

What is Soil?

Soil is a natural resource, like water and minerals. Healthy soil is critical in natural ecosystems and sustains our need to grow plants for food and fiber. Soil gives plants a place to sink their roots and anchor themselves. Soil is also a community with billions of organisms. Soil contains **organic matter** (decaying or decayed living things) and **minerals** (broken down rock). Soil that contains a partly decayed organic matter is called **humus**.

How Do Soils Develop? Five factors determine how soils develop:

- Parent material (mineral matter - rock, soil clay)
- Climate (determines the kinds of plants, how fast they grow and decompose)
- Vegetation (determines the amount and type of organic matter in the soil)
- Landscape (helps to prevent erosion)
- Time (all these process happen over long periods of time)

Healthy soil contains soil-dwellers and decomposers. The decomposers break down plant and animal tissue, forming humus, which helps roots grow by trapping water and air.

The four main types of decomposers are:

- Bacteria
- Fungi (including moulds and mushrooms) - make nutrients available to plants
- Microscopic actinomycetes (a special type of bacteria)
- Earthworms (eat soil, grind, digest and mix it - their tunnels provide air and the mucus helps stick soil particles together)

Characteristics of Different Types of Soil



Sandy	Loam	Clay
Runs between your fingers	Feels crumbly	Feels slippery when wet
Few lumps	Soft and feathery	Dry clay is very hard
When moistened and squeezed, it will not stay together	When moistened and squeezed, it will stay together forming a loose ball	When moistened and squeezed, it will stay together forming a tight ball
Light brown	Dark brown or black	Color is determined by the minerals it contains
Mostly minerals	Balance between mineral particles and organic matter	Mostly minerals, little humus
Little food for plants	Lots of nutrients for plants	Fine texture
Dries quickly	Absorbs water very well	Small pore size

Different Plants for Different Soils

Even though loam soil appears to be the best type of soil for all plants, not all plants grow well in it. Plants are adapted to different soils.

Practices Can Improve or Degrade Soil

To be economically sustainable, farmers need to make more money with their crops than they spend to grow their crops. They are able to do this by using very large machinery that can cover large parcels of land as they seed and harvest their crops. They also need to add fertilizer to the soil to increase the yield and irrigate to provide the need moisture for growth of the crop. Most farmers only grow one type of crop in one particular area - this is known as **monoculture**.

Fertilizer Use

Loss of organic matter is a very serious problem and can lead to soil erosion. If the soil has lost this organic matter (which has been built up over many years) the plants may not grow very well, because of the lack of sufficient nutrients in the soil. Plants require 6 basic nutrients from the soil in order to grow healthy. These nutrients are: nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), and magnesium (Mg). Typical nutrients in fertilizers are:

- The first number in a fertilizer formula is the amount of nitrogen in the fertilizer ... **Nitrogen** ... which is used by plants for producing **leaf growth and greener leaves**. Urea and ammonia are both used as sources of nitrogen.
- The second number is the phosphorus amount of ... **Phosphorus** ... which is used by plants to **increase fruit development and to produce a strong root system**.
- The third number is the amount of ... **Potassium** (potash) ... which is used by plants for **flower color and size**. It also helps to **strengthen the plant**.

Irrigation

Irrigation is a technique that farmers use to make sure that moisture gets into the soil for crop growth. It is often a problem in grassland areas, where the moisture evaporated quickly. Irrigation systems (using natural waterways and irrigation canals) can often be the life or death of a crop and must be maintained, to ensure an adequate supply of water is available when it is needed.

Clearing the Land

Farming practices changed from using human and animal power in the early 1900's to total mechanization by the 1950's to modern computerized controls in the present. Production practices have, over time, sometimes damaged large areas of soil throughout the Prairie Provinces. The white crusty ring around a body of water is salt, which has run off the land into the water. This condition is called **salinization** (salty soil) and can have the same effect as a drought. Two factors lead to increased salinization: not enough vegetation or too much water (irrigation). This problem can be corrected by replanting the areas where there is very little vegetation, so the plants can use up the water that falls before it runs off as excess or seeps into the soil dissolving the mineral salt in the soil and getting into the groundwater. Ploughing and cultivating the soil too much and the practice of regular summer fallow (cultivating the land to control weeds - by not planting a crop) exposes the soil surface to sunlight and higher temperatures, encouraging bacteria to decompose organic matter at a rapid rate and exposes it to sun and wind - thus increasing topsoil erosion.

Protecting Soil - Soil erosion can be prevented by planting a cover of vegetation on the surface to slow the flow of water runoff (giving it more time to absorb more water). This vegetation also helps to anchor the soil particles from the wind. **Zero Tillage** is one way to accomplish this and it also helps control the growth of weeds. Special farming equipment is also used, like the **Noble blade and drill** that replaced traditional plows. **Shelterbelts** (rows of trees), **Modification of waterways**, and **Crop rotation** (forage crops to add more organic matter - manure from livestock). This involves planting a different crop in a particular field every year. The plants from the different crops use the nutrients the other crops don't need.

Forestry can also have an impact on soils. Removal of trees from a particular area can lead to erosion by wind and water. Cut areas often are littered with debris, which has been left to lower erosion (and add organic matter to the soil) and replanting programs are started after the trees have been harvested. Vegetation near waterways is usually left undisturbed.

Hydroponics is a technique for growing plants, without soil in a water solution. (This occurs in greenhouses)