Diverse crop rotations benefit winter wheat

Growing soybeans or lentils ahead of winter wheat could beat canola.

BY VANESSA FARNSWORTH

Western Canadian growers are often on the fence when it comes to adding winter wheat to their crop rotations, particularly if they don't have canola stubble ready. A new study suggests that growing winter wheat immediately after soybeans or lentils has the potential to achieve superior grain yields and protein concentrations over canola.

"Canola is a priority crop for a lot of operations, given its historically higher cash value," says Brian Beres, research scientist with Agriculture and Agri-Food Canada in Lethbridge. "But the evolution of canola is such that a lot of the yield gains have been coming from adding growing degree day requirements, so you're ending up with these later harvests that aren't always an artifact of the environment."

Beres led a series of field experiments conducted at Lethbridge, Alta., Saskatoon and Indian Head, Sask., and Brandon, Man. from 2018 to 2022 to better understand the impact seven different rotational crops (soybean, lentil, field peas, faba bean, canola, flax and oats) have on subsequent wheat crops grown in three, two-year rotational schemes: winter wheat-winter wheat, hard red spring wheat-winter wheat and winter wheat-hard red spring wheat.

"In this particular experiment, we thought, we know canola is the gold standard, but a lot of things are happening on the Prairies when it comes to crop diversification or new crops. For example, there's this westward march of soybean production," Beres says. "So what's the compatibility with something like that, and will those responses persist if we go back-to-back with wheat? Let's test all these different crops that represent a range of species like cereals and lentils or pulses and canola, and let's put up combinations of winter wheat and spring wheat to also see if there's a differential response between growth habits."

Researchers found that when soybeans and lentils were grown as preceding crops, they consistently outperformed canola when it came to winter wheat grain yield and protein concentration. In the second year following lentil and field peas rotations, winter wheat grain yields were similar to what was seen following canola, but with higher protein concentrations. These findings suggest that these alternate stubbles represent viable options for replacing canola. "That soybeans and lentils were the same or even superior to canola was a

TOP Oat plot at Lethbridge seeded on May 4, 2019. Left photo shows growth as of June 9, 2019 and right photo shows growth on July 26, 2019. Hard red spring wheat-winter wheat was a second factor.

All photos courtesy of Ryan Dyck.

bit of a surprise," says Beres.

The study also found that soybean and faba bean stubbles in the hard red spring wheat–winter wheat system and field peas in the winter wheat–winter wheat system boosted wheat protein levels in the first wheat phase. Higher protein concentrations were also seen in the second year. In the final analysis, leguminous stubbles – especially lentils – resulted in superior in-season growth compared to canola, flax and oats. However, Beres notes that benefits from canola were more apparent in the second year of wheat, an indication that canola creates a break in the rotational scheme that translates into persistent benefits.

"We knew from our previous study that field peas, for example, could provide similar winter wheat yields as canola, which is counter-intuitive since an advantage of a crop like canola is it's cut fairly high, and so you get this great snow trapping effect from the tall and sturdy stubble. Following that logic, if you don't have much stubble residue, it's a train wreck in the making," says Beres. "But, if you think of field peas, the stubble residue isn't great, but for some reason it's providing benefits so that winter wheat survival isn't affected, and it produces similar or even higher yields than canola. Lentils were not a whole lot different."The study goes on to report that yields were higher in winter wheat than spring wheat in both years following rotational crops, suggesting that may be a sign that winter wheat responds better to preceding rotational crops than spring wheat and may also help improve the resiliency of cropping systems due to increased diversity.

Another notable finding was that winter wheat tended to perform better than hard red spring wheat in monoculture cereal systems, especially in the second year following rotational crops when both wheat types had reduced yields, something investigators say confirms winter wheat's value in cereal phases in Western Canada.

"The upside of this study is that it reinforces that there are a lot of options in regard to where winter wheat can fit in your operation. It can jump in behind just about everything and do quite well," Beres says, adding that proper sequencing of crops is still essential for success.

INTANGIBLE BENEFITS

Beres also notes that growers who add winter wheat to their cropping systems can expect to see intangible benefits amplified by the synergies that develop when multiple rotational crops are grown. Those benefits include greater, more stable yields, fewer diseases and weeds, less reliance on herbicides and better resilience to multiple environmental stresses than what's typically seen in monocultures. Growing leguminous crops can also build healthier soils and improve fertility, both of which foster more sustainable, productive cropping systems and better wheat performance. The increase in biological nitrogen fixation also reduces the need for synthetic nitrogen fertilizers.

In part, because it's competitive, winter wheat can be a lower input option. It tends to break with the life cycles of many insect, disease and weeds that have synchronized around a host with a spring growth habit. This can translate into reduced pesticide use and minimized risk from insects such as wheat stem sawfly.

"There are all these intangibles that we go on about such as improved water use in spring, earlier harvests, spreading out workloads, and people's eyes begin to glaze over, but once they try winter wheat and see how it pencils out and how they harvested early and had cash flowing in much earlier - that's when they really realize [what we mean]. And with experience, growers can consistently reap the benefits winter wheat can offer – particularly if the current spring wheat phase is lagging because of increased pest pressure."

Does this mean more growers in Western Canada should consider adding winter wheat to their systems? While Beres says canola won't be replaced anytime soon as the centre of many operations, every operation is unique; it really depends on where your farm is located.

"If you think of the Brown soil zone of the southern Prairies, there's very little motivation to adopt canola these days," says Beres. "And what we've shown is that if canola isn't part of your operation because of environment or some other reason, some of these other crops can be your gold standard because they kept pace with canola and, in some cases, even beat it. So, the big takeaway here is that we no longer have to strictly anoint canola as the gold standard ahead of winter wheat."

BELOW Pea plot at Lethbridge seeded on May 4, 2019. Left photo shows growth as of June 9, 2019 and right photo shows growth on July 26, 2019. Hard red spring wheat-winter wheat was a second factor.