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Economic and Agronomic Performance of Emerging Cropping Systems for Western Canada

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Introduction

- In 2021, western Canada produced over 1.4 million acres of soybean and about 420,000 acres of corn, with the majority of acres in Manitoba (Statistics Canada 2022).
- The development of better-adapted cultivars of soybean and corn, together with a warming climate, may support the further expansion of these crops in western Canada.
- Information is lacking for this region, however, as to how best to integrate these crops into existing crop rotations to achieve economically, agronomically, and environmentally sound cropping systems, and also regarding the weather-related risks and opportunities associated with growing these longer-season crops across the Prairies.

Materials and Methods

In 2018, field experiments were initiated at four sites in western Canada (Brandon, Indian Head, Saskatoon, Lethbridge) to investigate seven rotations consisting of various combinations of soybean (S), corn (M), wheat (W) and canola (C) (Table 1).

Table 1: Rotation Treatments

2-year:	wheat-canola	WC
	corn-soybean	MS
3-year:	soybean-wheat-canola	SWC
	corn-wheat-canola	MWC
	corn-soybean-wheat	MSW
	corn-soybean-canola	MSC
4-year:	corn-soybean-wheat-canola	MSWC

Treatments were arranged in a Randomized Complete Block Design (RCBD) with each phase of each rotation present in each year (Fig. 1). All crops were direct-seeded into stubble and managed using generally-accepted agronomic practices. Soybean was solid-seeded while corn was grown as a row crop.

Figure 1. Rotation study located north of Brandon, MB at AAFC's Phillips Farm

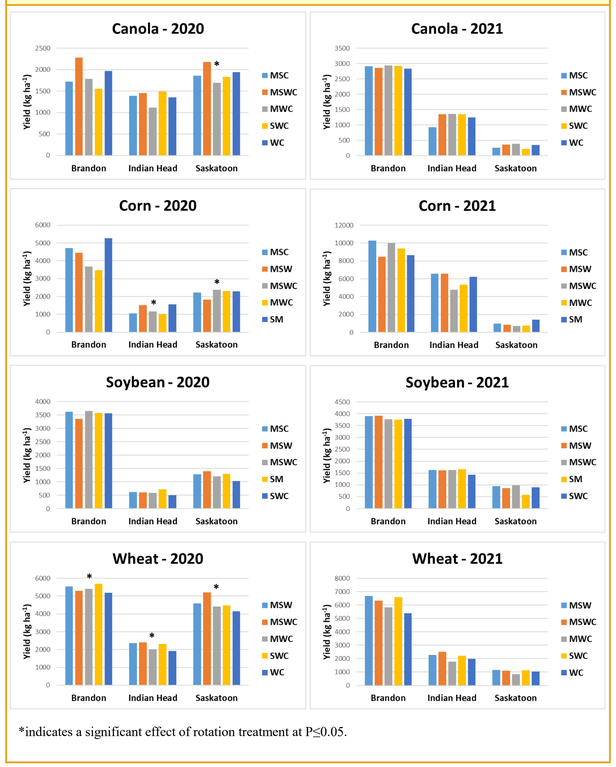
In 2018, plots of soybean, corn, wheat and canola were established to create the correct stubble for each rotation. Rotations were in place from 2019 to 2022.

Measurements included: crop yield and quality, economics, disease incidence/severity, weed pressure, soil factors (nutrient cycling, mycorrhizal colonization, soil health), energy and resource use efficiency, carbon footprint, and weather-related risks and opportunities. Economic analysis is underway. Preliminary yield trends observed from 2019 through 2021 at rainfed sites are summarized herein.

Results and Discussion

- Yield potential varied markedly among sites in most years due to various weather-related factors including dry/drought conditions in Saskatchewan, and a cold wet fall in 2019 that delayed harvest and prevented corn maturity at Saskatoon (Fig. 2).
- In 2019, preceding crop rarely affected crop yield (data not presented).
- In 2020, yields were affected by preceding crops in select crops and sites, but effects were inconsistent.
- Wheat was most often affected by preceding crop in 2020. Yields in WC were numerically the lowest of all treatments in all sites, and produced a statistically lower yield than one or more treatments where wheat followed soybean in rotation in all cases.

Figure 2. Effect of preceding crop sequence on yield of canola (C), corn (M), soybean (S) and wheat (W) at Brandon, Indian Head and Saskatoon in 2020 and in 2021.



*indicates a significant effect of rotation treatment at P≤0.05.

- While 2020 results suggested that a more diverse crop sequence with soybean preceding wheat may be beneficial, this effect was not evident in 2021.
- In 2021, while there was a numerical trend of lower wheat yields in the WC and MWC rotations at all sites, it is not known whether these trends will translate into statistically or agronomically significant effects going forward.
- Caution is required in interpreting and extrapolating these preliminary results given that changes in the plant/soil system due to rotation often emerge slowly and may evolve over time.

Summary

- The 2022 growing season marked the first year that all rotations completed a full rotation cycle.
- While preliminary results from the first years of this study showed occasional effects of crop sequence on yield, these findings should be regarded with caution.
- Effects of rotation often tend to accumulate slowly over time; therefore those rotations that perform well in the shorter-term may not be the most productive or sustainable in the longer-term.
- Understanding how rotations perform over time, not only in terms of yield and economics, but also in term of disease and weed pressure, soil health, and other factors, will help to identify those rotations that are likely to be economically, agronomically and environmentally sustainable in the longer-term.
- The aim will be to try to continue this study for at least another five years in order to determine the longer-term benefits and risks of these rotations.

Acknowledgements

Thank-you to the technical, field, and summer staff at all collaborating sites. This research was made possible by the Canadian Agricultural Partnership, Integrated Crop Agronomy Cluster, Western Grains Research Foundation, Manitoba Pulse and Soybean Growers, and the Manitoba Crop Alliance.

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