



Direct Seeding

March 1996

Agdex 570-6

Soil Quality and Moisture Conservation Benefits of Direct Seeding

Direct seeding of crops into standing stubble can enhance soil quality and moisture conservation by reducing the detrimental effects of tillage on soil. In comparison to conventional tillage systems, direct seeding can result in:

- better water infiltration
- increased seedbed moisture
- increased soil organic matter
- reduced soil erosion potential

The extent to which these benefits are realized depends on local soil type and weather conditions.

Water Infiltration Increases

Tillage can reduce infiltration of rain and snowmelt by changing the natural soil structure. Cultivator shovels, discs or plows create a compacted layer (or shear plane) beneath the bottom of the implement. Tillage also destroys natural pores, root channels and cracks, and fills them with loose soil particles. This problem is more pronounced in clay soils.

Direct seeding leaves more of the soil's natural channels and cracks intact, allowing water to infiltrate more easily. This is very important for deep storage of soil moisture, for reducing water ponding on the soil surface and for reducing runoff and water erosion.

Tillage can also reduce infiltration by leaving the soil surface bare of crop residue. Raindrop impact and running water can loosen soil particles and carry them into soil pores, sealing off the soil surface. On direct-seeded fields, crop residue cushions the impact of rainfall and reduces runoff, so soil particles are not as easily dislodged and moved.

Seedbed Moisture Increases

Standing stubble in the spring preserves seedbed moisture for planting. Soil moisture is greater in direct-seeded fields because of increased snow trapping and reduced evaporation at the soil surface. Higher moisture levels can improve crop germination in drier, warmer springs. However, in wetter and cooler springs, higher soil moisture may reduce soil temperature and delay crop development.

Wetter soils are slower to warm. As a result, direct-seeded fields are usually about 0° to 3°C cooler than tilled fields in the spring, depending on soil texture and amount of crop residue cover. Clay soils hold more moisture and tend to be cooler than loamy or sandy soils. See *Soil Temperature and Direct Seeding* (Agdex 590-2) for more information.



Soil Organic Matter Increases

Soil organic matter is a storehouse of plant nutrients and a binding agent that influences soil erodibility, aeration and water storage. Increasing organic matter increases the soil's nutrient- and moisture-holding capacity and reduces soil crusting.

Direct seeding can increase organic matter content in the upper soil layer if crop yields are maintained. Reduced soil disturbance helps to preserve organic materials that naturally accumulate from crop root growth and decomposition. Research has shown that the increase in organic matter is more pronounced for continuous crop rotations where straw is not removed.

The limited soil disturbance and increased crop residue cover under direct seeding also tend to increase earthworm populations. Earthworms are beneficial because they speed up recycling of crop nutrients from surface residue and may create large soil pores that help to improve water infiltration rates.

Long-term studies have found that direct seeding's most dramatic effect on soil organic matter is to increase its *active fraction*. The active fraction is made up of living organisms and readily decomposable organic materials. It is only a small proportion of the total organic matter pool; the rest is composed of compounds called *humus*, which are more complex and more resistant to decomposition. Increasing the active fraction helps soil to more quickly convert plant materials into crop nutrients and may help to decompose contaminants.

Soil Erosion Risk is Less

Water and wind erosion can reduce crop yields and physically destroy emerging crops. Direct-seeded fields are much less susceptible to erosion because of the protection provided by standing stubble. Soil texture, slope and the amount and type of crop residue also affect erosion risk.

Summary

Direct seeding systems can improve several factors affecting crop productivity. These include increased water infiltration, increased seedbed moisture, enhanced soil organic matter and reduced risk of soil erosion.

*Prepared by Robert Dunn and John Zylstra,
Alberta Agriculture, Food and Rural Development*

Factsheets in the Direct Seeding Series are also available through Alberta Agriculture's Internet site at <http://www.agric.gov.ab.ca/agdex/500/index.html>