GLASI
Great Lakes Agricultural Stewardship Initiative

Cover Crops

Cover crops are grown in agricultural fields both before the main crop is planted and after it is harvested. Cover crops can protect the soil, improve soil health, and immobilize nutrients to supply to subsequent crops. Many different plant species can be used as cover crops, each providing their own suite of potential benefits.

Benefits and functions of cover crops

Reduce water and wind erosion

Cover crops protect topsoil from water and wind erosion. The roots stabilize the soil, the stems intercept, slow, and disperse surface runoff, and the vegetation reduces the force of raindrop impact and increases surface roughness to slow winds. Water quality is protected as nutrients and chemicals bound to soil are less prone to being eroded by wind and water.

Reduce water losses

Cover crops conserve and even increase soil moisture by reducing evaporation, resulting in reduced stress to the main crop during drought periods. Roots also enhance water infiltration into the soil, which can increase soil water reserves and reduce surface ponding and runoff.

Nutrient cycling

Many cover crops act as temporary storage for nutrients. Some cover crop species scavenge nitrogen from the soil, which offers the added benefit of preventing nitrogen from leaching into groundwater, while other species fix atmospheric nitrogen. This stored nitrogen, along with other nutrients, is released as the cover crop decomposes and, if released at the appropriate time, could be made available for use by the subsequent main crop.

Enhances soil health & soil structure

Cover crops improve soil quality in a variety of ways. They increase soil biological activity and enhance biodiversity of soil organisms; species with deep roots or taproots can help break up soil compaction while fibrous roots systems can help bind soil particles together; high biomass cover crops increase soil organic carbon.

Economic benefits

Cover crops enhance nutrient cycling, moisture retention, and overall soil health which can result in increased crop yields. Cover crops diversify a cropping system which can reduce pressures from insects, nematodes, disease, and weeds, decreasing the need for pesticides and herbicides.

A cover crop of tillage radish provides many benefits including scavenging and storing nitrogen, alleviating soil compaction, suppressing weeds, reducing water and wind erosion, and increasing soil organic matter.

Types of cover crops

A number of plant species can be used as cover crops and will provide different benefits. Most cover crops can be categorized as legumes, grasses or brassicas.

Legumes

Legume cover crops fix atmospheric nitrogen and may supply this nitrogen to the subsequent crop if released back into the soil at the appropriate time. If legumes have not previously been planted in the field, cover crop seeds should be inoculated with nitrogen-fixing bacteria to optimize growth. Most legume cover crops can overwinter, offering protection during the high runoff events of late fall and spring when most nutrients and soil are lost. A legume cover crop that has overwintered may require manual termination.

Examples: Red Clover, Alfalfa, Hairy Vetch

Red clover, a type of legume cover crop, fixes nitrogen, protects the soil from erosion, suppresses weeds, and improves soil condition.

Oats, a type of grass cover crop, releases scavenged nitrogen when the plant decomposes.

Grasses

Grasses are non-legume cover crops that take up residual nitrogen from the soil but do not fix atmospheric nitrogen. If the non-legume cover crop is harvested, the nitrogen will be removed from the soil and no longer vulnerable to leaching. Otherwise, once the non-legume crop dies, the nitrogen that has been stored in the plant tissue will be released back into the soil and available to subsequent crops. Grass cover crops grow rapidly and produce a large quantity of biomass, increasing soil carbon and reducing erosion. Most grasses do not overwinter and will be terminated by cold temperatures; however, they can also be terminated chemically or mechanically in the fall or spring.

Examples: Oats, Barley, Ryegrass

Tillage radish, a species of brassica, can alleviate soil compaction and suppress weeds.

Brassicas

Brassicas are non-legume cover crops that scavenge nutrients from the soil. These cover crops grow rapidly and produce a large quantity of biomass, reducing erosion and increasing soil organic carbon. A unique characteristic of Brassicas is that they release chemicals that can be toxic to some weeds, nematodes, and other pests. Some species with a taproot can also help break up compaction.

Examples: Mustard, Rapeseed, Tillage Radish

Planning to use a cover crop

Careful planning is required to get the most out of the time and money invested in growing a cover crop.

Cover crop goals

Choose a cover crop that will match your goals. Some examples of cover crop goals include:

- Nitrogen cycling
- Reducing soil erosion
- Improving soil health and structure
- Increasing organic carbon in the soil
- Suppressing weeds, disease or pests

If a single-species cover crop does not meet your goals, consider using a multi-species cover crop. Be aware that multi-species mixes may require additional management, as the planting or termination timing of the various species in the mixture may differ from one another.

Crop rotation

Consider where in your crop rotation to use a cover crop. A rotation that includes winter wheat is a great opportunity to start using cover crops. Whether a cash crop or cover crop, winter wheat will offer overwintering soil protection. In addition, frost seeding a legume cover crop in the spring, or seeding an alternative cover crop immediately following wheat harvest, will provide an extended period of soil cover into the next winter. It is important to consider the potential residual effects of herbicides that may prevent successful establishment of certain cover crops and ensure that chemicals used to terminate cover crops will be compatible with the other crops in the rotation.

Seeding methods

The method of seeding depends on cover crop selection and farming operation, which in turn will influence the seeding rate and timing.

Drilling places the seed into the soil without prior soil cultivation and provides good seed-soil contact. Broadcast seeding a cover crop can occur with or without incorporation, although good seed-soil contact is difficult without a form of incorporation (pre-tillage may help). Both drilling and ground broadcast seeding require the previous crop to be harvested, which minimizes time for establishment of the cover crop. Cover crops seeded post-harvest should include species that grow in cool temperatures. Frost seeding a legume cover crop in the early spring when the ground is still frozen allows repeated freeze-thaw cycles to incorporate the seed into the soil.

Overseeding is when a cover crop is planted into a growing cash crop before leaf drop. The cover crop will grow as the main crop becomes established, which means shade-tolerant cover crops are required. This seeding method can maximize the timing for cover crop growth; however, good soil-seed contact may be problematic and interference with harvesting the main crop can be an issue. Overseeding can be done via aerial broadcast or on the ground using high clearance machinery.

A field where ryegrass has been overseeded into corn

Planning to use a cover crop (cont)

Growing conditions

Different cover crops require different growing conditions. Choose a cover crop that works well with your soil type, drainage, and climate. The method of seeding, time required for establishment, and termination will also influence the period of time available for growth.

Termination

A plan may be required to control the cover crop. Timing of termination is important to obtain the maximum cover crop benefits without interfering with the subsequent main crop.

Some cover crops are terminated by frost (winterkill), whereas a frost tolerant cover crop will need to be manually terminated in the fall or in the spring before planting the cash crop. If you plan to terminate an overwintering cover crop in the spring, choose a cover crop that will be manageable and not a nuisance for the main crop. Manual termination can be accomplished with machinery (tillage and mowing) or herbicide.

Cost

The availability and price of cover crop seed varies each year. Contact your local seed supplier for details. For a list of Ontario seed suppliers, please visit: http://www.omafra.gov.on.ca/english/crops/resource/covercrp.htm

A multi species cover crop mix of Oats, Field Peas, Oilseed Radish, Barley and Sunflower seen growing in the top photo and showing termination in the bottom photo. These species are all frost terminated; however, it is important to note that winterkill is not always reliable for Barley and Field Peas during mild winters. It is important to have a backup termination plan ready.
(Courtesy of Maitland Valley Conservation Authority)

Cover crop decision tool

There are many different species of cover crops, with each kind having different functions and benefits. Finding a species, or mix of species, that will help achieve your objective for using a cover crop is key. The **Cover Crop Decision Tool** (http://decision-tool.incovercrops.ca/) can help identify the cover crop best suited to meet your cover crop goals. The decision tool has information on each cover crop including planting information, termination methods, as well as the advantages and disadvantages of that crop.

Additional Information

There is a lot of cover crop information available on the Internet including the following sites:

For more in-depth information on cover crops, please visit:
http://www.sare.org/Learning-Center/Topic-Rooms/Cover-Crops

For more information on different cover crop choices in Ontario, please visit:
http://www.omafra.gov.on.ca/english/crops/facts/cover_crops01/covercrops.htm

Growing Forward 2
A federal-provincial-territorial initiative

OSCIA
Grassroots Innovation
Since 1939

UPPER THAMES RIVER
CONSERVATION AUTHORITY

Ontario

Canada