

## Policy Brief

# Investing in Cover Crop Technology

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## Executive Summary

Current Best Management Practices for establishing cover crops don't work in Western Canada. Taking \$470 Million of public money to encourage farmers to grow cover crops using the same BMPs that have already been found to be inadequate will be a waste of money and a loss of opportunity to focus on what will make the difference in getting to Canada's target of Net-Zero by 2050. A substantial investment in research and demonstration will be required.

## Introduction

To avoid the earth's temperature rising above 1.5C, we must use every technology known to man. Lal, Smith, McConkey, and others have reported that the soil is a tremendous sink for CDR and carbon dioxide removal (Lal 2016; Smith 2012; McConkey et al. 2020). The practices which enable us to do this are growing perennial plants and cover crops to complement cash crops.

The Canadian Federal government announced in March 2022 that it would spend \$470 million over ten years to support adopting climate-friendly farm practices. Two-thirds of Canadian Agriculture is in the Prairies. Cover cropping is a crucial practice to enhance soil carbon sequestration. Unfortunately, no Best Management Practices make cover cropping profitable on the vast majority of the 78 million acres of Prairie cropland.

Although the \$470M that the federal government is allocating to the On-Farm Climate Action Fund is a substantial investment, just how far would that go to subsidizing farmers to put in the cover crops needed to help sequester CO<sub>2</sub> into the soil? Assume the \$470 Million is for five years, 2/3 goes to Western Canada, and it all goes to the adoption of cover crops. The math on those numbers results in \$62 Million per year for Western Canada, which has about 78 million acres of eligible cropland suitable for cover crops. If the money were to be used as a subsidy, it would amount to 80 cents per acre. The cost of a cover crop seeded immediately after the cash crop is harvested is about \$20/acre for the machinery, fuel, and labour, plus the cost of the cover crop seed. Covers and Co., a cover crop seed company, sell a 'Grain Farmer' blend for fall-seeded cover crops for \$35/acre. Imperial Seeds #19 TG Soil Enhancer cover crop blend for late summer seeding at \$3.44 /lb and 6-10 lbs/ acre is \$ 20.64 to 34.40/acre. The USA's cheapest and most popular cover crop is fall rye at \$6 to \$15 /acre. Unless the farmer sees an improvement in soil quality and eventually a higher yield of their cash crop or a lower cost of production, they will soon stop "experimenting" with cover crops.

Since 80 cents an acre is not nearly enough to offset the cost of farmers sowing cover crops. It would be difficult to raise a subsidy to \$50 or even \$30/acre; the alternative would be to put a significant amount of the \$470 M into research to make the cost of establishing cover crops cheaper and the benefits larger and more immediate.

## Research Overview.

I have found very little innovative literature which would answer these two objectives. The 2020 Prairie Cover Crop Survey found that 47% of the farms found cover crops unprofitable (Morrison 2021). The profitable cases could be traced back to farmers who used the cover crops for grazing or organic farmers who used full-season cover crops to produce their nitrogen. These two groups represent a very small percentage of the farms that make up the 78 million acres of prairie cropland. The farm respondents

generally suggested payments for stored carbon, tax credits, or payments from conservation or watershed groups would help cover the extra costs.

Two strategies need to be examined to overcome the cover crop dilemma in Western Canada. These are delayed germination technology and synergy of species research.

Delayed germination of cover crop seed would allow one pass seeding. When farmers are seeding their spring crops, they could include a delayed germination cover crop. The cover crop could emerge either a few weeks after planting (to avoid being killed by herbicides used in the cash crop) or the cover crop could appear at the senescence of the cash crop. When the cash crop is harvested, the cover crop will already be growing.

Delayed germination technology has received attention in the past from several researchers. Seed coating research has been worked on since the 1960s with various objectives. Some of the first research was to coat spring seeded crop seed, sow it in the late fall and have the seed germinate and grow early in the spring to achieve a yield advantage. This was not commercially successful (Schreiber and LaCroix 1967; Johnson et al. 1999; Clayton et al. 2004). Delayed germination coating specifically for spring seeded cover crops was studied in Sweden by Stendahl (2005). He concluded some delay was achieved with acrylic polymers, but more work was needed. I found no other work on coating for delayed germination in cover crops.

Delayed germination can also be achieved with treatment with various chemicals and hormones, such as Free amino acids (Gressel and Holm 1964), auxin (Liu et al. 2013), (Tuan et al. 2018) and hydrophobic source gases, carbon tetrafluoride ([CF.sub.4]) or octadecafluorodecalin (ODFD)., (Volin et al. 2000). Adding hormones to the soil may have unintended consequences.

The most economical solution for delayed germination is likely through genetics. Graeber et al. (2012) reviewed the mechanisms that control seed dormancy at the molecular level. They concluded dormancy is a highly complex and adaptive trait; however, advances in next-generation sequencing will open up new possibilities. Abe et al. (2019) demonstrated how advanced genetic tools such as CRISPR have been used to regulate seed dormancy.

The second area of cover crop research needed is examining combinations of plants that create a synergy resulting in outcomes such as higher cash crop yields, extending the season to feed the soil microbes for enhanced soil building, greater resilience under biotic and abiotic stress conditions, and minimize cost while increasing consistency. There is a national effort, "Cover Crop Breeding Network," in the US to breed cover crops for better utility and outcomes (Wayman et al., 2017; Virginia Moore, 2021). In 2018 the group tested 70,000 lines of hairy vetch, crimson clover, and winter peas and expanded the program to include several types of grass and brassica species. After reviewing AAFC programs and a literature search, I could not find anything similar in Canada. Kevin Elmy (2022) comments from years of experience about the available synergies and antagonisms found with various cover crop species. He concludes by suggesting we work with nature's intelligence - biomimicry. Dutch farmers are now required to sow cover crops with at least two species states; Paul Bodelier et al. (2017) head up a project titled CCC: Clever Cover Cropping- Synergistic Mixtures for Sustainable Soils at the Netherlands Institute of Ecology. I could find no research looking at the synergy of species in Canada, particularly in Western Canada. Martens, Hoepfner, and Entz (2001) and Martens, Entz, and Wonneck (2015) describe some of the benefits of cover crops, particularly in organic systems. General

recommendations from NDSU (Abbey Wick, Caley Gasch, and Marisol Berti 2018 ) suggest that the Five Food Groups” concept developed by Lee Briese, certified crop adviser with Centrol Crop Consulting, be considered. The five food groups are cool-season grasses, cool-season broadleaves, warm-season grasses, warm-season broadleaves, and legumes. They do not have specific species or variety recommendations for optimizing value.

My personal experience is (outside of organic mixed farms with a cattle-centric lens) that current BMP practices for cover crops on grain farms in Western Canada do not work. Kelly Van Doren, an early adapter of cover crops and intercropping from Deloraine Manitoba, said this of cover crops in the spring of 2021 (paraphrased)--- I have made some money, and I have lost money with cover cropping and intercropping this year. I will not bother with either and grow oats on some fields, canola on others, and try to make some money when grain prices are high. Many grain farmers, including myself, have tried to incorporate cover crops into our cropping plans and have not found it economical. Often conditions are too dry to sow cover crops after harvest (unacceptable wear on seeding equipment compared to spring seeding) or too wet and late to be able to get on the fields to seed and always find it challenging to have enough labour to both harvest and seed on a timely basis.

#### Recommendation

I recommend putting most of the \$470 million into research to develop practical ways to make adding cover crops to our cropping systems agronomically and economically feasible --- innovate as if our lives depend on it. The other alternative is to find money to subsidize cover crop establishment.

David Rourke April 15, 2022

#### Additional note

##### Cost-benefit analysis for investments in agricultural research

Several studies have shown a healthy ROI for investments in agricultural research. “Formerly called the Consultative Group on International Agricultural Research, CGIAR is the world's largest global agricultural research network. The report found that CGIAR investments of roughly \$60 billion in present value terms have generated a benefit-cost ratio of 10 to 1 over the past five decades” (Pamela Kan-Rice 2020). Dr. Richard Gray has shown public investment in Canadian agricultural research historically has a rate of returns between 50 and 75% per year (Allan 2012). An investment in cover crop research would also be expected to give significant returns to public investment and help meet our collective goal of reaching net zero by 2050.

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