Research extends barley's home-province advantage

by Kieran Brett

With funding from ACIDF and ALMA, this scientist identified dozens of promising barley lines with the potential to yield more and provide more digestible energy to livestock.

Alberta cattle and Alberta barley are a match made in culinary heaven. Building on the breeding and management of cattle producers, barley provides the finish that makes the province's beef truly world class. That's according to John Vidmar, a Bioresource Technologies scientist with Alberta Innovates Technology Futures.

Dr. Vidmar in the field at Lacombe in 2013 with selected lines from the Vivar mutation population. Lines were selected based on variation in starch and protein contents and also show variation in height and maturity.

"We know that Alberta-grown beef is one of the best meats in the world," says Vidmar. "Barley provides that good fatty and marbling component in the meat, and it does that better than corn. When you look at which crop delivers more energy per hectare, based on cost, barley wins out in Alberta."

Corn, on the other hand, benefits from the attention of armies of plant geneticists, breeders and agronomists. These researchers are continually improving corn's yield, agronomic traits and field performance. Meanwhile, who's sticking up for Alberta barley? Vidmar, for one.

Between 2012 and 2015, he conducted a feasibility study on improving both yield and digestible energy in barley. More yield would benefit those who grow the crop; extra digestible energy would make barley more valuable as livestock feed. Vidmar's work was supported by the Alberta Crop Industry Development Fund (ACIDF), under the $8 million Feeding Initiative funded by the Alberta Livestock and Meat Agency (ALMA).

Nature's way, only faster

As Vidmar explains, plants are in an ongoing state of change caused by naturally occurring mutations. To improve the performance of a plant like barley, a scientist can speed-up evolution by *inducing* mutations (a process known as mutation breeding), observe these changes and bring desirable material into future generations.

"Once we look at these induced mutations, we can develop breeding lines from them," Vidmar explains, "and cross these breeding lines in order to make a better product."

Over the past decade, genetic advances have made this work quicker and easier. The sequencing of the barley genome is almost complete, and barley researchers can lean on a wide variety of genomic resources. This is how Vidmar conducted his feasibility study with a tiny

population of just 1,000 plants. These plants, plus available genetic resources, were enough for him to identify lines with the potential to yield more and provide more energy. Through this process, he worked closely with Alberta Agriculture and Forestry (AAF) barley breeder Pat Juskiw.

Near InfraRed Spectrscopy (NIRS) technology developed at AAF's Field Crop Development Centre (FCDC) allowed Vidmar to complete the project far more efficiently than would have been possible just 10 years ago.

"It only takes about five minutes to screen a line for all these traits," he says. "We put out 1,000 lines, of which 750 grew. We then screened each one and, from that, we developed a database of interesting variations. These included higher starch, lysine, soluble fibre, beta-glucan and fatty acids, as well as higher yield."

Deleterious mutation in a M3 line from the Vivar mutation population grown in the field at Lacombe in 2012.

A head start for barley breeders

To this point, all the work has been conducted in a controlled lab environment. To move these promising lines closer to commercialization, a significant amount of field work is needed. In 2016, FCDC will run replicated trials for the most promising barley lines, observing how they react to pests, their tendency to lodge, plumpness of seed and yield. The best of these lines – Vidmar has his eye on seven front-runners in particular -- could enter Co-op registration trials in 2017 or 2018.

Chlorophyl mutation in a M3 line from the Vivar mutation population grown in the field at Lacombe in 2012.

In this project, John Vidmar used leading-edge genetic and NIRS technology to find barley lines with the potential to deliver more yield for growers and more energy for livestock. If these advances keep barley ahead of corn, and add value for Alberta's crop and livestock producers, Vidmar believes this work helps strengthen agriculture in the province.

"Small gains can mean a lot," he says. "If we can add 1% to 2% in 2% in yield, that's going to make a big difference over time."

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