June 2023

# Canadian Cow-calf Cost of Production Network

## Approaches to Farm Management and Greenhouse Gas Reduction Practices

CONTENTS

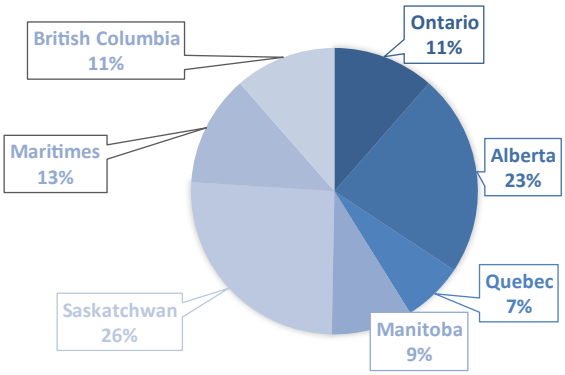



Brought to you by Canfax Research Services in collaboration with the Provincial Coordinators and funded by BCRC

# I. Introduction

Between 2021 and 2023, Canfax Research Services asked participants in the Canadian Cow-calf Cost of Production Network (CDN COP Network) to respond to two surveys, between January and April, in each of the three years. During this period, 177 unique responses were compiled from participants who completed one or both surveys. One survey focused on participant's approaches to on-farm management practices (n=144 responses) and the other focused on greenhouse gas (GHG) reduction practices (n=163 responses).

**CDN COP NETWORK SURVEY RESPONDENT PROFILE**




The purpose of this report is to present descriptive statistics from the surveys to identify opportunities and constraints for extension nationally and provincially, based on trends. Survey results outline what producers are reportedly willing, unwilling, not able, not sure, or already doing on their operations. These data provide insights into how producers perceive their activities, their knowledge about best management practices, and how they view these practices in relation to their own operations. In general, this report focuses on *what* producers are willing or not willing to undertake, and further analysis would be required to investigate the *how* and *why*.

There are couple of data limitations key to point out. As breadth was prioritized over depth in these short, 5-minute surveys, the interpretation of each approach by each participant may vary, especially where practices are similar or overlap. Furthermore, while the samples are not necessarily suitable for generalizing or benchmarking, the results do provide exploratory insights into participant's approaches to environmental and GHG practices on their operations during the last three years. All percentages reported herein are rounded up to the nearest whole number.

# II. Highlights

- Adoption rates were the highest for approaches to improve soil health: limiting soil disturbance (88%), soil erosion mitigation (85%), and building soil organic matter (94%). Producers improved soil health through a variety of practices listed within this report.
- After soil health, the highest reported adoption rates were for approaches to grazing management (81%) and improving the quality of winter feed (80%).
- Respondents were primarily "not sure" about approaches to monetize ecosystem services (50%) and integrated pest management (37%), but uptake varied from province to province. With so much producer uncertainty around these two approaches, there is a tremendous opportunity to investigate the barriers and opportunities these approaches may provide to improve cow-calf profitability.
- In most provinces, practices around manure management garnered the most responses for "not able", "not willing", or "not sure" about adopting, particularly for, "covering manure," and "faster incorporation of manure into the soil." This may indicate hurdles toward change in current manure management practices. However, many respondents indicated they would consider different manure management practices (detailed further in sections IV and V).

## III. Approaches to Farm Management Practice Survey Results

*Respondents were asked to describe their current approach to the following.*

### Intercropping (polycultures), and crop rotation incorporating cover crops

Intercropping (or polyculture) occurs when more than one crop is grown in the same spot at the same time. The aim of intercropping is to increase diversity, total yield, resource use efficiency, and suppress weeds (Martens et al. 2013, p.19). Similarly, the benefits of perennial forage in annual crop rotations have included greater yields for grains, enhanced soil nutrient status, and pest suppression, but study results vary region to region (Martens et al. 2013, p.20).

The highest adoption of intercropping and/or crop rotation with cover crops was in Ontario (50%), followed by the Maritimes (47%) and Manitoba (41%). Thirty per cent of all respondents indicated they were "not able to adopt" these approaches, a high proportion compared to other approaches listed. Producers who were "not interested" made up a comparatively larger portion of respondents in Quebec (25%) and the Maritimes (24%). A greater proportion of respondents were "not sure" in the Prairie provinces of Manitoba (25%), Saskatchewan (23%), and Alberta (20%).

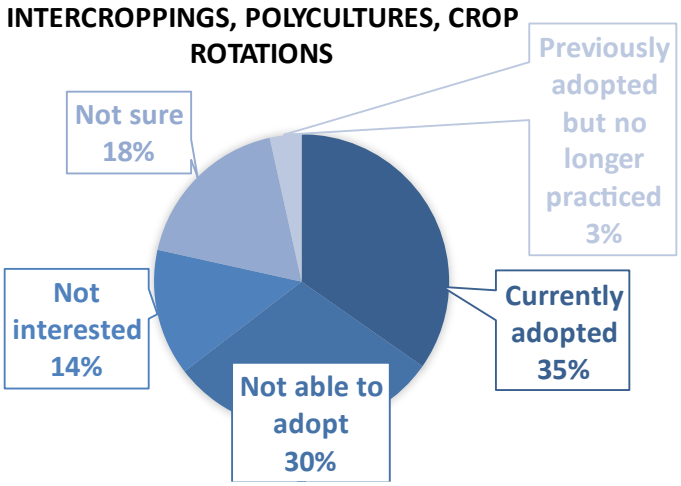



Table 1. **Provincial breakdown of approaches to intercropping (polyculture) and crop rotation incorporating cover crops**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **35** | **30** | **14** | **18** | **3** | **=144** |
| Alberta (%) | 29 | 40 | 6 | 20 | 6 | 35 |
| Saskatchewan (%) | 34 | 31 | 9 | 23 | 3 | 35 |
| Manitoba (%) | 41 | 17 | 17 | 25 | 0 | 12 |
| Ontario (%) | 50 | 13 | 25 | 6 | 6 | 16 |
| Maritimes (%) | 47 | 12 | 24 | 18 | 0 | 17 |
| Quebec (%) | 17 | 42 | 25 | 17 | 0 | 12 |
| British Columbia (%) | 29 | 41 | 12 | 12 | 6 | 17 |

## Cover Crops

A cover crop is any crop grown for the purpose of protecting and/or improving the soil, rather than for harvest of a product (Martens et al. 2013, p.14). These include late summer and fall seeded crops used for grazing or cover. Benefits include pest suppression and soil erosion mitigation. Cover crops are common where cropland is to be left fallow.

More than half of producers surveyed were using cover crops (56%), with 15% "not sure." The highest rates of adoption were in Ontario (69%) and the Maritimes (65%). The lowest rates of adoption were in Manitoba (42%) and Saskatchewan (49%). Nine per cent of respondents in Alberta and 14% of respondents in Saskatchewan indicated they had tried this approach but no longer practice it.

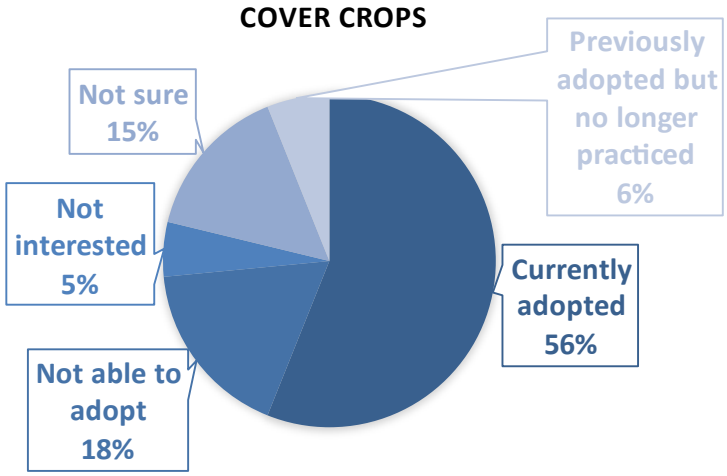



Table 2. **Provincial breakdown of approach to cover cropping**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **56** | **18** | **5** | **15** | **6** | **132** |
| Alberta (%) | 57 | 23 | 0 | 11 | 9 | 35 |
| Saskatchewan (%) | 49 | 9 | 6 | 23 | 14 | 35 |
| Manitoba (%) | 42 | 25 | 0 | 33 | 0 | 12 |
| Ontario (%) | 69 | 13 | 13 | 6 | 0 | 16 |
| Maritimes (%) | 65 | 6 | 12 | 18 | 0 | 17 |
| British Columbia (%) | 59 | 35 | 6 | 0 | 0 | 17 |

*No data for Quebec*

## Crop/Pasture Mixes

The integration of cropping and pasture production (pasture cropping) involves directly seeding cereal crops into perennial pastures during their dormant phase (Millar, 2009, p.777). This practice brings many opportunities to producers including low-input costs and regenerative agriculture for grain production. Soil health, pest suppression and nesting bird habitat are benefits of perennial forages replacing adverse effects from soil organic matter loss, erosion, contamination, and biodiversity loss in mono-cropping systems (Martens et al. 2013, p.21). It is possible that for producers, crop pasture mixes may have also been interpreted as intercropping, or cover cropping, as the difference between association cropping and sequence cropping was not distinguished in the survey.

Adoption of this practice in Canada was 70%, with 12% "not sure." In Ontario, 94% of respondents reported crop/pasture mixes. The lowest rates of adoption were in Manitoba (42%) and Quebec (58%), though these provinces also had the highest rates of respondents who were "not sure" (33% and 25%, respectively).

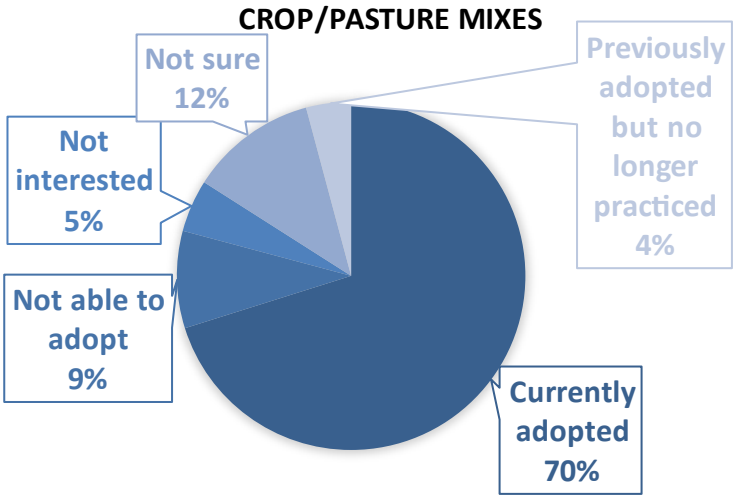



Table 3. **Provincial breakdown of approach to crop/pasture mixes**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **70** | **9** | **5** | **12** | **4** | **=144** |
| Alberta (%) | 71 | 14 | 0 | 11 | 3 | 35 |
| Saskatchewan (%) | 63 | 6 | 11 | 14 | 6 | 35 |
| Manitoba (%) | 42 | 17 | 0 | 33 | 8 | 12 |
| Ontario (%) | 94 | 0 | 6 | 0 | 0 | 16 |
| Maritimes (%) | 88 | 0 | 12 | 0 | 0 | 17 |
| Quebec (%) | 58 | 8 | 0 | 25 | 8 | 12 |
| British Columbia (%) | 71 | 18 | 0 | 6 | 6 | 17 |

## Soil Erosion Mitigation

Soil erosion removes nutrients from the soil and affects soil structure (Martens et al. 2013, p.6). Surface cover is key to mitigating erosion. Soil erosion can be caused by lack of surface water management for livestock, overgrazing, and contamination from run-off. Conservation tillage, cover cropping, and managing surface water and riparian areas to enhance vegetative growth are just a few of the many methods for soil erosion mitigation.

There was an 85% adoption rate of soil erosion mitigation practices in Canada, one of the highest within this report. Adoption rates exceeded 80% in all provinces except Manitoba (58%), where there was also a disproportionately high number of respondents who answered "not sure" (25%). Nationally, 3% of respondents were "not interested" in soil erosion mitigation, perhaps indicating it is not a necessity or a concern on their operation.

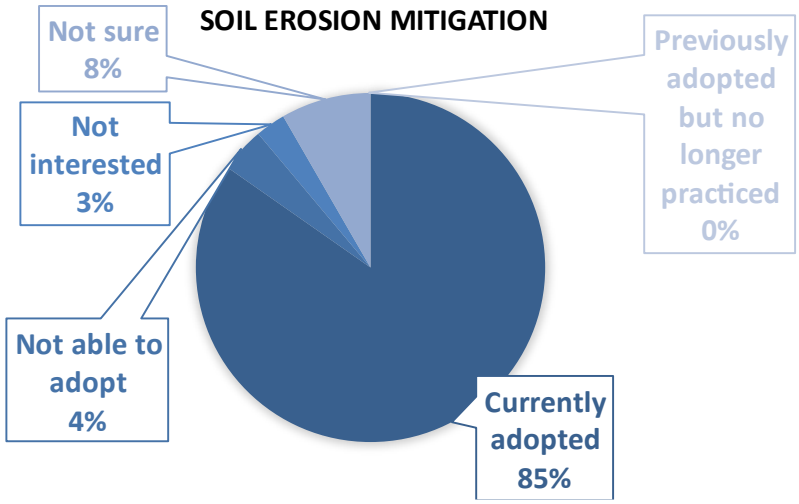



Table 4. **Provincial breakdown of soil erosion mitigation practices**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **85** | **4** | **3** | **8** | **0** | **=114** |
| Alberta (%) | 89 | 6 | 3 | 3 | 0 | 35 |
| Saskatchewan (%) | 86 | 3 | 3 | 9 | 0 | 35 |
| Manitoba (%) | 58 | 8 | 8 | 25 | 0 | 12 |
| Ontario (%) | 88 | 6 | 0 | 6 | 0 | 16 |
| Maritimes (%) | 88 | 0 | 0 | 12 | 0 | 17 |
| Quebec (%) | 84 | 0 | 8 | 8 | 0 | 12 |
| British Columbia (%) | 88 | 6 | 0 | 6 | 0 | 17 |

## Build soil organic matter, enhance soil biodiversity, and generate new topsoil

Soil organic matter is made up of plant residues, microbial biomass, detritus, and humus ("Soil Organic Matter" 2021, p.1). Soil organic matter supports the soil's water holding capacity by forming micropores and macropores. These pores provide habitat for diverse plant life and underground microorganisms (Bot and Benites, 2021). The abundance and presence of these microorganisms in the soil affects soil nutrient cycling and soil nutrient retention that influences plant and animal biodiversity above-ground as well (Wagg et al. 2014, p.5266). Soil and ecosystem biodiversity only grow and become complex with sufficient soil organic matter. Most productive agricultural soils have between 3% and 6% soil organic matter ("Soil Organic Matter" 2021 p.1). Annual cropping has been widely considered a major detriment to soil organic matter (Martens et al. 2013, p.3). Annual cropping activities vary on cow-calf operations in the production of home-grown feed, depending on the production system and the type of rations being fed to cattle.

Most (94%) CDN COP Network participants responded that they have adopted practices to build soil organic matter, enhance soil biodiversity, and generate new topsoil. This approach had the highest rate of adoption (nationally) out of all practices reported herein. This outcome could be achieved in any number of ways on a cow-calf operation: through conservation tillage, annual/perennial crop rotations, legume cover crops, avoiding soil compaction, manure management, grazing (trampling), responsible use of fertilizers, crop residues, animal detritus, or composting. Self-reported adoption of many of these specific practices for building soil organic matter are noted elsewhere in this document.

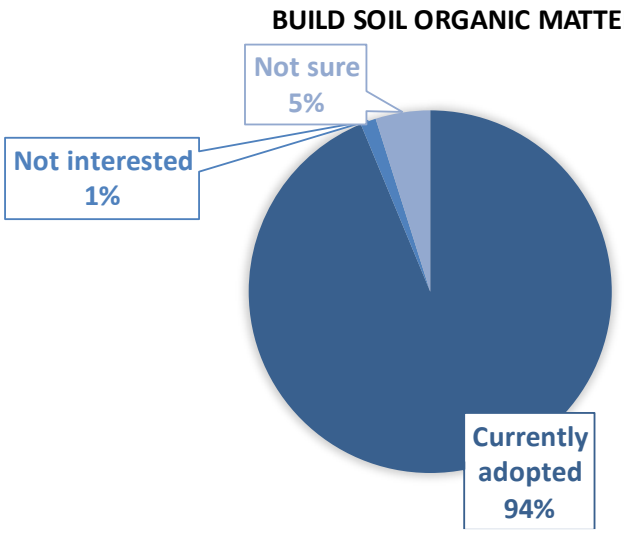



Table 5. **Provincial breakdown of approaches for building soil organic matter**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **94** | **0** | **1** | **5** | **0** | **=144** |
| Alberta (%) | 94 | 0 | 3 | 3 | 0 | 35 |
| Saskatchewan (%) | 91 | 0 | 0 | 9 | 0 | 35 |
| Manitoba (%) | 92 | 0 | 0 | 8 | 0 | 12 |
| Ontario (%) | 94 | 0 | 0 | 6 | 0 | 16 |
| Maritimes (%) | 94 | 0 | 0 | 6 | 0 | 17 |
| Quebec (%) | 92 | 0 | 8 | 0 | 0 | 12 |
| British Columbia (%) | 100 | 0 | 0 | 0 | 0 | 17 |

## Limit Soil Disturbance

Limiting soil disturbance is one of three principles in the Food and Agriculture Organization's (FAO) conservation agriculture approach ("Conservation Agriculture" 2021). Soil disturbance can occur cumulatively from many small instances of compaction, dug outs, allowances, paddock space, fencing, mechanical operations, and contamination from machinery (e.g., oils), and lack of vegetative cover, or on a large scale, through land use change. Land use change has been a recent focus of research investigating the capture and release of carbon on agricultural land. Protecting native vegetation limits future soil disturbance.

The highest adoption rates for limiting soil disturbance were in Saskatchewan (97%), Ontario (94%), and Quebec (92%). The lowest adoption rates for limiting soil disturbance were in Manitoba (67%) and the Maritimes (76%). Respondents in Manitoba and the Maritimes had the highest rates of uncertainty regarding the practice (17% and 12%, respectively), as well as the highest occurrence of previous adoption though no longer practicing (8% and 6% respectively). The turnaround in adoption highlights that there may be hurdles for some producers to limit soil disturbance, whether it is because of land availability, production constraints, or otherwise. Four per cent of producers reported "not able to adopt" soil disturbance limiting practices; inability to limit soil disturbance was highest in British Columbia (12%). Producers in Manitoba and Quebec reported "not interested" in limiting soil disturbance. This presents opportunities in these regions for education (not sure), incentives (not interested), and for investigating and unlocking constraints (not able to adopt, or previously adopted but no longer practiced) in these regions.

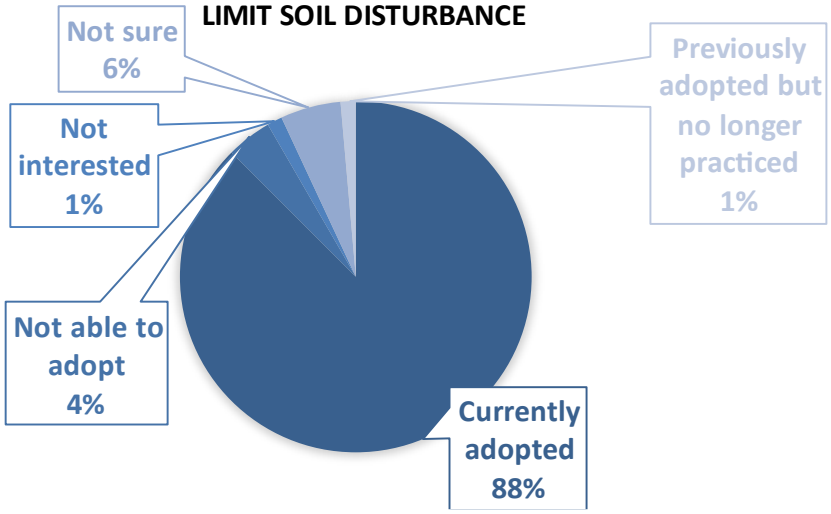



Table 6. **Provincial breakdown of approaches to limiting soil disturbance**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **88** | **4** | **1** | **6** | **1** | **=144** |
| Alberta (%) | 86 | 9 | 0 | 6 | 0 | 35 |
| Saskatchewan (%) | 97 | 0 | 0 | 3 | 0 | 35 |
| Manitoba (%) | 67 | 0 | 8 | 17 | 8 | 12 |
| Ontario (%) | 94 | 0 | 0 | 6 | 0 | 16 |
| Maritimes (%) | 76 | 6 | 0 | 12 | 6 | 17 |
| Quebec (%) | 92 | 0 | 8 | 0 | 0 | 12 |
| British Columbia (%) | 88 | 12 | 0 | 0 | 0 | 17 |

## Earn Additional Income from Ecosystem Services (e.g., carbon sequestration, pollination)

Ecosystem services of natural systems directly and indirectly benefit humans or enhance social welfare (Johnston, 2021). Common examples include pollinating bees making food for humans, wetlands mitigating floods, cattle promoting biodiversity and soil health on grassland, and grassland sequestering carbon. Ecosystem services may support conservation of private rangelands. Payment for ecosystem services is a financial benefit for landowners in exchange for managing their land to provide that service. Existing, tangible examples include income earned from hunting, and carbon credits.

This practice presented the highest percentage of respondents who were "not sure" (50%). This practice presents the greatest opportunity among all practices in this report for learning and communication about monetizing private rangelands to enhance cow-calf profitability. The highest adoption rates were Quebec (33%) and Alberta (26%). There are potential lessons to be learned from these provinces.

**EARN FROM ECOSYSTEM SERVICES**

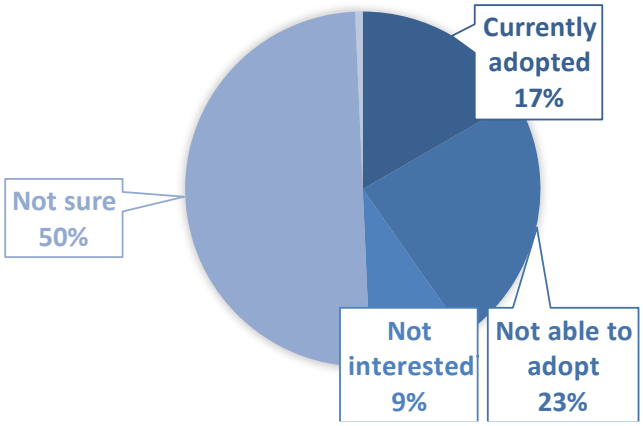



Table 7. **Provincial breakdown of approaches to earning from ecosystem services**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **17** | **23** | **9** | **50** | **0** | **=144** |
| Alberta (%) | 26 | 20 | 9 | 43 | 3 | 35 |
| Saskatchewan (%) | 11 | 26 | 11 | 51 | 0 | 35 |
| Manitoba (%) | 0 | 33 | 8 | 58 | 0 | 12 |
| Ontario (%) | 13 | 19 | 6 | 63 | 0 | 16 |
| Maritimes (%) | 18 | 24 | 6 | 53 | 0 | 17 |
| Quebec (%) | 33 | 17 | 0 | 50 | 0 | 12 |
| British Columbia (%) | 12 | 29 | 18 | 41 | 0 | 17 |

## No-Tillage

No-tillage is listed as one example of an agricultural practice that minimizes soil disturbance, one of the three guiding principles of FAO's "Conservation Agriculture." No-tillage is used to help conserve soil moisture and would be particularly useful in drier regions. Under dry conditions, no-tillage can enhance yields and make better use of water resources by limiting soil disturbance and allowing soil to maintain moisture content. Erosion mitigation and lower energy bills are two other positive outcomes from no-tillage practices (Martens et al. 2013, p.26-27). Further advantages may include lowering carbon emissions, enhancing water quality and providing overall soil stability.

The highest adoption of no-tillage practices was in Saskatchewan (83%) and Quebec (66%), however adoption rates are close among each province. A larger sample size would refine comparability among the provinces. The lowest adoption rates were in Manitoba (33%) and British Columbia (41%). In Manitoba, many producers may be uninterested (17%), or have not had success with no-tillage, as 17% have previously adopted but no longer practice no-tillage. In British Columbia, it is possible that the landscape and amount of cropland acres were contributing factors for the 29% of respondents unable to practice no-till (i.e., not relevant, possible, or profitable for their operation).

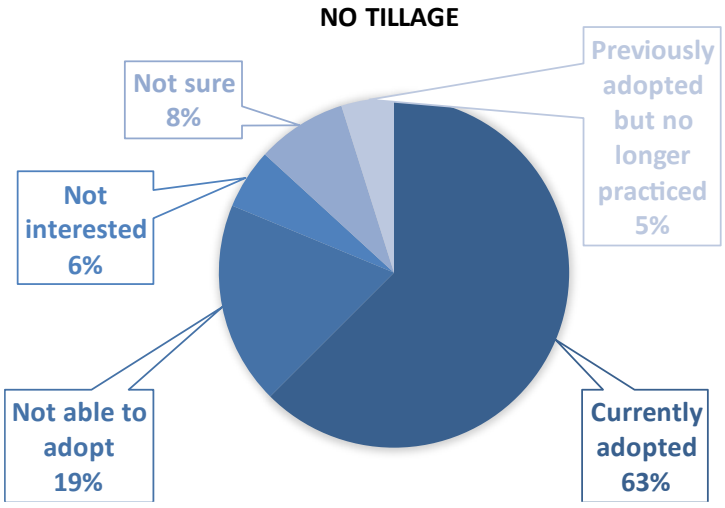



Table 8. **Provincial breakdown of approaches to no tillage**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **63** | **19** | **6** | **8** | **5** | **=144** |
| Alberta (%) | 66 | 23 | 3 | 6 | 3 | 35 |
| Saskatchewan (%) | 83 | 11 | 0 | 6 | 0 | 35 |
| Manitoba (%) | 33 | 33 | 17 | 0 | 17 | 12 |
| Ontario (%) | 56 | 13 | 13 | 19 | 0 | 16 |
| Maritimes (%) | 59 | 18 | 6 | 6 | 12 | 17 |
| Quebec (%) | 68 | 8 | 8 | 8 | 8 | 12 |
| British Columbia (%) | 41 | 29 | 6 | 18 | 6 | 17 |

## Integrated Crop/Livestock Production

The goal of crop and livestock integration is to promote the synthesis of both crop and livestock systems. It is not a matter of just raising crops and raising cattle, but to utilize the function of both species in an interconnected way. These functions involve nutrient cycling, consumption and "processing" of crop residues, and pest management. The benefits go beyond their functional application so that the integrated functioning of crops and livestock together create a whole more than the sum of its parts. Increased and/or stabilized incomes, and the potential to reduce GHG emissions are further possible advantages from crop and livestock integration (Martens et al. 2013, p.33-34).

Sixty-five per cent of respondents reported adoption of integrated crop and livestock production practices. The highest adoption rate was in Ontario (94%) and the lowest adoption rate were in Manitoba and Quebec (50% in each) where large proportions of respondents (42% and 25%, respectively) were not sure about the approach, indicating there is potential for two-way communication about the practice within the regions. Quebec (8%) and Manitoba (8%) had the highest proportion of producers who reported trying integrated crop and livestock production and then moving away from it. British Columbia (24%) had the highest percentage of producers who indicated "not being able to adopt" the practice, alongside Saskatchewan (23%). Adoption was also low (50%) in both Quebec and Manitoba.

**INTEGRATED CROP/LIVESTOCK PRODUCTION**

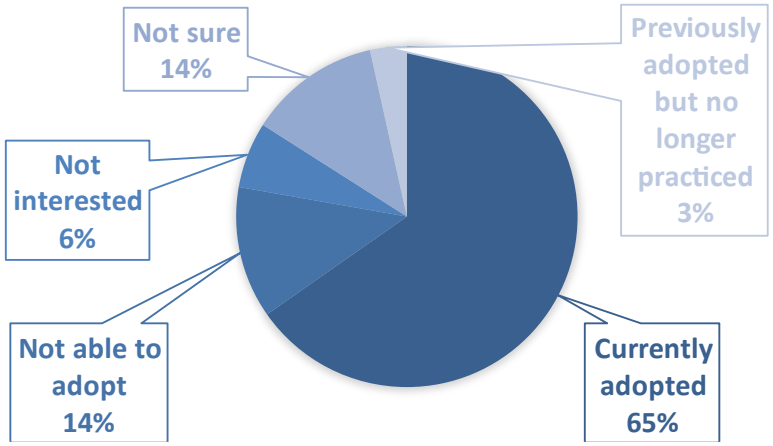



Table 9. **Provincial breakdown of approaches to integrated crop and livestock production**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **65** | **14** | **6** | **14** | **3** | **=144** |
| Alberta (%) | 74 | 14 | 0 | 9 | 3 | 35 |
| Saskatchewan (%) | 54 | 23 | 9 | 11 | 3 | 35 |
| Manitoba (%) | 50 | 8 | 8 | 25 | 8 | 12 |
| Ontario (%) | 94 | 0 | 6 | 0 | 0 | 16 |
| Maritimes (%) | 76 | 0 | 12 | 12 | 0 | 17 |
| Quebec (%) | 50 | 0 | 0 | 42 | 8 | 12 |
| British Columbia (%) | 53 | 24 | 12 | 6 | 6 | 17 |

## Integrated Pest Management

The goal of integrated pest management is to keep pests from causing problems through interventions that minimize risks and hazards to humans, plants, and animals. Bio-based, cultural, physical, and chemical solutions are used to manage pests within a framework of application that reduces air and ground water contamination, protects non-target species that can be directly or indirectly harmed via malignant forms of pest control, and risks to workers exposed to pesticides, using lower cost inputs. Proactive approaches to integrated pest management, instead of pesticide application, include proper soil preparation, site selection, changes to planting times, forecasting, trapping, setting thresholds, monitoring and record keeping ("What is Integrated Pest Management" 2021).

More than one-third of respondents reported having adopted approaches to integrated pest management strategies (41%). The highest rates of adoption were in Ontario (56%) and the Maritimes (59%), with the lowest rates of adoption in Quebec (25%). Across the CDN COP Network, more than one-third (37%) of respondents were "not sure" about the practice, while another 12% of respondents indicated they were "not able to adopt" the practice. These figures present an opportunity for exploring the barriers for integrated pest management in the cow-calf sector with the goal of reducing variable costs.

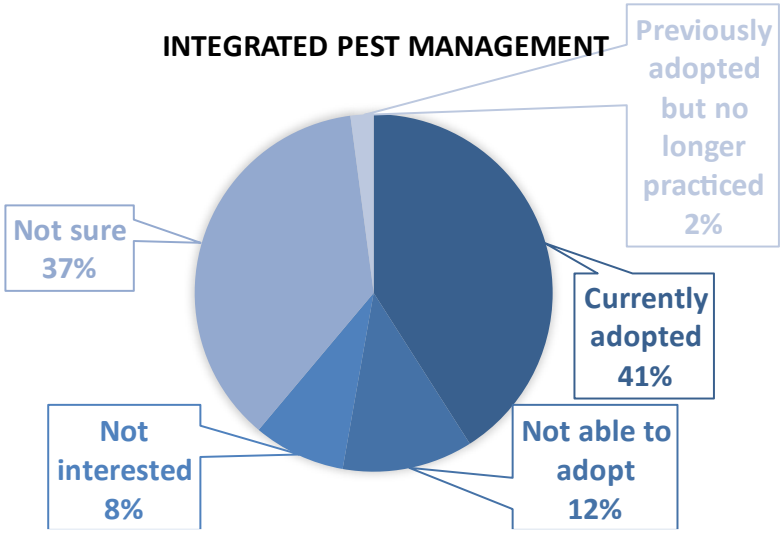



Table 10. **Provincial breakdown of approaches to integrated pest management**

| | Currently Adopted | Not able to adopt | Not interested | Not sure | Previously adopted but no longer practiced | =N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **41** | **12** | **8** | **37** | **2** | **=144** |
| Alberta (%) | 46 | 9 | 9 | 37 | 0 | 35 |
| Saskatchewan (%) | 31 | 17 | 9 | 37 | 6 | 35 |
| Manitoba (%) | 33 | 0 | 0 | 67 | 0 | 12 |
| Ontario (%) | 56 | 6 | 6 | 31 | 0 | 16 |
| Maritimes (%) | 59 | 6 | 24 | 12 | 0 | 17 |
| Quebec (%) | 25 | 17 | 8 | 42 | 8 | 12 |
| British Columbia (%) | 35 | 24 | 0 | 41 | 0 | 17 |

# IV. GHG Reduction Practice Survey Results

## Grazing Strategies for Productivity and Regrowth

Vast amounts of carbon can be stored in grasslands to offset emissions from animal production, transportation, and energy development. The push towards carbon neutral is advancing available financial incentives to measure carbon sequestration. This means grasses used for grazing need to be given time to regrow and be managed under strategies that promote grass health. Examples include rotational grazing, which involves more frequent livestock movement that gives grasslands longer recovery times between grazing (Genever, 2018 p.11).

With 81% of producers managing grazing strategies for productivity and regrowth, this approach has the fourth highest adoption rate among the practices reported herein. Adoption is relatively consistent between all provinces, between 79% and 90%, except for within British Columbia (68%) and Quebec (45%). Forty-five per cent of respondents within Quebec would however consider grazing strategies for productivity and regrowth. Eleven per cent of respondents within British Columbia indicated they were "not able" to adopt this practice, and 21% indicated they "would consider" it. In fact, most respondents who had not already adopted grazing strategies for productivity and regrowth were willing to consider it, representing an opportunity to learn from previous and undertake future extension. Barriers in this area could be related to use of crown land, community pastures, or rental agreements that limited what grazing management is feasible.

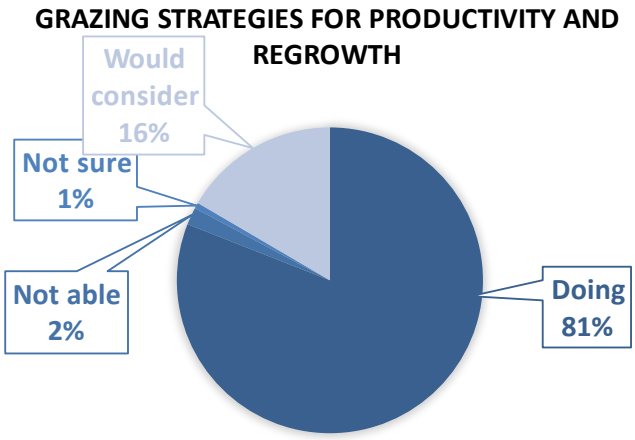



Table 11. **Provincial breakdown of grazing strategies for productivity and regrowth**

| | Doing | Not able | Not willing | Not sure | Would consider | N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **81** | **2** | **0** | **1** | **16** | **=163** |
| Alberta (%) | 85 | 3 | 0 | 0 | 13 | 39 |
| Saskatchewan (%) | 90 | 0 | 0 | 0 | 10 | 39 |
| Manitoba (%) | 79 | 0 | 0 | 0 | 21 | 14 |
| Ontario (%) | 82 | 0 | 0 | 0 | 18 | 17 |
| Maritimes (%) | 86 | 0 | 0 | 0 | 14 | 21 |
| Quebec (%) | 45 | 0 | 0 | 10 | 45 | 11 |
| British Columbia (%) | 68 | 11 | 0 | 0 | 21 | 19 |

## Improving Quality of Winter Feed

Cattle can lose up to 1 in 10 bales worth of feed energy as methane when digesting low quality hay. Therefore, feeding high quality forages has the potential to reduce methane emissions ("Optimizing Feed and Forage Quality" 2021). High-quality feeds improve the efficiency of digestion which could reduce GHG emissions. Diets formulated based on feed tests are optimized to meet animal requirements.

Most (80%) respondents were improving their winter feed quality, and 18% would consider it. This practice is among the top-five highest adoption rates in this report. Only 1% indicated they were "not able" to adopt the practice. Most respondents who were unable to improve quality of winter feed were located in British Columbia (5%). Given the potential of this practice to off-set emissions and the nearly unanimous buy-in from cow-calf producers, the approach could present a win-win for producers and society.

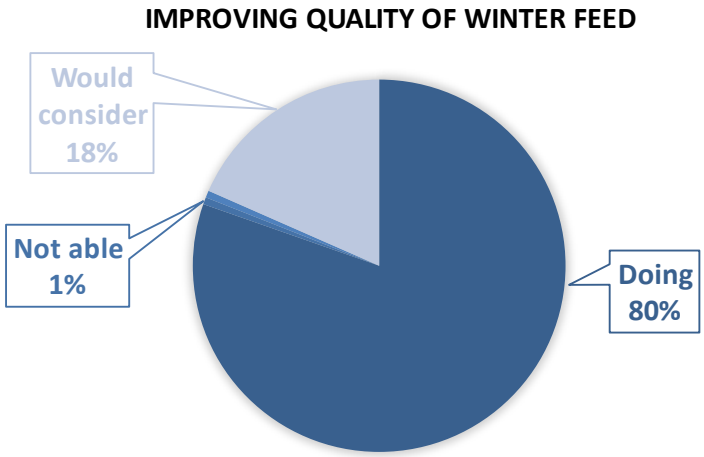



Table 12. **Provincial breakdown of approaches to improving quality of winter feed**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **80** | **1** | **0** | **0** | **18** | **=163** |
| Alberta (%) | 87 | 0 | 0 | 0 | 13 | 39 |
| Saskatchewan (%) | 82 | 0 | 0 | 0 | 18 | 39 |
| Manitoba (%) | 86 | 0 | 0 | 0 | 14 | 14 |
| Ontario (%) | 78 | 0 | 0 | 0 | 22 | 18 |
| Maritimes (%) | 81 | 0 | 0 | 0 | 19 | 21 |
| Quebec (%) | 64 | 0 | 0 | 0 | 36 | 11 |
| British Columbia (%) | 68 | 5 | 0 | 5 | 21 | 19 |

## Improving Feed Storage to Reduce Waste

Sunlight, precipitation, evaporation, and ground condition are environmental factors that affect the quality of stored feed. The dimensions of hay bales, the density, and the way bales are stacked further affect the surface area exposed to the element and the amount of feed wasted ("Proper Hay Storage Reduces Waste" 2021). When less feed is wasted, fewer inputs, including fossil fuels, are needed in production and transportation of feed.

Strategies to reduce feed waste have been adopted at the highest rates in Manitoba (79%) and Ontario (78%). Nationally, 66% of producers were already implementing approaches to improve storage to reduce feed waste, and a further 26% "would consider" it. A very low percentage of producers were "not willing" (1%), "not able" (3%), or "not sure" (4%) about adopting this practice.

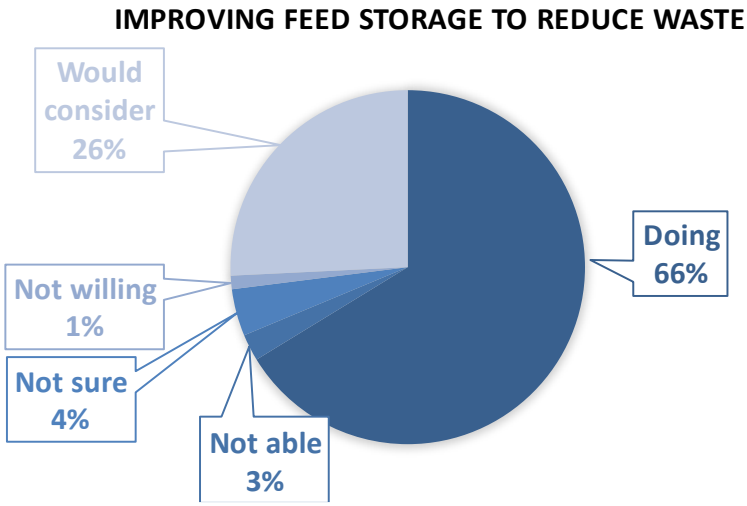



Table 13. **Provincial breakdown of improving feed storage to reduce waste**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **66** | **3** | **1** | **4** | **26** | **=163** |
| Alberta (%) | 62 | 3 | 3 | 10 | 23 | 39 |
| Saskatchewan (%) | 59 | 0 | 3 | 5 | 33 | 39 |
| Manitoba (%) | 79 | 0 | 0 | 7 | 14 | 14 |
| Ontario (%) | 78 | 0 | 0 | 0 | 22 | 18 |
| Maritimes (%) | 71 | 5 | 0 | 0 | 24 | 21 |
| Quebec (%) | 73 | 0 | 0 | 0 | 27 | 11 |
| British Columbia (%) | 58 | 11 | 0 | 0 | 32 | 19 |

## Composting

Composting is a manure management strategy where turning/aeration promotes microbial degradation of manure organic matter, stabilizing compounds in the manure and reducing total emissions released into the atmosphere over the manure storage period. Composting on-site reduces carbon footprints associated with transport of inputs like fertilizer and outputs like manure. Compost can be spread on-site to maintain soil quality and improve whole-farm nutrient recycling. Land application of compost, as apposed to fresh manure, also reduces the risk of spreading pathogens, parasites and weed seeds onto land where manure is spread (Larney and Hao, 2007).

Like improving feed storage, composting is an approach practiced by most (54%) cow-calf producers with the remainder who mostly "would consider" it (31%). The high rate of those willing to consider composting compared to other manure management approaches surveyed for this report presents a starting point for mitigating GHG emissions from manure. The lowest rates of adoption were reported in Quebec (27%) and the Maritimes (57%), where a number of producers are "not sure" about the practice (18% and 10%, respectively), and Alberta (56%) and Saskatchewan (44%), which had the highest rates of producers who are "not willing" to practice manure composting (10% and 8%, respectively). Composting requires an initial investment, involves plenty of labour that is currently in short supply in the agricultural sector, and takes time to pay off. Still, very few producers were completely unwilling, so investigation into the costs and benefits of composting in provinces with low adoption could prove fruitful.

**COMPOSTING**

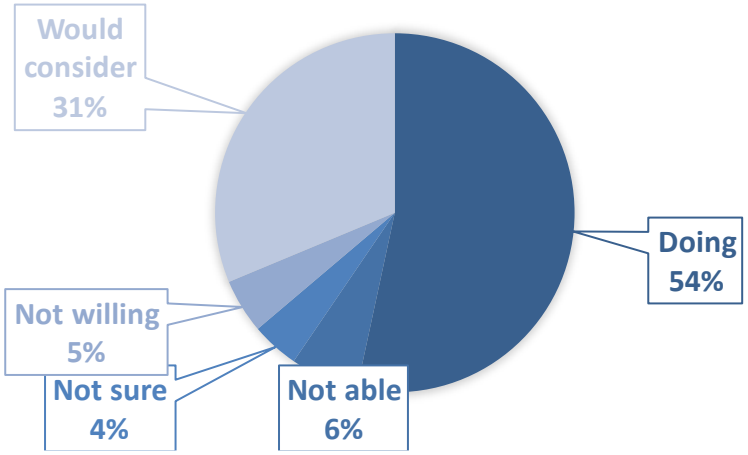



Table 14. **Provincial breakdown of approaches to manure composting**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **54** | **6** | **5** | **4** | **31** | **=163** |
| Alberta (%) | 56 | 5 | 10 | 0 | 28 | 39 |
| Saskatchewan (%) | 44 | 5 | 8 | 5 | 38 | 39 |
| Manitoba (%) | 70 | 7 | 0 | 0 | 23 | 14 |
| Ontario (%) | 67 | 0 | 0 | 0 | 33 | 18 |
| Maritimes (%) | 57 | 0 | 5 | 10 | 29 | 21 |
| Quebec (%) | 27 | 0 | 0 | 18 | 55 | 11 |
| British Columbia (%) | 47 | 26 | 0 | 5 | 21 | 19 |

## Covering Manure Storage

Covering the surface of manure reduces the transfers of GHGs to the atmosphere by increasing the resistance between liquid manure and the air and the release of gases stored in manure. Methane can be removed from under the cover and flared or used to produce heat or electricity ("Manure Management and Greenhouse Gases" 2004). This is a practice that has more regional applicability due to variation in rainfall.

Covering manure storage is a practice that is underwhelmingly adopted nation-wide (27%), with uptake led by producers in Ontario (33%) and Maritimes (38%). Still, 26% of producers "would consider" adopting the practice. All provinces except Ontario had some producers reporting they are "not able" to cover manure storage, which may be influenced by weather conditions or manure storage types currently implemented on-farm. There was a geographic trend in producer willingness to cover manure storage; the highest percentages of producers "not willing" to cover manure storage were in the Prairie provinces of Saskatchewan (23%), Alberta (18%), and Manitoba (14%), while these rates were much lower (0-6%) in Eastern Canada.

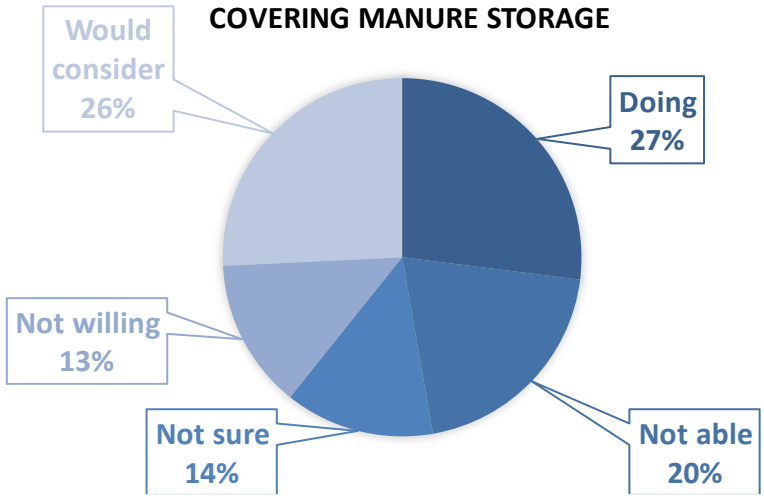



Table 15. **Provincial breakdown of approaches to covering manure storage**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **27** | **20** | **13** | **14** | **26** | **=126** |
| Alberta (%) | 18 | 28 | 18 | 15 | 21 | 39 |
| Saskatchewan (%) | 26 | 21 | 23 | 13 | 18 | 39 |
| Manitoba (%) | 36 | 7 | 14 | 14 | 29 | 14 |
| Ontario (%) | 33 | 0 | 6 | 6 | 56 | 18 |
| Maritimes (%) | 38 | 19 | 5 | 5 | 33 | 21 |
| Quebec (%) | 18 | 18 | 0 | 28 | 36 | 11 |
| British Columbia (%) | 26 | 37 | 5 | 21 | 11 | 19 |

## Faster Incorporation of Manure into the Soil

When applying manure to land as fertilizer, nitrogen at the surface may be lost as ammonia. These losses occur quickly, the majority within a day of application (Rotz 2004). Faster incorporation of manure into the soil reduces nitrogen present at the surface, limiting volatile losses.

This approach to managing manure has the lowest reported rate of adoption of all the practices in this report (19%). Quebec (37%), Ontario (28%), and British Columbia (26%) are the current leaders in adopting this approach to manure management. Significant year-over-year variability in the reported uptake suggest relevance of this practice varies year to year for cow-calf producers, however trends are similar despite fluctuations among respondents in the numbers. A considerable fraction of respondents, 25%, indicated they were "not able" to undertake this approach, with another 16% "not willing." However, 28% of producers, "would consider" incorporating manure more quickly into the soil, indicating some potential for further adoption. Widespread adoption of this practice may be an uphill battle given the current labour availability, land availability, fuel price and marketing price constraints faced by cow-calf producers.

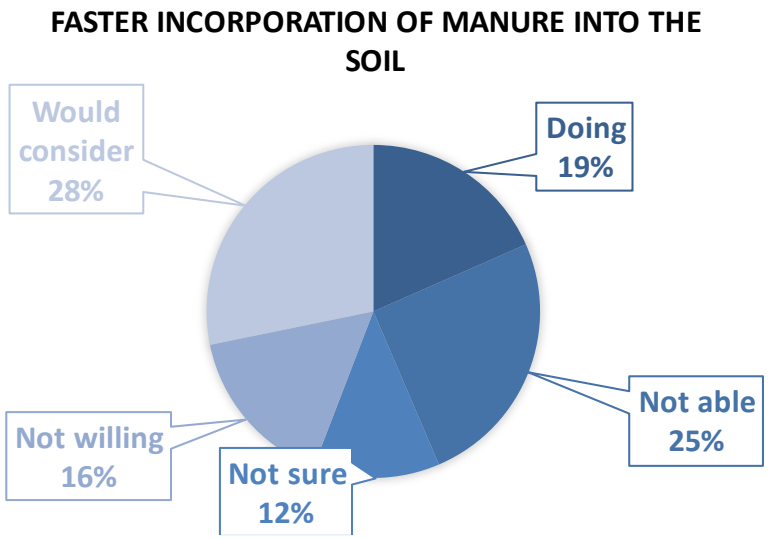



Table 16. **Provincial breakdown for faster incorporation of manure into the soil**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **19** | **25** | **16** | **12** | **28** | **=163** |
| Alberta (%) | 15 | 33 | 13 | 15 | 23 | 39 |
| Saskatchewan (%) | 15 | 18 | 23 | 13 | 31 | 39 |
| Manitoba (%) | 0 | 43 | 36 | 7 | 14 | 14 |
| Ontario (%) | 28 | 28 | 11 | 6 | 28 | 18 |
| Maritimes (%) | 14 | 24 | 5 | 10 | 48 | 21 |
| Quebec (%) | 37 | 9 | 0 | 27 | 27 | 11 |
| British Columbia (%) | 26 | 21 | 21 | 11 | 21 | 19 |

## Improving Herd Genetics for Feed Efficiency

Livestock genetically selected for feed conversion helps decrease GHG emissions. These animals may digest feed faster, and the less time it takes for feed to digest in the rumen, the fewer GHG gases emitted from the animal ("Manure Management and Greenhouse Gases" 2004).

Nationally, 49% of respondents were improving their herd genetics for feed efficiency, and a further 32% "would consider" it. The current low rates of adoption, but high willingness to try, indicates an approach that could present significant advancements for the cow-calf sector. Ten per cent of respondents indicated they were "not able" to improve their herd genetics, potentially due to use of community pastures where herd sires are selected by someone else, with the highest proportion in Manitoba (29%). Only 5% of respondents nationally indicated they were "not willing" to try, with the highest proportions in Alberta (8%), Manitoba (7%) and Ontario (6%).

**IMPROVING HERD GENETICS FOR FEED EFFICIENCY**

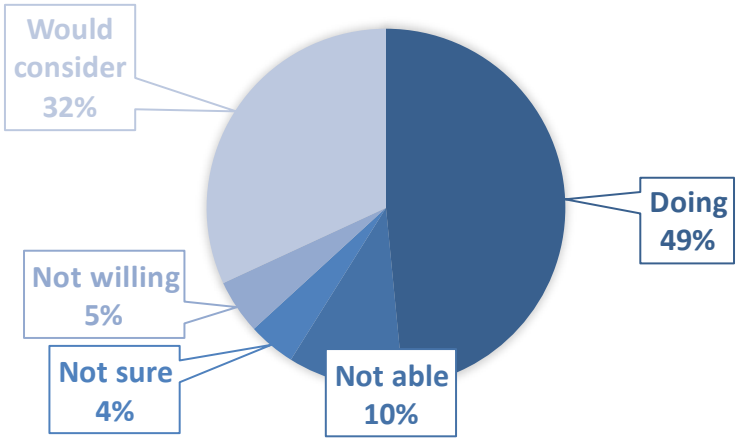



Table 17. **Provincial breakdown of improving herd genetics for feed efficiency**

| | Doing | Not able | Not willing | Not sure | Would consider | N<br>n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **49** | **10** | **5** | **4** | **32** | **=163** |
| Alberta (%) | 64 | 5 | 8 | 5 | 18 | 39 |
| Saskatchewan (%) | 41 | 13 | 5 | 0 | 41 | 39 |
| Manitoba (%) | 14 | 29 | 7 | 14 | 36 | 14 |
| Ontario (%) | 56 | 17 | 6 | 6 | 17 | 18 |
| Maritimes (%) | 52 | 5 | 5 | 0 | 38 | 21 |
| Quebec (%) | 45 | 0 | 0 | 10 | 45 | 11 |
| British Columbia (%) | 47 | 11 | 0 | 5 | 37 | 19 |

## Using Extended Grazing Strategies to Reduce Fossil Fuels

Extended grazing may reduce the use of and reliance on fossil fuels ("Bale Grazing Advantages" ND) and in some production systems may reduce methane emissions when compared to dry lot feeding (Alemu et al. 2016 p.28). Animals remaining on pasture longer spread manure that is more quickly incorporated into the soil versus manure that must be shoveled from a pen, stored and spread. In this way, fewer fossil fuels are required to handle, transport and spread of manure, and emissions from storing manure are minimized.

While earlier it was noted that 81% of producers adopted grazing strategies to improve productivity and regrowth of grazing lands, only 59% of producers are using extended grazing strategies to reduce fossil fuels. Many respondents who were not already using extended grazing strategies would consider trying them (37%). Saving on feed costs would likely be a primary driver, whereas reducing fossil fuel use could be a side-benefit. No producer indicated an unwillingness to adopt the practice. Extended grazing practices also reduce the need for solid manure storage, and thus related mitigation strategies associated with manure management. Communicating the added enhancements to manure management, fossil fuel reduction, and potentially lower winter feed costs as a benefit of extended grazing may be a compelling approach to reduce GHGs.

**USING EXTENDED GRAZING STRATEGIES TO REDUCE FOSSIL FUELS**

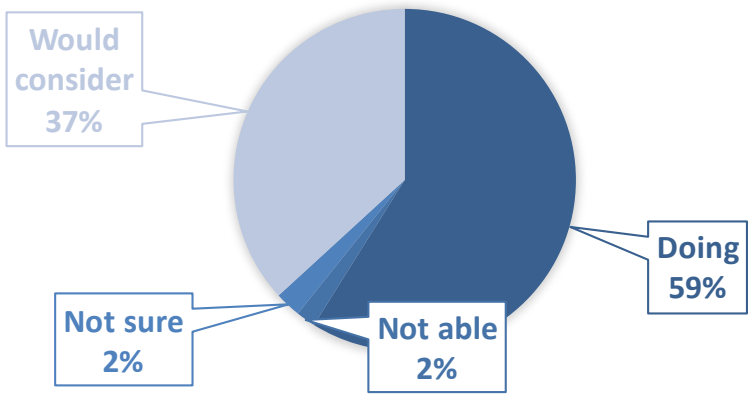



Table 18. **Provincial breakdown of using extended grazing strategies to reduce fossil fuels**

| | Doing | Not able | Not willing | Not sure | Would consider | N n |
|---|---|---|---|---|---|---|
| **Canada (%)** | **59** | **2** | **0** | **2** | **37** | **=163** |
| Alberta (%) | 54 | 0 | 0 | 5 | 41 | 39 |
| Saskatchewan (%) | 59 | 0 | 0 | 0 | 41 | 39 |
| Manitoba (%) | 64 | 0 | 0 | 0 | 36 | 14 |
| Ontario (%) | 67 | 0 | 0 | 0 | 33 | 18 |
| Maritimes (%) | 57 | 5 | 0 | 0 | 38 | 21 |
| Quebec (%) | 45 | 9 | 0 | 9 | 36 | 11 |
| British Columbia (%) | 63 | 5 | 0 | 5 | 26 | 19 |

## V. Charts - Provincial Approaches by Practice

This section provides a summary visualization of practice adoption by province, using the tabular data presented in previous sections. Figures 'a' present the farm management approaches presented in section III, and figures 'b' presents the approaches to GHG emissions reduction discussed in section IV. The visualizations make the trends clear to identify. For example, with red bars signifying "not able to adopt," it is clear to see the prevalence concerning manure management practices (figures b) nation-wide.

**Figure 1a. Ontario**

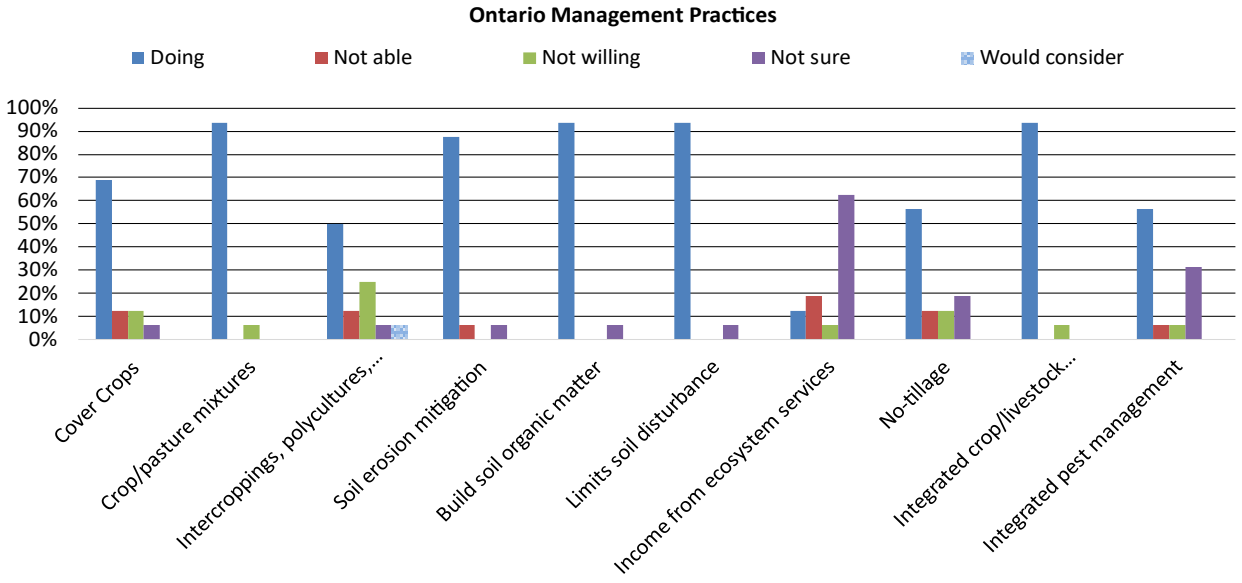



**Figure 1b. Ontario**

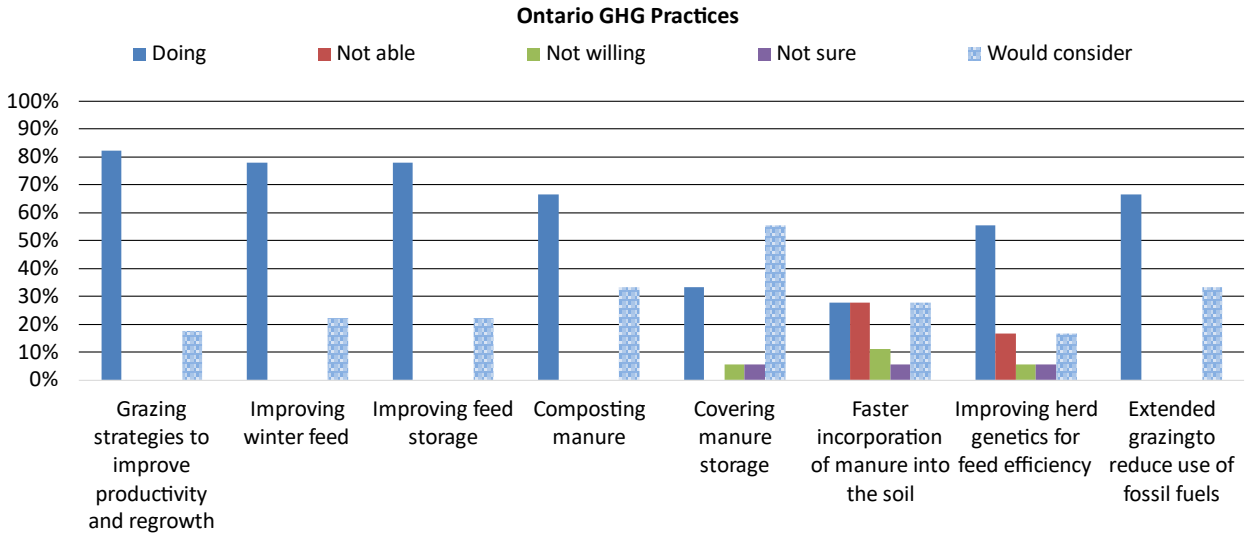


**Figure 2a. Alberta**

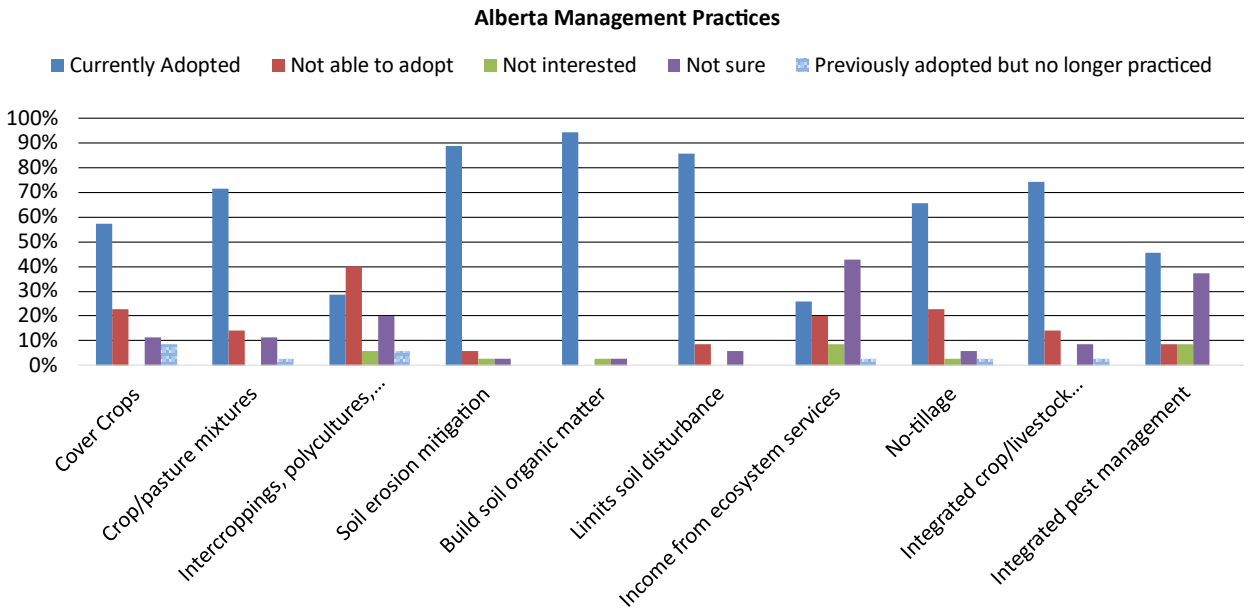



**Figure 2b. Alberta**

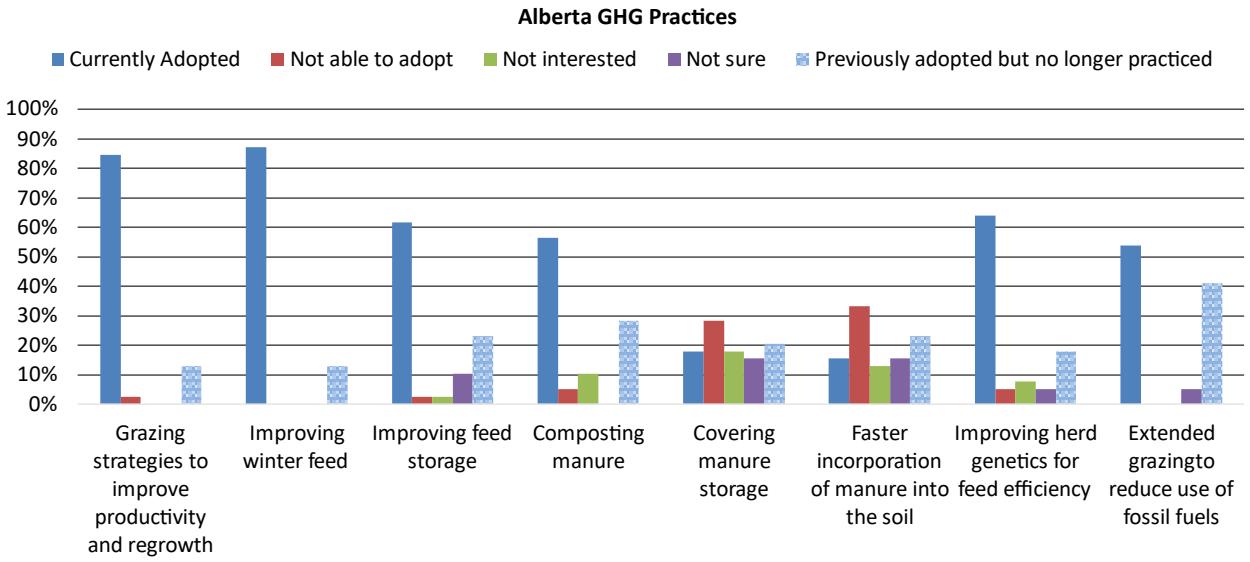


**Figure 3a. Saskatchewan**

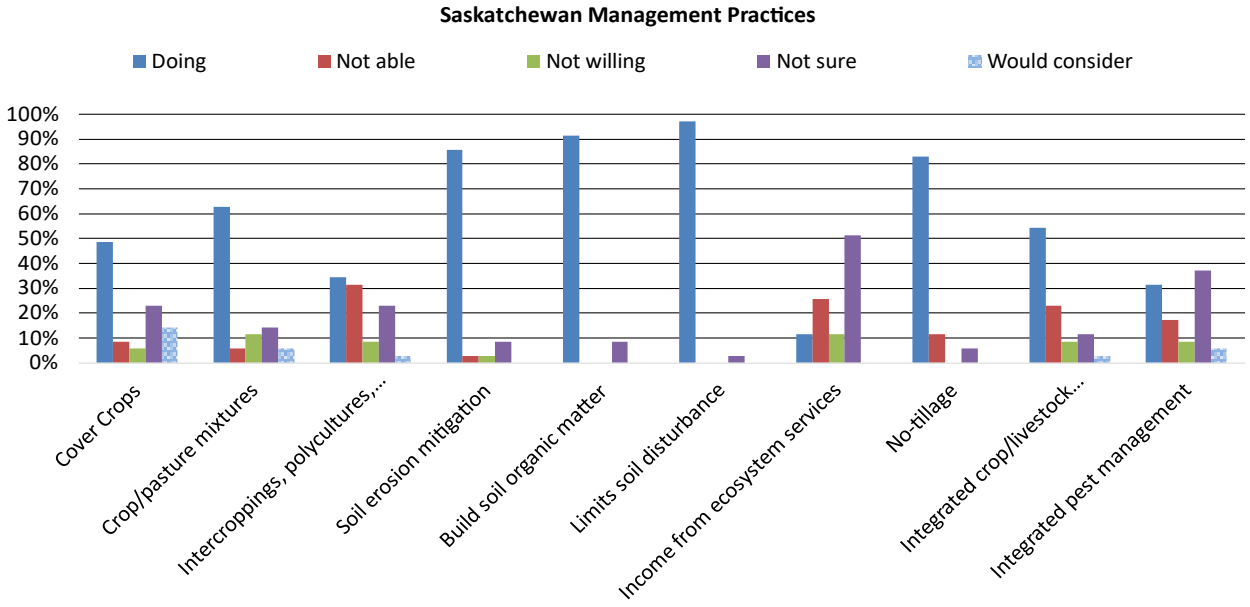



**Figure 3b. Saskatchewan**

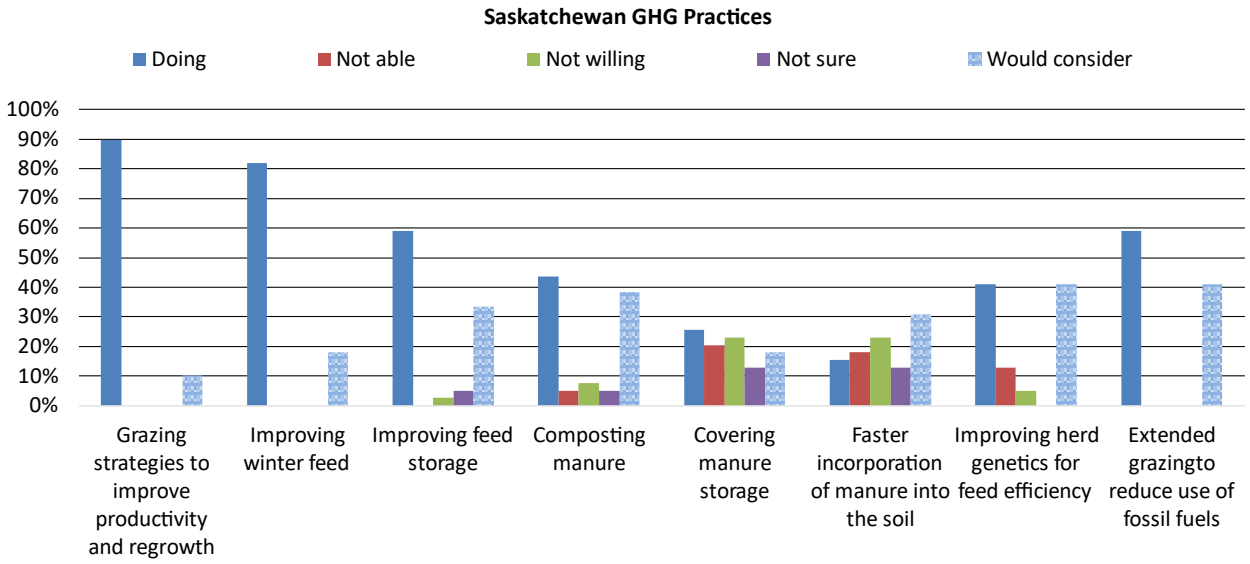


**Figure 4a. British Columbia**

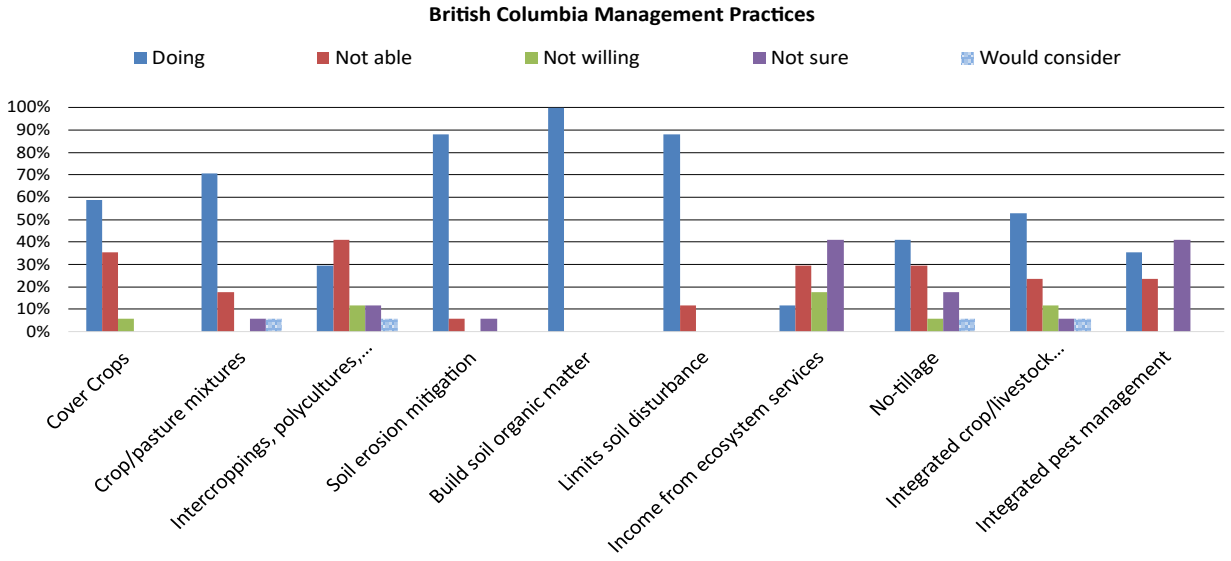



**Figure 4b. British Columbia**

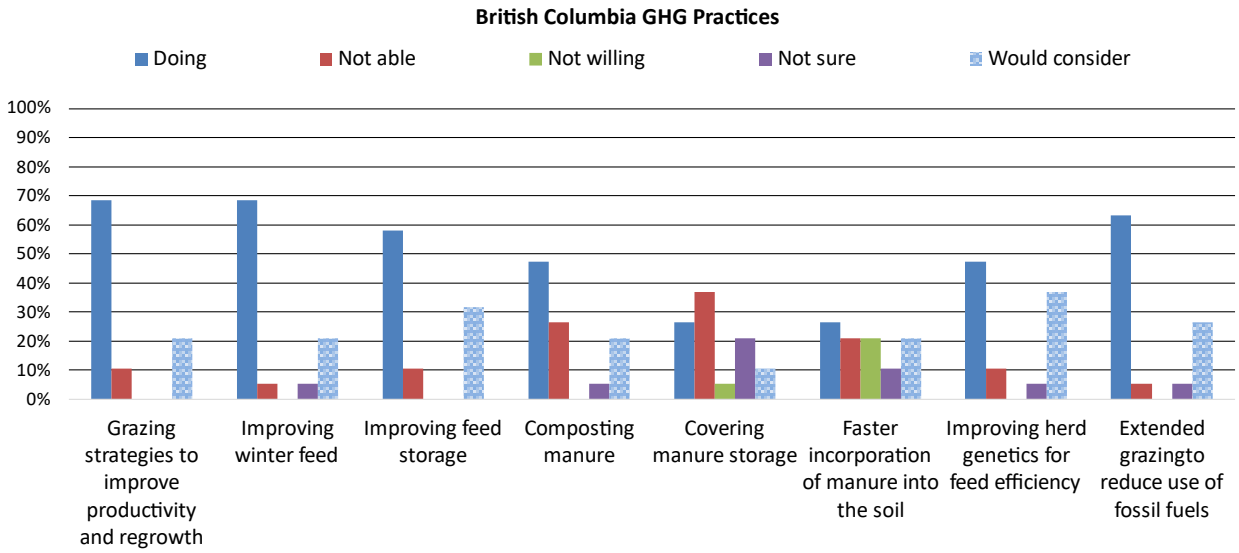


**Figure 5a. Manitoba**

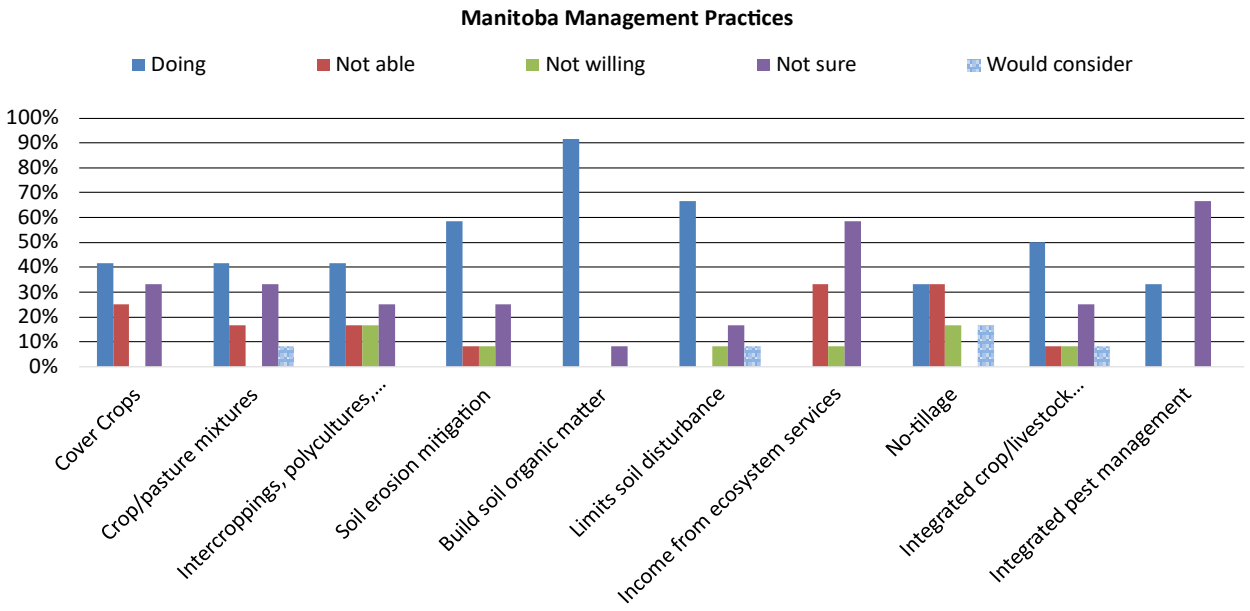



**Figure 5b. Manitoba**

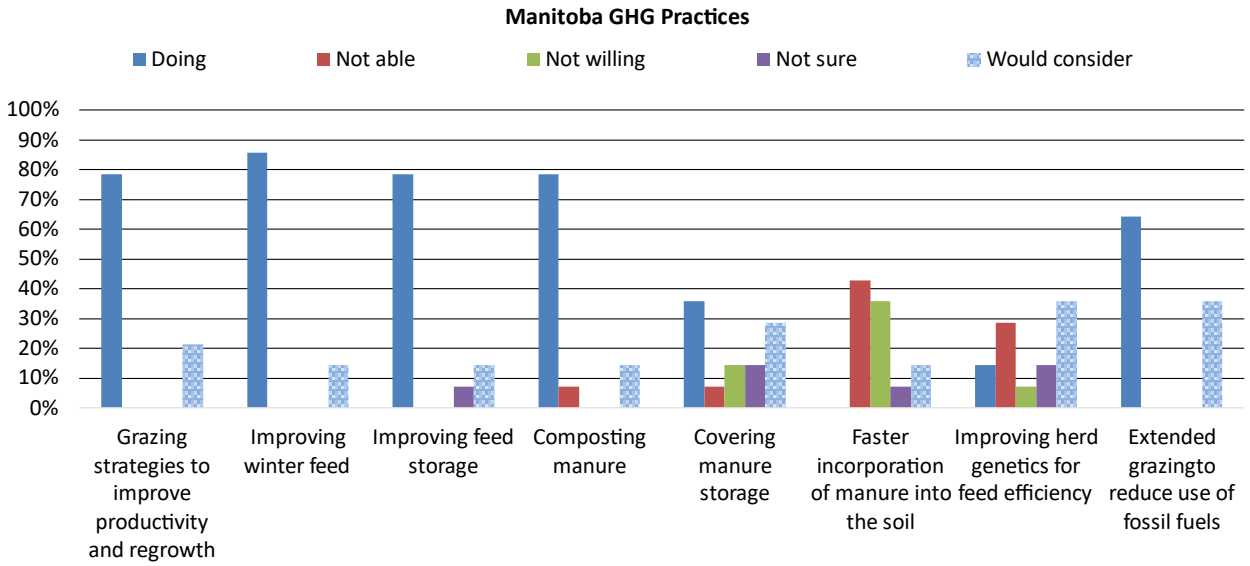


**Figure 6a. Maritimes**

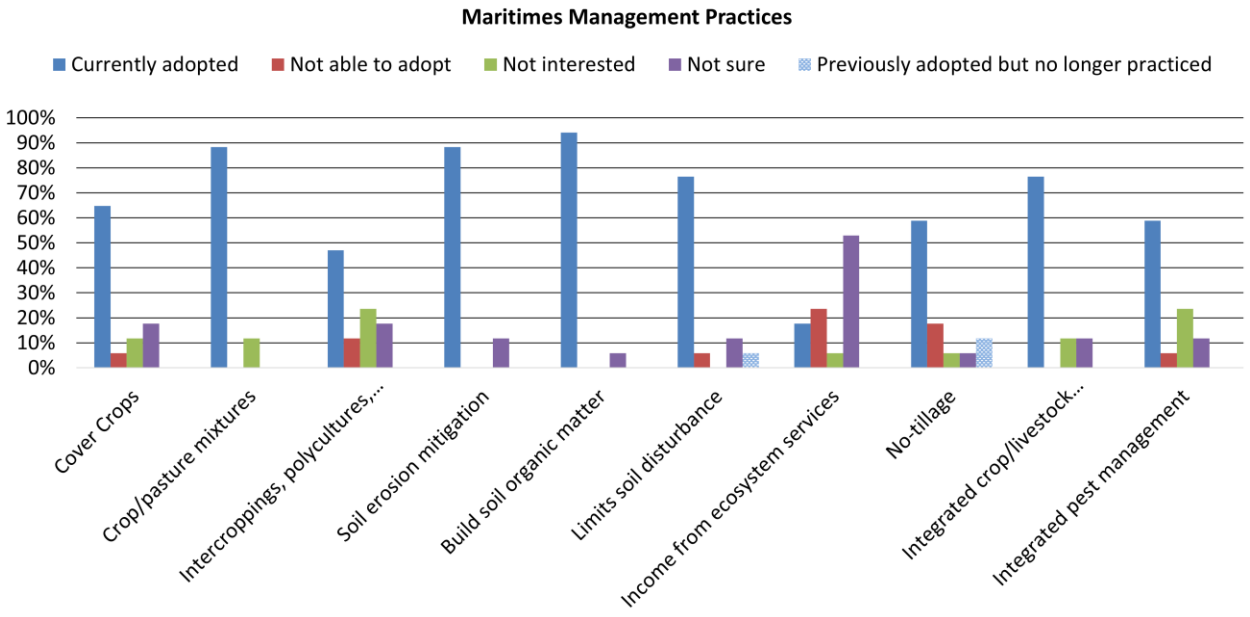



**Figure 6b. Maritimes**

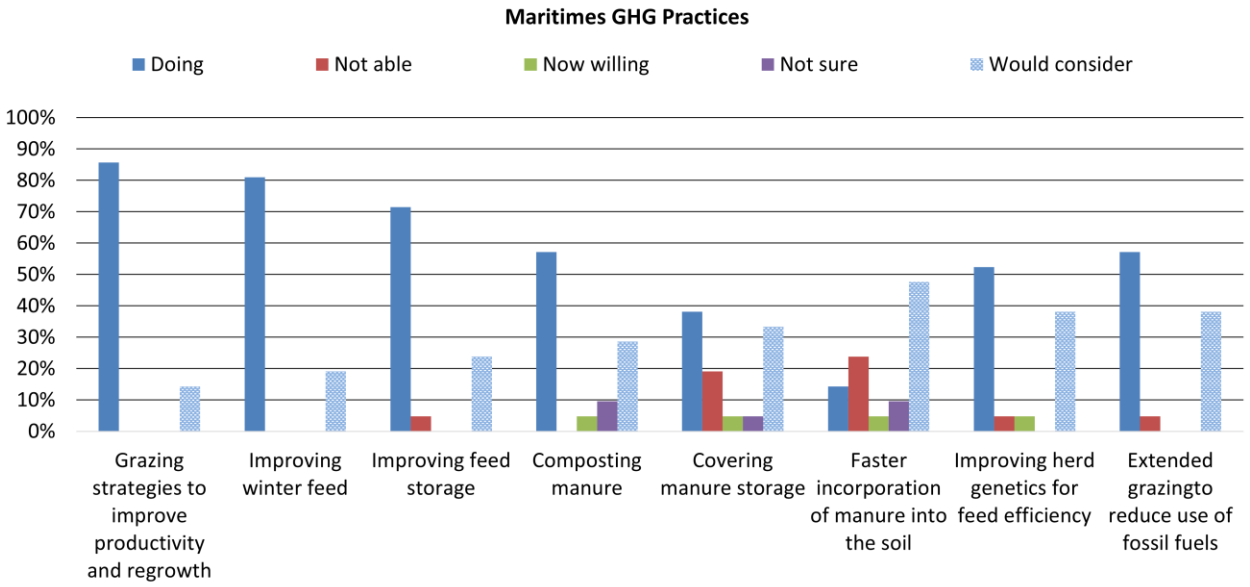


**Figure 7a. Quebec**

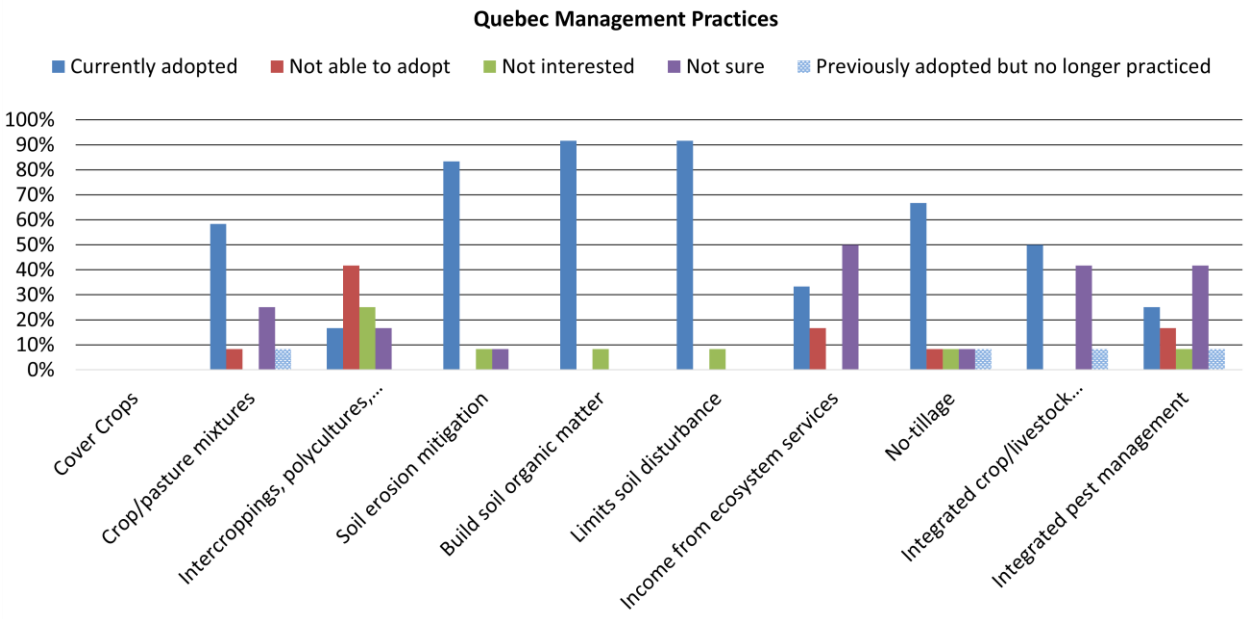
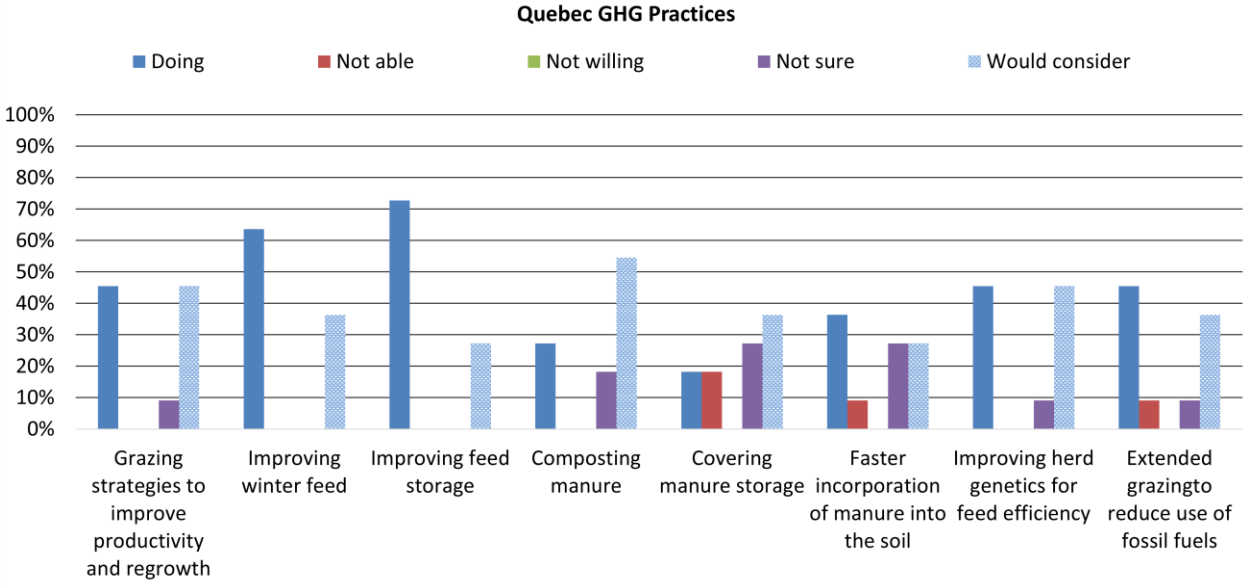



**Figure 7b. Quebec**



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