BMPs THAT COMPLEMENT CROPLAND DRAINAGE

Not all drainage BMPs relate directly to the planning and management of drainage infrastructure. Soil health and management practices can help to reduce the need for drainage caused by soil degradation. Other practices, such as proper pesticide and nutrient application, can help reduce the concentration of soil sediment and crop inputs moving into and out of cropland drainage systems. This chapter introduces several of these BMPs, which are explored fully in other BMP books.

Soil organic matter is a very small part of the soil with a large role to play. Many soils used for crop production have soil organic matter levels between 2 and 4%. And yet, organic matter is second only to soil texture in importance.

BMPs FOR SOIL MANAGEMENT

Many problems with wet soil and drainage maintenance can be prevented or rectified with soil management BMPs.

Soil management BMPs include practices that:

- add organic matter
- reduce organic matter loss
- improve structure and porosity
- reduce the risk of compaction.

You will definitely find some overlap among the BMPs that address a particular problem. This is good news: adopting one measure can often help you on several fronts.

Organic Matter Additions

Growers can directly affect the organic content of their soils. Excessive tillage, soil erosion and poor crop rotation will accelerate the loss of organic matter. On the other hand, there are a number of BMPs that maintain and improve organic matter.

✔ **Cover crops such as rye, oats and barley are suitable cereal cover crops for most soils. Others such as field peas, buckwheat, and oilseed radish can also be useful. Cover crops improve surface drainage conditions.**

✔ **Forages in rotation such as grass or legume-based hay crops will add some organic matter and greatly improve seedbed structure in the short run. Suitable forages include: trefoil, red + alsike clover, orchardgrass, and timothy.**

Conservation Tillage Systems

Conservation tillage systems such as no-till involve very limited tillage and the management of residue left by the previous crop. Mulch tillage (e.g., chisel plough) mixes residue into the soil surface to reduce wind and water erosion. Vertical tillage leaves more residue on the soil surface than mulch tillage, and reduces the potential for tillage erosion.

✔ **Mulch tillage refers to any system where the soil is moderately disturbed between harvesting one crop and planting the next, and at least 30% of residue is left on the soil surface. Mulch tillage systems improve infiltration rates and reduce runoff.**

Reducing Surface Crusting

Following the rapid wetting and drying of an overworked seedbed, a solid sheet forms (0.2–5 cm or 0.07–2 in. thick) that is tight enough to prevent water infiltration and crop emergence. A track record of poor soil management (e.g., excessive tillage) and few organic matter inputs is most often the cause.

✔ **Adopt tillage options that maintain at least 50% of aggregates greater than 2 mm (0.07 in.) or use reduced secondary tillage, no-till or mulch tillage to reduce soil structure degradation and leave crop residue on the soil surface.**

✔ **Rotate crops to include soil-building crops such as grasses and legumes or cover crops.**

✔ **Manage manure to build soil organic matter.**

✔ **Use timely tillage. Prevent soil clodding by tilling only when soil moisture is suitable. Only use a rotary hoe to break up the crust if a crust has formed before the crop emerges: this is a remedial measure.**

Reducing Compaction

Compaction is the process of increasing soil density by packing soil particles closer together. It can occur anywhere in the soil profile, but tends to be seen near the surface or at plough depth. Soil compaction can impede the movement of water through soil by gravity. Soil management BMPs can lessen the impact of compaction on soil structure.

- ✔ Time operations with care. Stay off wet fields. Check that soil has proper moisture conditions for working at (and below) tillage depth.
- ✔ Use longer crop rotations that include forages/cereals. Soils with subsurface drainage can grow a wider range of deep-rooted crops (e.g., alfalfa).
- ✔ Limit the amount of traffic, including tillage, across a field.
- ✔ Use controlled traffic strategies such as tramlines or strip tillage.

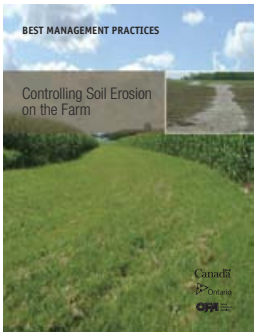
✔ Adjust tillage equipment. Ensure it lifts and shatters soil (coulter chisel, cultivator) as opposed to pulverizing and grinding (disk). Alternate tillage depth so that tillage pans aren't created, or try no-till.

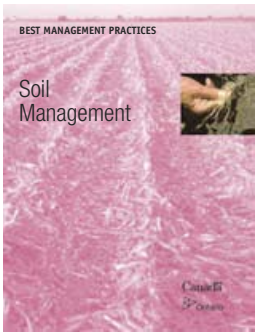
Non-Tillage BMPs for Cropland Conservation

Non-tillage practices can help to control erosion by reducing the effect of steep slopes and increasing soil cover. Conservation practices include cropland buffers and contour farming.

- ✔ In areas of extreme erosion, consider retiring the land with tree plantings.

✔ Contour strip cropping involves alternate strips of row crops, cereals and forages on the contour level, which slow surface flow and increase infiltration rates.





BMPs TO MINIMIZE CROP INPUT RUNOFF

Without careful consideration and management, crop inputs applied to cropland can find their way to drainage channels and natural watercourses.

Implement BMPs on the land adjacent to the surface channels or surface inlets (including blind inlets) to reduce the risk of these materials entering the cropland drainage system. Take special care when applying nutrients, manure, or pesticides in fields where surface inlets have been installed.

By combining the BMPs in the previous section with BMPs for nutrient and pesticide application, you'll drastically reduce the potential for contaminated drainage outflow.

Nutrient Application

Crop nutrients are applied to soil in the form of inorganic fertilizers, manure and biosolids. The following BMPs are suitable for the application of all forms of crop nutrients.

✔ Test soil regularly. Follow soil test results. In this way you'll apply what's needed – reducing risk of loss from the soil system.

✔ Calibrate crop nutrient (e.g., manure) application equipment. Accurate application rates and uniformity will reduce the risk of loss from cropland.

✔ Prepare and follow a nutrient management plan for your operation. It will help balance crop nutrient requirements with nutrient applications, and will set out effective separation distances.

To reduce the risk of manure in outflow, follow these BMPs.

✔ Reduce manure application rates if there's a chance for manure in outflow, i.e., when soils are too wet, in early spring and late fall, and following several consecutive days of rain

- always consider reducing rates instead of pre-tilling on highly erodible, fragile soil.

✔ Spread manure when the ground is dry and no water is flowing from the drainpipe.

✔ Pre-till land before applying liquid manure.

✔ Don't spread if any one of the following conditions is present:

- rainfall occurs shortly before application
- heavy rains are forecast within 12–24 hours of spreading on subsurface-drained lands
- ground is frozen and/or snow-covered.

✔ Incorporate manure when and where there is minimal risk for soil erosion.

✔ Develop a monitoring and contingency plan for manure application. React to spills and leaks. This will reduce the risk of manure entering the drainage system.

Check flow from end pipe at outfalls for discolouration and odour after applying liquid manure.

For more information on nutrient management, please see the Best Management Practices books, *Managing Crop Nutrients, Manure Management* and *Nutrient Management Planning*.

Pesticide Application

Herbicides and other pesticides are very expensive, and must be applied judiciously in crop production systems to help you reach goals for crop yield and quality.

✔ Employ integrated pest management strategies. Identify, monitor, and determine critical pest and economic thresholds – before selecting pest control methods.

✔ Read and follow the label instructions before making application. Do not exceed recommended rate and frequency of pesticide use.

✔ Select nozzles to attain the droplet size spectrum that will give you proper coverage and deposition. This will reduce the risk of pesticide drift.

✔ Calibrate your application equipment before using it.

✔ Don't spray pesticides if weather is inappropriate, e.g., rain or high wind. Washed-off insecticides and fungicides can cause off-site damage and reapplication is expensive.

When applying pesticides, follow label directions for separation distances from environmentally sensitive areas.

For more information on pest management, see the BMP books, *Integrated Pest Management* and *Pesticide Storage, Handling and Application*.