EVALUATING THE ROI OF DIVERSIFIED CROPPING SYSTEMS

It is sometimes tempting to consider financial outcomes in annual rather than multi-year increments. Farming is a great example because a single year's activities are well-defined with inputs and efforts for that year resulting in an entire year's worth of profits. To keep annual cash flows healthy, producers must juggle a lot of factors and a major consideration is the projected sales price of any given crop.

However, if producers were presented with scientific, multi-year and multi-growing-region models that prove explicit, long-term gains when using a diversified system to maintain productivity and profitability—would that help simplify and ease some of the stress of producers' annual planning?

Adjunct Professor Dr. Elwin Smith and Professor Dr. Danny LeRoy (Department of Economics, University of Lethbridge) are the principal investigators for the research project entitled *Economic value of diversified cropping systems.* The four-year project ran from 2018-19 through 2021-22 and eight collaborators from the Universities of Lethbridge, Alberta, Manitoba; AAFC Lethbridge and Lacombe; and Alberta Agriculture and Irrigation worked with Smith to produce research results that compared productivity and profitability of two cropping systems. Those systems are: 1) Short crop rotations, where annual crop prices and resulting profit are often the major consideration but can risk future growing conditions on the farm and long-term profits; and 2) Diversified crop systems, which take into consideration multi-year productivity, farm environment health (reduced plant disease, weed pressure from herbicide resistance and insect damage), and lower overall input costs. In recent years, typically high-production acres of crops in Canada are canola, pulse, soybean and corn.

"These crop choices reflect the current higher net returns from these crops, at least in the short term," Smith stated. "Until recently, few long-term costs associated with short crop rotations and frequent planting of one or two crops were observed by producers. However, there is accumulating evidence that plant diseases, such as blackleg (*Leptospaeria maculans*) and club root (*Plasmodiophora brassicae*) in canola, the root disease *Aphanomyces euteiches* in pea and lentil, and leaf diseases on cereals such as barley, increase with short rotations. The long-term productivity and profitability of these crops and rotations is reduced with increased disease levels."

Weeds, diseases and insect pests (all referred to as 'pests' in this study) quickly adapt through intensive selection pressure or environmental conditions ideal for the 'pest' when constantly using the same control chemicals, cultural practices and cropping system. Production costs will continue to increase if a more integrated method of controlling pests (including more diverse crop rotations) is not adopted by producers. To be competitive and profitable, producers need to know: 1) the profitability of different cropping systems, including diversified crop rotations and pest control practices; and 2) the benefit of diversified cropping systems in preventing a decline in long-term productivity and profitability, and 3) the business risk associated with different cropping systems.

With the goal in mind, a variety of specific rotations were identified and analyzed to delineate and quantify the trade-offs between short pulse crop rotation lengths (few break years between pulse crops) and longer rotation lengths with a greater diversity of crops. The variability of return (risk) was evaluated because crop yields and prices, and the damage from the disease varies from year-to-year.

While looking at several crops (including canola, wheat and corn), lentil and field pea based crop rotations were included particularly to evaluate the economics in the presence of the root disease *Aphanomyces*. Prior to the disease becoming prevalent throughout the Prairies, crop rotations with frequent pulse cropping were more profitable. In many cases, pulses were grown every second year in the same field.

This strategy now appears less lucrative. Yield damage to pulses from *Aphanomyces* reduces the profitability of short pulse-based rotations.

A risk-returns assessment focused on three regions in the semi-arid Prairies where pulse-based rotations are used extensively: the Brown Soil Zones of Saskatchewan and Alberta, and the Dark Brown Soil Zone of Saskatchewan. The analysis evaluated the net cash flow for a situation of no yield damage from *Aphanomyces*, determined the level of the disease at which the net cash flow was higher for recommended seven-year rotations, and modeled the net cash flow when crop prices and yields, and disease damage was stochastic (a variable process where the outcome involves some randomness and has some uncertainty). This stochastic model also included the option of crop insurance, and the net cash flow was evaluated in a risk framework. The structured approach generated results providing affirmation to existing mitigation strategies while revealing new and meaningful insight.

While more specific results can be found in the full project report, learnings can be summarized as follows:

- In the absence of disease, shorter pulse rotations had higher net cash flow than long rotations (advantage varied by ecoregion).
- A low level of disease and associated damage make longer rotations more economically viable.
- Longer rotations were more profitable with or without crop insurance when risk of disease exists (specifically *Aphanomyces*).
- Crop insurance did not favour any rotation over another, but it did reduce net cash flow variability due to indemnifying payouts triggered by low crop yields.
- For risk-neutral farmers, seven-year rotations in all regions of Saskatchewan and four-year rotations in the Brown Soil Zone of Alberta had higher average net cash flows.

Based on the findings, with price risk and production uncertainties and across each of the lentil and pea growing regions tested, the results suggest pea and lentil growers should consider adopting agronomically recommended rotations with at least six break years in pulse production when *Aphanomyces* is present in their fields to maximize economic return.

Portions of this article were extracted from articles written for the POGA Oat Scoop (November 2020 and March 2023) by contract author Pam Yule, Right Angle Business Services.

"We have neglected the truth, that a good farmer is a craftsman of the highest order, a kind of artist." – Novelist and farmer Wendell Berry.

Project
Economic value of diversified cropping systems

Industry Funders
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