Smart Agriculture Research

2023 Summary: FCC - Converting Marginal Farmland out of Annual Production to Perennial Cover

The objective of this project is to identify alternative uses and best management practices (BMPs) for marginal farmland and technologies that aid in their implementation. It will also assess the operational implications of these practices and the economic impacts of each.

INTRODUCTION

Marginal land – land unsuitable or less suitable for production of the desired crop – can be found within cultivated fields of annual crops across Canada.

Conducting conventional farming practices across both productive and nonproductive acres results in reduced profitability and the deterioration of land. Strategies and practices to farm the marginal land differently present various opportunities to increase profitability, improve the soil and promote long-term sustainability of annual agriculture production.

Precision agriculture provides opportunities to implement these strategies. Applying BMPs to targeted areas of marginal farmland using precision agriculture equipment is commonly referred to as precision conservation.

OBJECTIVES & STUDY DETAILS

- Identify BMP strategies within broadacre crop production of the Canadian Prairies for the management of marginal land.
    - Conduct a SWOT analysis of each BMP and respective necessary technologies identified.
- Explore technologies that can be used to identify marginal land as well as to implement, assist or enable the BMP.
- Develop financial tools and models to determine if changing the production strategies for the marginal land within a field will be of financial benefit.
    - Identify costs, revenues and net return related to each BMP.
    - Evaluate each BMP with a partial budget assessment, considering a multi-year impact analysis.

- Identity incentives that can be used to promote implementation of BMPs.
- Create implementation roadmap/workflow for BMP strategies (converting marginal farmland to perennial cover or alternative use.)
    - Specify practice considerations and limitations for producers who are applying these BMP strategies during the initial years of implementation.
- Development of an implementation plan for Olds College Smart Farm marginal land using one or more of the BMPs researched.

Learn more at oldscollege.ca/SmartFarm

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RESULTS

This project was divided into multiple deliverables, presented in iterations, keeping FCC involved and helping guide the project.

The first deliverable highlighted an extensive range of BMPs that could be utilized on economically marginal cropland to increase profitability or support biodiversity. It also included information as to how various types of precision agriculture technologies could be used in identifying and managing marginal farmland to be taken out of production.

Informed by this report, FCC selected six BMPs for further investigation, to be conducted in the second deliverable. This provided more detailed information on the selected BMPs, alongside a partial budget model, to estimate financial impacts of implementation.

Upon presentation of these results, FCC selected the three BMPs for Olds College Centre for Innovation (OCCI) to develop implementation plans that could be conducted on existing economic marginal cropland of the Olds College Smart Farm:

1. Perennial grass & legume mixes
2. Pollinator habitats
3. Wetland restoration

FCC was presented with many different possibilities for BMP implementation on marginal land of the Olds College Smart Farm. With their input, three of the options were selected for implementation plans to be created. This process included:

1. Estimating the financial impact (current and expected expenses and revenues) as a result of implementing the selected best management practices.
2. Identifying investments required to implement the best management practices.
3. Documenting the expectation of impact on farming operations and logistics of cultivated cropping production.
4. Developing protocols and assessments to measure the impacts resulting from the conversion of the marginal land.

To support informed decision-making regarding the selection of BMPs per marginal area and the respective targeted plant species, OCCI conducted soil sampling on each of the marginal areas to aid in determining the leading issues present in the soil.

FUTURE RESEARCH

Using the findings of this research, OCCI and FCC are converting two areas of existing marginal land on the Olds College Smart Farm to alternative production uses.

At the Steckler Field, a three-acre marginal area is being established for perennial grasses and legumes. Meanwhile, an eight-acre marginal area within Field 18 is being converted to perennial flowers for pollinator habitats.

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ADDITIONAL INFORMATION

Modern agriculture technology offers many solutions to assist and complete various types of work on marginal farmland – whether it be for land restoration or removal purposes.

With the use of farm expense and revenue records, application datasets and harvested yield maps, profit/loss maps of fields can be generated. Profit/loss maps, when studied with other datasets and imagery, can be used to identify the areas of marginal land to fix, remove or further assess to determine the limiting factors of that area within a field. From this assessment, precision agriculture technologies can be used in the implementation of the various BMPs explored, such as terrain and GPS mapping for drainage or remote sensing and imagery to study the land of concern.

Utilizing precision agriculture technology in the application of marginal land, BMPs offer ideal opportunities to make the best use of existing resources while increasing the profitability of annual production.

The use of profit/loss maps allow producers to delineate areas of economically marginal land based upon their own specified level of profit, where a different use of the land may benefit the overall profitability of the farm.

In many cases, producers may consider removing land where, on average, low levels of profit are generated. Selecting this value to segregate marginal from productive land will be situational to each producer and is influenced by many factors, including risk tolerance, equipment efficiencies and revenue opportunities from alternative production options or environmental programing and incentives.

While some of the BMPs researched do not generate a direct source of revenue, they can greatly benefit the surrounding environment, including annual crops, which may create sources of indirect revenue. These benefits include supporting increased biodiversity and pollinator populations, protecting the soil and managing groundwater levels and quality. As they do not generate revenue, the use of incentive programs can support (and therefore increase) the adoption of these practices.

Removing marginal farmland from production needs to be thoughtfully planned so as to be effective in generating revenue and preserving conventional cropping on the surrounding farmland while creating accessibility to recurring activities such as checking livestock on pastures, haying or inspecting solar panels.

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ADDITIONAL INFORMATION

For the selection of an appropriate BMP and plant variety, it is recommended that producers complete preliminary testing and analysis of their marginal lands, recognizing there is no single BMP to implement across all forms of marginal land.

For example, dry, eroded areas will need to be managed differently from waterlogged low-lying soils. Different BMPs can be used to manage each of these types of areas, but there is no one single BMP to productively manage all of them. Factors necessary to consider in this selection, include:

- Size of the area
- Condition of the land
- Land accessibility
- Soil properties
- Soil nutrients
- Existing vegetation
- Existing farm operation plans
- Required equipment
- Revenue possibilities
- Investment requirements
- Risk tolerance of the producer

To quantify the success from the implementation of a BMP at a producer level, a variety of tests and measurements can be conducted. However, to be able to determine a change, baseline measurements of the existing environment needs to be conducted prior, so the producer or supporting program can quantify the impact of the BMP.

Metrics that can be used to track the progress of change and success from BMP implementation can include KPIs regarding crop input use, plant yields and water levels. Financial metrics can calculate the ROI and the break-even point of the BMP, while environmental tests can determine how the BMP has changed the water, soil and environment.