SEINE RAT ROSEAU WATERSHED DISTRICT

University of Manitoba

Cover Crops 101

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Cover … it's in the name

Cover crops are plants that are grown as a management tool to achieve soil health and agronomic goals. They are grown to cover the soil when it would otherwise be left bare. This could be in the fall or early spring between cash crops, during the main growing season, across an entire field or in an area within a larger field. Cover crops provide soil cover when they are growing as well as after termination with their residue.

Photo credit: Yvonne Lawley

Figure 1. Cover crop mixture grown over a full growing season to manage a flood prone section of a field while the remainder of the field grows a cash crop.

Figure 2. A legume cover crop, like peas, can be used as green manure (living cover crop incorporated into soil for organic matter and nutrients).

Photo credit: Virginia Janzen

Figure 3. Radish used as a relay crop (crop seeded into an already established crop) covering the soil between soybean rows. Interseeding and overseeding are additional terms used to describe this method of using cover crops.

Photo credit: Yvonne Lawley

What's the plan?

Like any new practice, using cover crops comes with both risks and rewards. Cover crops need a management plan just like cash crops. Beginning with setting specific goals, the following are six cover crop planning basics that will help you build a plan to reach your goals and guide adjustments when conditions change:

Cover crop planning basics

1. GOAL: Know your goal
2. WINDOW: Find your rotation window
3. SPECIES: Determine what plant species to grow
4. SEEDING: Choose seeding strategy
5. TERMINATION: Choose plant termination strategy
6. EVALUATION: Evaluation of cover crop and plan for next cash crop

Cover Crops 101

1 Know your goal

Some cover crop goals can be seen within one or two growing seasons, while other goals will take many years to realize. You may have one main goal or you may work towards multiple goals simultaneously.

Immediate

- Cover soil to reduce erosion
- Scavenge nutrients to reduce losses
- Graze high quality forage
- Increase trafficability in wet conditions
- Keep roots in the soil
- Increase biodiversity
- Capture snow for moisture

Short-term

- Increase water infiltration
- Fix nitrogen
- Manage excess soil moisture
- Suppress weeds
- Enhance habitat for pollinators and beneficial insects
- Capture energy from the sun and carbon from the air to feed soil biology

Long-term

- Increase organic matter and water holding capacity
- Improve soil structure for drainage
- Manage soil compaction
- Enhance soil microbial communities and nutrient cycling
- Carbon sequestration
- Decrease fertilizer/input costs
- Increase farm profitability

Exploring four cover crop goals

Setting specific goals for cover crops will help you select cover crop species and management options to help you reach those goals. Remember that cover crops are a tool to be used in combination with other best management practices.

Goal #1	What do I need from the cover crop?	Cover Crop examples
Fix nitrogen	Legume cover crops that fix nitrogen from the atmosphere through symbiotic relationship with *Rhizobia* bacteria.	Legumes like field pea, faba bean or clovers

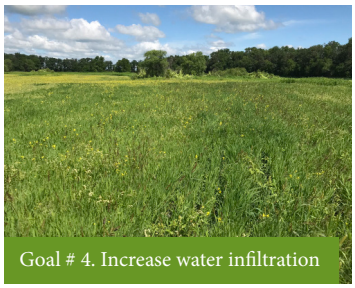
Goal # 1. Fix nitrogen

Goal # 2. Sequester carbon

Goal #2	What do I need from the cover crop?	Cover Crop examples
Sequester carbon (and build soil health)	Cover crop shoot and root growth to contribute carbon to the soil.	Mixture of cool season grasses, legumes, & broadleaves

Goal #3	What do I need from the cover crop?	Cover Crop examples
Cover soil to reduce erosion	Quick cover crop establishment and abundant biomass that can provide cover for the soil in the fall and spring.	Cool season grasses like fall rye and oat

Goal # 3. Reduce erosion



Goal # 4. Increase water infiltration

Goal #4	What do I need from the cover crop?	Cover Crop examples
Increase water infiltration	Adequate soil coverage and plant root growth to improve soil structure.	Mixture of cool season grasses, legumes, & broadleaves

Cover Crop Resources

1 Goal

The following resources describe cover crop basics and explore possible goals for the practice.

- **2020 Prairie Cover Crop Survey**
  Highlight: Respondents from Prairie provinces answer about their cover crop practices.
  https://umanitoba.ca/agricultural-food-sciences/make/make-ag-food-resources#crops
- **Managing Cover Crops Profitably**
  Highlight: Pages 9 – 11 details possible cover crop goals and Pages 62 – 72 discusses selection of different cover crop species based on goals and location.
  http://www.sare.org/publications/covercrops/covercrops.pdf
- **Mid-West Cover Crops Council website**
  Highlight: Information on research from North Dakota. *https://mccc.msu.edu/statesprovince/north-dakota/*
- **Cover Crops Field Guide**
  Highlight: A physical book to purchase as a cover crop reference guide.
  https://ag.purdue.edu/agry/dtc/pages/ccfg.aspx

2 Window

When to use cover crops will depend on where a window exists in your crop rotation.

- **Cover Crops – Making it work in Manitoba**
  Highlight: From time marker 17min 10sec – 20min 41sec briefly highlights some cover crop windows in Manitoba.
  https://www.youtube.com/watch?v=HoAyGR3R3WM

3 Species

Select cover crop species with characteristics that can help to meet your goals. Also choose plants that can be successfully grown in your region.

- **NDSU Soil Health Minute: Comparing Warm and Cool Season Grass Cover Crops**
  Highlight: Video showing these crop types at different planting dates.
  https://www.youtube.com/watch?v=a1X6DvjB8KQ
- **Cover Crops Canada Species List**
  Highlight: Describes characteristics of common cover crop species used in Manitoba.
  https://covercrops.ca/species/
- **USDA Cover Crop Chart**
  Highlight: Compare different cover crop species by characteristics such as growth cycle, plant architecture and water use.)
  http://www.ars.usda.gov/Services/docs.htm?docid=20323
- **USDA Carbon to Nitrogen Ratios in Cropping Systems**
  Highlight: Explains C:N and its importance in crop nutrient cycling.)
  https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd331820.pdf
- **Cover Crop Decision Tool by the Midwest Cover Crops Council**
  Highlight: Find out which cover crops can meet common goals. Note that Manitoba is not yet an area supported for selection. For now use North Dakota and a northern located county (Cavalier for eastern MB or Bottineau for western MB) when exploring decision tool.)
  https://mccc.msu.edu/covercroptool/

4 Seeding

It is difficult to find local seeding rate recommendations for cover crops. Start with provincial recommendations for cash crop seeding and adjust. Increase rate if broadcasting or if shoulder season seeding date occurs later in the fall.

- **Manitoba Agriculture**
  Highlight: Recommended seeding rates of Manitoba's major crops.
  https://www.manitoba.ca/agriculture/crops/crop-management/index.html
- **Managing Cover Crops Profitably**
  Highlight: Page 70 for common cover crop seeding rates. *http://www.sare.org/publications/covercrops/covercrops.pdf*

5 Termination

Many cover crop species will terminate by winterkill. Grazing, herbicides and mechanical termination are options when termination needs to be managed.

- **Changing plans: Fall rye termination timing in Manitoba soybean production**
  Highlight: Page 28 for information on comparing termination timings of fall rye.
  https://www.manitoba-pulse.ca/wp-content/uploads/2021/11/Pulse-Beat-94_December-2021_FINAL_WR.pdf
- **Annual Cover Crop Options for Grazing and Haying in the Northern Plains**
  Highlight: Grazing considerations from research conducted in North Dakota.
  https://www.ag.ndsu.edu/publications/livestock/annual-cover-crop-options-for-grazing-and- haying-in-the-northern-plains

6 Evaluation

The following resources are examples of some basic tools to assess your cover crop practice.

- **Cover crop soil coverage:** Canopeo app which calculates % of green vegetation on soil surface
  https://canopeoapp.com/#/login
- **Soil health measurements:** OMAFRA website
  http://www.omafra.gov.on.ca/english/crops/field/news/croptalk/2017/ct-0917a6.htm

Cover Crop Planning

Use this checklist to tailor a plan for getting started with cover crops according to the needs and resources of your farm. Remember to start small and scale up as you gain experience. Depending on your operation, starting small could be a small plot, an area within a field, or a small field. This checklist will help you dig deeper into the six cover crop planning basics:

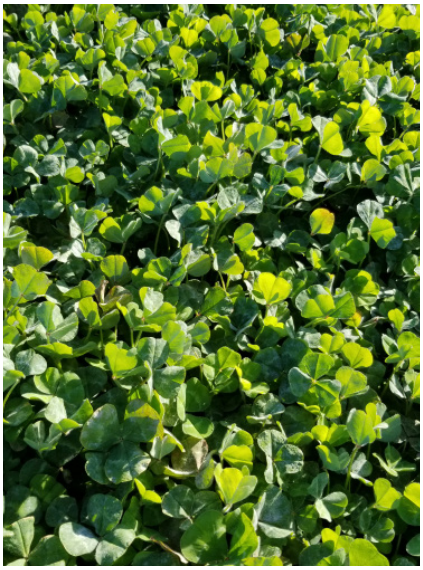
Cover crop planning basics

1. GOAL: Know your goal
2. WINDOW: Find your rotation window
3. SPECIES: Determine what plant species to grow
4. SEEDING: Choose seeding strategy
5. TERMINATION: Choose plant termination strategy
6. EVALUATION: Evaluation of cover crop and plan for next cash crop

1 Know your GOAL

- [ ] What are your goals for the cover crop?
- [ ] If you have several, what rank do you give each goal? For example, from most important to least; or from short term goals to long term goals.
- [ ] Did you complete this important step? You may be tempted to skip this step but it is important for the steps that follow. For example, your goals will determine when you plant, what you plant, how you terminate and the ultimate success of your cover crop.

Your goals may change with time, so it is important to re-evaluate from year to year.



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Cover Crop Planning

2 Find your rotation WINDOW

- ☐ What is your typical crop rotation?
- ☐ When are your typical harvest dates?
- ☐ When is the longest shoulder season window?
- ☐ Do you have the ability to interseed into an already established crop?
- ☐ Do you have an available full season window?
- ☐ If you have several options, which window addresses your most important goal?
- ☐ After narrowing down to your best window, what is the compatibility with your current herbicide and fertility program and the crop that will follow in rotation?

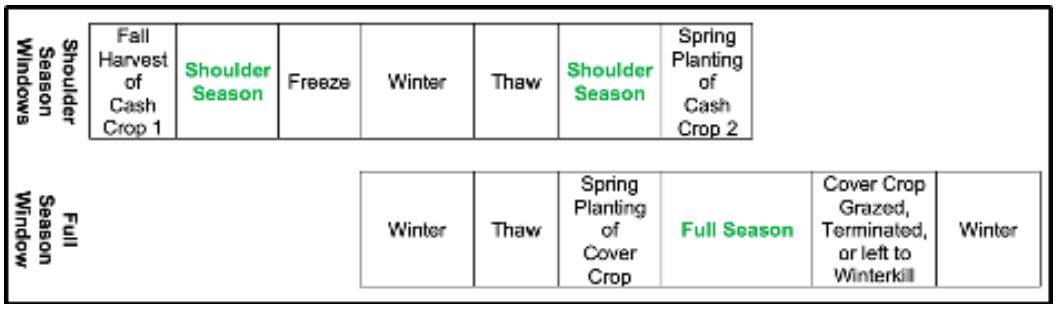

Figure 1. Timeline highlighting shoulder season windows and full season window for cover crops.

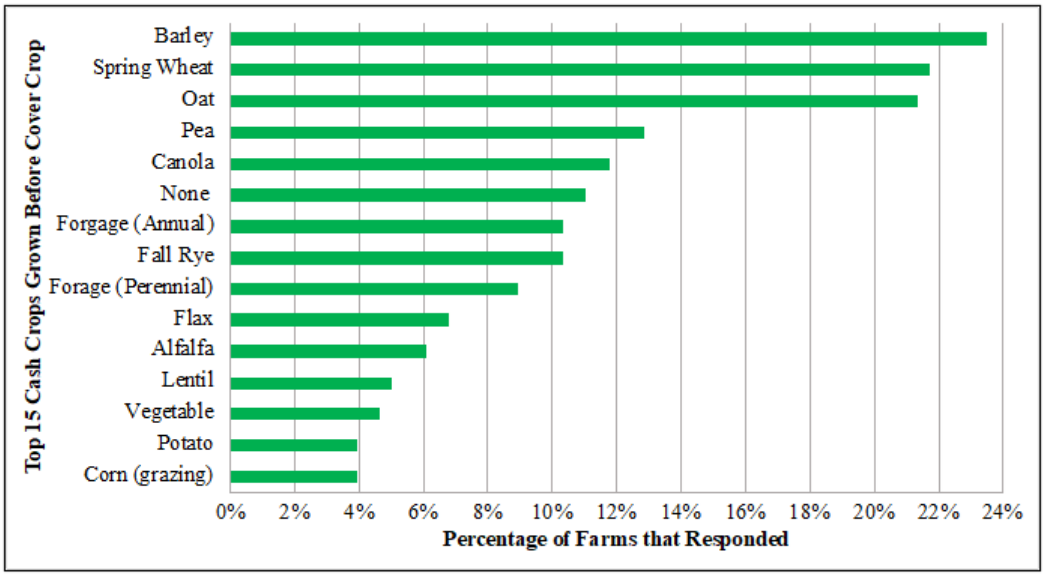

Figure 2. Top 15 cash crops grown before cover crops by farms that responded to 2020 Prairie Cover Crop Survey (N = 281). Note that respondents were asked to select all answers that applied from a list, and so may have selected two or more answers.

Cover Crop Planning

3 Determine what plant SPECIES to grow

Plant Characteristics

- ☐ What plant characteristics will help accomplish your goals?
- ☐ Which plant species have the best combination of those characteristics?

Crop Diversity

- ☐ How do the species compliment your current crop rotation?
- ☐ Would the species add diversity to your current crop rotation vs. act as a disease or pest host?

Plant type basics

Grasses
- Readily available seed
- Provide rapid ground cover
- Nitrogen scavengers

Legumes
- Ability to fix nitrogen

Other Broadleaves
- Some species have taproot
- Nitrogen scavengers

Warm season
- Need warm temperatures of midsummer (full growing season)

Cool season
- Prefer cooler temperatures and can be seeded later in the summer

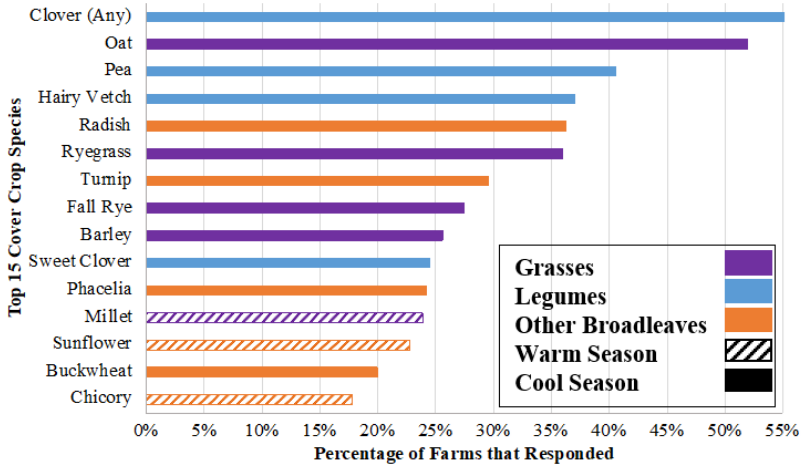

Figure 3. Top 15 cover crop species grown by farms that responded to 2020 Prairie Cover Crop Survey (N = 281). Note that respondents were asked to select all answers that applied from a list, and so may have selected two or more answers.

Mixture of species

Whenever possible use multiple plant types in a mixture which can decrease establishment risks and increase diversity to the cropping system.

C:N ratio of cover crop residue

C:N is the ratio of carbon units to nitrogen units in plant material and can affect the rate of plant residue decomposition and nutrient cycling in the soil. A brief summary is:

High C:N ratio in plant residue → immobilize N in soil
Low C:N ratio in plant residue → mineralize N to the soil

Pairing low C:N cover crops with high C:N cash crop residues helps to improve nutrient cycling in the soil. In general, there is a low C:N ratio among crops seeded in fall shoulder season in Manitoba as these crops do not reach maturity.

Planting window

- ☐ Which species are suited to your intended growing season? For example, warm vs cool season species or overwintering vs winterkilled species.

Access to seed

- ☐ Is seed available to you?

Cover Crop Planning

4 Choose SEEDING strategy

Method

- [ ] What equipment is available to you for seeding the cover crop?
- [ ] For mixtures with small and large seed, will you blend the seed to plant with one box or use multiple tanks?

Timing	What to consider...
☐ What is your seeding rate?	Start with provincial recommendations for cash crop seeding and adjust. Increase rate if broadcasting or if shoulder season seeding date gets later in the fall.
☐ What is your seeding rate in a mixture?	If seeding a mixture, decrease seeding rates relative to monoculture seeding. For example, if seeding a three-way mix, start adjusting by dividing each monoculture rate by 3. Also, take seed size into account when dividing seed rates, as larger seeds will need to be a greater part of the mix (by weight) than smaller seeds.
☐ What is your seed cost?	Seed cost is a good factor to consider when determining seeding rates for species with more expensive seed. Consider blending a new or expensive cover crop species with an easily available and inexpensive species.

Herbicides

- [ ] Are there residual herbicides from previous crop that will limit cover crop establishment?

Method of Planting	Percentage of Farms That Responded
Air Seeder	49%
Seed drill	37%
Broadcaster	26%
With tillage	9%
Hand Seeded	5%
Planter	2%
Airplane	1%

Table 1. Method of planting for cover crops grown by farms that responded to 2020 Prairie Cover Crop Survey (N = 281).
Note that respondents were asked to select all answers that applied from a list, and so may have selected two or more answers.

Cover Crop Planning

5 Choose TERMINATION strategy

Method

- ☐ Will the selected cover crop species winterkill or is termination needed?
- ☐ If spring cover crop growth is important to meeting your goals, what is your termination plan?
- ☐ If termination is needed, will you use herbicides, tillage, mowing, or a combination of strategies?

Timing	What to consider...
☐ When do you need to terminate the cover crop in order to plant your cash crop?	A safe place to start for termination is 2 weeks before cash crop planting. As you gain experience and if you want to increase cover crop growth before planting some strategies to consider might include: i) using strip tillage or zone herbicide application to create a seed bed for row crops; or ii) seeding legume crops, that fix their own nitrogen, into living cover crops.
☐ What are the current environmental conditions?	In drought years, terminating a cover crop close to cash crop planting can use up valuable soil moisture needed for cash crop establishment.
☐ What is the alternative?	Some unexpected conditions to plan for include if conditions are too wet for tillage or too cold for herbicide efficacy.

Method of Termination	Percentage of Farms That Responded
Grazing	46%
Winter Kill	37%
Tillage or Incorporation	30%
Will not terminate	24%
Herbicide	21%
Mowing	16%
Roller crimping	5%
Tarp, mulch or black plastic	1%

Table 2. Method of termination for cover crops grown by farms that responded to 2020 Prairie Cover Crop Survey (N = 281).
Note that respondents were asked to select all answers that applied from a list, and so may have selected two or more answers.

Cover Crop Planning

6 EVALUATION of cover crop

Looking Back

Observations

- ☐ Did you observe any water or wind soil erosion?
- ☐ Did you observe any weed suppression? Did you have weed challenges?

Measurements

- ☐ Did you have sufficient cover crop biomass (tonnage) or ground cover?
- ☐ Did you leave check strips for comparison?
- ☐ Was yield of cash crop impacted?
- ☐ Did you perform any soil tests? For example, shovel test to observe plant roots and soil structure, aggregate stability, water infiltration, or lab soil tests.
- ☐ If goal was to graze, were you able to graze the cover crop?
- ☐ How many grazing days (tonnage/quality) were provided?
- ☐ Have soil organic matter values changed?

Conclusion

- ☐ What went wrong?
- ☐ What went right?
- ☐ Did you meet your immediate or short term goals?
- ☐ Did you meet any long term goals?

Looking Forward

...and plan for next cash crop

Fall tillage and residue management

- ☐ What adjustments may be needed to your standard fall tillage or crop residue management practices?
- ☐ Are there opportunities to combine fall management with cover crop seeding?

Weed control

- ☐ What adjustments may be needed to your standard fall weed management, especially for perennial weeds?

Fertility plan

- ☐ What adjustments may be needed to your standard fall fertility plans?

This fact sheet was written by Virginia Janzen and Dr. Yvonne Lawley of the Department of Plant Science at the University of Manitoba and published by the Seine Rat Roseau Watershed District in March 2022. It is available at https://srrwd.ca/.