FIELD GOOD AGRONOMICS

Fact Sheet #2018.3

Utilizing Intercrops and Cover Crops to Improve Soil Health

The 2011 census reported that Canadian farmers have increased soil organic carbon since 1981 by adopting zero to minimal till management. (Agriculture and Agri-Food Canada).

However, continuous monocropping has left our soils compact with little active soil biology. Pesticide reliance has also increased, with concerns of weed and disease resistance on the rise. Incorporation of intercrop and cover crop systems has been shown to successfully combat some of these issues.

Cover Crops

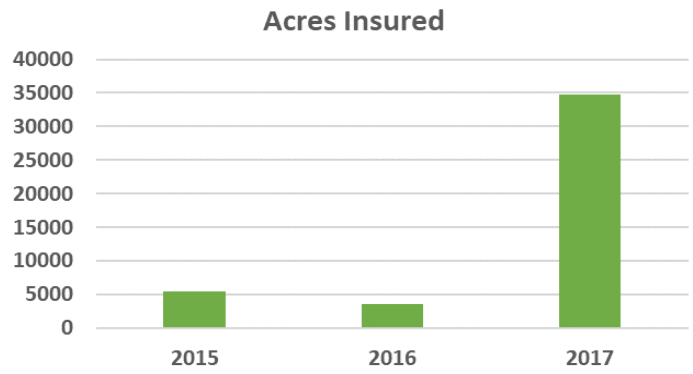
Cover crops, also known as "green manure" or "green mulch," provide many benefits when added to current farming practices.

- Designed to keep photosynthetic plant material on the surface of the soil to protect it from erosion and nutrient leaching
- Usually underseeded with an annual crop, either at seeding time or following emergence of the annual crop
- Following harvest, the cover crop is either worked back into the soil, terminated by a herbicide program, or grazed by cattle.

Intercropping

Intercropping combines 2 or more cash crops together in one field, opposed to the conventional monocrop method where 1 cash crop is grown individually in one season.

- Insured intercropped acres are increasing (Saskatchewan Crop Insurance Corporation)



Benefits

- Compact soils tend to have high bacterial populations, which compete with the plant for nutrients and contribute to nutrient immobilization
- Extensive rooting systems improve soil aggregation and structure, providing an environment for beneficial microorganisms
    - Predate on bacteria and improve nutrient cycling
    - Protozoa alone can increase nutrient mineralization by 45% (Jill Clapperton, Rhizoterra; 2017)
- Cover crops and buffer strips provide habitat for beneficial insects such as bees and predatory ladybugs, beetles and crickets
- Beneficial insects feed on troublesome crop pests such as aphids and diamondback larvae, as well as the seeds of common weeds
    - Weed-seed predation is responsible for up to 90% of all weed-seed losses (Chris Willenborg, The Western Producer; 2017)
- Enhanced weed competition from the cover crop
- Overyielding often occurs on intercropped fields
    - Yield of the intercrop exceeds the yield of the component crops grown in monoculture on the same total land area (University of Manitoba).

Seeding

Intercrop seeding management is a bit different from conventional monocrop seeding. Lana Shaw suggested a simple rule of thumb for intercropped seeding rates where the "pulse should be greater than 75% and the oilseed/cereal should be less than 50% of the recommended monocrop seeding rates" (South East Research Farm).

There are a couple different seeding methods that have been shown to work for both of these alternative cropping systems:

- Alternate Row - Seed the cover crop (or annual in intercrop system) in alternate rows from the main annual. This method is beneficial when seeding at different depths.
- Mixed seeding within row – One pass system where annual crop is seeded in the same row as the cover crop, or for intercropping both annuals are seeded in the same row. Need to consider the symbiotic compatibility of the two crops together. Clover is a great option for the cover crop system as it isn't very aggressive at emergence.
- Broadcast – After the annual crop has been seeded, broadcast the cover crop or second annual following emergence.

Intercrop mixtures

It is recommended that a new grower only start with a 2 crop mixture until they are comfortable with management of seeding, harvest and seed storage/separation. It is also important to match the maturity of the companion crops.

- For example, with a pea/canola mix choose a late maturing pea variety and early maturing canola variety.
- Beneficial to choose a canola variety that is pod shatter resistant so that there is flexibility with harvest timing.

Below is a list of some mixtures that Lana Shaw has suggested from research conducted at the Agri-ARM South East Research Farm.

- Pea with canola or mustard
- Fababean with canola
- Lentil with mustard
- Soybean with flax
- Chickpea with flax

Pea and canola intercrop

Photo credit: Lakeland Agricultural Research Association

Perennial Cover - using perennial forage mixtures such as wheatgrass and bromegrass for long term cover

- Produce a much more extensive root system than annual crops
- Nitrogen fertility enhancement by the growth of legumes within the perennial mixture
- A reduced rate of organic matter decomposition
- Carbon storage and sequestration
- Improved water infiltration rates

Useful Cover Crops

Legumes - capable of fixing nitrogen and has been shown to contribute a significant amount of nitrogen to the current crop and crops in subsequent years.

- Red Clover: short lived perennial legume which can overwinter. Not very aggressive so can be seeded in a mixed row with annual crop.
- Alfalfa: herbaceous perennial legume which can overwinter.

Red clover cover crop

Photo credit: Ralph Pearce, CountryGuide

Non-legume Broadleaves

- Tillage Radish/Turnips: Brassicae family. Deep rooted plant that provides deep soil nutrient recovery as it brings a variety of deep nutrients to the surface, making them available to the annual crop. Easily decomposable residue.
- Buckwheat: Polygonaceae family, summer annual. Aggressive low canopy crop making it very good at outcompeting weed species. Needs to be terminated before going to seed. Easily decomposable residue.

Tillage radish/turnip cycle in the soil

Links

Agri-ARM South East Research Farm https://www.southeastresearchfarm.org/home.html

Agriculture and Agri-Food Canada
http://www.agr.gc.ca/eng/science-and-innovation/agricultural-practices/soil-and-land/soil-organic-matter-indicator/?id=1462905651688

Alberta Agriculture and Forestry
http://www1.agric.gov.ab.ca/%24department/deptdocs.nsf/all/agdex890

Country Guide https://www.country-guide.ca/2016/10/11/back-to-cover-crop-basics-with-red-clover/49613/

Lakeland Agricultural Research Association http://www.laraonline.ca/trial-runs-projects/peola-intercropping-peas-and-canola/

Michigan State University
http://msue.anr.msu.edu/news/benefits_of_using_red_clover_as_a_cover_crop

Ontario Ministry of Agriculture, Food, and Rural Affairs
http://www.omafra.gov.on.ca/english/crops/facts/cover_crops01/cover.htm
http://www.omafra.gov.on.ca/english/crops/facts/cover_crops01/covercrops.htm

Rhizoterra https://www.rhizoterra.com/What_is_soil_health

The Western Producer https://www.producer.com/2017/11/farmers-must-foster-weed-seed-eaters/

University of Manitoba
http://umanitoba.ca/outreach/naturalagriculture/articles/intercrop.html