NPM

EARLY SPRING and SUMMER Cover Crop Options for Wisconsin Cropland

Cover crops are a proactive way to keep the soil covered during times of the year when a field may otherwise be fallow, such as before a late-planted crop, following a short-season crop, or when a harvested crop isn't planted. **A successfully established and well-managed cover crop can protect the soil from erosion, recycle and prevent loss of nutrients, suppress weeds, and improve soil health and function. Growing cover crops and keeping living roots within the soil has been shown to increase soil organic matter, improve aggregate stability, increase water infiltration and reduce runoff, and promote soil microbial communities.** A cover crop can also potentially prevent future crop yield reduction due to fallow syndrome.

While not an exhaustive list, basic selection and management information for some common and economical annual plant species suitable for use as cover crops in Wisconsin are outlined in this publication. Selection of cover crop(s) species for a particular field should consider objectives and needs, field and growing season conditions, and resources available for cover crop planting, management and termination. Although all of the following cover crop options can provide soil cover for erosion protection, weed suppression and soil improvement, each are particularly well-suited to specific cover cropping objectives, geographic regions and planting seasons.

Base cover crop species selection on specific goals:

- ☑ *Nitrogen fixation*
- ☑ *Nitrogen scavenging*
- ☑ *Erosion protection*
- ☑ *Soil building*
- ☑ *Quick establishment*
- ☑ *Weed suppression*
- ☑ *Forage production for grazing or harvest*

GENERAL CONSIDERATIONS

- For best results, a cover crop should be managed similarly to a cash crop, including appropriate seeding techniques and rates, and adequate soil fertility. All of the following cover crop choices can be established via drilling or broadcast and incorporation with light tillage. Good seed-to-soil contact at the appropriate depth for each species improves germination and establishment. It is recommended to use seed tested and tagged by a lab using Association of Seed Analysts (AOSA) standards.

- Limited soil moisture can reduce establishment success, particularly with mid- to late summer seedings. Drilling vs. broadcast seeding cover crops is recommended when soils are dry and rain is not in the long-term forecast.

- Weed competition may present a challenge to slowly establishing cover crops. Selection of high biomass, fast establishing cover crop species can help to reduce in-season weed pressures. If weeds become an issue, cover crops may need to be mowed to prevent weed seed production.

- Before planting the cover crop, review the crop rotational restrictions associated with any herbicides used in the field within the last 18 months. A herbicide's residual soil activity may impact germination and establishment of the cover crop(s) selected, as well as the legalities of using the cover crop as a livestock feed. Rotational or planting interval restrictions and allowances are listed on the herbicide product's label. For more information, see: *Herbicide Rotation Restrictions in Forage and Cover Cropping Systems* https://ipcm.wisc.edu/download/pubsPM/2019_RotationalRestrictions_final.pdf

For the purposes of this publication, U.S. Highway 10 is the dividing line used for the Northern and Southern regions of the state. Note that these regions are defined differently for crop insurance purposes.

COSTS OF ESTABLISHMENT

Each of the cover crop options outlined below provides an estimate of seed costs at the recommended seeding rates. In addition to seed costs, farms will incur expenses associated with seedbed preparation and planting. Potential cover crop establishment costs are estimated in the table on the right, using data from the 2017 Wisconsin Custom Rate Guide (https://www.nass.usda.gov/Statistics_by_State/Wisconsin/Publications/WI-CRate17.pdf) and an agronomy services retailer (2020).

Many of the cover crops described below are typically winter-killed. For those that overwinter, spring herbicide costs are often similar to those when a cover crop is not grown. Therefore, a majority of the financial expense of growing cover crops is associated with seed and seeding.

Potential cover crop establishment costs

Scenario 1	Cost per acre
Primary tillage (chisel plowing)	$18
Secondary tillage (finishing disc/cultivator)	$16
Planting (conventional grain drill)	$17
	$51 total plus seed cost
Scenario 2	
Herbicide (burn-down)	$18
Custom spraying	$9
Planting (no-till grain drill)	$22
	$49 total plus seed cost

SPRING

PLANTING DATES

Statewide: early April through mid-May

Oats, Spring Barley, Spring Wheat or Spring Triticale (spring cereal grains)

Advantages/disadvantages

Spring cereal grains are the primary option for early spring planting. They will germinate faster in cool soil and grow more rapidly in early spring than most other species. If not terminated as a vegetative green manure, maturation and seed development will begin in June or July. Spring cereals typically complete their life cycle between mid-July to early August, depending on variety and planting date, after which time plants senesce and die. Shattered (dropped) seed can re-establish, however, spring cereals are not considered aggressive or invasive weeds.

At slightly higher seeding rates and with adequate soil fertility and early planting, spring cereals can provide an economical source of harvestable forage for cattle. Boot stage, generally considered optimum for yield and quality, will occur in mid- to late June. Oats and spring barley can yield 1-3 tons dry matter (TDM) forage per acre.

Spring cereals can also be used as a companion or "nurse" crop for establishing longer-season cover crop legumes, such as medium red clover.

Planting recommendations

Seeding rate: 50–60 lb/A for a cover crop and/or nurse crop, 85–100 lb/A for forage.

Depth: Drill 1–2 inches deep or broadcast and lightly till-in.

Management requirements

For optimal growth, apply 40-60 lb N/A, (for forage, add 20 lb P_2O_5 & 90 lb K_2O/A)

Approximate seed cost is $20/A (cover seeding rate)

Spring cereal grains are the primary option for early spring planting. They will germinate faster in cool soil and grow more rapidly in early spring than most other species.

EARLY SUMMER

PLANTING DATES

Northern: June through July

Southern: mid-May through July

Medium Red, Berseem and Crimson (clovers)

Advantages/disadvantages

Unlike the cereals, clovers will supply their own nitrogen (N) for growth, and will provide N credits for a subsequent grass crop, like corn or wheat. **Berseem clover** is a fast-growing, true annual clover that will winter-kill. It has an upright growth habit and has been observed to produce more resilient soil cover into the following spring than crimson clover. **Crimson clover** is a southern U.S. adapted winter annual that variably overwinters in Wisconsin. It has a more prostrate, lower growing habit and so, is more suited to grazing than mechanical harvest, if forage is desired. If it survives the winter, crimson clover grows quickly in spring, adding biomass and N accumulation. Plant annual legumes as cover crops until July 20 in northern Wisconsin and until August 1 in the south. **Medium red clover** is a short-lived perennial and will establish more slowly than the annual clovers. It is more adapted to an early season planting (see early April through mid-May section above) but can work well if planted by mid-July. Medium red clover typically persists two to three years without termination.

As they are slower to establish, clovers are best planted in a mix with oats or spring barley to better compete with weeds and to ensure good soil cover. When planted in a mix with small grains, expect 1–3 TDM biomass production by fall. Alternatively, a recent field trial in eastern Wisconsin produced significant cover crop biomass with a mix of crimson and berseem clover. This mix combines the upright habit of berseem clover with the prostrate growth of crimson clover and is more competitive with weeds than either clover species alone.

Research trials suggest up to a 40 lb/A N credit from a well-established, mature berseem or crimson clover cover crop, and up to 80 lb/A with medium red clover. Growth and total N fixation is decreased in dry and/or warmer than average temperatures during the summer. N accumulation and release to a following crop can be variable and will depend on several crop and soil factors. A Pre-sidedress Soil Nitrate Test (PSNT) can be used to gauge in-season release of N to a subsequent corn, sweetcorn or wheat crop.

Planting recommendations for all clovers

Seeding rate: 10–12 lb/A alone or 6–8 lb/A in a mix with 20–30 lb/A oats or spring barley. Approximate seed cost (with oats) is $26–37/A.

7 lb/A berseem + 7 lb/A crimson. Approximate seed cost is $29/A.

Depth: ¼ inch (oats/barley 1½ inches).

Inoculate clover seed with *Rhizobium leguminosarum* biovar *trifolii (R. trifolii)*

Management requirements

Clipping clovers in late summer will encourage new above ground growth and additional root growth. Spring termination of crimson clover may be required.

As an annual cover crop, clovers are best planted in a mix with oats or spring barley to better compete with weeds and to ensure good soil cover.

Rye or Triticale (winter cereal grains)

Advantages/disadvantages

Limited experience planting winter rye in mid-summer suggests it can be a summer cover crop option. In a 2015 demonstration in south central Wisconsin, rye planted July 3 produced 1.6 TDM/A by September. Stem elongation does not occur without vernalization (cold temperatures), so first year growth is limited to tillering. Planted in summer, rye should produce a thick cover but may succumb to leaf rust infestation by fall. See sections in Late Summer Planting Dates for planting and management guidelines.

Sorghum-sudangrass, sudangrass and pearl millet are drought tolerant once established. If harvested as a forage, prussic acid and plant nitrate accumulation must be considered and managed, particularly for sudangrass species.

Sorghum-sudangrass, Sudangrass or Pearl millet

Advantages/disadvantages

If planting in the first three weeks of July, consider a warm season grass, such as sorghum-sudangrass, sudangrass or pearl millet for fast, high yielding biomass production. Three to five tons of dry matter (TDM) per acre or more is possible if growing conditions are warm and 60–80 lbs/A available soil nitrogen are provided. Sorghum-sudangrass, sudangrass and pearl millet are drought tolerant once established and are excellent for suppressing weeds, preventing erosion, scavenging/recycling nutrients and adding soil organic matter. If harvesting sorghum-sudangrass as a forage following a frost, prussic acid must be considered and potentially managed. Cooler than average conditions will limit growth and forage yield. At later planting dates, warm season grasses may be potentially less desirable, particularly for forage, in northern Wisconsin.

Planting recommendations

Seeding rates:
For sorghum-sudan and sudangrass, seed at 15–20 lbs/A as a cover crop or 20–30 lbs/A for forage, ¾ - 1 inch deep.

For pearl millet, seed at 10–15 lbs/A as a cover crop or 15–20 lbs/A for forage, ½ - 1 inch deep.

Soil temperature should be a minimum of 65 degrees F at planting.

Management requirements

Mowing will likely be required to keep biomass manageable for planting the subsequent crop and to prevent seed production. Mowing and light fall tillage will help minimize N immobilization to a following corn crop. As an alternative to tillage, increasing the percentage of total nitrogen supplied by early season N applications can potentially reduce N immobilization impacts on crop growth. For corn, sweetcorn and wheat, in-season N availability can be monitored using a pre-sidedress nitrate test (PSNT).

Approximate seed cost is $15–20/A (cover crop seeding rate).

If corn is planned for the following year, a seed mix of sorghum-sudangrass or sudangrass and soybean (30 lbs/A) could be considered. The nitrogen fixed by soybean may enhance decomposition of the sorghum-sudangrass residue. The use of forage type soybean should be considered if grazing or forage harvest is a primary goal. Soybean seed and inoculant will approximately double the seed costs as compared to a sorghum-sudangrass monoculture. Soybean should be treated with a *Bradyrhizobium japonicum* inoculum to take advantage of potential N-fixing capabilities.

Approximate seed and inoculant cost is $30–40/acre (non-traited, non-treated soybean).

LATE SUMMER

PLANTING DATES

Northern: mid-July through mid-August

Southern: mid-July through early Sept.

Oats, Spring Barley, or Spring Triticale (spring cereal grains)

Advantages/disadvantages

Spring cereal grains will grow rapidly in late summer and continue until a hard freeze. They typically do not overwinter in Wisconsin. Spring cereals are often the best choice as a lower cost soil cover or if fall-harvested forage is a primary goal. Spring cereals are more forgiving of temporary dry conditions than legumes and will grow longer into the fall. Oats and spring barley have had equal yields in several University of Wisconsin fall forage trials (1–3 TDM/A), with spring triticale yielding slightly less.

Planting recommendations

Seeding rate: 50–60 lb/A for a cover crop, 85–100 lb/A for forage.

Depth: Drill 1–2 inches deep or broadcast and lightly till-in.

August 1st is a target date for summer/fall planting of annual cereal grains in much of the state.

Management requirements

For optimal growth, apply 40–60 lb N/A, (for forage, add 20 lb P_2O_5 & 90 lb K_2O/A).

Approximate seed cost is $20/A (cover seeding rate).

Rye or Triticale (winter cereal grains)

Advantages/disadvantages

Winter rye or triticale can be planted August through October for a late summer and overwinter cover. Stem elongation will not occur without vernalization (cold temperatures). When planted in August, winter cereals will produce a thick cover but usually less than 1 TDM/A before winter dormancy. Little fall biomass production should be expected from winter cereals planted after mid-to late September. Both rye and winter triticale will grow rapidly in early spring, with rye breaking dormancy earlier. Winter cereals can be somewhat difficult to manage with tillage after significant spring growth. Chemically terminated winter cereals sometimes leave soil conditions difficult for no-till planting the subsequent crop. Rye, in particular, may also release allelopathic compounds after harvest or termination that can be toxic to germinating corn and alfalfa seedings. Properly managed, any crop can potentially follow a winter cereal cover, but soybeans may be the best option.

Planting recommendations

Seeding rate: 50–60 lb/A for cover; 90–100 lb/A for early spring forage, planted before September 15 (northern) and October 1 southern).

Depth: Drill 1–2 inches deep or broadcast and lightly till-in.

Management requirements

Terminate winter cereal cover crops, chemically or with tillage, 10 days to two weeks prior to planting the subsequent crop to minimize allelopathy, N immobilization and hard soil conditions, especially if growth exceeds eight inches. Alternatively, some farmers have success planting green(no-till into growing rye and then terminating the cover chemically soon after planting). If equipment is available, farmers have also had success no-till planting into rye that has been rolled and crimped once the rye has reached boot stage or later.

If planting into significant winter cereal biomass, consider increasing the percentage of total N supplied by early season N applications to potentially reduce N immobilization impacts on crop growth.

Oats or spring barley are often the best choice as a lower cost soil cover or if fall-harvested forage is the main goal. They are more forgiving of temporary dry conditions than legumes and will grow longer into the fall.

For corn, sweetcorn and wheat, in-season N availability can be monitored using a PSNT.

Approximate seed cost is $17/A.

A mixture of 20 lbs rye and 40 lbs oats or spring barley per acre will produce slightly greater above ground biomass production in late summer/fall, while still providing some overwinter cover. A mixture of winter and spring cereals can reduce the potential for crop management challenges often associated with monocultures of winter cereals.

Approximate seed cost is $20/A

Winter rye or triticale can be planted August through October for an overwinter cover. Planted in August, winter cereals will produce a thick cover but usually less than 1 TDM/A before winter dormancy.

Before planting cover crops, review the crop rotational restrictions associated with any herbicides used in the field within the last 18 months.

Brassicas and Mixtures

Advantages/disadvantages

Planting a multi-species mix that includes a grass, legume and brassica species (radish, turnip, rape) may provide soil health benefits as compared to a single species alone. Daikon radishes (e.g., Tillage, Groundhog, Nitro, oilseed or forage radish) are a fast-growing, edible root vegetable capable of producing a girthy taproot that can extend several feet into the soil if planted in July or August. Turnips and rapeseed have similar taproots to radish but with less girth. Depending on species selection, turnips often have more bulbous growth at or above the soil surface and are better suited to late summer and fall grazing. Turnips may overwinter, requiring spring termination and do not produce the odors of radish upon decomposition. Turnips and rapeseed are better suited than radish if planted in September. Other brassica species include kale and canola. All brassicas may produce seed if planted too early in July.

Radishes have been shown to be good scavengers of residual soil nitrate, but measured N release to a following crop has been variable.

Planting recommendations

Brassicas have competitive, leafy top growth. Mixes must consider compatible species and modest brassica seeding rates.

Possible mixes and seeding rates for radish, rapeseed, kale and canola plantings (turnip seeding rates should be reduced by approximately half):

1–2 lbs/A brassica + 20-30 lbs/A oats, spring barley or rye.

1–2 lbs/A brassica + 6 lbs/A berseem (or medium red) clover + 20 lbs/A oats, spring barley or rye.

1– 2 lbs/A brassica + 25 lbs/A field peas + 20 lbs/A oats, spring barley or rye.

Management requirements

Brassica monocultures are not recommended due to low residue persistence once winter-killed. Further, large brassica taproots can loosen soil creating conditions susceptible to gully erosion. Brassicas, therefore, should be planted as a low percentage of a cover crop mix and in combination with a cereal grain or a forage grass to help stabilize and protect the soil from erosion. For optimal growth, apply 40–60 lb N/A from fertilizer, manure or legume credits.

Approximate seed cost is $20–35/A.

Daikon radishes are a fast-growing, edible root vegetable capable of producing a girthy taproot that can extend several feet into the soil if planted in July or August. For optimal growth, apply 40–60 lb N/A from fertilizer, manure or legume credits.

For More Information

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Additional Resources

NPM Cover Crops Webpage
https://ipcm.wisc.edu/covercrops/

Midwest Cover Crops Council
http://mccc.msu.edu/

This publication is available from the Nutrient and Pest Management (NPM) Program. Contact us at: phone (608) 265-2660, email (npm@hort.wisc.edu), or visit our website: ipcm.wisc.edu

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