACTORS

AGCO 4274

2010 FENDT 820, CVT, loader and grapple, 710's, 4 hyds., dual PTO, 200 HP, $137,900. 306-682-0738, Humboldt, SK.

CASE/IH 4286

2001 MX120 w/loader; 2000 MX135; and 2008 Maxim 140 w/loader; 2001 MX170 w/loader. 204-522-6333, Melita, MB.

2015 CASE 580 QT, 1029 hrs., full load, ext. warranty, PTO, eng. break, $430,000 OBO. 403-575-5491, Brownfield, AB.

$175,000 2008 CIH 435 Quadtrac, Stk# 87499, 5212 hrs., 30" track, 4 SCV, guidance system, Degelman 7900 14' blade w/silage ext. 403-854-3334, Hanna, AB.

2003 CASE/IH STX 450, quad track, 7065 hrs., Cummins, 16 spd. PS, 4 hyd. outlets, plus return line, 30" tracks, exc. cond. $125,000. 306-861-4592, Fillmore, SK.

2009 CASE/IH MAGNUM 215, MFWD, 2500 hrs., big 1000 PTO, 480/80R46 duals, 380/85R34 front, dealer Greenlight, excellent condition, $110,000. Call 306-459-7604, Weyburn, SK. mdmellon@sasktel.net

WANTED: 4786 IHC, 1980 and newer in good condition. Call 780-635-2527 or 780-645-1430. St. Vincent, AB.

2012 CIH STEIGER 550 Quadtrac 1995H, 30" tracks, dual hyd. pumps, leather, shedded, $289,000 OBO. Call 780-204-0391, Mayerthorpe, AB. jekfarm@gmail.com www.buymyfarmequipment.com

2016 CIH FARMALL 75A, MFWD, 20 hrs., 8 forward gears/2 reverse, 3PTH, 540 PTO, $29,000 OBO. 204-648-7085, Grandview

$375,000 2013 CIH 550 Quadtrac, Stk# 85942, 2846 hrs., powershift, hi-flow hyds., PTO, full GPS, guidance ready. 403-625-4421, Claresholm, AB.

2012 CIH 500HD, 1915 hrs., 4 remotes, tow cable, luxury cab, red leather heated seats, 16 spd. PS, 57 GPM hyd. pump, 710 tires, buddy seat, gd cond., $228,000 OBO. Ph/tx Brandon 306-577-5678, Carlyle, SK.

STEIGER 4289

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CATERPILLAR 4292

$440,000 2013 CHALLENGER MT965C, Stk#83676, 834 hrs., 525 HP, hi-flow hyds., 5 SCV, PTO, GPS, Degelman 7900 blade. 403-783-3337, Ponoka, AB.

2014 MT965C, 800's, 5 hyds., GPS, 1025 hrs., 525 HP, loaded, $349,900; 2013 MT 545D, loader & grapple, 24 spd., dual PTO, 1512 hrs., cab susp., 155 HP, $139,900. 306-682-0738, Humboldt, SK.

JOHN DEERE 4295

2013 JD 9410R, 4WD, PS, 1480 hrs., 1000 PTO, high flow hyd. w/5 remotes, leather trim, premium HID lights, 620/70R42's, $199,500 USD. www.ms-diversified.com Call 320-848-2496 or 320-894-6560.

1990 JOHN DEERE 8560 4WD, 230 HP, PTO, new rubber, always shedded, with JD AutoSteer, $43,500 OBO. Phone/text 204-242-4332, Manitou, MB

WRECKING FOR PARTS: JD 8850 4 WD, w/8- 24.5x32 Goodyear Dyna Torque tires 80+%. Needs eng. repair. Can be sold as a complete unit. 1-877-564-8734, Roblin MB

JOHN DEERE 4295

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1964 JD 4020: New top end, sleeves, pistons, batteries, oils, & fluids. $9500 OBO. 204-739-3392, Fisher Branch, MB.

REDUCED PRICE! 1983 JD 4450 MFWD w/Ezee-On FEL 2130 grapple, 15 spd. PS, 3 hyds., 7925 hrs. showing, 14.9-26F, 20.8R32, duals available. 306-283-4747, 306-291-9395. Langham, SK.

2012 JD 6150R, MFWD, 380 FEL and grapple, bought new in April 2013, 1775 hrs., shedded. Call 306-297-6404, Simmie, SK.

$125,500 1997 JD 9400, Stk#89153, 8100 hrs., 425 HP, rebuilt trans., 710 duals, with Degelman two-way blade. 403-280-2200, Calgary, AB.

1997 JD 9400 4WD, 425 HP, 8562 hrs., 12 spd., diff. lock, 4 hyds., 20.8x42 triples new 400 hrs. ago, does light duty work, mint condition, always shedded, $100,000. 306-675-6136, Kelliher, SK.

1992 JD 4055 MFWD, 9032 hrs., great for baler or grain auger, exc. cond., $40,000 OBO. Kdranch@yahoo.com 306-846-4501, 306-846-7770, Dinsmore, SK.

2011 JD 9530T, 18 spd. PS, 36" tracks, 4 hyds. plus return line, front weights, end idler weights, AutoTrac ready, mint cond., $195,000. 306-861-4592, Fillmore, SK.

2000 JD 7710, 5130 hrs; 2000 JD 8310; 2001 JD 7810; 2009 JD 7830, 3800 hrs. All MFWD, can be equipped with loaders. 204-522-6333, Melita, MB.

2008 JD 7230 Premium, MFWD, 3 PTH, 3 hyds, w/JD 741 FEL, bucket, grapple, 2677 hrs vg. 306-625-7277, Stewart Valley, SK.

2007 JD 9420, 4713 hrs., 1 owner, all available options, 800 Firestone deep tread tires, weights, 15 spd. Powershift, climate control, Active Seat, extra lighting, SN# RW9420P051184, excellent condition, $150,000. Charles Cattle Co., 306-457-2935, Stoughton, SK.

1978 JD 4440 2WD, 9300 hrs., 1200 hrs. on complete rebuild, meticulously maintained, 134a A/C, Pioneer hyd. coupler conversion, 42" wheels, 50 series hood lights, upgraded steps, fresh eng. & trans. oils, $40,000. 306-577-9141, Wawota, SK.

UTILITY TRACTORS: John Deere 6200, 2 WD, open station with loader; JD 5085 E, MFWD w/loader. 204-522-6333, Melita.

2 JOHN DEERE 8970's: 5400 hrs., powershift, $79,000 Cdn OBO; 6800 hrs., 24 spd., $69,000 Cdn. OBO. Both have PTO and 3PTH. 218-779-1710. Delivery avail.

1992 JD 4255, 2WD, w/265 loader, 3800 hrs., great shape, $52,000 OBO. Medicine Hat, AB. 403-581-8269 or 306-628-7380.

$134,900 2009 JD 7830, Stk#82122, 6906 hrs., 165 HP, IVT, new engine in May 2017, 520/R42 & 420R30 tires, AutoTrak ready. 403-362-3486, Brooks, AB.

2005 JD 9520T, 5380 hrs., 3PTH, no PTO, needs 36" tracks, new head, exc. cond., $96,000. 780-919-6639 Sherwood Park AB

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2012 Case IH Steiger 600 Quadtrac
36" Tracks; Lux Cab, HID Lights, 6 Remotes, 113 GPM Hyd, AccuGuide, Stk: 024150 (SA)

COMBINES

2017 Case IH 9240 36" Tracks, Ext Wear Rotor, Folding Auger, Lux Cab, Leather, AccuGuide, HID Lights Stk: 026350 (ME) **$575,000**

2016 Case IH 9240 620 Duals, Lux Cab, Lat Tilt w/Rocktrap, AccuGuide, 50' Folding Unload, Magnacut Chopper, HID Lights Stk: 022940 (SC) **$499,000**

2016 Case IH 8240 520 Duals, Lat Tilt, Rocktrap, Ext Wear Rotor, Standard Chopper, Deluxe Cab, Leather Seat, Pro 700, AccuGuide Ready Stk: 022117 (SC) **$405,000**

2014 Case IH 8230 900 Singles, Lat Tilt, Deluxe Cab, GPS, Folding Auger, Pivot Spout, Hyd Fold Hopper Cover, 865 Engine & 640 Rotor Hrs, Stk: 025289 (SC) **$335,000**

2013 Case IH 9230 620 Duals, Lux Cab, Lat Tilt w/Rocktrap, AccuGuide, Hyd Grain Tank Cover, Magnacut Chopper, HID Lights Stk: 021990 (ES) **$350,000**

2012 Case IH 9120 620 Duals, HID Lights, Magnacut Fine Chopper, AccuGuide, Pro600 Monitor, 24'Auger Stk: 023485 (PA) **$275,000**

2012 Case IH 7230 520 Duals, Lat Tilt, Ext Wear Rotor, Hyd Folding Cover, Std Chopper, HID Lights, AccuGuide, Air Compressor Stk: 021503 (PA) **$269,000**

2009 Case IH 7120 520 Duals, Lateral Tilt, AccuGuide, Power Mirrors, Std Cut Chopper, 3016 Header /W SwathMaster Pickup Stk: 205692B (LL) **$189,000**

2006 Case IH 8010 14' CIH 2016 Pickup, 520 Duals, Rocktrap, Pro 600 Monitor, St. Rotor, Maurer Topper, Fine Cut Chopper, Long Auger Stk: 021412 (ME) **$155,500**

2006 Gleaner R65 Pickup Header, 900 Singles, Single Spreader, 500 Hrs on Reman Engine Stk:026973 (ME) **$92,500**

2012 Challenger 540C 620 Duals, Power Fold Hopper, MAV Chopper, Small Grain Rotor, AutoSteer, Leather, PH15 PU Header Stk: 026658 (SA) **$245,000**

2012 MF 9560 520 Duals, MAV Chopper, Power Ford Hopper, AutoSteer, Leather, MF 4200 PU Header Stk: 026657 (SA) **$270,000**

SPRAYERS

2016 Case IH 4440 120', AIM Pro, Active Susp, Pro 700, AccuGuide, AccuBoom, AutoBoom, Front Fill, Wide Fenders, Trelleborg 710s Stk: 022565 (SA) **$495,000**

2014 Case IH 4430 120', Lux Cab, Active Susp, HID lights, AutoBoom, AccuBoom, Viper Pro Monitor, AIM Pro, 380s & 620s, Raven Smartrax Steering Stk: 023711 (PA) **$380,000**

2013 Case IH 4430 100', Deluxe Cab, AIM, Pro 700, 372 Receiver, 2 Sets Of Tires, HID Lights, AutoBoom, AccuBoom Stk:024786 (SC) **$305,000**

2011CaseIH4420 120',DlxCab,380s&650s,HIDLight,AirComp,ViperPro,SmartraxAutoSteer, AutoBoom, AccuBoom, Crop Dividers, Fan Reverser Stk: 021959 (ME) **$213,000**

2009 Case IH 4420 100', AIM, 1200 Gallon, Norac Boom Height Control, Sectional Control, Autopilot, 380s & 520s, Ag Leader Monitor Stk: 020576 (ES) **$199,500**

2013 Case IH 3330 100 Ft, 380 & 650 Tires, Active Susp, Front Fill, AIM Command, Deluxe HID Lighting, AccuBoom, AutoBoom Stk: 022510 (SA) **$249,900**

2000 Case IH SPX2130 78', AutoSteer, 2 Sets of Tires, 660 Gallons Stk: 024745 (SA) **$69,900**

2014 Case IH 4530 Floater 70', Lux Cab, Power Mirrors, Deluxe HID Lights, Fenders, Double 6" Auger 50 CF, Viper 4 Monitor, 1550 Hours Stk: 024242 (SC) **$320,000**

2011 Case IH 3230 100', Dlx Cab, Active Susp, HID Lights, Pro 600, AccuGuide, Fenders, AccuBoom, AutoBoom Stk: 028123A (LL) **$229,000**

2010 John Deere 4830 100', 1000 Gallon Tank, AutoSteer, Swath Pro, AutoBoom, 2 Sets Of Tires, Crop Dividers Stk: 021520 (SA) **$215,000**

2014 New Holland SP240f 120', 1200 Gal SS Tank, Intelliview IV Monitor, AccuBoom, AutoBoom, 2 Sets of Tires Stk: 024111 (LL) **$299,000**

2009 Apache AS1010 100', 1000 Gal, Raven Control & GPS, 5 Way Nozzle Bodies, 1800 Hrs Stk: 026632 (SC) **$190,000**

1998 RoGator 854 100', 800 Gal SS Tank, Ez-Guide AutoSteer, Rate Controller, Rinse Tank Stk: 023420 (LL) **$49,000**

TRACTORS

2014 Case IH Steiger 620 Quadtrac Luxury Cab, PTO, Twin Flow Hyd, 36" Tracks, 6 Remotes, Pro 700, AccuGuide, HID Lights Stk: 025032 (ME) **$489,000**

2015 Case IH Steiger 540 800 Duals, AccuGuide, 6 Remotes, PTO, HID Lights, 2 Hyd Pumps, Weight Pkg. Stk: 016410A (LL) **$429,000**

2016 Case IH Steiger 580 Quadtrac Lux Cab, LED Lights, Pro 700, AccuGuide, 2 Hyd Pumps, 6 Remotes, PTO, 36" Tracks, Tow Cable Stk: 022922 (SC) **$565,000**

2014 Case IH Steiger 550 Quadtrac Luxury Cab, Dual Hyd Pumps, PTO, HID Lights, Tow Cable, HID Lights, 6 Remotes, Viper Pro, Raven AutoSteer Stk: 023776 (PA) **$481,000**

2016 Case IH Steiger 500 520 Triples, Deluxe Cab, HID Lights, AccuGuide, Pro 700, 4 Remotes, Hi-Cap Hyd, 342 hours Stk: 023022 (SC) **$380,000**

2016 Case IH Steiger 420 520 Triples, Deluxe Cab, HID Lights, Pro 700, AccuGuide, 4 Remotes, High Capacity Hyd, PTO Stk: 023173 (SC) **$379,000**

2009 Case IH Steiger 485 Quadtrac Dlx Cab, Hi Cap Hyd, PTO, 30" Tracks, Cab Suspension, AccuGuide Stk: 023118 (SA) **$255,000**

2012 John Deere 9510RT 36" Tracks, Leather Seat, 4 Remotes, SF2 GPS, GreenStar Display, High Capacity Hyd 58 GPM, 2070 hours Stk: 024350 (SC) **$350,000**

2013 New Holland T9.615 36" High Idler, Lux Cab, HID Lights, GPS AutoGuidance, Twin Pump Hyd, Radar, PTO, 2700 hours Stk: 025507 (SC) **$410,000,**

$488,000
2015 Case IH Patriot 4440
120 Ft, 320's & 710's, AIM Pro, Dlx HID Lights, Pro 700, AccuGuide, Fenders, Stk: 019638 (ME)

$199,500
2009 Case IH Patriot 4420
100 Ft, AIM, Norac Autoboom, Ag Leader Monitor, AutoPilot, Sec. Control. Stk: 020576 (ES)

$315,000
2013 Case IH Patriot 4430
120 Ft, Lux Cab, Active Susp, Viper Pro Monitor, Smartrax, 380's & 650's, Stk: 025178 (SC)

* Finance Terms: O.A.C. Certain conditions apply. Offer subject to change and cancellation at any time.

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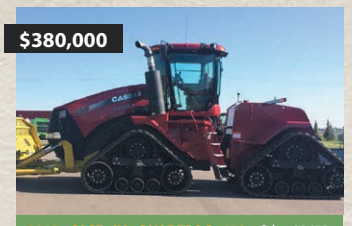
2012 Claas 770TT, Stk 91846, 1374 Eng / 854 Sep Hrs, Lat Tilt, Chopper, 2WD Tracks, P516 Pickup, Comes w/Maxflo 1200 40' Draper Header ..... VULCAN,, AB

2009 JD 9530T, Stk: 91141, 3785 Hrs, 475 hp, 36" Tracks, Deluxe Comfort Cab Package, Guidance-Ready, Cat 5 Wide Swing Bar Drawbar..... SASKATOON, SK

2012 Fendt 933V, Stk: 91880, 3790 Hrs, 330 hp, IVT, IF710/70R42 & IF620/75R30 Michelins, 4 SCV, Pilot Steering, Trimble CFX750 Display..... STETTLER, AB

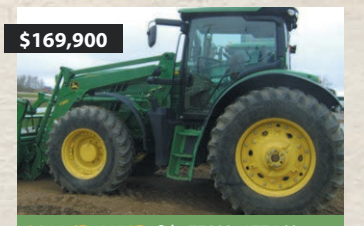


2013 CASE IH QUADTRAC 450, Stk: 82672, 1963 Hrs, IVT, 30" Tracks, PTO, Hi-Flow Hydraulics, Guidance Ready, Degelman Blade ....CALGARY,, AB

2013 Case IH 8230, Stk: 74782, Sep. Hrs: 830, Lat Tilt Feederhouse, PRO 700 Monitor, Yield Monitor.... WATROUS, SK

2012 NH T9.560HD, Stk: 88325, 2061 Hours, Powershift, Triples, HI-Flow Hydraulics, Guidance-Ready..... MELFORT, SK

2014 John Deere 9510R, Stk; 88825 1850 Hours, 18 Speed Power Shift, Duals, Hi-Flow Hydraulic System, Guidance-Ready..... SASKATOON, SK



2014 JD 6150R, Stk: 77002, 1774 Hours, MFWD, Partial Power Shift, Rear PTO: 540/1000 ..... MELFORT, SK

2013 JD 1895, Stk: 91881, Acres: 20000, Width: 43', 10" Spacing, Double Shoot, Narrow Gauge Wheels, TBH 1910 550 bu Cart .....CLARESHOLM, AB

2008 Case IH ATX400, Stk: 82653, Acres: 40000, Width 52', Spacing: 10", Single Shoot (towers/hoses Dbl Shoot), ADX3430 430 bu Capacity ....HANNA, AB

2009 JD 1830, Stk: 82564, Width: 61', 10" Spacing, Double Shoot, 550 lb Opener, Hose Blockage Warning, TBH 1910 430 bu Cart..... VULCAN, AB

2012 Flexi - Coil 5000HD, Stk: 75278, Width: 57', Spacing 10" Double Shoot, 5.5" Packers, w/ JD 1910 Two-Between 430 bu Cart... CALGARY, AB

2015 Morris C2, Stk: 6742, Acres: 4500, Width: 61', 12" Spacing, Double Shoot, Polymer Boot 4" Wide, 5.5" Otico Packers, 950 VR TBH Cart....DRUMHELLER, AB

2013 JOHN DEERE S680, Stk: 71451, Sep Hrs: 853, 2WD, Duals, Spreader, Lat. Tilt Feeder ..... MELFORT, SK

2013 CASE IH 8230, Stk: 84053, 886 Engine Hours, Sep Hours: 663, Lateral Tilt Feeder, Yield Monitor.....PRINCE ALBERT, SK

2015 JD S680, Stk: 91140, Sep Hrs: 854, 2WD, 615P, Extra High Capacity Air Cleaner, Lat Tilt Feeder, Chopper..... SASKATOON, SK

2008 MASSEY FERGUSON 9895, Stk: 78068, Sep Hrs: 1232, 2WD, Duals, 4200 Pickup, 350 bu Hopper w/ Mav Chopper.....MELFORT, SK

2015 JD S680, Stk: 74087, 759 Eng/591 Sep Hrs, 615P, Lat Tilt, Small Grains Package, Pwrcast Tailboard, Finecut Chopper, JD Link til Feb 2019 ...VULCAN, AB

2015 CLAAS 880, Stk: 88526, 1100 Eng/825 Cut Hrs 659 Corn Header, 15' Grass Pickup, GPS Ready, 3-Year Engine Warranty Remain.....PONOKA, AB

2013 CASE IH 9230, Stk: 81983, Sep Hours: 703, Lateral Tilt Feederhouse, Yield Monitor, Full Autosteer.....ROSTHERN, SK

2013 NEW HOLLAND CR8090, Stk: 79298, 1406 Eng/939 Sep Hrs, Lat Tilt, Twin Rotors, Pro 700 Yield & Moisture, Spreader/Chopper....DRUMHELLER, AB

2013 NEW HOLAND CR9090, Stk: 89606, Sep. Hours: 787, Lateral Tilt Feeder, Yield Monitor.....PRINCE ALBERT, SK

2013 JD S680, Stk: 82178, 1423 Eng/1012 Sep Hrs, NO PICKUP, Lat Tilt, Pwrcast Tailboard, Pwr Fold Hopper, 26' Auger, 2630 Display..... BASSANO, AB

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2011 JD 7230 Premium, MFWD 3 PTH, 3 hyds., auto quad trans., w/JD 741 FEL bucket & grapple, shedded, yard work /small cattle farm. 4960 hrs., VG, $95,000. 306-697-3545, 306-730-8792, Grenfell, SK

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$269,000 2015 JD 7230R, Stk#80127, 1924 hrs., 230 HP, IVT, IF600/70R30 & IF710/70R42 tires, 5 SCV, SF3000, 4600 display. 403-783-3337, Ponoka, AB.

2000 JD 9400, 425 HP, 12 spd. powershift, 4 hyd. outlets, plus return line, new hyd. pump (48 GPM), 3 yr. old tires, 80% remaining, 710/70R38, mint cond., $110,000. 306-861-4592, Fillmore, SK.

2000 JD 2140 2WD, JD 80 HP loader utility, 4000 hrs., shedded, well maintained, used as auger tractor, no winter use, very good cond. $19,500. Melfort, SK. Call 306-921-7683 or 306-752-4336, or email Bobdegelman@gmail.com

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MASSEY FERGUSON 4301

2014 MF 7615, Deluxe cab, cab susp., loader & grapple, CVT, 150 HP, 2510 hrs., $139,900. 306-682-0738, Humboldt, SK

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2014 VERSATILE 2375, 710's, PTO, 4 hyds., 12 spd. standard, 1 owner, $185,000. 306-682-0738, Humboldt, SK.

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$215,000 2012 FENDT 933V, Stk#91880, 3790 hrs., 330 HP, IVT, IF710/70R42 & IF620/75R30 Michelins, 4 SCV, Trimble CFX750. 403-742-4427, Stettler, AB.

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CAT D7 17A HDV Dozer, CCU w/Towner breaking disk, and LaPlat cable scraper, $15,000. 780-632-7352, Vegreville, AB.

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BRAUNVIEH 5047

HERD DISPERSAL SALE: Bred cows 96 FB registered Braunvieh cows, bred to FB Braunvieh bulls; PB black Braunvieh (homo polled & hetero black bulls). Exposed June 17th to Sept. 1st, $3200 OBO. Please call us at 403-243-5530, Huxley, AB., or e-mail: calvin@fieldstonebraunvieh.com Website: www.fieldstonebraunvieh.com

CHAROLAIS 5055

REGISTERED PUREBRED CHAROLAIS bulls: 40+ yearling and 5 coming 2 year olds, for sale by private treaty. Belmont, MB. Brad 204-537-2367 or 204-523-0062 **www.clinecattlecompany.ca**

10 PUREBRED BRED Charolais heifers, some are AI. Wood River Charolais 306-478-2520 McCord, SK.

15 PUREBRED CHAROLAIS cows & 10 commercial cows, bred Charolais. Layne & Paula Evans, 306-252-2246, Kenaston, SK.

TEN PUREBRED CHAROLAIS bred heifers. Layne and Paula Evans, 306-252-2246, Kenaston, SK.

GALLOWAY 5070

30 BELTED GALLOWAY X Galloway, yearlings & two-year-olds, certified organic, no grain. 780-356-2239, Grande Prairie area.

GELBVIEH 5075

DAVIDSON GELBVIEH/ LONESOME DOVE RANCH 29th Annual Bull Sale, Saturday, March 3, 2018, 1:00 PM at their bull yards, Ponteix, SK. Complimentary lunch at 11:00 AM. Pre-sale viewing and hospitality, Friday, March 2nd. Selling 100+ purebred Gelbvieh yearling bulls, Red or Black. Performance and semen tested. Vernon and Eileen 306-625-3755, Ross and Tara 306-625-3513, Ponteix, SK. Bidding in person or on-line: www.dlms.com View catalog and video on our websites: www.davidsongelbvieh.com and www.lonesomedoveranch.ca

FANCY PUREBRED HEIFER Calves. Jen-Ty Gelbviehs, 403-378-4898, Duchess, AB. www.jentygelbviehs.com

HOLSTEIN 5100

FRESH AND SPRINGING heifers for sale. Cows and quota needed. We buy all classes of slaughter cattle-beef and dairy. R&F Livestock Inc. Bryce Fisher, Warman, SK. Phone 306-239-2298, cell 306-221-2620.

400 BULLS- FREE DELIVERY! SIGHT UNSEEN PURCHASE PROGRAM
HILL 70 QUANTOCK RANCH BARN BURNIN' BULL SALE
Saturday, February 3, 2018 — *12 noon at the Ranch Lloydminster, AB/SK*

95 Red Angus- 65 Two's & 30 Yearling
60 Horned & Polled Hereford- Two's
90 Black Angus- 60 Two's & 30 Yearlings
70 Charolais- 35 Two's & 35 Yearlings
30 Red & Black Simmental- Two's
20 Red Angus x Gelbvieh- Two's
35 Black Angus x Simmental Hybrids- 10 Two's & 25 Yearlings
30 Red Angus x Simmental Hybrids- Two's
150 Bred & Open Commercial Females

Bill Creech "The Bull Guy"
1.800.665.7253

Look for our catalogue & bull sale video on the website in early January
info@hill70quantock.com
HILL70QUANTOCK.COM

HILL 70 QUANTOCK RANCH Bulls
Connor Creech 780.871.8496
Ted Creech 306.307.2873
Adam Creech 780.218.4301

SALERS 5185

PUREBRED SALERS HERD DISPERSAL. Details at: www.sweetlandsalers.com Ken Sweetland, Lundar, MB., 204-762-5512.

SIMMENTAL 5205

PB RED SIMMENTAL 2nd and 3rd calvers. Also red heifer calves. Crocus Simmentals, Swift Current, SK. Call 306-773-7122.

WELSH BLACK 5235

WELSH BLACK- The Brood Cow Advantage. Check www.canadianwelshblackcattle.com Canadian Welsh Black Soc. 403-442-4372.

CATTLE VARIOUS 5240

65 YOUNG RED & Red cross bred cows, bred to Charolais bulls, due April 1st; 65 young black and black/white face cows, bred to Black Angus bulls, due April 1st, $2100. Call 306-577-1996, Kipling, SK.

50 SIMMENTAL & SIMMENTAL Cross bred cows and heifers, bred Simmental, start calving March 1st. 306-762-4723, Odessa.

HOME RAISED TOP Quality Bred Heifers, vaccinated, Ivomec, bred to calving ease Black Angus bulls. Start calving mid March. 66 Black Angus; 13 Red Angus X; 12 Hereford (SOLD). Winston Hougham, Please call 306-344-4913, 306-821-2751, Frenchman Butte, SK. magnumranching@gmail.com

180 BLACK & RED Angus cross cows, 3-5 years old, bred to top Black & Red Simmental bull. To start calving April 5th, vaccinated with Bovishield FP5, excellent deep square cows; Also 35 Angus cross heifers bred to easy calving Angus bull. Call 204-851-0745, Elkhorn, MB.

14 RED ANGUS bred heifers, to start calving March 25th. Ivomec'd and vaccinated. Call evenings, Garry Yeo, 306-873-9078 or 306-873-3788, Tisdale, SK.

FOR SALE: 12 F1 POLLED Shorthorn Red Angus heifers, will make good brood cows. Call 306-277-4351, Gronlid, SK.

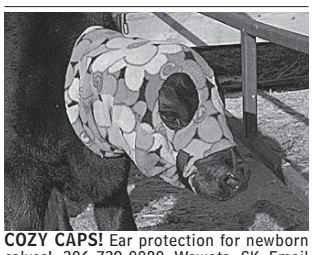
12 SIMMENTAL & Simmental Angus cross bred heifers, red and black, bred easy calving Simmental, for Feb and March calving. Call Lee at 306-335-7553, Balcarres, SK.

RED ANGUS CROSS Simmental Bred Heffiers, Bred Red Angus exposed June 12th. Call 306-458-7544, Midale, SK.

110 BRED RED ANGUS Simmental cross heifers, bred Red Angus for 30 day calving period, bulls out July 1st. 306-355-2700, 306-631-0997, Mortlach, SK.

100 BLACK ANGUS 3rd and 4th calvers; 250 Black & Red Angus 2nd calvers. Swift Current, SK. 306-773-1049, 306-741-6513.

EXCELLENT SET OF hand picked Red & RWF heifers. 80 red and RWF, exposed 45 days, start calving Feb 1st. 125 red and RWF, exposed 60 days, start calving April 1st. Average weight 1200 lbs. Bred to top of the line Red Angus low BW bulls. 403-740-5197, Big Valley, AB.



COZY CAPS! Ear protection for newborn calves! 306-739-0020, Wawota, SK. Email cozycaps@outlook.com

CATTLEMENS FINANCIAL CORP. Programs for cow/calf operators and feedlots, proceeds as you sell and equity draws. 780-448-0033 or www.cattlefinance.com

10 PB RA & 5 RA/Simm. bred heifers, bred RA July 14-Aug. 28. Kept these as own replacements out of 75 but must sell due to drought/feed shortage. Processed one month ago: RA 1017 lbs., Simm X 1068 lbs. Call Roger: 306-221-1558, Minton, SK.

CATTLE VARIOUS 5240

60 BLACK BRED heifers, bred Black Angus, easy calving bulls, bulls out 60 days, start calving May 1st, all vaccinations & Ivomec, $2300. 306-283-4388, Saskatoon, SK.

25 BLACK BRED heifers, bred Black Angus, easy calving bulls, bulls out 60 days, start calving May 1st, all vaccinations & Ivomec, $2300. 306-283-4105, Saskatoon, SK.

CATTLE WANTED 5245

LOOKING FOR an investor to purchase cow/calf pairs (up to 400) or looking to finance directly from the farmer. Prefer Red or Black Angus. Pay back over 8 years with a 30% return on your principal. Call 204-848-2205, ianarnold10@hotmail.com

WANTED: CULL COWS and bulls. For bookings call Kelly at Drake Meat Processors, 306-363-2117 ext. 111, Drake, SK.

HORSES

QUARTER HORSE 5415

9 YEAR OLD flashy rope horse. Bo is a 15.2 HH finished head horse used at numerous jackpots. A well started heel horse, used on the ranch for every job under the sun. Doctored cows/yearlings, dragged thousands of calves, and hauled to AZ. one winter but mainly hauled and used as a pickup horse across Western Canada the last 2 yrs. Flashy as they come and reliable. Videos available, serious inquires only please. Please call 306-263-3232, Tyvan, SK. Email: youngslandc@gmail.com

HARNESS/VEHICLES 5470

HORSE COLLARS, all sizes, steel and aluminum horseshoes. We ship anywhere. Keddie's, 1-800-390-6924 or keddies.com

BOBSLEIGH, BUCKBOARD, BUGGY, and wagon for small ponies. All excellent condition. 306-536-9210, Belle Plaine, SK.

BOBSLEIGH w/HEAVY DUTY 2-1/2" cast runners, like new condition. Phone 306-237-4406, Perdue, SK.

SHEEP

SHEEP EVENTS/ SEMINARS 5597

CANADIAN VERIFIED SHEEP Program (OFFS) workshop in conjunction with Sask. Sheep Development Board's AGM and Symposium will be held at Ramada Plaza Hotel 1818 Victoria Ave, Regina, SK. Jan 12-13, 2018. Please call: 306-933-5200 or mail to: sheepdb@sasktel.net to register, please visit: www.sksheep.com for details.

SPECIALTY

ELK 5760

NORTHFORK- INDUSTRY LEADER for over 15 years, is looking for Elk. "If you have them, we want them." Make your final call with Northfork for pricing! Guaranteed prompt payment! 514-643-4447, Winnipeg, MB.

BUYING ELK for Meat, Hunting and Breeding. Call for options and prices, Ian 204-848-2498 or 204-867-0085.

GOATS 5765

HERD REDUCTION SALE on PB Nubians, does, bucks and bucklings, no CAE/CL. Call 306-231-4036, Humboldt, SK.

LIVESTOCK EQUIPMENT 5790

CATTLE SHELTER PACKAGES or built on site. For early booking call 1-800-667-4990 or visit our website: www.warmanhomecentre.com

2000 HIGHLINE 6800 bale processor, 1000 PTO. 204-525-4521, Minitonas, MB. Website: www.waltersequipment.com

FREESTANDING PANELS: 30' windbreak panels; 6-bar 24' and 30' panels; 10', 20' and 30' feed troughs; Bale shredder bunks; Silage bunks; Feeder panels; HD bale feeders; All metal 16' and 24' calf shelters. Will custom build. 306-424-2094, Kendal, SK.

FFS- FUCHS FARM SUPPLY is your partner in agriculture. Stocking **mixer, cutter, feed** wagons and **bale shredders**. We are industry leaders in **Rol-Oyl** cattle oilers. 306-762-2125, Vibank, SK. www.fuchs.ca

48" **BELTING** DOWN to 32". Good for cattle feeders. Call 403-346-7178, Red Deer, AB.

2014 BALE UNROLLING deck off Chevy 3500, remote control, hyd. pump, good condition. 204-381-1240, Woodmore, MB.

HIGHLINE BAIL PRO 6600, LH discharge, average condition, $2400 OBO. Whitkow, SK. 306-445-9833, cell 306-445-9814.

SUPREME 700TMR w/scale, 6' unloading conveyor, dry hay recutter at back, dual wheels, always shedded, excellent cond., $36,000. 204-758-3374, St. Jean, MB.

PAYSEN LIVESTOCK EQUIPMENT INC. We manufacture an extensive line of cattle handling and feeding equipment including squeeze chutes, adj. width alleys, crowding tubs, calf tip tables, maternity pens, gates and panels, bale feeders, Bison equipment, Texas gates, steel water troughs, rodeo equipment and garbage incinerators. Distributors for El-Toro electric branders and twine cutters. Our squeeze chutes and headgates are now avail. with a neck extender. Ph 306-796-4508, email: ple@sasktel.net Web: www.paysen.com

STEEL VIEW MFG. Self-standing panels, windbreaks, silage/hay bunks, feeder panels, sucker rod fence posts. Custom orders. Call Shane 306-493-2300, Delisle, SK. www.steelviewmfg.com

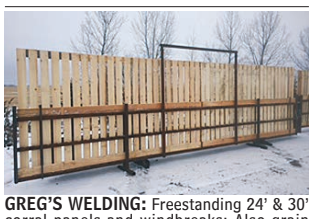
SVEN ROLLER MILLS. Built for over 40 years. PTO/elec. drive, 40 to 1000 bu./hr. Example: 300 bu./hr. unit costs $1/hr. to run. Rolls peas and all grains. We regroove and repair all makes of mills. Call Apollo Machine 306-242-9884, 1-877-255-0187. www.apollomachineandproducts.com

MOLE HILL DESTROYERS: Level those rough hay fields, speed up haying operations, less downtime. Save money. For more information phone 306-542-7325. Visit: www.molehilldestroyers.com

FOR A FREE DEMONSTRATION without obligation, of a Luther Cattle Brush and Oiler, give Cliff a call at 306-734-2997, Aylesbury, SK. It's the one they love to use!

CATTLE SHELTER PACKAGES or built on site. For early booking call 1-800-667-4990 or visit our website: www.warmanhomecentre.com

RENN 12' 10 HP rollermill, large rolls, new style, vg cond., half price of new, $6500, can deliver; **FarmKing** PTO rollermill vg cond, $2950. 204-729-5162, Brandon, MB.



GREG'S WELDING: Freestanding 24' & 30' corral panels and windbreaks; Also grain and silage troughs; as well as calf shelters. Call for pricing, 306-768-8555, delivery available. Carrot River, SK.

2002 JIFFY 920 Bale Processor, new rotor, flails, and bushings. Call 306-839-4708, Pierceland, SK.

ORGANIC PRODUCTS

CERTIFICATION SERVICES 5943

WANT THE ORGANIC ADVANTAGE? Contact an organic Agrologist at Pro-Cert for information on organic farming: prospects, transition, barriers, benefits, certification and marketing. Call 306-382-1299, Saskatoon, SK. or info@pro-cert.org

GRAINS 5947

WANTED: ORGANIC LENTILS, peas and chickpeas. Stonehenge Organics, Assiniboia, SK., 306-640-8600, 306-640-8437.

ORGANIC CO2 FERTILIZER: CropPlus. A 100% natural, organic, mineral based, foliar applied fertilizer. It contains carbon dioxide, which is very beneficial in plant health. Apply with any sprayer. $10/acre. Cory Wiebe 204-247-2142, Roblin, MB.

PERSONAL 5950

PERSONAL ADS

Personal Advertisements will not be accepted over the telephone. Only those advertisements carrying the written signature of the advertiser will be published. (Although name and address will not appear in one's ad, we must have this information for our files.) Full payment must also accompany Personal Ads.

Replies to Western Producer box numbers will be forwarded for two months.

ARE YOU A GENTLEMAN, 55-65? Seeking companionship for occasional outings for lady busy with gardening, helping others, cooking, animal care, music, many other interests. Reply to: Box 2010, c/o The Western Producer, Saskatoon, SK S7K 2C4

PERSONAL VARIOUS 5952

ARE YOU SINGLE and would rather be in love? Camelot Introductions has been successfully matching people for over 23 years. In-person interviews by Intuitive Matchmaker in MB and SK. Call 306-978-LOVE (5683), 204-257-LOVE (5683) www.camelotintroductions.com

PETS

THE ANIMAL PEDIGREE ACT

No person shall, without an express statement that the animal's registration, identification or status as a purebred is from a jurisdiction other than Canada and that the animal will not be registered or identified in Canada by the person, sell, as registered or identified, or as eligible to be registered or identified, or as a pure-bred, any animal without providing to the buyer thereof within six months after the sale the animal's duly transferred certificate of registration or certificate of identification. Any person who contravenes any provision of this Act or the regulations (a) is guilty of an offence punishable on summary conviction and is liable to a fine not exceeding twenty-five thousand dollars; or (b) is guilty of an indictable offence and is liable to a fine not exceeding fifty thousand dollars. For further information contact: Canadian Kennel Club Etobicoke, On.

REGISTERED 5970

CHESAPEAKE BAY RETRIEVER puppies From great hunting parents, both health certified and titled in hunt tests. Registered, vaccinated, de-wormed and ready to go December 20th. Pedigrees available upon request. Inquire to: 306-776-2510 or e-mail: flatrocktrucks@outlook.com

NON REGISTERED 5971

10 YEAR OLD female Dalmatian, spayed, in good health, will take offers; 3 year old female PB German Shorthaired Pointer, $600 OBO. 204-322-5614, Warren, MB.

WORKING DOGS 5973

GREAT PYRENEES PUPS born to working parents. Vet checked, first shots, ready January 15th, $300/each. 403-308-4781, E-mail: heathernelsonfarm@gmail.com

REGISTERED BORDER COLLIE pups from working parents. Call Richard Smith 780-846-2643, Kitscoty, AB.

LARGE PUREBRED ALASKAN malamute/cross pups. Born Oct 10, these well marked pups, possess strong stamina, and loyalty, reasonably priced at $327.50. Call 306-947-2190, Hepburn, SK.

PUREBRED BORDER COLLIE pups for sale, Elvin Kopp bloodlines, can be papered, c/w 1st shots, vet checked, micro chipped, $750. Call 403-575-1309, Consort, AB.

REAL ESTATE

COTTAGE/LOTS 6125

LOG SIDING, LOG cabin logs, Fir timbers, Fir flooring, Cedar. Special orders. Check out more info. at: **rouckbros.com** Lumby, BC., 1-800-960-3388.

MOBILE HOMES 6127

WWW.MEDALLION-HOMES.CA modular homes/lake houses/RTM's. Visit our sales lot, or check online for stock, homes and all other plans. Factory direct orders built to your specs! Trade-ins welcome, buy and sell used homes. Hwy 2 South, Prince Albert, SK. Call 306-764-2121 or toll free 1-800-249-3969.

READY TO MOVE 6128

RTMS AND SITE built homes. Call 1-866-933-9595, or go online for pictures and pricing at: www.warmanhomes.ca

J&H HOMES: Western Canada's most trusted RTM Home Builder since 1969. View at www.jhhomes.com 306-652-5322

RTMS AND SITE built homes. Call 1-866-933-9595, or go online for pictures and pricing at: www.warmanhomes.ca

HOME HARDWARE RTM Homes and Cottages. Phone 1-800-663-3350 or go online for floor plans and specs at: www.northbattlefordhomehardware.com

RESORTS 6129

VEGAS TIMESHARE: INT'L exchanges, 2 bedroom, 2 bath, full kitchen, laundry, fireplace, pools, selling due to health. 306-453-2958, Carlyle, SK.

RECREATIONAL PROPERTY 6130

LOOKING FOR YOUR piece of paradise? 2-1 ac. lots near Lac des Iles. Approx 140 ac. overlooking Lac des Iles. For more info: 306-238-7702, e.alexander@littleloon.ca

FARMS & RANCHES

ALBERTA 6132

Take a Look

ORGANIC LAND in MD of Mackenzie, north of Peace River: 1200 seeded ac., 1800 sq.ft house w/garage, 6800 sq.ft. shop, 60x120 cold storage, 100,000+ bu. grain storage, power, phone, natural gas, dugout, on school bus route. 780-928-2538 or 780-841-1180.

1235 ACRE RANCH WITH IRRIGATION: Includes 920 acres dry land, seeded into grass. 320 acres with 160 acres irrigation and 160 acres of River Valley and Coulee's. 2 pivots and rain gun. This place is a great set up for 200-250 cow/calves. All is fenced & cross-fenced. Full cattle handling system. Corrals set up for 500-600 cows. Majestic views of the Rocky Mountains and River Valley SE of Calgary. **Vulcan County ID#1100622. Real Estate Centre, 1-866-345-3414. For all our listings visit: www.farmrealestate.com**

ATTENTION

LAND FOR SALE: 505.18 ac. of cross fenced grass ready to be turned back into grain land. Land is beside busy airport in Central Alberta. $3600/acre. Call 780-385-0524, Killam, AB. kelndor@syban.net

FARM LAND INVESTORS wanted for east central Alberta and West central Sask, Looking for investors to partner with or directly invest in good land. Land will be mangaged by a proven top producing 3rd generation farm business in a prime area for expansion. Area has multiple wind farms in the planning stages to be constructed in the next few years as well as oil and gas. Farmland is a safe place to invest with good returns and the time is now. **E-mail: farmland@netago.ca**

SASKATCHEWAN 6133

RM MAPLE CREEK #111. For sale N 1/2 35-11-26-W3. 320 cult. acres, 60x100' steel quonset on 2' cement fdn, power, water for up to 100 head of cattle, 1 mile of Hwy #1 frontage. Call 403-866-2214.

Farm **Land Rent** Tender
3669 cultivated acres RM 125
Land is all located in a block east of Peebles SK. About 125 KM SE of Regina
Well farmed, top line fertilizer, weed control and agronomic practices
This is a great chance to rent a solid block of grain land in an excellent crop producing area of Sask.
Contact Guy for details
Guy Shepherd
1-306-434-8857
www.farmboyrealty.com
FARM BOY REALTY

1745 ACRES RANCH Land with Wind Opportunity: 1745 acres +/- half an hour South of Assiniboia, close to St. Victor (Big Money Valley). All deeded land except for one quarter, which is Crownland lease. 1980 house approx 1100 sq. ft., 40'x60' steel quonset, 40'x50' shop w/concrete floor, not heated, 40'x60' quonset/cattle shed. All natural spring water on the property. Mostly native grass/pasture. Another opportunity with this land is that 5 quarters are signed up with Suncor for possible future wind/solar power. **ID#1100624, Assiniboia, SK. Real Estate Centre, 1-866-345-3414. For all listings visit: www.farmrealestate.com**

SASKATOON SOUTHWEST, River Valley View Estate, near golf course. Paved road and all services to site, $229,500. Phone 306-382-1299 or 306-382-9024.

WANTED: Saskatchewan grainland, housing, and vacant lots. Will pay min. 10% premium on current pricing. Within 25 miles of Leader SK. Box 5001, c/o The Western Producer, Saskatoon, SK S7K 2C4

SASKATCHEWAN 6133

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Do you have farmland to sell? Looking for top-notch exposure and representation? We provide a forum for competitive bidding like no other as well as the benefit of being protected through the Real Estate Industry, combined with the excitement and results provided by a Live & Online Auction.
Hammond Realty & Berlinic Auctions Ltd. are taking consignments of farmland for a Multi-Seller Land Auction Event to be held in Yorkton, SK.
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Listing deadline: January 24, 2018
Call **Wade Berlinic** for full details and how this option may fit YOUR farmland.
HAMMOND REALTY

TOM@SASKFARMLAND.COM Interested in the value of your farmland and considering selling? Up to date market evaluations done at your farm. Coldwell Banker Signature. Tom Neufeld 306-260-7838.

RM OF FOAM LAKE #276 for sale SE-35-28-12-W2, 160 acres (approx. 102 cultivated). Call 780-724-3735 for info.

WANTED: 1000 ACRE grain farm w/yard in northwest Saskatchewan. Call anytime: 780-205-4296 or email 3star@telus.net

RM OF ROSEDALE #283 By Tender: SE 1/4 22-29-4 W3, 160 cult. ac. Highest or any tender not necessarily accepted. Submit tenders to: Box 37, Hawarden, SK., S0H 1Y0. Tenders close February 1, 2018. For more info, call Larry at 306-229-9926.

RIVER RETREAT: Saskatoon South - 177 acres forested, organic river front land. 50 acres cultivated. $6500 per acre. Phone 306-382-1299 or 306-382-9024.

SECLUDED RIVER RETREAT: 80 acres on west bank, pt of 01-46-04 W3. Summer road and river access, $167,500. Phone 306-382-1299 or 306-382-9024.

RM OF ELDON: SW 22-49-24 W3 Ext 24 and NE 09-49-24 W3 Ext 8. 298.88 acres. Surface lease revenue. For sale by Tender with bids closing Feb 1, 2018. Details at www.forrestlandtender.ca or contact Vern McClelland, RE/MAX of Lloydminster, 780-808-2700.

LAND WANTED TO rent or purchase in RM #248 and RM #218. Call 306-726-8090, Cupar, SK. pjhart@sasktel.net

WANTED: GRAIN LAND for rent in Northern/Central Saskatchewan. Call Mike 306-469-7741, Big River, SK.

SASKATCHEWAN 6133

WANTED 5,000 to 20,000 ACRES OF GOOD CROP PRODUCTION LAND IN SASKATCHEWAN AND ALBERTA
Please call Marcel at **1-403-350-6868**
Marcel LeBlanc Real Estate Inc.

LOOKING FOR LAND w/Aggregate Potential
In Saskatchewan
Call POTZUS LTD.
Phone: 306-782-7423
Fax: 306-786-6909
Email: info@potzus.com

WANTED

GRAIN LAND TO RENT, 35 mile radius of Rouleau, SK. Call 306-776-2600 or email: **kraussacres@sasktel.net**

FARMLAND WANTED
Cell: 306-230-1588
Office: 306-361-8926
Fax: 306-665-1443
justin.yin.ca@gmail.com

JUSTIN YIN
FARMLAND MARKETING SPECIALIST

FARMLAND NE SK (Clemenceau) 4 qtrs plus 36 acre riverside parcel with 5 bdrm. home. Featuring: bins on concrete with direct hit on railroad cars, 40 acres of mostly mature spruce timber, 2 farmyards- 1 bordering Etomami River and 50 miles of provincial forest, exc. elk hunting and other big game and goose. 580 acres wheat, mustard, barley and peas. Full line of farm and sawmill equipment also available. Will separate. Reg Hertz, 306-865-7469.

Acres of Expertise.
HAMMOND REALTY
Kevin Jarrett
(306) 441-4152
kevin.jarrett@HammondRealty.ca
HammondRealty.ca

RM OF FRENCHMAN BUTTE: SW 35-52-25 W3 Ext 5 and NW 35-52-25 W3 Ext 2. 207 acres. For sale by Tender with bids closing February 6, 2018. For details, visit www.moorelandtender.ca or contact Vern McClelland, RE/MAX of Lloydminster, 780-808-2700.

MANITOBA 6134

CHATFIELD/POPLARFIELD: Opportunity to run your own cattle & grain farm. 1240 sq. ft. bungalow. 800 ac. owned, 1920 leased. 200 acres cult. balance hay & fenced pasture. Many outbuildings, $799,000. Call Claudette: 1-888-629-6700. LJBaron.com

MANITOBA 6134

1) LARGE DAIRY FARM west of Brandon; 2) 1/2 Section close to and west of Winnipeg. Henry Kuhl: Farmland Specialist, Royal LePage Alliance, Winnipeg, MB. 204-885-5500, 204-856-3140.

PASTURES 6136

MULCHING- TREES, BRUSH, Stumps. Call today 306-933-2950. Visit us at: www.maverickconstruction.ca

CUSTOM GRAZING AVAILABLE for 2018. Accepting cow/calf pairs, approx. 1000 acres, highly assessed cultivated land seeded to oats, plus 600 acres valley pasture with 1.5 miles of river exposure. Located North of Aylesbury, SK. Call Cliff Luther, 306-734-2997.

RECREATIONAL VEHICLES

ALL TERRAIN VEHICLES 6161

4 WHEEL BOMBARDIER Rotex, 250 hrs, like new, $4000; Wanted: 14' bumper hitch dump trailer. 306-304-1959, Goodsoil, SK.

SNOWMOBILES 6168

1995 POLARIS INDY Trail 2-Up seat, in good cond., orig. spare belt never used, $2500. 306-278-2542, Porcupine Plain, SK.

RENTAL/ACCOMODATIONS

APARTMENTS/HOUSES 6210

APARTMENTS FOR RENT, Langham, SK. Quiet, well maintained, close to schools. 1 and 2 bedrooms starting at $650. Contact Blaise at 306-349-9351.

HOME FOR RENT: Furnished, 2 bed + den, 2 bath, close to U of S, Saskatoon, SK. $1300/mo. + utilities. Call 306-270-4323.

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MCDONALD CREEK PASTURE is accepting tenders for Pasture Manager, 1640 head pasture, Tenders closes Dec. 31, 2017, for info contact Allan 306-222-3915, Email: a.lqutaerhorse@sasktel.net. Mail: Box 1, Grandora, SK, S0K 1V0.

HOG FARM WORKERS, DeGroot Pork Net Inc., Silver, MB., is looking for full-time workers. Job duties include daily chores, assisting sows at farrowing, AI, breeding, some minor record keeping, etc. We have two locations in Interlake, MB. One is located 7 miles SW of Arborg, MB., and the other is at 9 miles SW of Fisher Branch, MB. Weekend work required. Experience an asset but not required. Starting wage is $12 -15.28/hr., plus benefits. Please E-mail resumes to: hr.degrootpork@gmail.com or mail to: Box 874, Arborg, MB., R0C 0A0, 519-800-4095.

FULL-TIME FARM LABOURER HELP. Applicants should have previous farm experience and mechanical ability. Duties include operation of machinery, including tractors and other farm equipment, as well as general farm laborer duties. $25/hour depending on experience. Must be able to cross US border. Location: Pierson, MB. Feland Bros. Farms, Greg Feland and Wade Feland, Box 284, Pierson, MB. R0M 1S0. 701-756-6954.

2 SEASONAL FARM Machinery Operators required. Must be able to operate grain cart, tandem grain truck, FWA tractor w/rockpicker, 4 WD tractor for harrowing. Also manual labour for upkeep of leafcutter bees and general servicing of equip. May 1 to Nov. 15. $15-$18/hr. 101008187 SK Ltd., 303 Frontier Trail, Box 372, Wadena, SK., S0A 4J0. Fax: 306-338-3733, ph 306-338-7561 or cfehr9860@hotmail.com

DAIRY FARM MANAGER: Permanent full-time position on robotic milk farm, experience required. hmvanderslujis@gmail.com

SASKATCHEWAN CUSTOM FARMING operation seeking Full-time and Part-time employees for 2018. Competitive wages and scheduled time off. Housing and meal plans supplied. Must be at least 18 and have or be willing to acquire AZ/1A license. Inquire by phone to: 306-776-2510, or e-mail: flatrocktrucks@outlook.com

FARM/RANCH 8016

FARM LABOURERS WANTED. Lincoln Gardens is a seasonal vegetable farm located at Lumsden, SK. Seeking 8 seasonal field labourers, starting April 15, 2018. Duties include: Planting, weeding and harvesting vegetable crops. Sort, wash, weigh vegetables. Hand move irrigation pipes. 50 to 60 hrs./week. Must be available weekends. Starting wage is $11.00/hr. Send resume with references to: Lincoln Gardens, Box 750, Lumsden, SK., S0G 3C0.

MECHANIC/FARM WORKER WANTED for PT(or FT) work on modern mixed farm from Apr.-Nov. near Calgary, Must have mechanics for modern equip., operating seeder, combine and tractors. Valid Class 3, preferably Class 1. Housing negotiable, start now, good fit for semi-retired with flex. hrs. Send resume to: lscattleco@xplornet.com fax 403-335-0086 or call between 9AM-4PM 403-335-3694.

SEEKING A FULL TIME COWBOSS for large cattle ranch in BC. Competitive wages, housing & benefits. Duties include: horsemanship, colt breaking, calving, shoeing, fencing & feeding. Must be experienced and have an intimate knowledge of working cattle horseback on large timbered range areas. Excellent communication and leadership skills, the ability to give and take direction while working in a management team environment. Please send resumes to: info@nicolaranch.com

SEASONAL WORKER FOR grain operation. Duties: roguing seed fields, hand labor, irrigating, field & yard work. Heavy lifting req. $13.60-15/hr. karlinfarms79@gmail.com

ALTHOUSE HONEY FARMS INC. 1/2 mile south Porcupine Plain, SK., 500 McAllister Avenue. 7 positions required for 2018 season, May to October. Wages $13-$18/hr. depending upon experience. Job duties: assisting in spring hive inspection, unwrapping, and splitting, supering, building supers and honey frames, honey removal and extracting, fall feeding, applying mite control and wrapping hives for winter. No education required. WCB coverage. Phone Ron Althouse 306-278-7345, Email: althousehoney@sasktel.net

FARM LABOURER WANTED: Farm machinery operating experience required; Repetitive farm duties including cleaning and maintance of farm equipment, dealing with live stock. Plant, spray, harvest crops. Minimum 1 year farming experience required, Aylesbury, SK. Email: rmengel@sasktel.net

LOOKING FOR PEOPLE interested in riding feedlot pens in Strathmore or Lethbridge, AB. area, w/above average horsemanship skills, willing to train. 2 positions available. Wages depending on qualifications. 403-701-1548, Strathmore, AB.

SEEKING A FULL TIME COWBOY for large cattle ranch in BC. Competitive wages, housing & benefits. Duties include but are not limited to: horsemanship, colt breaking, calving, shoeing, fencing & feeding. Send resumes to: info@nicolaranch.com

FARM LABOURER REQUIRED for livestock operation. Duties include: operating, maintaining seeding & harvesting equip. Smoke free enviro., $17/hr. Housing avail. Lyle Lumax, 204-525-2263, Swan River, MB.

AGROLOGIST/ LABOURER: Permanent position on grain farm. Non-smoking. Applicants should have previous farm experience, knowledge & mechanical ability. Duties include operating tractors, combines, sprayers, floater, grain augers, climbing grain bins, know how to operate GPS on equipment, variable rate applications as well as general farm labour duties. Applicants must have Class 5 license, 1A license, like animals, be responsible, honest and show initiative to take on any challenge that arises. Weyburn, SK. area. Please call 306-861-3774.

HELP WANTED 8024

FULL-TIME POSITION ON a cow/calf operation. Must have knowledge of calving, AI, general farm work, working with a show herd of Angus and Simmental cattle. One bedroom apartment available. The RK farm is located in Central Ontario. Contact Sandy Reid at rkanimalsupplies@xplornet.com or call 519-588-7560.

MANAGEMENT 8025

FARM MANAGER: PAGE FARMS is seeking a Farm Manager for the 3000 ac. grain farm SW of Winnipeg. Candidate must have exp. in all aspects of grain farming, as well as plan and execute for all areas of the farm (inputs, supplies, marketing, relationship building, employee mgmt., maintenance of equip., building & facilities, record keeping, book keeping & more) in an efficient & cost effective manner. Must be mechanically inclined & have a class 1A license (or be willing to obtain one). The position is salaried (will depend on experience) and also includes housing, vehicle & cell phone. Great opportunity for a family, has a supportive community & schooling nearby. To apply, forward resume with references & cover letter to: pagefarm@mymts.net or mail to: PAGE Farms, Box 59, Starbuck, MB R0G 2P0. Deadline: Jan. 15, 2018.

PROFESSIONAL 8032

EXECUTIVE DIRECTOR, The Saskatchewan Conservation & Development Association Inc. (SaskCDA) is currently accepting applications for the position of Executive Director. As the Executive Director, you will represent the Board at meetings with other Agencies dealing with water management. You will also deal directly with the Secretary-Treasurers of the 100 C&Ds and 13 WABs located throughout the province. You will also be responsible along with the Board to organize an Annual General Meeting as well as any other meetings that may be called. You will be expected to keep the SaskCDA website current. The Executive Director is responsible, along with the Board, to determine an annual budget and to set and collect the membership and insurance fees for the C&Ds and WABs. The Executive Director maintains accurate accounting records and has the books audited. The Executive Director is also responsible to ensure that the SaskCDA maintains its status as a Non Profit Organization. Location of position flexible with location of suitable candidate. Salary and benefits as well as starting date are negotiable. Please E-mail ed@saskcda.org to request a job description.

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WHAT'S NEW?

A SPECIAL FEATURE OF THE WESTERN PRODUCER | E-MAIL: NEWSROOM@PRODUCER.COM | 306-665-3544 | EDITOR: BRIAN MACLEOD

The little plane that did

Drone technology will be feeding Climate Corp's needs for big data from above

BY MICHAEL RAINE
SASKATOON NEWSROOM

A farmer and a Toronto entrepreneur have taken their dream from door knocking to delivery in 2 1/2 years.

Norm Lamothe and David MacMillan came together to lift agricultural aerial drones to the level of large-scale service provider.

"When you have a family farm with limited acres you need another plan to ensure you have an income. I have done a few things in aviation. Precision agriculture makes a lot of sense as a farmer, so this business made sense too," said Lamothe.

MacMillan has been involved in several public companies that were startups and liked Lamothe's idea of providing farmers with aerial images and data from their fields on a timely basis, "even when there is cloud cover."

MacMillan said the idea of being involved in "sustainable agriculture is also very appealing from a business perspective."

"Providing farmers with tools to be able to grow more and profit more from it, that is a good place for a business to be in," he said.

The pair created a company called Deveron to provide Canadian farmers with a service that quickly delivered aerial reconnaissance data from farmers' fields during the growing season.

Lamothe said Deveron provides its customers with bare soil analysis, for topography mapping that gives producers tools to plan tiling, ditching and other tasks.

They also carry out in-season normalized difference vegetative index mapping that can used to highlight areas in the fields that need attention.

"We also look for high-yielding zones that can help farmers make choices about their areas that aren't doing as well," said Lamothe.

The company has put together regional teams able to send out drones to fly fields on demand.

"Most farmers have enough to do. They prefer to get that work done by someone else and that would be us," he said.

"We can deliver whether (or not) there is cloud and at higher frequency, so we compare favorably to satellites," he said.

They began the business in Ontario before adding Western Canada. They operate in most provinces, from New Brunswick to Alberta, and work with crops that range from corn, soybeans and potatoes to grains and oilseeds.

But a recent deal with Monsanto's Climate Corp. has put their business plan on a fast track, and as a result, they now operate in the U.S. Midwest.

David MacMillan, left, and Norm Lamothe started Deveron 2 1/2 years ago and have seen some large partners come on board, including Climate Corp. The drone services company provides producers with a fee-for-service aerial imaging and data coverage of their fields. | MICHAEL RAINE PHOTO

Climate Corp.'s Fieldview software system provides producers with in-depth information about their crops and fields, and Deveron's high-definition imaging can feed that system.

"That gives us access to the 120 million acres that they are serving now. That is one-third of the North American market. A real stepup for a start-up," he said.

"That's a lot of doors we don't have make cold calls to."

Deveron was already starting to work with some companies, but now that it is working with one very large client, as well as individual farmers, it can roll out plans for additional sensors and technology ahead of schedule, he said.

"Now, we are working hard on automation, to get turn-around on large scales as fast as possible for farmers," he said.

Deveron, a public company listed on the Canadian Securities Exchange, also relies on good advice. It acquired help in that regard starting last summer with the addition of Art Froehlich, formerly of Alberta Wheat Pool and Hoechst Canada, and now on the boards of Richardson International and marketing company AdFarm.

"He knows western agriculture really well, and brings a great perspective for us. And Ian Grant, he has retired (as president from DuPont Pioneer) and has that large scale agricultural industry perspective and knows everybody, like Art," he said.

David Massoti, formerly of Spar Aerospace and Rogers, and Dave Sippell, formerly with Agricore, Syngenta and Pioneer HiBred, are also advisers to the young company.

Climate Corp.'s platform allows producers to store and analyze their data, as well as create prescription maps. The Deveron imaging complements Climate Corp.'s satellite views already in place.

MacMillan said he and Lamothe are taking a longer-term view of growth for the business.

"We have seen startups get that hockey stick growth, raise lots of money and expand like crazy and then run out of steam and money, not able to deliver. We are planning to grow steadily with a plan for the long haul. We want to be in this business," he said.

"We are encouraging producers to try it. No need to put all your eggs in one basket. Like farm inputs, they don't want to do something new on all their acres right away. And that works for us too. We can grow our business for the right reasons, farmers can make more money with more information," he said.

mike.raine@producer.com

Soil mapping soon to be more usable

Digital platform provides access to information about Saskatchewan soils collected throughout the 20th century

BY ROBIN BOOKER
SASKATOON NEWSROOM

The first phase of the Saskatchewan Soil Information System is expected to be launched for early 2018.

The SKSIS is a digital platform that stores and allows access to information on Saskatchewan soils collected throughout the 20th century, including soil surveys.

Angela Bedard-Haughn of the University of Saskatchewan said soil surveys are a great resource for making management decisions.

SKSIS will "improve access to this existing soil survey information, which was collected (through) thousands upon thousands of painstaking hours out in the field, and make it easier for people to use this information," Bedard-Haughn said at the Saskatchewan Agronomy Update in Saskatoon Dec. 12.

Currently, it can be challenging for people who want to use information from provincial records.

"It is available as PDF documents and lots of the maps you can download in a GIS format. But unless you're really good with GIS, and you understand the inner workings of how survey information is set up, it's really tricky to actually use this information," she said.

The usefulness of PDF files is limited for applications like landscape modelling and precision agriculture.

Bedard-Haughn said it's time to translate the information into a form that works better with the tools agronomists and producers use.

The SKSIS uses base map information from the soil surveys and overlays aerial satellite images. Users can choose display themes, the transparency of the satellite imagery and also choose type to display.

There are many ways users can filter the soil survey information to get a better sense of what's happening on the landscape.

"The bulk of the information that you can pick out of the soil surveys, that information is encoded here and you can sort through it and display it dynamically as you so choose," Bedard-Haughn said.

"Just by adding a little colour for the soil associations that have common properties, you can start to see a little more patterns associated

CONTINUED ON NEXT PAGE »

with those areas."

Specific locations can be searched for by using township and range denotations, or through latitude and longitude.

Users can click on a specific location and information about it will pop up in a box on the bottom right of the interface screen.

"Surface expression, slope descriptions, stoniness, texture, ag capability and the salinity, so some of the things that tend to be most interesting to the typical producer," Bedard-Haughn said.

Registered users can upload new information to the site.

"If you're a soil nerd and you see a really cool profile and you just can't wait to share it with everybody, you can actually upload it along with the spatial information of it, and that will show up as a point on the map. So when other people are interested in the soil in the area it will show up," she said.

Users can upload photos, or even geolocate studies that were performed in a specific area.

SKSIS also aims to refine existing soil data with the use of digital soil mapping (DSM) techniques.

"So the digital soil mapping techniques really allow us to refine soil type and property maps, better predict the landscape scale variability for management planning or for predictive modelling, and refining it is less labour intensive than going out and redoing the soil surveys," Bedard-Haughn said.

The soil survey information is now on a scale of 1 to 100,000 resolution (one centimetre on the map equals one kilometre on the ground), which is too coarse for most agriculture applications.

Through DSM techniques, the SKSIS will hopefully have a one to 1,000 resolution, or better, and will be able to identify in-field variability.

A high-quality digital elevation model is necessary when conducting digital soil mapping.

"In some places, we have LiDAR (light detecting and ranging) flights that have been flown ... that allows us to get a really high resolution digital elevation model. In a lot of areas in Saskatchewan we don't yet have that information, but we can get it actually relatively easily now with drone technology," Bedard-Haughn said.

Last year, drones with LiDAR imagery were flown over three sites and statistical approaches were then used to select representative sample points on the field. Then soil sampling was carried out at those points.

This mapping procedure produced a more refined soil map for the area that broke the field down into soil-type zones.

Hydrological modelling was used to further refine the data.

"I have another student that is looking at wetland soil mapping approaches. And so we combined his approaches that used hydrological modelling to look at how water is distributed across the landscape, to figure out where the wetlands would be on there, and then combined the two approaches to get the maximally accurate map or representation of that landscape," Bedard-Haughn said.

She said growers can use these soil maps with information such as yield maps to help manage inputs.

"This refined data is designed to visualize the within-field variability. You overlay that with the yield, play around with it and you get a lot more powerful information for your decision making," she said.

Revisions to the SKISS website are still being done with feedback from users.

The next step is to create a more refined soil map for the province based on information from the digital elevation models derived from shuttle radar.

Semi-automated protocols are also being developed to help users upload information they've collected on their fields.

"If you have flown a drone flight and you have point soil information for a piece of land, you can upload that, and with a little bit of interaction, develop one of those refined digital soil maps for a piece of land on your own as well," Bedard-Haughn said.

If funding permits, future plans call for incorporation of an application program interface to make it easier for other programs to interact with it.

She said allowing the program to incorporate multiple types of information will make it a more collaborate space.

However, she said there are challenges.

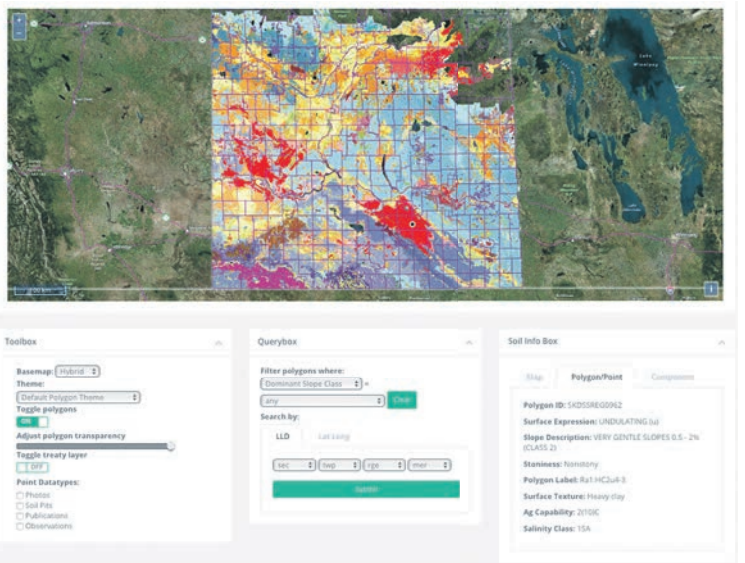
"Some folks have concerns regarding privacy, information about their land being publicly available....

"Certainly in the realm of precision agriculture, everybody has their own approach, and so there can be concerns of people knowing what's going on in other people's fields. That's going to be a challenge," she said.

Much of the information the SKSIS uses is already publicly available, just harder to access.

Producers who would like to participate in the projects as beta testers can email Bedard-Haughn at angela.bedard-haughn@usask.ca.

robin.booker@producer.com



Registered users of the Saskatchewan Soil Information System will be able to upload photos or find studies done in specific areas. | SKSIS IMAGE

Blue River's technology is designed to grow John Deere's approach to plant-selective systems. Machinery will manage individual plants, rather than acres and fields. | JOHN DEERE PHOTO

Managing fields could soon move to plant level

New system could identify stressed plants and apply fertilizer only to them

BY SEAN PRATT
SASKATOON NEWSROOM

CHICAGO, Ill. — One of the pioneers of the big data movement is ready to take the next step.

"We want to go from field-level data to plant-level data," said Keith Soltwedel, marketing manager with John Deere Intelligent Solutions Group.

"I know we might all laugh today, but I think that's coming, where we're going to know every 36,000 corn plants in an acre of ground and how we treat each one of those plants differently in order to maximize yield."

John Deere announced in September it was acquiring Blue River Technology for US$305 million. The 60-person firm from Sunnyvale, California, is an industry leader in artificial intelligence.

"We are using computer vision, robotics and machine learning to help smart machines detect, identify and make management decisions about every single plant in the field," Jorge Heraud, Blue River co-founder, said in the September news release announcing the acquisition.

Soltwedel said big data started with yield-monitoring combines and evolved into a variety of applications for seed, chemicals and fertilizers.

The technology has already evolved past the field level with spray nozzles that allow for row-by-row application of pesticides.

The next phase is being able to detect which plants are weeds and applying pesticides only to those plants or determining which crop plants are stressed and applying fertilizer to those.

"It's futuristic, yes, but 30 years ago having a tractor drive itself was pretty futuristic and today people don't live without it anymore," said Soltwedel.

Being able to do something "then and there" with the data coming off the field is the very definition of "actionable data," he said.

That has been one of the knocks on big data. Farmers are gathering reams of information, but they aren't doing anything constructive with it.

Soltwedel said another criticism was that companies were initially trying to do it all on their own, like John Deere with its Apex software system.

"What Deere learned from our dealers and from our customers is that this industry is too big to try to do it yourself and do it alone," he told the recent 2017 DTN Ag Summit in Chicago.

So Deere launched the John Deere Operations Center, where farmers can manage all their equipment, production and farm operations data on a single website. It is working with 75 technology companies.

"We believe that we are the most open platform in agriculture," said Soltwedel.

He said the idea of collaborating is foreign to the agriculture sector, which tends to be "tight-lipped" and reluctant to share information all the way back to the individual farm level.

Adam Litle, sales manager with Granular, which is using Silicon Valley software to transform farming, said producers have a role to play in ensuring the companies they work with are open.

"You should be demanding that your information technology providers work with each other and share data. Don't accept anything else," he said.

"What we keep hearing is that growers don't want to use 10 different pieces of software. They're really looking for a more consolidated operating system."

sean.pratt@producer.com

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GLACIER farmmedia CONTENT SOLUTIONS

The digital revolution is coming, just not everybody knows it yet.

BY TERRY FRIES | FREELANCE WRITER

IF SOMEONE DOESN'T UNDERSTAND something, it's difficult to tell them they need it.

It's happened before, however, and Denise Hockaday of Climate Corporation hopes the lessons learned from that experience will help address some of the issues facing the new digital technologies coming to market today.

"Someone made this comment to me that sums it up nicely. Before autosteer, a farmer said 'why do I need autosteer? I can drive,' " Hockaday said. Today, however, the same farmer says they can't operate if their autosteer isn't working, she added.

Hockaday, Climate business lead for Canada, said once farmers start to understand how new digital technology can help them in real-world ways, they will begin to parse its value.

Digital technology is on the cusp of triggering the biggest evolution to agriculture of at least the past three decades. Data gathered and properly analyzed can produce precise field maps to improve seeding and fertilizer applications, collect weather data, guide equipment maintenance and repair, and find ways to help farmers manage with fewer labour resources while meeting stricter environmental and food safety requirements.

Yet according to a recent survey conducted by Glacier FarmMedia, few farmers see digital technology investment as a greater priority than other farm investments.

Hockaday said market research at Climate Corporation, a division of Monsanto, which offers a range of digital tools designed to bring field data collection, agronomic modelling and weather data into one location, backs up the findings of the FarmMedia survey.

She said she's seen the story play out before.

In the survey, farmers repeatedly cited cost as one of two main barriers limiting their adoption of new digital technologies. Farmers' confidence in their understanding of the technology and questions surrounding their ability to get support were also commonly cited obstacles.

Hockaday said digital technologies are no different than anything else that exists outside of what she calls the "spaces" of what most farmers do every day. The more novel or unique it is, the more likely it is to find resistance.

"For example, if there is a hybrid that gives you three more bushels to the acre or something like that, then you can clearly articulate the value," she said.

But farmers find it more difficult to see the return on investment with digital technologies because they haven't come into contact with it in the past.

If farmers aren't seeing practical results, they are going to struggle to come up with a business case for it, she said.

Most farmers are already well on their way to putting these new technologies to use. They are collecting reams of usable data via the onboard computers on their farm equipment or from other sensors and monitors. Yet only about 50 per cent of the data is currently used.

For Hockaday, convincing more farmers to put that information to work is about organizing the data into formats farmers can visualize and put to use on their farms.

"A couple key things that have been a struggle for data is a place to put it all in one spot so then you can actively do some analysis and the second piece is to have the tools to do the analysis," she said.

That means bringing together data from various sources, even technologies that may not have been compatible in the past and putting the information in one central location where it can be analyzed and used to develop recommendations.

"It's like any new technology use or … anything. You have to put it into the context of their own farm."

In the survey, farmers showed that they recognized the benefits of digital technology, but they still didn't see those benefits as valuable enough to motivate them to rush out and buy them.

"So, you have to start from ground zero and help people understand what it is and what it can do for them before it can be real in their minds and they can start to figure out what it would look like on their farms."

That kind of outreach could be exactly what farmers are looking for.

Farmers in the survey said they were not ready to buy into new digital technologies right now, but the majority said they see themselves as being ready in one to two years, especially for data technology systems and sensors.

In addition to those two technology types, two others were included in the survey, autonomous vehicles and telematics, but Hockaday doesn't view any of them as being completely independent.

She acknowledged autonomous vehicles are further away from farmer acceptance than other technologies, but she said the key to any of them is what happens afterward.

"You can put a sensor on a tractor in a field but if you can't record why, and see why or what happened, or the effects of a particular practice, it may not be of much value.

"To me, it starts with being able to bring your data into one spot and that's why I think the data piece is so important because then you can start to understand that data or visualize it."

She said once that happens, farmers start to see how that field sensor is relevant to them.

Hockaday said what's been missing in terms of taking this new technology out to the real world is a comprehensive and understandable way to bring the information together in ways farmers can use it.

"People are well on their way as far as collection. But it's more what you do with it afterwards that needs some work."

She said ClimateCorp.'s FieldView brings the fragmented aspects of digital technologies into one platform. She said the goal was to provide a place where varied technologies that may not normally be compatible, are brought under one roof.

> *To me, it starts with being able to bring your data into one spot and that's why I think the data piece is so important because then you can start to understand that data or visualize it.*
>
> — **DENISE HOCKADAY** | CLIMATE CORPORATION

"For example, one has got a John Deere seeder or drill and they've got a Case combine. Well, up to this point, you couldn't bring that information together and look at it in the same context because the monitors in the equipment speak different languages," she said.

Being able to bring the languages into one spot enables farmers to look at the information in the context of the environment, application data, what was planted, when it was planted and all of the other decision-making processes that go into growing a crop, she said.

It empowers farmers to try new things because it gives them the ability to measure the outcomes, she added.

THE INNOVATION ISSUE

WHAT FARMERS SAID

In a recent technology survey, 75 percent of farmers asked said they wouldn't be ready to adopt autonomous vehicles on their farms for at least three to five more years. Few said the technology was a high priority for them. These farmers got a close look at one such machine, the DOT autonomous field platform, at the 2017 Ag in Motion farm show. | FILE PHOTO

Earlier this year, Glacier FarmMedia and Climate Corp. co-commissioned an online survey to find out what drives farmers to engage with new innovations. Respondents were asked a series of questions about four types of technology: data gathered from equipment, specialized sensors, autonomous vehicles and telematics. Our editorial team analyzed the results of the report and set out to ask farmers what they think of these kinds of new technology.

Autonomous vehicles not on the radar for most farmers

BY ROBERT ARNASON
BRANDON BUREAU

IT SEEMS LIKE the future of almost everything that moves lies in autonomous technology.

Small and large companies are spending billions to develop driverless cars and driverless transport trucks.

The story is similar in the world of agriculture. Established players like Case IH and machine shop start-ups are working on autonomous farm vehicles capable of going back and forth across cropland for things like cultivation, seeding and spraying.

The concept seems like a good fit for farming because producers spend many lonely hours inside tractor cabs, sometimes through the night and into the wee hours of the morning.

But there's one problem. Or maybe two problems.

Many farmers aren't ready for driverless tractors and others don't want the technology at all.

A Glacier FarmMedia survey of 432 farmers across the Prairies, conducted earlier this year, found that a large percentage of respondents are not ready for autonomous vehicles.

About 75 percent said they won't be ready for three to five years and only a small percentage of farmers were interested in investing in autonomous vehicles.

"Just four percent cite it as a high priority for investment and 70 percent rank it as a low priority," said a summary of the survey, designed to measure farmer readiness for innovation.

The survey looked at farmer perceptions of four emerging technologies: data collection and use, specialized sensors, autonomous vehicles and telematics, such as remote system diagnosis, and connecting machines to equipment dealers.

Of the four technologies, respondents were most reluctant to adopt autonomous vehicles. A few respondents also included personal comments, explaining why they aren't interested in driverless tractors.

"(There's) no freaking way those things (will) ever be on my property, replacing friends, neighbours, and family working together," one farmer said.

Another producer said driverless vehicles would extinguish the human element of rural life.

"By removing the farmer and his need for employees, you remove the basics of life as well."

Adam Gurr, who farms near Rapid City, Man., understands the reluctance farmers feel toward driverless tractors. Many growers enjoy being in the field on a tractor.

"From my brother-in-law, in particular, he's mentioned that he likes running the tractor," said Gurr, who operates Agritruth Research, an agronomic research firm. "For some of the jobs we do, like seeding, I love being out there too."

There's also the social aspect of being out in the field with a group of people, working together to harvest a crop or get seeding done before it rains.

About 39 percent of survey respondents said budget constraints were the primary reason not to invest in autonomous vehicles.

The number two reason, at 14 percent, was that it's too complicated.

On the positive side, respondents said autonomous vehicles would save time and decrease operating costs.

The Western Producer contacted a couple of companies developing autonomous farm vehicles, but didn't get a response by press time.

Western Canadian farmers may be unsure about driverless tractors, but many investors and corporations are betting on the technology. In 2016, Goldman Sachs predicted that small, autonomous farm vehicles could become a $45 billion market.

Gurr isn't opposed to driverless tractors, but he would prefer to have an autonomous setting on a tractor.

"So you can use (the tractor) for other things. It's just not an autonomous unit," he said. "Maybe you could just put it on autonomous because you've got to do something else for three or four hours."

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SEE THE SURVEY REPORT AT WWW.PRODUCER.COM/DIGITALFARMSURVEY

As big data comes to the farm, are poli

BY WILLIAM DEKAY
SASKATOON NEWSROOM

AS INNOVATIVE agricultural technologies speed forward, researchers are exploring gaps in existing policies or laying the groundwork for new guidelines that will affect farmers, stakeholders and the public for years to come.

"We're on a path and farming is increasingly going to look different. It's going to keep on getting more efficient and more things will become automated and there will be more data driving better decisions," said Graeme Jobe from the Johnson Shoyama Graduate School of Public Policy at the University of Saskatchewan.

Jobe and Jo-Anne Relf-Eckstein are part of the U of S team headed by principal investigator Peter Phillips focused on identifying the opportunities and barriers for digital technology and agriculture for Western Canada from a policy perspective.

The group is exploring what is working well, what needs to change and what doesn't exist in agriculture policy.

It's part of a larger national undertaking called the Creating Digital Opportunities Project, which is a five-year project made up of researchers from universities across Canada that started in 2015.

Teams of researchers are looking into how prepared Canada's industries are to adapting to the future while assessing opportunities, risks and barriers.

The evaluation will help determine what policy changes are necessary.

"Our group's goal within the project is to identify the most significant digital transformations that are happening in agriculture and to produce a number of papers, potentially policy briefs, that tell the story of those changes," said Jobe.

Over the past two years, Jobe and Relf-Eckstein attended numerous trade shows, field days and producer information events across Western Canada that featured the newest technological products and services.

They interviewed about 25 individuals, asking what they saw as limiting factors and positive aspects for digital technology in agriculture.

"We asked them about the micro: What is it that you do? What does your company do? What's your role? If you're someone who's trying to help farmers adopt this technology, why are some guys not going to adopt (it)? We asked them for their comments on the macro: What do you think the future of digital technology is in agriculture and where do you see this going?" said Jobe.

Added Relf-Eckstein, "a common theme was that digital ag-tech opportunities are happening fast and in a big way. Across all 25 individuals, we saw a strong entrepreneurial space being created for agriculture leveraging digital technologies from other sectors, mostly automotive and defense."

Smaller western Canadian companies reported they saw difficulties in securing venture capital as the biggest limitation.

"The lack of venture capital affects the ability for them to grow and become relevant. The innovation per se is already there," said Relf-Eckstein.

"So, we're seeing two paths. You either have to leave Canada to secure venture capital or be bought out."

Jobe said those smaller companies have a lot of growth potential and the Canadian economy and Canadian agriculture would benefit from their successes.

One gap that is becoming a growing issue surrounds ownership of on farm data.

"That's a policy question that I anticipate will become more and more hotly contested as more people start to realize what's already being done with their data," Jobe said.

Farmers are agreeing to use technologies like sensors, drones and satellite data that is taken from their farming operation and then packaged into a software product, which is then sold back to them to improve their individual efficiency.

"It's a big deal and it's going to continue to grow and make farming more and more efficient and really change things, but I think we have to think in the back of our minds about what else can be done with all that data there and what do these companies want to do with it, and what implications does it have for the farmer," he said.

"If you know a lot about someone's farming operation, could you then low-ball them when you're buying grain from them (for example) ... I wonder if someday we can sell this data?

He said no evidence has emerged that this kind of thing is happening, but it's an example of things that future agriculture policy needs to anticipate and prepare for.

Companies like Google, Amazon and Facebook can now target individual consumers based on their internet searches, a practice that is expected to increase throughout all areas of retail.

Glacier FarmMedia's Innovation Readiness Survey explored farmer perceptions of data, sensors, autonomous vehicles and telematics.

It determined that farmers see potential benefits in these four digital technologies, but are in no rush to adopt them because the barriers currently outweigh potential benefits.

Budget constraints are the main impediment to adoption, as well as lack of understanding and product support after purchase.

The study reported that in the short-term most farmers believe they will not get the return on investment necessary to make the technology worthwhile.

However, 10 percent of farmers are fully using data technology now, 20 percent are actively testing and 30 percent said they will be ready in two years.

Jobe and Relf-Eckstein said questions of ownership over the information gathered by these new technologies become important because storing vast quantities of information can have implications for many things.

"Does the farmer enter into the contract that they sign when they use the equipment? Do they say in that contract this company can do whatever they want with the data collected off my farm? Does government have to step in and legislate some kind of protection for farmers that would give them greater protection over that data?" Jobe said.

An example that cited the limitations of a farmer's ownership of data involved a court case in the United States where collected data from a crop sprayer was subpoenaed and resulted in a conviction.

While in transport, a nozzle leaked a chemical into a ditch on public land. Regulators had no proof but were successful in petitioning for the sprayer's data, which recorded tank volumes and when the nozzle was on or off.

Based on the available data, Jobe said the court came down with a guilty verdict.

"So that's another big public policy question. If you're collecting that data, should it be available? Should it be petitionable in court if there's some kind of accusation or suspicion of wrongdoing?" he said.

There is currently no policy in Canada in response to ag-specific situations like this, he said.

"I'm sure there's some privacy legislation that might apply to this, but I'm not sure how.

"Then there's the terms in the contracts that are signed by farmers and those would probably come under some consumer protection legislation, but I don't think that has any bearing on our concerns based on the situations I've described," he said.

Before agriculture policies can be shaped, Jobe and Relf-Eckstein

CONTINUED ON NEXT PAGE »

icy makers keeping up?

Graeme Jobe, left, and Jo-Anne Relf-Eckstein, far right, are part of a University of Saskatchewan team headed by principal investigator Peter Phillips, middle, that is focused on identifying the opportunities and barriers for digital technology and agriculture for Western Canada from a policy perspective. | WILLIAM DEKAY PHOTO

» CONTINUED FROM PREVIOUS PAGE

said misperceptions regarding agricultural technologies in Western Canada must be overcome.

"In the East, I would say there's definitely a perception that the agriculture industry in Western Canada isn't technologically advanced when, in fact, it very much is and has been for a long time," said Jobe.

Added Relf-Eckstein: "We have to make a really strong case to grab the attention (of policy makers) and it helps because we've had some (positive) economic reports out since this project started that really support Ottawa looking at Western Canada."

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Quicker, cheaper biofuel production in the works

BY KAREN BRIERE
REGINA BUREAU

Researchers at the University of British Columbia, Okanagan, have developed a biofuel production method they say is quicker, cheaper and safer than other methods.

It involves pre-treating agricultural crop waste with carbon dioxide at high temperature and pressure in water before it is fermented.

Cigdem Eskicioglu, an associate professor of engineering, said this process known as hydrothermal pretreatment can produce biofuel in almost half the time as other methods.

"Methane is a biofuel commonly used in electricity generation and is produced by fermenting organic material," she said. "The process can traditionally take anywhere from weeks to months to complete."

But she, with colleagues in Europe and Australia, used the pretreatment to speed that up. The idea is to break down larger molecules into smaller ones that can be fermented much more quickly.

They compared traditional processes with the new method using wheat straw, rice straw, corn husks, biomass sorghum and Douglas fir bark. The result was faster hydrolysis rates of 20 to 30 percent during anaerobic digestion for the pretreated straw, sorghum and corn husks.

The treated Douglas fir bark produced methane 172 percent faster.

Eskicioglu said the potential to harness energy more efficiently opens a world of possibilities.

"Our new fermentation process would be relatively easy to implement on site and because the bioreactors can be much smaller, the costs can be kept low," she said in a news release.

The process requires equipment and material already available on an industrial scale, she said, so retrofitting existing bioreactors or building new, smaller ones, can be easily done. She also said the new method is much safer because it doesn't use or generate toxic chemicals.

Her findings were published in the September edition of *Water Research*.

"Results indicated that hydrothermal pretreatment is able to accelerate the rate of biodegradation without generating high levels of inhibitory compounds while showing no discernible effect on ultimate biodegradation," said the study abstract.

Using organic waste from municipalities, industries and agriculture to produce biofuel isn't a new concept but production hasn't caught on as well as early proponents had hoped.

Eskicioglu, who grew up in Turkey, completed her environmental engineering doctorate at the University of Ottawa in 2006. She heads UBC Okanagan's bioreactor technology group.

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GETTY ILLUSTRATION

Big doubts about big data

Everyone assumed farmers were immersed in farming their data layers, but they were wrong

> ***All those yield maps. That was a lot of work for nothing. We started doing yield maps way back as soon as that technology was available. But now, the agronomists we hire don't even look at yield maps. The agronomist does the soil testing, infrared maps, satellite images and they make up our variable rate prescription maps. We haven't got time for all that.***
>
> **DARYLE LAVCOCK**
> RUSSELL, MAN., FARMER

BY RON LYSENG
WINNIPEG BUREAU

BIG DATA OFFERS layers upon layers and tonnes upon tonnes of valuable information that can cut input costs and boost yields. So why aren't farmers making better use of it?

Daryle Lavcock started collecting GPS-referenced yield data 20 years ago, mainly because experts and informed sources said it would someday be valuable.

Today, it's all in the trash file. Not that the data was faulty. It was just useless. The two crop consultant companies he has worked with over the years both told him they don't factor in yield data in making prescription maps.

"All those yield maps. That was a lot of work for nothing. We started doing yield maps way back as soon as that technology was available. But now, the agronomists we hire don't even look at yield maps," says Lavcock, who farms 5,000 acres with his son at Russell, Man. Their rotation includes beans, peas, oats, barley, wheat and canola. He makes use of the data he collects, but doesn't do the homework himself.

"The agronomist does the soil testing, infrared maps, satellite images and they make up our variable rate prescription maps. We haven't got time for all that.

"I wouldn't even try to grow oats and barley without variable rate. We want malt barley and we want milling oats. We don't want them to lodge and we don't want fertilizer where it shouldn't be. But I'm not convinced variable rate pays on wheat and canola."

Lavcock adds that his agronomist conducted drone trials on the farm this year to gather more base-line infrared data that will be used in future prescription maps.

Larry Spratt farms 6,000 acres near Melfort, Sask., an area with a half dozen firms offering agronomic consulting services. He collects yield data and as-applied data, but has not yet made the step into variable rate.

"I've sat down with all six different companies we have in this area and I've done trials on my own farm with most of them. So far, I haven't seen that I'd get the rate of return I need from variable rate," explains Spratt.

"This past year was the very best crop I've ever had. But for the past 10 years up until 2017, we've been drowned out. When I sat down with the agronomists and ran the numbers, it didn't matter whether I put down 10 pounds of nitrogen or 170 lb., my yield was the same. So why would I do variable rate?"

Spratt says he knows of producers who pay $4 per acre for variable rate prescription maps, but once their crop is in the bin, they don't bother to sit down to analyze whether it was worth the cost. They take it on blind faith that the system is working.

"We deal with Richardson Pioneer and also an independent dealer. I don't pay them to walk my fields. I just buy fertilizer and chemical from them. They scout my fields at no charge because scouting is one of the services they provide as part of the package.

"If I hired someone to scout my fields, if I paid an agronomist for that, they're going to cover their butts by telling me to spray for a wide range of things.

"For example, a lot of guys spray their canola for sclerotinia because that's what the consultant says. But it still hasn't been proven to my satisfaction that it's worthwhile. If you're paying a guy to scout your canola, chances are he'll err on the side of caution and tell you to spray.

"I have an ag degree. I like to study my plants. I like to scout my fields. But I always like their second opinion."

Kevin Dell farms 4,900 acres with his father, Dennis, near Wynyard, Sask. They don't do variable rate. They have not collected yield data because their combines don't have the necessary equipment, nor have they accumulated other layers of data. Kevin says there's a good reason for that.

"We have fairly new equipment, but none of it's capable of doing variable rate. It's just not quite new enough," says Kevin, explaining they would need a new drill, sprayer and combines. Total cost could exceed $2 million.

Dell says he's delved into the realm of big data and variable rate, and he thinks it can be viable. He expects the farm will be ready in the future, just not the near future. In the past couple years, they've started working with a consultant on crop management issues.

"When it comes to variable rate, I think I'm more knowledgeable than my father, but I don't think variable rate is fully proven yet. We have a few neighbours around here who've tried variable rate, but they didn't see a benefit so they quit. They already had newer equipment, so that cost wasn't a big factor."

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Farmers not rushing to grab digital tools: survey

BY RON LYSENG
WINNIPEG BUREAU

WHAT HAS BECOME known to many as "big data" has promised to transform farming by optimizing crop inputs and yield.

Yet a recent survey by Glacier FarmMedia shows farmers are slow with the uptake.

The survey of 428 prairie farmers conducted this fall indicates that half the field data collected is not downloaded or expected to be used in future planning. Even farmers with clear access to their data collection still expressed considerable confusion over how to put that information to use, or how to apply a specific technology to help their specific farm.

Only six percent of farmers rated data technology as a high investment priority compared to other uses of time and capital. For all the attention given big data in recent years, there was a clear lack of enthusiasm for investing in the technology. Most farmers say they recognize the benefits of farming the data, but do not see a strong enough return on investment to justify the cost. Budget constraints were cited as the main barrier.

As well, a large percentage of farmers view data technology as too complicated. Nearly half the respondents chose as barriers to adoption factors such as "too complicated" or "don't know how to use the data" or "I understand equipment but not data" or "I can't get help when I need it."

Surprisingly, farmers younger than 45 are more likely than older farmers to say that the major barriers are knowledge or support issues. Compared to the overall survey group, more farmers in the higher income group are further along in testing the technologies or have fully adopted digital technology. Although they are less likely to cite financial constraints, they are similar to the overall group in their lack of comfort with understanding digital technologies.

According to the survey, 10 percent of respondents are now using data technology, 20 percent say they are testing data technology and 30 percent say they will be ready in two years. The remaining 40 percent of farmers are not committed. The report summary states that simply promoting the benefits of big data in managing their farm is not enough to cause them to buy in.

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In a recent survey about digital technology on the farm, only six percent of farmers surveyed rated data technology as a high investment priority compared to other needs. | GETTY IMAGE

FARMERS READINESS FOR DATA TECHNOLOGY

A recent survey on digital farm technology asked farmers when they will be ready to adopt data technology on their farms. Here are their responses:

I will not be ready for 3-5 years	34%
I will be ready in 1-2 years	30%
I am actively testing the use of data now	20%
I have fully adopted the use of data on my farm now	10%
Other (please specify)	7%

WHY DON'T FARMERS USE DATA?

In a recent survey, farmers were asked what keeps them from using data gathered from field operations. This is how they responded, by age:

Top reasons cited for not using data:	age <45	age 45+
Budget constraints	42%	34%
Lack of time	37%	33%
Too complicated	34%	29%
Don't know how to use the data /data from sensors/ once I've collected it / technology	29%	25%
Data / sensors / processes are not automated enough	23%	23%
I understand equipment but not data /sensors/ autonomous operation/telematics	21%	20%
I can't get help when I need it	21%	18%
Other barriers	22%	16%

What do farmers say are the main benefits to using data captured from field equipment?

Decrease cost	37%
Increase yield	38%
Save time	14%
Other (please specify)	11%

Source: 2017 Digital Farm Survey

Connecting the DOTs

Autonomous platform leaves the tractor behind

BY MICHAEL RAINE
SASKATOON NEWSROOM

DOT IS WHAT HAPPENS when farming processes are examined carefully. Does seeding require bigger machines? Does spraying mean going faster and wider? Does anyone need to pilot a field roller? Or any other field machine, except maybe a combine, for now?

The new machine design, the DOT, retires the tractor and giant airseeder and drill from the field and substitutes a much smaller U-shaped, operator-less, powered platform and air drill. The latter can be swapped for a sprayer, land roller, grain cart or any of about 100 other implements and industrial tools that have already been identified for autonomous automation.

After a debut to thousands of farmers at last summer's Ag In Motion farm show, DOT, or at least its technology, has been making the rounds of industry events in search of feedback.

"We are reaching out to farmers to get their thoughts. We know this is a big change, but farmers see it and get what it could mean," said Norbert Beaujot, the founder of SeedMaster and the creator of DOT.

For the past three winters, one of the fathers of reduced tillage equipment has been taking in the sun in Mexico and considering the next step-change in agriculture autonomous work.

"Stepping back from the day-to-day has given me the opportunity to consider the subject of farm machinery size, the constant trading cycle and everything that goes with it," said Beaujot.

The seeding equipment inventor and manufacturer built his Saskatchewan operation into a global business that continues to grow after 25 years.

Despite marketing one of the world's largest seed drills, Beaujot said "bigger isn't the answer in the long run."

"I asked myself why we need the tractor in the first place. It is just a part of bigger," he said.

It's a big, U-shaped tool carrier that wraps around the implements it operates. There's no need for giant tires, ballast and hundreds of horsepower just to move the power unit or cab and operator station.

"We purposely didn't put a seat on it. If it was there, somebody would want to sit on it. That's the wrong direction," said Beaujot.

How it works

The DOT platform is designed to carry and power the implements, following a predetermined way-path in the field.

Trent Meyer, who runs SeedMaster, a sister company to Dot Technology Corp., said optimizing those paths is one way that the DOT system pays its way.

"No farmer intends to drive around needlessly in their fields, but no farmer will tell you it doesn't happen all the time.... With DOT, the farmer predetermines where the machine will travel before it gets to the field, for the most efficient operations," he said about the system's specialized guidance and field operations software.

The DOT is aimed at a 30-foot wide tool for the North American, Eastern European and Australian markets. A smaller version might also be built for Europe and Asia.

Two of the DOT units could seed 4,000 acres "with lots of capacity to spare," said Meyer.

"They would do the work of a 70 or 80 foot unit and do it far more efficiently," he said.

As well, an operator could run multiple machines because of the autonomous operation.

Beaujot said the labour savings are significant, but the machines also don't need to stop to accommodate human needs.

The company is offering licensing opportunities to other manufacturers on a "cost recovery basis."

"Not every farmer wants a SeedMaster (seeding unit). They might want somebody else's technology, and that is great, too," he said.

Implements attach to the DOT with a set of latches, and the unit picks up the tool and powers it.

Change in the industry and overall technology originally spurred Beaujot to start working on a "different path."

Meyer said business realities were also creeping into the thinking at SeedMaster.

"Rapid devaluation of farm equipment has been a growing issue for both manufacturers and farmers, and that was dragging down our business. So it also made good business sense to be involved in a solution," he said.

"In August of 2016 CaseIH came out with their cabless, autonomous tractor and we knew that it would grease the wheels a little. Before that ATS, who did the (autonomous system) for CaseIH, declined to work with us, so we knew someone was working on a solution and it was time to get on this project," said Meyer.

"No driver. The connection behind the tractor is a problem. Get away from the drawbar and hitch and you take out some of that unpredictability when it comes to precision placement (in the field)," he said.

"We found some key inefficiencies (in what is done now): need smaller more nimble units, lower power per acre, lower investment, higher degrees of functionality. And that is what was targeted."

Next spring, when the first six units will be on farms for testing, producers will be following their predetermined paths, and sets of eight cameras will be watching out and recording if the machines run off their established trails.

"At a maximum of five m.p.h. in the seeder and eight in the sprayer, we don't believe machines need operators," Meyer told farmers attending Canola Week meetings in Saskatoon earlier this month.

Before a single rank toolbar could be designed, which is needed for the relatively narrow DOT to operate at legal road widths, Beaujot had to solve another issue. Seeding tools on the relatively narrow spacings needed for the small grains and oilseeds grown on the Prairies, 12 to 15 inches at most, need to be set on toolbars in multiple ranks for residue clearance.

"I have been working on that since the start of Seed Hawk," he said of more than 25 years of trying to deal with the issue.

"And we have it," he said about a driven, flexible pin-disc that he developed to operate between the shanks.

"It allows us to run narrow (rows) without plugging."

The narrow width allows DOT to turn end-ways for transport. The 30-foot unit rotates and measures just 12 feet wide when operating on the road.

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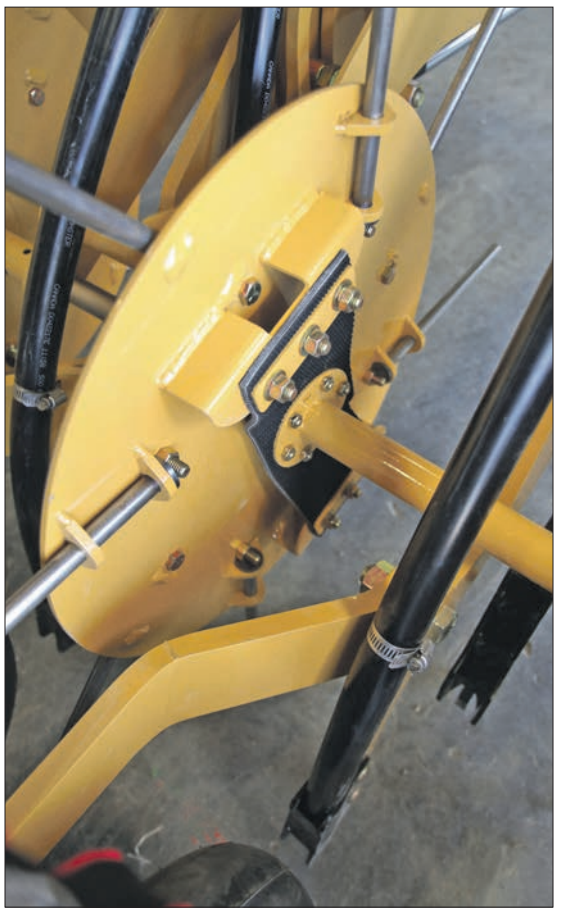

OPPOSITE PAGE: Norbert Beaujot stands with the first DOT powered platform ahead of release last summer. The prototype has a 165 h.p. Tier 4 Cummins engine, which will be swapped for a 200 h.p. Tier 5 in production for 2019. Independent, hydraulic wheel motors guide the machine with sub-inch control.

TOP LEFT: The DOT fitted with a SeedMaster seeding unit operates as a single rank, 30 foot unit. No cab is present or needed on the machines.

TOP RIGHT: To solve the problem of plugging the drill's single rank, Beaujot developed a flexible tine disc that spins soil and crop residue out from between the twin shank system.

MIDDLE: Up to 2,000 people gathered during first demonstrations of the DOT during the Langham, Sask., AIM farm show last summer.

BOTTOM LEFT: Around the yard or when changing implements, the hand control replaces autonomous operation. It has a kill switch and there is a separate kill device that will stop the DOT at any time.

BOTTOM RIGHT: The U-framed DOT chassis weighs about 8,000 lb., about that of a large farm pick-up truck. The company has identified more than 100 potential implements and tools that could be fitted to the unit. |
MICHAEL RAINE PHOTOS

Beaujot has long been concerned with the size of machinery in transport, so this met one of the safety and road damage objectives. The 30-foot width was based on average seeding windows and combine capacities.

SeedMaster's field residue blockage removal tool runs between a single rank of precision air drill shanks. Its flexibility to rise and fall with the shanks, but rely on the cooperative power of the whole section, makes it unique.

By the time the machines reach the production phase, a Tier 5 emissions compliant 200 horsepower diesel engine will provide the juice for all operations. It's currently a 164 h.p. Individual wheel motors and high efficiency hydraulics allow for some creative field maneuvers that a tractor and towed implement could not achieve. As well, per acre fuel costs are very low with average savings of about 30 percent.

At about 8,000 pounds, the DOT powered platform weighs about as much as some large pick-up trucks. The seeder or other implement adds the additional weight needed for field traction.

"There is a lot of waste in running that massive tractor, with that big glass cab and air conditioning around in the field. And soil compaction," said Meyer.

While safety might be something that comes to mind, "there will be 25,000 U.S. cars running on roads in 2018, 100,000 by 2020," he said about the technology that DOT uses for navigation and fail-safes.

"Sensor technology has become so inexpensive and effective because of cars, this is only really now possible."

The scalable system allows farmers from 1,500 to 3,000 acres to run one unit, and then producers can add machines for each subsequent jump in operational size, "which pairs well with combine economics."

The company believes the resale will be better than with the very largest equipment that now dominates small grains and oilseed farms because the machines can be used by a wider selection of producers.

They also feel that as producers' average age rises, it opens up the window for older farmers to remain active, cutting the "cab-time."

The company hopes to see machines available for sale by 2019.

"This is prairie farmer's solution to autonomous machinery. They can ditch the hitch," said Beaujot.

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HANDS-FREE FIELD T

Researchers showcase 'the future of farming' using autonomous vehicles to plant, treat and harvest one hectare of barley

BY BARB GLEN
LETHBRIDGE BUREAU

THE MISSION: to plant, treat and harvest one hectare of barley using only autonomous farm equipment.

Mission accomplished.

The feat occurred this year in a field at Harper Adams University in the United Kingdom, and university researcher Jonathan Gill, one of the self-professed geeks behind the project, considers it a rubicon in the future of farming.

"We wanted to break down the perceptions of what can actually be done with agricultural technology," Gill told those at the Farming Smarter conference in Lethbridge earlier this month.

"Everybody thinks it's really, really difficult, that it's well off into the future and (we) just wanted to really show that the capabilities are there now."

Gill and his team equipped a tractor and an older model combine with modern technology allowing them to operate the equipment autonomously. The tractor and its system cost about $60,000 and pulled a drill calibrated in a nearby plot and then used on the hands-free hectare, which is 2.5 acres.

The combine, 25 years old with a two-metre header, used laser scanners to reap an estimated 67 bushels per acre from the plot.

It "worked as well as a brand-spanking new Lexion," said Gill, albeit operating at an average speed of about four km-h.

The team also developed a scout vehicle, adapted from an old wheelchair, which it sent to the field in the early crop stages for soil and plant samples to determine fertilizer and herbicide needs.

They also used soil maps and drones with multi-spectral cameras to check the crop later in the season. One drone was equipped with grabbers to pull some plants and carry them off the field so the team could determine ripeness.

From start to finish, autonomous equipment was used for pre-seed herbicide application, planting, rolling, fertilizing, applying herbicides and fungicides and a pre-harvest desiccant and finally, combining.

"After doing nine applications with our tractor, we got quite confident with our system," said Gill, who fondly recalled eating fish and chips while watching the farm equipment work.

"We wanted to make sure that all agricultural machinery was able to be adjusted into our methodology."

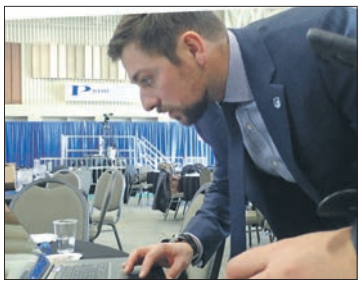
Gill said autonomous technology has been in the hands of major farm equipment manufacturers for a while, but they've instead concentrated on the push for larger, faster equipment and implements.

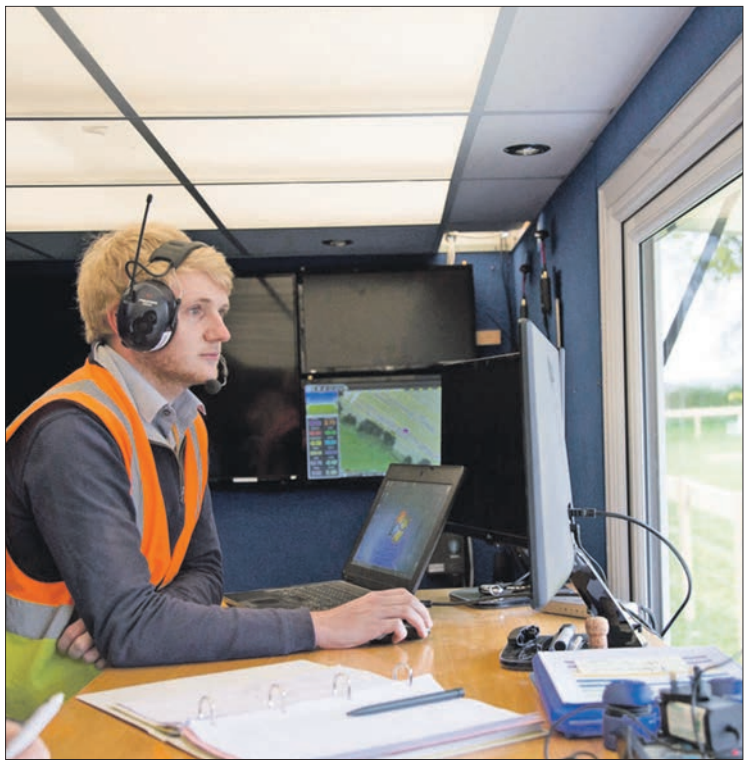
The Hands Free Hectare project garnered international attention, which was also a goal for Gill and his team. Social media was liberally used to show the project as it progressed.

"I wanted to make sure that the world saw that a crop and agriculture was exciting. This entire industry is kind of backwards in the understanding of how technology can actually be used to actually make our lives a little bit better," he said.

A second season and a crop of winter wheat is now planned, "to prove it wasn't a fluke" but also to explore ways to improve yield through better crop sensing and agronomics.

Why attempt a hands-free hectare in the first place?





Gill said autonomous equipment on a wider scale could address farming problems such as limited time windows, cost of machinery, limited labour and soil compaction caused by large machines.

He also said that lack of resolution in current precision farming methods make it difficult to make best use of the information because of large machine size. Robots could move variable rate applications to the individual plant level.

Details on the project can be found at handsfreehectare.com.

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Researchers in the United Kingdom recently farmed one hectare of cropland with nothing but hands-free equipment. | HARPER ADAMS UNIVERSITY PHOTOS

Researcher understands farmer doubts about hands-free farming

BY BARB GLEN
LETHBRIDGE BUREAU

The Hands-Free Hectare project proved farming is possible using only automatic equipment, including drones. | HARPER ADAMS UNIVERSITY PHOTO

FARMING BY ROBOT? Remote control? Laser-sensing technology? Drones?

Canadian farmers don't believe they will make major use of autonomous farming methods for at least another five years, according to a survey undertaken by Glacier FarmMedia.

However futuristic it may sound, hands-free farming methods exist and have successfully been used in the Hands Free Hectare project at Harper Adams University in England (www.handsfreehectare.com).

Jonathan Gill, a lead researcher on the project, talked about the accomplishment Dec. 5 at the Farming Smarter conference in Lethbridge. He wasn't surprised to hear about survey results that showed farmer ambivalence.

"I can understand that, mainly because the amount of investment in technology for certain machinery has to pay back whatever it is, over a set period of time, so generally agricultural machinery is worked on a three-to-five year basis.

"Maybe that's the reason why people are saying, 'well you know, not yet but when it's actually available for me … I'll be there using it in my next round of upgrading my equipment.'"

Gill and his team proved that older equipment can be automated for hands-free capability. They used a low horsepower tractor and a 25-year-old combine to farm a single hectare.

Instead of one large machine, be it a tractor or combine, several automated smaller machines could do the same job in the same amount of time and if one broke down, work could still continue, said Gill.

As well, smaller machines are lighter, causing less compaction and making it possible to work fields earlier in spring and later in fall.

"The exciting thing is, a machine doesn't have to be monitored, in a sense, all the time because it can run for a longer period of time. It can have no breaks, it can run throughout the dark and it can continue to do work," Gill said in an interview.

"Smaller machines are easier to maintain and look after and repair. An awful lot cheaper as well."

Gill said major farm equipment manufacturers have the technology to produce autonomous equipment but haven't had the impetus to produce and market it.

"Why would they actually put their neck out when they can keep on selling larger and larger machinery that can still keep on making them profits and do the job that generally the market believes they need," Gill asked.

"However, this cycle needs to be broken down because it's not actually doing good for our agricultural practices. It's not helping us look after our soils. We're not putting more back in, enabling us to actually get good, rounded approaches to things."

Agriculture can benefit from current and concentrated research on autonomous passenger vehicles and trucks. That work can solve issues around safety and collision avoidance, as well as other traffic factors.

"All you've got to do is just take that technology, throw it onto a tractor and it will be safe enough to work in an area that doesn't generally have people."

Such farm equipment may help address the labour shortage, said Gill, but he also thinks it could bring people back to rural areas for the highly skilled jobs that require knowledge of robots, sensors and drones.

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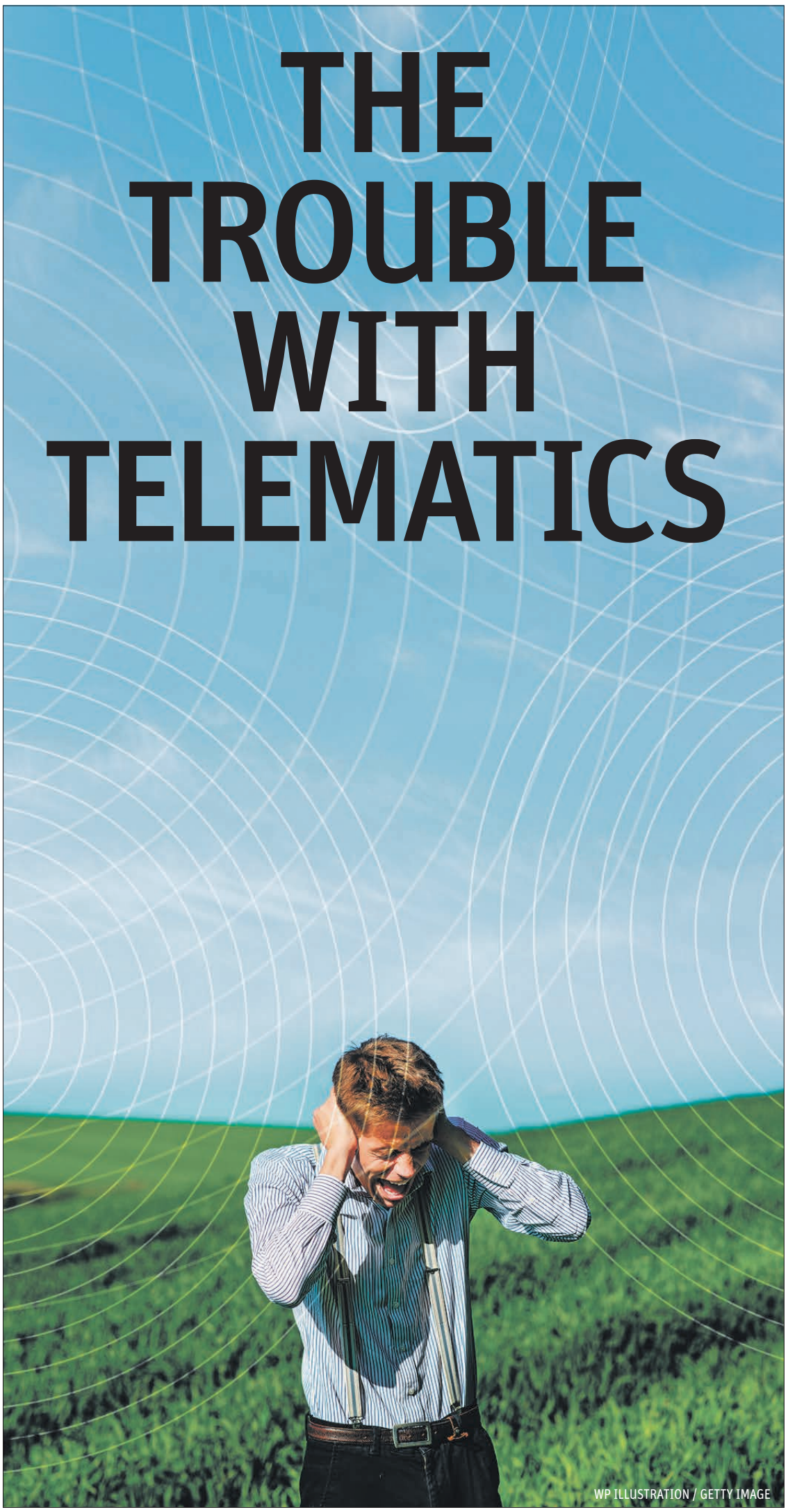
THE TROUBLE WITH TELEMATICS

Telematics takes data from the field but farmers have been slow to make the trip

BY BRIAN MACLEOD
SASKATOON NEWSROOM



WP ILLUSTRATION / GETTY IMAGE

WHEN IT COMES TO telematics, that special set of data that helps monitor the performance of big equipment, acceptance by farmers appears to be coming in fits and starts, with the emphasis on the younger generation.

The challenge, several dealers say, is to provide training and follow-up to farmers who are now buying equipment with the big guns of data collection on board.

"I don't know how many times I've walked into a farm office and I've seen a farmer or a farm manager pull out a Ziplock bag with all of his USB sticks, and he's been collecting data for a dozen years, and it's all sitting in a Ziplock bag and he's done nothing with it," said Steven Dyck, president and general manager of Western Tractor, which has locations in southern Alberta and Saskatchewan.

"Even for that next generation, us, as a dealership, we've got to create easy buttons for them."

That easy button comes in the way of training, easier access to data, and follow-up help, issues that a Glacier FarmMedia survey shows are concerns for farmers who are wandering into the fledgling field of telematics data.

Telematics gathers information from on-board sensors about equipment location, operations, diagnostics, and maintenance. Users can connect their machines to their offices and mobile devices or equipment dealers or manufacturers, which can then study the data and advise farmers.

The GFM survey suggests that farmers are aware of the potential for telematics data use. Some 42 percent of farmers surveyed said it would save time, while 39 percent said it would result in decreased costs.

But few farmers have yet taken the deep dive. Just 11 percent say they are testing telematics now and only five percent say they have fully adopted its use. More than a quarter of farmers say the industry will not be ready to make telematics data useful to them for one to two years and 29 percent say the industry won't be ready for another three to five years.

Only about a third of farmers believe the industry is ready now.

Regardless, 56 percent of farmers feel they're not going to adopt telematic data use for three to five years.

This is despite the widespread availability of the technology on newer machines.

The biggest barrier to acceptance of telematics is budget constraint, say 43 percent of survey respondents. Many believe they'll have to buy new machines with the onboard equipment, though some dealers say after-market upgrades are possible.

More than one in five farmers say they do not know how to use the technology, almost the same number say they don't understand telematics, and 17 percent say they can't get help when they need it.

On that last part, some dealers agree it has been an issue, though there is now a focus in that area.

"They're not alone in that sometimes," said Grant Kromrey, branch manager of Tingley's Harvest Centre in Lloydminster, Alta. "(The) last couple of years in the dealership side, even with ourselves, we've struggled with some of the telematics."

But changes to technology, especially the availability to view data in smart phone apps or tablets, is helping, said Kromrey.

"One thing we've really seen change is the advances in smartphones and apps. We've really seen them increase. (They're) a lot more user friendly, making it more instinctive to work your way through menus ... simplifying the operations."

That ease of use is vital to the growth of telematics, he said.

Randy Gates, manager of the precision technology department for the Mazergroup, which operates 13 locations in Manitoba and one in eastern Saskatchewan, understands some farmers' reluctance to embrace telematics. He says manufacturers have to help.

"I don't think the manufacturer (has) done a good enough job providing us with information and the understanding of it."

Dealers must play a role in helping producers, he said.

Gates compared the use of telematics to people getting their first smartphone and only using the basics.

"If you actually sat down and showed the guy the value, is there going to be huge savings? Yeah, there could be. Is there going to be huge time savings? In my mind there definitely will be. How to get it across is what the manufacturers and the dealers need to work on."

Most dealers interviewed agreed that acceptance of telematics is likely going to be a generational issue.

"The under-35 type crowd, they're the ones that eat that technology up," said Jeff Schlachter, a co-owner of Wheatbelt Sales in Wadena, Sask. "The older guys still want the plain and simple."

That plays out in what he sees in sales.

"Some companies make different models for how advanced you want to get. (The) new Kubota, for instance, there's a standard (model) and there's a premium. The premium has all the fancy touch screens ... in the cab and the standard just has a plain-Jane powershift."

But equipment buyers are "probably still two-thirds standard and a third premium," he said.

Dyck agrees.

"In southern Alberta we've got some pretty large farming operations. It's very common to see 10,000 acre-plus farms here, 20,000 acre-plus farms there, so a lot of the farmers are not the guys sitting in the cabs anymore.

"It's their hired help. It's their children (who) are doing it now and we're finding the next generation is embracing that, because, quite frankly, they are far more technically literate."

In some areas, telematics has yet to take off.

"I've had nobody asking me for it," said Mathew Marshall, sales manager at Raymore New Holland in Saskatchewan. Farm size could be an issue, he said.

"We don't have huge fleet farmers here that own 15 combines. For telematics, as of right now, some new equipment definitely is coming with it, you can activate it, but nobody's really asking for that."

Still, Kromrey believes the industry is reaching a milestone. Dealers have a better handle on the data, they're becoming better at servicing and explaining the equipment, and apps and smartphones are making it much more accessible. He thinks the three-to-five year time frame for heavier adaptation of telematics will be compressed.

"I actually believe that you're going to see that time frame shorten. Most of the industry has gone to the point where it's become a staple. The biggest thing for (the dealers') side is that we are going to need to show the benefits to the end user much more quicker and get them involved. I think that's going to move it along quicker."

Dyck agrees.

"We've been heavily invested in this for a number of years now," he said. "We believe this is the future of farming and we have focused primarily with our next generation farmers, especially in trying to turn telematics and data into meaningful decision-making tools.

"For famers, it's a complete mind shift for them, but I also say ... it's a complete mind shift for the dealers too. It's a cultural shift that needs to happen within the dealerships themselves."

Gates says farmers are on the cusp of a major move into telematics.

"I'm betting that ... maybe not in this coming year, maybe the following year, I'd love to see (the GFM) survey out again, and I bet you these numbers will have changed quite a bit."

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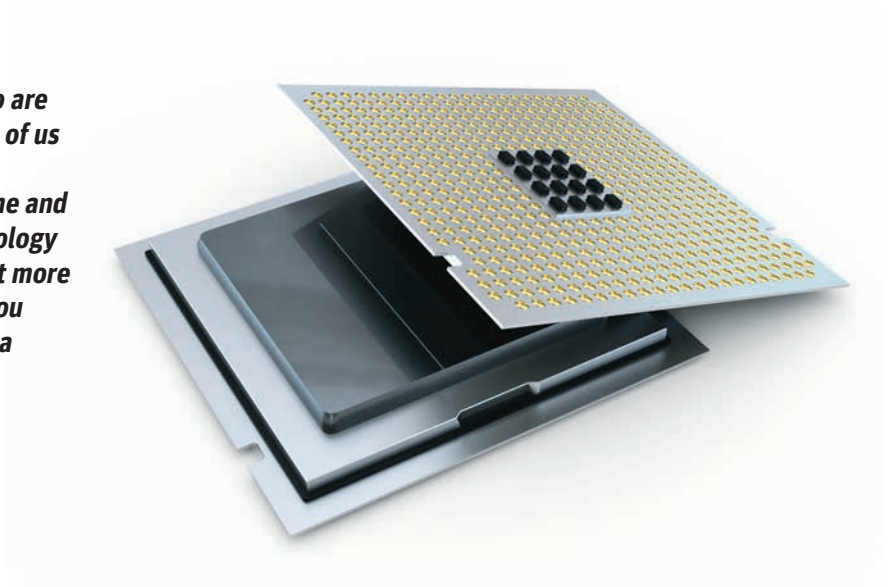
Those of us who are under 40, most of us have been playing with computers for a long time and we are a lot more technology literate, and I think a lot more willing to try it. When you grow up with it, it's not a foreign concept.

CHRIS HERRNBOCK
HUMBOLDT, SASK., FARMER



You pretty much have to be a computer guru to get into that stuff. If you have one thing fail on you, you can be sitting all day doing nothing, waiting for a computer guy to come out and tell you what's wrong.

TAVIS HUEBNER
SPALDING, SASK., FARMER

Sensor sensibility

Sensor technology holds appeal, but each generation assesses its value differently

BY ROBIN BOOKER
SASKATOON NEWSROOM

CANADIAN FARMERS are dithering when it comes to using specialized sensors, according to a Glacier FarmMedia survey.

In an online survey filled out by 428 farmers from late August to mid-October, only seven percent of respondents said they have fully adopted the use of specialized sensors, and only 20 percent are actively testing them.

In the survey, farmers said they are agreeable to greater use of sensors and view them as labour-saving, time-saving and more affordable than some of the other technologies they were asked about.

However, most farmers are not rushing to be early adopters, with 37 percent saying they will be ready to use specialized sensors in three to five years, and 30 percent saying they will be ready in one to two years.

For the survey, specialized sensors were defined as sensors that can measure, monitor, control and gather information on field operations. These include yield monitors, variable rate controllers, directional guidance controllers, electrical conductivity sensors, soil moisture sensors, and leaf wetness sensors and weather sensors.

Tavis Huebner, 26, works a 4,500-acre farm with his father near Spalding, Sask. He considers himself to be a slow adopter of the latest sensing technology.

He said technology such as GPS is widely used even by smaller farmers because they are a relatively low-cost investment that provides a significant return. However, it takes a large farm's economy of scale to recover the costs associated with the latest sensor technology.

"GPS and auto-rate, which we use, took our overlap down from around 20 percent to less than five percent. So it provided huge savings on inputs instantly. To get that next five percent improvement, there is a hell of a lot of cost to get into it."

Most farmers passively use yield and moisture monitors that come standard on combines, even if they aren't very accurate.

Huebner said farmers have to make significant equipment investments if they are to use information from yield monitors in a more active way to help build useful tools like prescription maps.

"You can hire an agronomist and they can put the prescription maps together, but you still have to put the capital cost out on the seeding end and the sprayer end of it. You either have to be all in or all out."

Huebner said producers are also hesitant to use more sensors because of the steep learning curve required.

"You pretty much have to be a computer guru to get into that stuff. If you have one thing fail on you, you can be sitting all day doing nothing, waiting for a computer guy to come out and tell you what's wrong," he said.

He added most farmers can't afford the down time when support from the nearest dealership can be an hour away.

Anthony Eliason farms with his family on a 5,000-acre farm near Outlook, Sask. He considers himself a moderate adopter of cutting edge sensing technology. He uses GPS and auto-steer guidance in sprayers, tractors and combines, and he is looking at getting into sectional control for his seeder.

To monitor the farm's 1,200 acres of irrigated land, Eliason, 32, installed soil moisture sensors last year. The sensors are connected to a wireless network, which enables him to monitor soil moisture from his phone.

"I can actually start up my pivots, have them all set to my phone and never have to drive out into my field and (trample) crops to turn things on and off, which is nice," Eliason said.

Before buying, he tested soil moisture sensors through a dealership to gauge how they fit into his operation.

The sensors proved to be a big time saver because he no longer has to drive fields to take core samples and dig holes to see the moisture profile.

Drones are becoming ever more useful in agricultural applications, as is the use of sensors for various purposes. | FILE PHOTO

When deciding which sensors to buy, Eliason said he looks for sensors that will either save him time, or help prevent a potential disaster.

He said bin temperature sensors can help keep growers ahead of potential problems, such as heating issues with straight-cut canola.

Eliason is in charge of managing the sensors on his farm, but his dad also recognizes the importance of having these new technologies.

"When he was my age, he was one of the first guys that put in irrigation," Eliason said. "He understands that sometimes you have to take that risk to try something new."

Chris Herrnbock farms 3,200 acres with his family near Humboldt, Sask., and is among a younger generation of farmers ushering in strategies that rely on the use of advanced sensing technology.

"Those of us who are under 40, most of us have been playing with computers for a long time and we are a lot more technology literate, and I think a lot more willing to try it. When you grow up with it, it's not a foreign concept," he said.

Herrnbock has always liked and tinkered with electronics, a hobby that is now helping him farm. For instance, he built and programmed weather stations with probes that have become important pieces of farm equipment.

"The way the software works is it calculates what full saturation is in the soil, and then gives you a percentage of that. You can log onto the weather stations any time to see where it's at," he said.

Herrnbock sees a time in the near future when swarms of smaller robots perform tasks now in the realm of large, high-horsepower farm machinery.

But in the meantime, he uses whatever technology and sensors he can get his hands on, as long as it makes production and economic sense.

"Economic pressure forces us to be more and more efficient. More and more of this stuff is going to be a requirement. The days of just spreading fertilizer willy-nilly have come and gone," he said.

Through the use of combine yield monitors, soil testing and drones, he produces prescription maps that allow him to apply product with his air drill at a variable rate.

He also uses NDVI imagery from his drone to create prescription maps that enable him to top-dress nitrogen in cereal crops at variable rates.

His drone takes thousands of images as it flies a quarter section in a grid pattern. Then DroneDeploy software changes the different shades of green in the crop into the NDVI image. He then uses Farm Works software to convert the NDVI image into zones, and then creates a prescription for the different zones.

"It's about 30 minutes to fly a quarter section, then it takes a few hours for DroneDeploy to create the NDVI imagery. So typically, you'd go fly a bunch of fields on a Monday, and then by Tuesday afternoon you'd have the NDVI imagery. And then after that, basically it takes maybe 15 minutes to create a prescription map out if it," he said.

The drone and software Herrnbock uses allow him to more closely adhere to a more ecologically friendly and efficient nutrient management strategy, by staging nitrogen applications on about 1,000 acres of cereals each year.

"If you have a year with lots of moisture and good yield potential, you can really push for an 80 or 90 bushel crop. When you're in a dry year with no moisture, you can hold off and save yourself that $25 to $30 an acre," Herrnbock said.

"We tried doing the front loading, where we did it all with the air drill in one pass. Yes, it's convenient but there is so much that gets lost."

Sensing technology will become easier and less expensive as it develops, and Herrnbock said it will begin to assist in all aspects of farming.

"Hand-held sensors for soil and plant tissue is $300, a drone is $2,000, the weather station I cobbled together with about $200 worth of materials.

"You're not spending $700,000 on them. As robotics come out, more and more drones come out, there will be a place for them because some of the larger machines are being priced so far out of the market that when something less expensive and more efficient comes into the market, I think there will be a lot of adopters going after it," he said.

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The discovery that could shake up the beer industry

New molecular markers can help breeders to quickly identify malting barley varieties with high levels of a very useful protein

BY SEAN PRATT
SASKATOON NEWSROOM

JASWINDER SINGH can hardly contain his excitement when talking about TLP8, a useful protein he discovered in barley.

"It could revolutionize the brewing industry," said the associate professor at McGill University's plant science department.

Maltsters despise beta-glucan, a key sugar found in barley. If it is not properly degraded during the malting and germination process it can lead to highly viscous wort, which creates headaches.

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> ***I can tell you right now, that would be of high interest to people in the malting-brewing community. I would say that is a pretty significant finding.***
>
> **ANDREW NGUYEN**
> CANADIAN MALTING BARLEY TECHNICAL CENTRE

GETTY IMAGE

RIGHT: Dr. Rajiv Tripathi and Prof. Jaswinder Singh discuss the interaction of a newly identified protein, TLP8, with beta-glucan and their value in the malting and food industry. | IRFAN IQBAL PHOTO

"There will be a problem during filtration. The wort will be difficult to filter," said Singh.

That is why malt barley breeders always select varieties with low levels of beta-glucan.

Singh and his research team identified 22 genes in barley that were related to the germination process.

One of those genes produces the TLP8 protein, which is expressed differently in malt versus feed varieties. It is found at three times higher levels in malt varieties like AC Metcalfe, Bentley and Morex than in feed varieties such as Cowboy, Coalition and Steptoe.

Singh also noticed that during the germination process the amount of beta-glucan was reduced by 60 percent in malt varieties compared to 20 percent in feed varieties.

He realized it was the TLP8 protein that was helping reduce beta-glucan levels by binding itself to the sugar during germination.

Now that it has been identified, a number of things could be done with the protein to enhance the efficiency of the malting process.

New molecular markers can be developed to assist breeders to quickly identify which varieties have high levels of the TLP8 protein.

Gene editing technology could be used to increase the amount of the protein in malt barley varieties.

Or the protein could be synthesized on a large scale and used as an additive in the malting-brewing process.

Andrew Nguyen, malting and brewing technical specialist with the Canadian Malting Barley Technical Centre, thinks Singh's discovery is a big deal.

"I can tell you right now, that would be of high interest to people in the malting-brewing community," he said. "I would say that is a pretty significant finding."

High beta-glucan levels are a major contributing factor to poor quality malt, resulting in reduced malt extract levels and lower alcohol yields.

"High beta-glucans are usually just all bad," he said.

Nguyen said genetic modification isn't common in malt barley varieties, but if something could be done using traditional breeding techniques to identify lines with high levels of the TLP8 protein it would be well received.

Maltsters already use glucanases enzymes to break down beta-glucan during the malting-brewing process but those enzymes are temperature sensitive whereas the TLP8 protein is not.

The next step in the research process is to see if the protein performs the same way in the real world as it did in the lab. Maltsters will be providing Singh and his team with wort samples to see if the protein decreases the amount of viscosity.

"The concept is there. The hypothesis is proved. It is just a matter of doing it," said Singh.

"I really want to see viscosity changes."

The second phase of the research project could take up to one year and if everything goes as planned the malting industry could soon have a promising new tool that will make the whole process more efficient.

A separate project could be spun off from Singh's research discovery. Breeders could create varieties with low levels of the TLP8 protein, which could increase the amount of beta-glucan in those varieties.

Beta-glucan is a dietary fibre, so the idea would be to produce barley that could be used to enhance the amount of fibre in food products like cereal.

"It can also revolutionize, in the future, the food industry," said Singh.

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GROW YOUR

The BioCouture project uses living organisms like bacteria to make fibre, creating material that can be cut and sewn or formed around a three-dimensional shape to create clothes and perhaps one day, objects such as lamps or furniture

MICHELLE HOULDEN ILLUSTRATION

BY WILLIAM DEKAY
SASKATOON NEWSROOM

FASHION DESIGNERS and biologists are weaving together their talents to create a new sustainable fibre that is biodegradable and wearable.

Using synthetic biology, they can engineer organisms for growing consumer products. One process creates a gel-like film made from a byproduct of kombucha tea to make clothing, shoes and handbags.

The recipe is a symbiotic mix of micro-organisms, such as bacteria and yeasts, which spin cellulose in a fermentation process. These tiny threads form layers in the liquid and, over time, produce a mat on the surface.

The process has transformed the way Suzanne Lee looks at clothes and creates them.

The fashion designer started the BioCouture research project, which is an idea she presented in her book, *Fashioning the Future: Tomorrow's Wardrobe.*

Lee works with scientist David Hepworth in the United Kingdom, who develops materials made from non-hydrocarbon-based feedstock.

Instead of taking an agricultural approach for producing fibre from sources such as cotton in a field or wool from sheep, Hepworth is focused on living organisms like bacteria to make fibre.

Their commercial business aims to bring living, bio-based materials to the textile and fashion industry.

Lee explained their recipe, as well as the future applications, during a TED talk video presentation.

The fabric farm process starts by brewing tea and then adding sugar, which is poured into a growth bath. After it cools, a living organism and acetic acid is mixed in. An optimum temperature must be maintained, but the process can be taken outside during hot weather.

Several days later, the fermenting goop bubbles away as bacteria feed on sugar nutrients in the liquid.

"So, they're spinning these tiny nano fibres of pure cellulose and they're sticking together, forming layers and giving us a sheet on the surface," she said.

About two weeks later, the static culture is about 2.5 centimetres thick and left alone to grow on its own.

To harvest, it is taken out of the bath, washed and spread on a wooden sheet to air dry.

As it dries, it compresses to something that looks like transparent paper or vegetable leather, which Lee said also resembles human skin.

"You can either cut that out and sew it conventionally, or you can use the wet material to form it around a three-dimensional shape. And as it evaporates, it will knit itself together, forming seams," she said.

However, there are shortcomings.

"If I was to walk outside in the rain

CONTINUED ON NEXT PAGE »

OWN CLOTHES

wearing this dress today, I would immediately start to absorb huge amounts of water. The dress would get really heavy, and eventually the seams would probably fall apart, leaving me feeling rather naked," she said.

Another limitation is that in cold conditions, the cellulosic fibre becomes brittle and falls apart.

Mass production is another challenge of working with the fibre because its growth cycle in the lab takes three to four weeks, which could bottleneck manufacturing.

Other researchers have designed prototypes of vests, shoes and handbags using the same kombucha tea process.

Young-A Lee, author of the book, *Sustainable Fibers for Fashion Industry* said the new cellulose-based fabric is completely biodegradable in the soil. It can also reduce waste by creating a continuous cycle of reuse and regeneration termed a "cradle to cradle" system.

Ananas Anam, based in the United Kingdom, has adopted biomimetics by taking waste from pineapples.

The organization uses the leaf fibre from pineapples to make a leather alternative to try and offset mass leather production and chemical tanning.

According to the company's website, founder Carmen Hijosa was inspired by the use of plant fibres in traditional weaving such as Barong Tagalog garments in the Philippines.

Their research showed that the strength, flexibility and fineness of the pineapple leaf fibres stood out as a raw material. The company has developed a non-woven textile that can be commercially produced.

Designers are using the textile to craft products such as footwear, clothing, interior furniture and automotive upholstery.

The pineapple industry produces about 13 million tonnes of pineapple leaves as a byproduct each year, which are often discarded to rot or be burned.

Harvesting and selling the fibres from the pineapple leaves provides an additional income for Philippine farmers.

Stuart Smyth from the University of Saskatchewan's College of Agriculture and Bioresources said this idea has huge potential for the Prairies if researchers could find a way to use existing biomass to create the cellulose.

"I think it would provide an opportunity for some biomass that would essentially not have any market value, to now have market value in the proximity of 200 or 300 kilometres from any plant that was going to set up to try and enter into this market," said Smyth, who also holds the industry research chair in agri-food innovation at the university.

"That could be as simple as a livestock producer who has a bunch of old bales that are no longer valuable as animal feed and they could load them up and sell them for a little bit instead of spreading them or having them rot on a field."

Sustainability fibres in clothing are driving popular clothing companies to find ways to transform.

Levi Straus is spinning recycled plastic bottles into its denim jeans and is working with other companies on an initiative to find sources of more sustainable cotton. However, it's unlikely that microbial cellulose will replace cotton, leather or other textiles on a mass scale any time soon.

Still, growing clothes and making fibres in a factory is a viable alternative, which would reduce waste caused by disposable clothing, and reduce society's reliance on natural resources.

"Ultimately, maybe it won't even be fashion where we see these microbes have their impact. We could, for example, imagine growing a lamp, a chair or maybe even a house," said Suzanne Lee.

"So, I guess what my question to you is: in the future, what would you choose to grow?"

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Blockchain technology offers food safety, traceability and more

BY BARB GLEN
LETHBRIDGE BUREAU

THERE'S ONE THING people tend to agree on when it comes to blockchain: it's hard to get your head around it.

Yet blockchain looks likely to play a huge role in the future of agriculture, potentially in food traceability and in other ways.

In simplest terms, blockchain consists of digital records that are time stamped, linked and encrypted so they can't be modified without knowledge and approval from everyone who provided the data. New data is added according to a protocol that can be verified by others in the chain.

Thus, the chain is managed by those involved, without need for an independent third party to verify changes. It's a ledger that everyone on the network can see.

Bitcoin is the most well-known example of the blockchain concept.

In agriculture, the most obvious use is in food traceability and the meat production chain in particular.

Aidan Connolly, chief innovation officer with international animal health company Alltech, called blockchain "one of most exciting of potential technologies."

"I think that has tremendous implications for agriculture. We have not typically, as farmers, we have not liked people knowing exactly where our cattle come from. At the same time, when there's a disease, we want to be able to trace it back," said Connolly.

Verifiable records and traceability will preserve and restore consumers' confidence in the food system, he added, because any instance of food contamination can be traced and swiftly addressed.

"Blockchain is a technology that allows us to do so in a manner that keeps us comfortable that we're not giving away all of our secrets and therefore perhaps not trading away our margins to the end food retailer, but at the same time making sure that if something does occur ... that we can actually find out where that occurred, what it is we need to do to stop it happening again."

Michael Boehlje, an agricultural economist at Purdue University, said agriculture is running behind some other industries in its use of blockchain. The diamond industry, for example, is using it to trace the source of gems to ensure they have been mined legally by the intended workforce.

"I think that this whole issue of traceability and food safety will be probably the biggest impact that blockchains have on the agricultural sector," said Boehlje.

Banks and multinational retailers are also using the technology, added Connolly.

"I think when you see people like Walmart getting behind blockchain and using it in countries like China and being so impressed by its potential that they then start taking it to the United States and elsewhere, I think you can see what the possibilities are.

"Traceability is a fundamental part of our future."

Writing for DecisionNext, a San Francisco-based market forecast company, its sales and marketing director Janette Barnard referred to blockchain as the missing link in the food chain. Her white paper can be found at bit.ly/2BMnuDR.

Though Barnard indicated the technology is in "the infantile stages" for use in food, it could address challenges including traceability, food safety, price discovery and food waste reduction.

On the traceability file, she said blockchain could allow the industry to track many different meat characteristics from gate to plate: place of a meat animal's birth, how it was raised, what it was fed, where it was processed and the path it took to a meat tray in a retail store.

That same pathway lends itself to food safety.

As for price discovery, Barnard said in her paper that "if enough participants throughout the supply chain decided that price transparency is critical to the market, then blockchain could serve as an ideal mechanism for capturing accurate prices, storing them, and providing price transparency to appropriate participating parties."

Blockchain could help reduce food waste by giving more immediate information on the demand for meat products so only the required amount would be delivered.

However, Barnard noted in her conclusion that successful use of the technology depends on collaboration and the willingness of everyone in the chain to participate.

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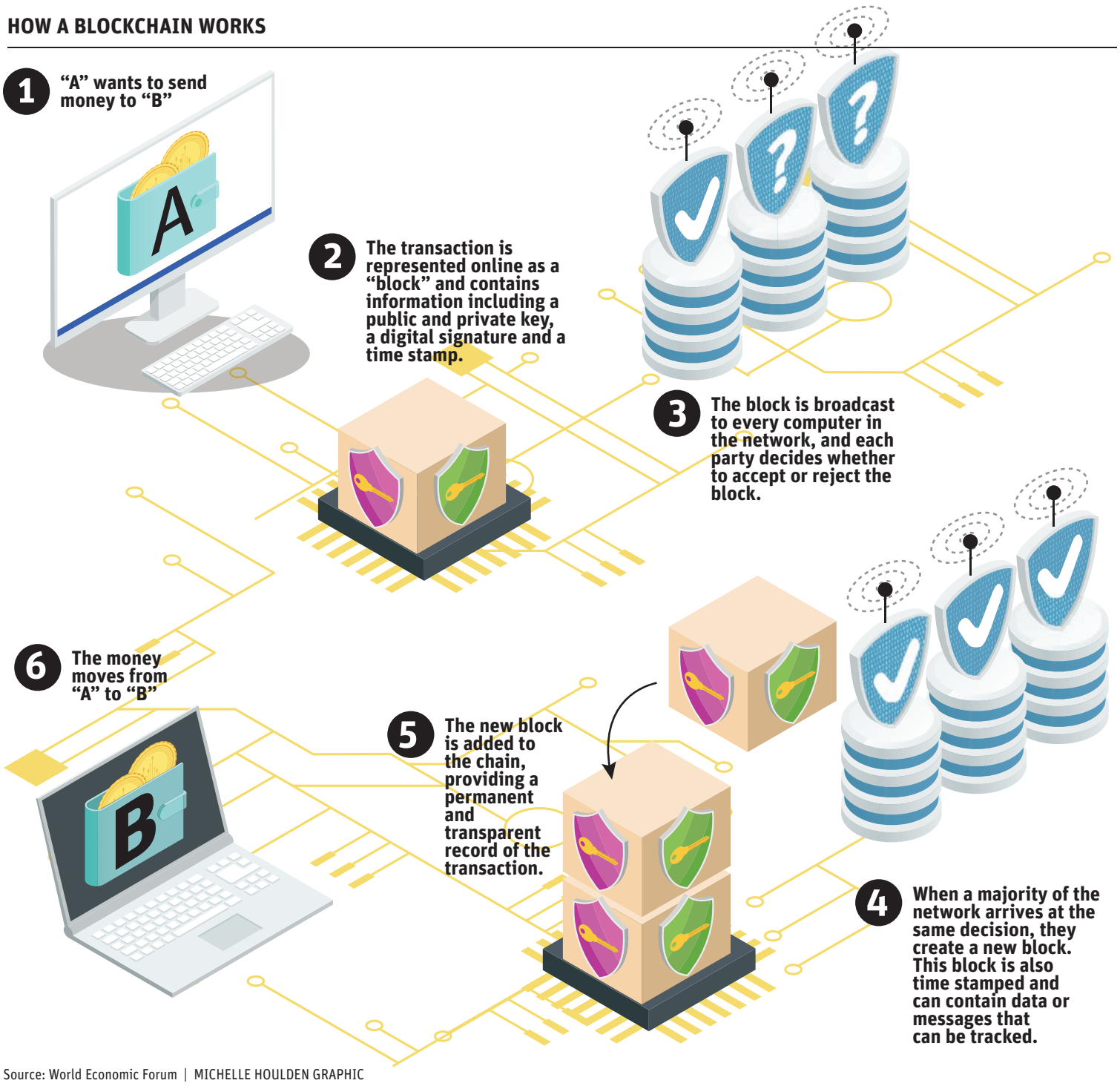
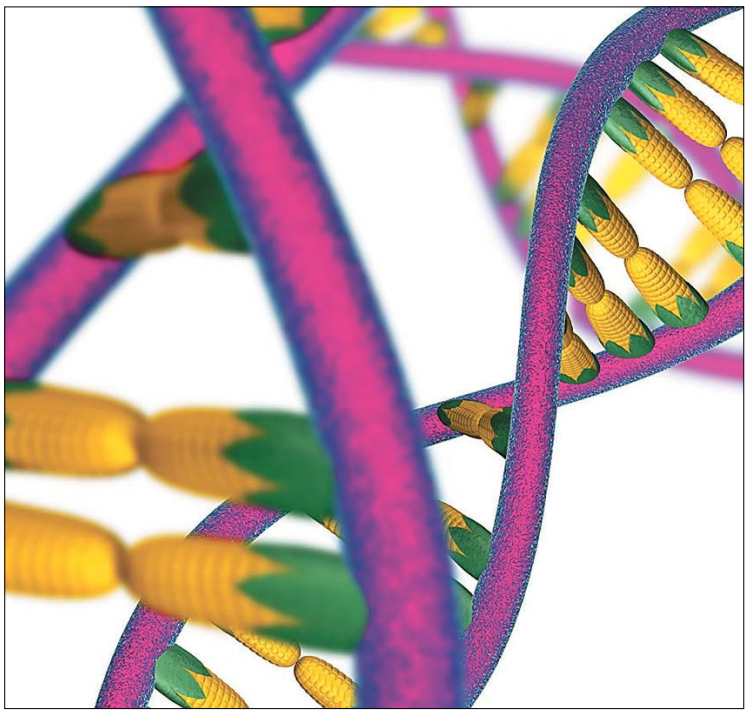
HOW A BLOCKCHAIN WORKS



Source: World Economic Forum | MICHELLE HOULDEN GRAPHIC



The agri-food supercluster may be eligible for some of the federal government's $950-million innovation fund. | FILE PHOTOS

Supercluster makes big innovation pitch

Initiative aims to create 300,000 jobs and generate $30 billion in economic growth

BY JEREMY SIMES
EDMONTON BUREAU

THE INTERIM CHIEF executive officer for Canada's agri-food supercluster is all about getting industry players together to push it to new heights during the next few years.

Rob Davies will lead the Smart Agri-Food Supercluster for now, as members continue to make their case to the federal government that they should have access to its $950-million innovation fund.

"Through innovation and technologies that are already out there, this is designed to increase Canada's share of global agriculture exports," said Davies, who has more than 30 years of experience in the agri-business sector.

He's spent most of that time as the CEO of the Weyburn Inland Terminal in Saskatchewan.

"This is really designed to build lasting benefits."

The supercluster is composed of members from big and small businesses, post-secondary institutions, government agencies, agriculture associations and research and advocacy groups.

The supercluster has been listed as one of the nine groups that may get access to the federal government's innovation fund. The government is expected to announce the winners early next year.

Davies said if his organization is selected, its goal is to create more than 300,000 jobs, generate $30 billion in economic growth and reduce greenhouse gas emissions by 40 mega tonnes.

"It seems like a monumental task, but we see advantages to utilizing new technologies and thought-processes to build a platform and bring all players together in a cost-effective way," he said. "It gets the whole value chain working together."

While it's too early to outline specific projects that the supercluster would pursue, Davies provided an example of how all industry players could work together to boost the sector.

He said the agriculture sector could partner with the oil and gas industry to get its hands on better in-ground field sensors to monitor and collect data on soil quality.

As well, satellite imagery specialists and software developers would be part of the partnership.

The satellite specialists would provide more data, and software developers would compile that information, as well as any data generated from the in-field sensors, to develop a program that could be used by farmers or agronomists.

The program would give specifics on soil quality, and it could let farmers know how much irrigation they need, how much fertilizer to add, or how much pesticide to spray.

"It helps them optimize their production and also helps to minimize environmental challenges around water use or pesticide use," he said. "You then combine that with harvest data, and that provides feedback to producers to help them understand productivity and make better decisions for the next year."

As well, he said companies that sell food products would be part of the picture.

For example, all industry players could work together to develop tracking systems for agri-food products. Wholesalers would use that information when marketing the products to consumers.

"It's connecting everyone, from the gate to the plate," he said. "It's important to consumers but also important to processors and everyone else on the value chain.

"This all could be viewed as a bit hard to wrap our hands around, but if you think back to 20 years ago, who had auto-steer? Now it's just part of what we do."

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