

Soil Conservation Practices

Soil is the most important resource on which agriculture is based. Proper management of this valuable resource is vital to sustain long-term agricultural productivity. Unfortunately, soil erosion is usually only identified as a problem when channels are cut through fields that are so deep they restrict cultivation practices. In fact, soil erosion occurs at unsustainable levels when small rills are recognizable in a field.



Gully erosion through a field

Soil loss is not only a problem for the farmer, with the loss of organic matter and fertility, it is also an environmental problem. Sediment entering streams can destroy fish habitat and water quality especially when soil particles contain contaminants such as pesticides or nutrients.

Soil conservation practices are tools the farmer can use to prevent soil degradation and build organic matter. These practices include: crop rotation, reduced tillage, mulching, cover cropping and cross-slope farming.

Crop Rotation is a tool that enables farmers to increase soil organic matter content, soil structure and rooting depth. This is accomplished by growing secondary crops which enhance soil health.

Root crops are particularly destructive to soil structure because of the extensive shattering of soil aggregates during seedbed preparation and harvest. For this reason, root crops should not be grown more than once every three years.

A recommended rotation for a root crop is:

- Year 1 - root crop
- Year 2 - grain underseeded to forage
- Year 3 - forage



A forage, grain and potato rotation grown in strips across the slope

The recommended crop rotation where the primary crop is corn consists of two years of silage corn followed by three or more years of forage. No-till planting, cover cropping or mulching, should be incorporated into this rotation. Where field slope is flat and grain corn is grown, then corn can be grown for three years. When growing grain corn and silage corn, it is recommended to grow the grain corn

on the sloping fields, as grain corn leaves considerably more residue on the soil surface than silage corn.

Cover Cropping and Mulching are effective at reducing soil erosion by leaving a cover over the soil which reduces soil displacement associated with the impact of raindrops hitting soil particles. They also reduce the volume and velocity of runoff over the soil.



Cover crop drilled into harvested corn silage field

Selecting the correct cover crop depends on:

- How much cover will the crop supply
- Can the crop be harvested the next season
- The importance of weed control
- Soil improvement
- Nutrient conservation
- Date of seeding

Cover crops should be seeded in time to produce a minimum of 10 cm of growth (tillering stage) before winter. If this growth is not achieved by the end of November then the field should be mulched.

The following table can be used as a guide to the latest seeding dates for cover crops. These dates may vary depending on the fall climate and location in the province.

<u>Crop</u>	<u>Date</u>
Annual ryegrass	Sept. 25
Spring cereals	Oct. 1
Winter wheat	Oct. 4
Fall rye	Oct. 8

Cover crops can be seeded by conventional methods, by no-till drills or by broadcast seeding 2 to 5 days prior to a crop harvest. Winter wheat or fall rye should be seeded at a rate of 140 kg/ha and annual ryegrass at a rate of 30 kg/ha.



Barley growth germinated by chisel ploughing after grain harvest in August

Mulching consists of applying organic material over the exposed soil. Hay makes the best mulch, but it is important to ensure that the hay is harvested before weeds are mature. Straw can also be used.

Mulch should be applied to fields after late season crops (i.e. carrots, potatoes, onions and corn) are harvested. Mulch should be applied at a rate of 3.3 to 4.5 T/ha to ensure at least 85% cover of the soil surface.



Hay mulching on a snow covered field at rates of 4.5 (left) and 2.2 tonnes per hectare (right)

Ensure that equipment applying mulch travels across the slope of the field to avoid wheel ruts down the slope of the field where runoff can flow. Mulching with hard core round bales and

positioning the bales throughout the field will save time and enable up to 10 ha to be mulched in a day.



Mulch can be applied on frozen ground to avoid rutting the field

Mulch can be ploughed under in the spring to provide organic matter to the soil

Conservation Tillage is field operations aimed at preserving soil aggregates, organic matter and surface residue from previous crops.

Conservation tillage can include changes such as:

- timing of tillage (fall to spring)
- using less destructive tillage implements (chisel plough instead of moldboard plough)
- less tillage (one pass instead of two)



Residue levels of 54% after one pass of a coulters cart (on left) and 24% after mulch tilled (on right)

Residue management is a facet of conservation tillage that is designed to leave crop residue on the soil surface to prevent erosion. The amount of residue on the soil

surface depends on the amount of residue left from the previous crop and the tillage performed.

Tillage affects residue levels by:

- burying more residue with each pass
- burying more residue with increased speed
- discs bury more residue than shovels
- moldboard ploughs bury almost all residue

Cross-Slope Farming is the practice of conducting field operations perpendicular to the field slope. This includes:

- Tillage and seeding
- Planting strips of different crops
- Diversion terraces

Cross slope farming is the most effective method to control large volumes of runoff that flow over a long field. Other soil conservation practices can be effectively integrated with cross slope farming.

Farming across the slope requires fields to be wide enough to efficiently farm and may require equipment modification to avoid side hill slippage on steep slopes.

Diversion terraces are shallow grassed ditches, with a berm on the downhill side, which are constructed across the slope to intercept surface runoff water moving down the field. The terraces decrease the slope length and remove large flows of water safely from the field with the help of grassed or rock waterways.

Terrace construction information:

- Terraces may remove up to 5% of land from production
- Terraces should be designed to have a grade along the length that is less than 2%
- The position of a terrace in a field depends on field slope, soil type and other soil conservation practices used.



Soil excavated when forming the channel is used to construct the berm



Erosion mat or straw should be used when seeding a waterway

Grassed waterways are shallow channels that allow large volumes of runoff to flow down a slope without causing erosion. Grassed waterways can be constructed in natural depressions in fields where water accumulates. Waterways should be 6 m wide, 30 cm deep and have a saucer shape.

Tillage should be performed perpendicular to grassed waterways. The tillage equipment should be lifted gradually when approaching the waterway to ensure that the runoff water enters the waterway and avoids water flowing along the tilled field parallel to the waterway.



Grassed waterway

Waterways should be:

- Covered with jute mat or straw before seeding
- Seeded before the end of August
- Lined with geotextile and quarry stone on steep slopes
- Fertilized and mowed annually
- Not used as a roadway
- Repaired or reseeded when necessary

Buffer strips are vegetative areas that separate field boundaries from watercourses. These buffer strips are effective at stabilizing stream banks with their extensive root system. They are also efficient at preventing soil and contaminants from entering watercourses by providing an area for field runoff to collect. These areas allow soil particles to settle out of the runoff water. A proper buffer strip should consist of at least 3 m of natural vegetation and, if the field is row cropped, an additional 2 m wide grassed buffer strip should be left.



Watercourse with rockied banks and a grassed buffer strip

Stream banks in high flow watercourses will need additional protection from erosion. These areas require the placement of large rock along the banks. A permit from the Nova Scotia Department of Environment and Labour is required for any construction work along a watercourse.