

Fall Cover Crop Species Selection and Management

By Sonny Murray and Caitlin Congdon

Planting cover crops in August and September is a strategy for maximizing soil carbon sequestration (building soil organic matter), suppressing weed growth, decreasing soil erosion and preparing the field for the next crop. Early fall planting allows cover crops to establish well before the onset of shortening days and cold weather. Depending on the previously harvested crop, soil fertility and the cover crop selected, there can be ample time for cover crop growth and soil improvement.

DESCRIPTION OF CASE STUDIES AND THEIR ASSOCIATED OBSERVATIONS:

Case Study A: To demonstrate potential management strategies with cover crops (both single species and mixes), two case studies were carried out in early 2023. Starting on August 8, 2023, a selection of single-cover crop species and cover crop blends were planted in a sandy loam in the Annapolis Valley. A list of the cover crops and the seeding rate can be found in Table 1. Observations include assessing species for winterkill, carbon to nitrogen ratios (C:N) and canopy coverage were taken.

Table 1: Seeding rates of cover crops used in Case Study A.

Cover Crop	Lbs/ac	Kg/Ha
Clovers		
Crimson	12	13
Balansa	5	6
Frosty	5	6
Alice	5	6
Huia	5	6
Single Cut	5	6
Double Cut	5	6
Vetches		
Chickling	40	45
Hairy	20	22

Cover Crop	Lbs/ac	Kg/Ha
Peas		
Austrian Winter	30	34
Forage	30	34
Other Annuals		
Oilseed Mustard	8	9
Oilseed Radish	8	9
Tillage Radish	6	7
Buckwheat	30	34
Phacelia	8	9
Lablab	25	28
Annual Grasses		
Sorghum Sudan	40	45
Pearl Millet	25	28
Oats/Peas	50	56
Barley	80	90
Winter Rye	100	112
Prarex Oats	100	112
Annual Ryegrass	12	13
Perennial Ryegrass	12	13
Italian Ryegrass	12	13
Turf Fescue	14	16
Mixes		
Vitality-Belgan	20	22
Equilibre	67	75
Equilibre/Radish	67	75
Passes Partout	67	75
Belge	20	22
Seasonal	67	75
Nitrogen	62	69
Simplified	11	12
Automnal	58	65
Honey Production	23	26
Allterrain	67	75
Multipurpose	58	65

Case Study B: In an adjacent area, selected fall cover crops were planted weekly, starting August 8th until September 22, 2023. Species included in these plantings are listed in Table 2. Cover crops were allowed to mature and overwinter without being terminated chemically. Some of the cover crops overwintered as expected, and others were winter killed.

Table 2: Late seeded cover crop species and the associated planting dates and rates.

Cover Crop Species	Lbs/ac	Kg/ha	Planting Dates
Tillage Radish	6	7	Aug 8
Annual Ryegrass	12	13	Aug 17
Perennial Ryegrass	12	13	Aug 25
Italian Ryegrass	12	13	Sept 1
Oats/Peas	50	56	Sept 7
Winter Rye	100	112	Sept 15

Observations from the Case Studies: Cover crops that overwintered included Austrian winter pea, Italian ryegrass, Perennial ryegrass, Winter cereal rye, Vetch, Red and White clover, and Crimson, Balansa and Berseem clovers. Winter-killed cover crops included oats, Barley, Forage Peas, Oilseed mustard and radish, Buckwheat, Phacelia, Lablab, Sorghum Sudan grass, and Pearl millet and Sunflower.

OVERWINTERING VS WINTERKILL COVER CROPS

Cover crops that overwinter may be beneficial in some instances where the successive crop is planted late the following spring. Crops like soybeans, corn or late-planted vegetables allow the cover crop to grow through April, further protecting the soil and adding additional organic matter. However, in crop rotations where early planting is required, having a cover crop overwinter can be detrimental to management as it may need to be terminated before the crop will be planted, the cover crop residue may need to be incorporated, and the soils may be slower to warm up as they are shaded. The remaining residue may break down more slowly and pose a problem for small-seeded crops that require a fine seedbed. In cases where the cover crop is expected to overwinter, but an early crop is to be planted, glyphosate may be applied in the late fall to terminate the cover crop.

Additionally, overwintering cover crops may produce seeds unexpectedly in the spring if not terminated in time. Italian or Perennial ryegrass or even winter cereal rye may illustrate this point. In early May, these overwintering cover crops may not look too aggressive, but in late May, they may have rapidly grown and already produced viable seed, which may become a weed for several years.

COVER CROP RESIDUE CONTRIBUTION TO SOIL C:N

Cover crop residues added to the soil with a C:N greater than 24:1 will result in a temporary nitrogen deficit (increased immobilization), and those with a C:N of less than 24:1 will result in a temporary nitrogen surplus (increased mineralization). Therefore, cover crop management must strike a balance between crop residues covering the soil and nutrient cycling, which will supply valuable nutrients to produce the next crop. An awareness of crop C:N is necessary to select cover crop species or blends and keep a cropping sequence on the right path toward sustainability.

Table 3: C:N measured on October 24, 2023, on various cover crops.

	Planted Aug 7	Planted Aug 17	Planted Aug 25	Planted Sept 1
GDD to end of October	225	180	150	125
	C:N	C:N	C:N	C:N
Oilseed Radish	15			
Brown Mustard	19			
Tillage Radish	13	10	15	13
Barley	15			
Pearl Millet	17			
Oats/Peas	18	17	15	11
Sorghum Sudangrass	23			
Annual Ryegrass	25	28	17	12
Prarex Oats	26			
Italian Ryegrass	21	23	21	14
Perennial Ryegrass	21			
Vitality Mix	21			
Equilibre Mix	24			
Winter Rye	14	17	15	8
Passes Partout	20			
Seasonal	29			
Belge	28			
Nitrogen Mix	17			
Honey Production	23			
Automnal	28			
Simplified	21			
Brown Mustard	31	17	9.93	
Hairy Vetch	10	9	8	

In the fall cover crop planting date demonstration, C:N was measured on October 24, 2023 (Table 3). In general, as the plantings occur later into the fall, C:N decreases across all species. It is essential to recognize that many fall-planted species do not reach maturity before termination. Therefore, they do not reach their full potential C:N. If the cover crop is allowed to overwinter and mature in spring, the C:N can be very different. Later fall-planted cover crops tend to break down easily because they produce smaller total amounts of biomass as the planting date gets later, but also, the C:N is lower with later plantings. From the data collected, if any of the cover crop species selected are planted after August 7 and fall terminated, none will have a C:N above 26:1 and will not tie up nitrogen in the following year. The C:N of cover crops can change as they mature; winter cereal rye at heading is roughly 37:1, while at pre-boot, they are 26:1. A mix of hairy vetch (C:N of 11:1) and cereal rye is a popular blend to address this balance. Terminating the blend of winter cereal rye and vetch close to maturity in spring will have a combined ratio of 26:1, meaning minimal nitrogen should be tied up for the subsequent crop.

COVER CROP CANOPY COVERAGE

Canopy cover is one way to look at the success of a cover crop. By covering the soil surface, we are cooling the soil surface and protecting it from erosion by slowing rainfall droplets and wind speeds. Using the Canopeo app, we can quantify the amount of canopy closure. Canopeo is a rapid and accurate green canopy cover measurement tool. Canopeo analyzes photos to quantify the percent canopy cover of live green vegetation for any agricultural crop using downward-facing photos taken with a mobile device. Canopy measurements were collected on October 24, 2023. After that point, it was generally recognized that there would be very little growth until the spring due to cooler temperatures and winter dormancy in perennial or winter annual plant species. Looking at the Canopeo readings from successively later plantings (Table 4), as expected, the amount of canopy achieved decreases with later plantings. Some crops stick out as filling their canopy more quickly and at later dates. Italian ryegrass, oats/pea mixes and tillage radish are good at establishing quickly and covering the soil, while hairy vetch and brown mustard are slower to cover the soil. Winter rye establishes quickly and can be slightly slow in covering area due to its growth habit.

Table 4: Canopeo rating of canopy coverage (%).

	Planted Aug 7	Planted Aug 17	Planted Aug 25	Planted Sept 1
GDD to end of October	225	180	150	125
	% Canopy Coverage	% Canopy Coverage	% Canopy Coverage	% Canopy Coverage
Oilseed Radish	96			
Brown Mustard	95			
Tillage Radish		99	87	69
Pearl Millet	53			
Oats/Peas	90	85	69	41
Sorghum Sudangrass	71			
Annual Ryegrass	95	71	48	47
Italian Ryegrass	95	87	81	62
Perennial Ryegrass	51			
Vitality Mix	90			
Equilibre Mix	93			
Winter Rye	89	75	55	44
Seasonal	77			
Brown Mustard				17
Hairy Vetch	95	75	91	27

SUMMARY

By comparing the amount of growth from each species with successive plantings, the last planting date for each species can be chosen to achieve acceptable maximum growth. These critical dates can be roughly transferred to other regions with shorter falls by calculating and comparing remaining GDDs. These can be found in Table 1 for each planting date.

Hairy Vetch planted before mid-August tended to be well established but did not survive the winter compared later planting dates. Planting past September 1 allows time for the establishment of only a small selection of cover crop species. This establishment will help reduce movement of topsoil by wind and water erosion but will do little to build organic matter unless it is allowed to overwinter and grow in the early spring before the next crop. Cover crops which are suitable for later plantings and will overwinter include winter cereal rye, ryegrasses, and hairy vetch. Tillage radish, oats and barley can be planted until mid-September with reduced top growth and will not overwinter.

With fall planting, the earlier the crop can be planted and established, the more biomass will be produced. Care must be taken to plant into moisture as the soil surface can be pretty dry at this time of year. If the seed is placed in dry soil, weeks can go by before the seed germinates, losing critical establishment time. Therefore, broadcasting onto the soil surface may not be the best planting method. For more information on planting dates for winter cereal rye, check out [this video](#) on a previous demonstration.

The strategic timing of planting cover crops in August and September offers multifaceted benefits for soil health and crop management. Our case study and analysis underscored the importance of considering various factors such as crop selection, seeding rates and the carbon-to-nitrogen ratio to optimize cover crop performance. Understanding the dynamics of canopy cover, growth patterns and critical planting dates enables farmers to make informed decisions, maximizing soil protection, erosion control and organic matter accumulation. As we navigate the complexities of fall planting, it is clear that careful attention to timing and methodology can yield significant dividends in sustainable agriculture practices, paving the way for resilient and productive crop systems in the future.

ADDITIONAL RESOURCES:

- [Nova Scotia OFCAF Cover Crop Page](#)
- [YouTube Cover Crops Playlist](#)

The following are prints of a 1x1 foot square taken overhead of the different cover crops planted on August 8, 2023 and taken on October 24, 2023. These will help growers understand the amount of residue that was produced by each species and mix.

MIXES



SUMMER GRASSES

Annual Ryegrass



Sorghum Sudan Grass



LEGUMES

Hairy Vetch



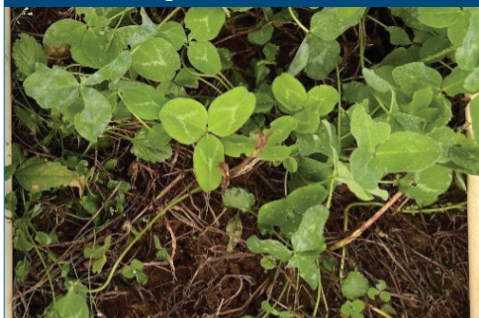
Austrian Winter Pea



Crimson Clover



Single Cut Red Clover



Lablab



BRASSICAS

Tillage Radish



Brown Mustard



Oilseed Radish



MISC

Italian Ryegrass



Phacelia



Buckwheat



CEREALS

Barley



Pearl millet



Winter Rye

