SOIL COLOUR

Organic matter (humus), manganese and iron are the primary coloring agents in soil.

The dark color of many productive soils in Nebraska and throughout the Midwest is due to organic matter.

The dark soil color from organic matter at the soil surface aids in the absorption of heat from sunlight to warm the soil.

Soil shades of red, yellow and gray are due to the amount and chemical form of iron and manganese present. Red soils contain oxidized iron. Oxidized iron is also observed on metal objects that have been exposed to the atmosphere. We call it rust.

Yellow soils contain hydrated iron. Gray soils indicate chemical reduction of iron and/or manganese due to wetness and lack of oxygen. Yellow and gray coloration can be found in the subsoil of some Nebraska soils which remain wet for some portion of the year. These subsoil colors serve as an important indicator of natural drainage conditions. In a soil series description, these colors are designated by the term "mottles" as for the Aksarben series.

Sloping land that has been eroded excessively may expose subsoil horizons that are lighter in color and possess little organic matter.

SOIL WATER

Soil acts as a sponge to take up and retain water. Movement of water into soil is called infiltration, and the downward movement of water within the soil is called percolation, permeability or hydraulic conductivity.

Pore space in soil is the conduit that allows water to infiltrate and percolate. It also serves as the storage compartment for water.

Infiltration rates can be near zero for very clayey and compacted soils, or more than 10 inches per hour for sandy and well aggregated soils.

Low infiltration rates lead to ponding on nearly level ground and runoff on sloping ground. Organic matter, especially crop residue and decaying roots, promotes aggregation so that larger soil pores develop, allowing water to infiltrate more readily.

Permeability also varies with soil texture and structure. Permeability is generally rated from very rapid to very slow (Table 2.4). This is the mechanism by which water reaches the subsoil and rooting zone of plants. It also refers to the movement of water below the root zone. Water that percolates deep in the soil may reach a perched water table or groundwater aquifer. If the percolating water carries chemicals such as nitrates or pesticides, these water reservoirs may become contaminated.

Permeability class	rate (inches/hour)
very rapid	greater than 10
rapid	5 to 10
moderately rapid	2.5 to 5
moderate	0.8 to 2.5
moderately slow	0.2 to 0.8

slow	0.05 to 0.2
very slow	less than 0.05

Table: Permeability classification system

Several terms are used to describe the water held between these different water contents.

Gravitational water refers to the amount of water held by the soil between saturation and field capacity.

Water holding capacity refers to the amount of water held in the soil against gravity, or the total volume of water in the soil at field capacity. Plant available water or available water capacity is that portion of the water holding capacity that can be absorbed by the plant, and is the amount of water held between field capacity and wilting point.

The volumetric water content measured is the total amount of water held in a given soil volume at a given time. It includes all water that may be present including gravitational, available and unavailable water.

Water in the form of precipitation or irrigation infiltrates the soil surface. All pores at the soil surface are filled with water before water can begin to move downward. During infiltration, water moves downward from the saturated zone to the unsaturated zone. The interface between these two zones is called the wetting front.

When precipitation or irrigation cease, gravitational water will continue to percolate until field capacity is reached. Water first percolates through the large pores between soil particles and aggregates and then into the smaller pores.

Available water is held in soil pores by forces that depend on the size of the pore and the surface tension of water. The closer together soil particles or aggregates are, the smaller the pores and the stronger the force holding water in the soil. Because the water in large pores is held with little force, it drains most readily. Likewise, plants absorb soil water from the larger pores first because it takes less energy to pull water from large pores than from small pores.