USDA NRCS
Natural Resources Conservation Service
Conservation Across America

Estimating Soil Moisture by Feel and Appearance

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Evaluating soil moisture using feel and appearance is a simple low cost method that may be used to:

- Determine when irrigation is needed.
- Estimate the available water in the root zone prior to planting or irrigation
- Estimate the amount of irrigation water to apply
- Determine the depth of penetration of irrigation water.

During the process of collecting soil samples for moisture assessment, the producer will have an opportunity to identify restrictive layers caused by compaction, as well as, some non water related problems like weed or insect pressure and nutrient deficiencies.

Prior to the collection of samples for estimating soil moisture, the producer must determine the soil type, texture and available water holding capacity of each layer sampled. Soil texture, which is the relative amounts of sand, silt, and clay contained in soil, plays an important role in determining the amount of water a soil will hold. The portion of water in the soil the can be readily used by plants is the available water capacity (AWC) of the soil. The AWC ranges shown in **Table - 1** for various textural groups may be used as a guide in estimating soil moisture. Soil maps, soil texture, and AWC for each soil type can be found in a published Soil Survey Report available through the USDA, Natural Resources Conservation Service office in each county or state.

Table 1 - Typical Available Water Capacity (Inches/Foot) for Given Textural Range

		Available Water Capacity (AWC)
Coarse Texture –	Fine Sand and Loamy Fine Sand	**0.6 – 1.2**
Moderately Coarse Texture -	Sandy Loam and Fine Sandy Loam	**1.3 – 1.7**
Medium Texture –	Sandy Clay Loam, Loam, and Silt Loam	**1.5 – 2.1**
Fine Texture –	Clay, Clay Loam, and Silty Clay Loam	**1.6 – 2.4**

USDA, Natural Resources Conservation Service, Program Aid 1619.

Sampling Procedures

Soil moisture is typically sampled mid-way through 1-foot increments in uniform soils, or mid-way through increments that correspond to the natural soil layers in the profile. For example, if a soil had 14 inches of fine sandy loam over clay, the first sample would be 7 inches deep, then sample in 1-foot increments thereafter to bottom of the root zone. For most agronomic crops a sampling depth of 3 – 4 feet will be sufficient to comprise the active root zone. Three or more sampling sites per field should be evaluated depending on the crop, field size, irrigation method, and soil variability.

For each sample the feel and appearance method involves:

1. Obtaining a soil sample at the selected depth using a probe, auger, or shovel;
2. Squeezing the soil sample firmly in one hand several times to form an irregular ball;
3. Observe ability to a form ball, ability to ribbon, loose particles, soil/water stains on fingers, and soil color. A ribbon is formed when soil is squeezed out of hand between the thumb and index finger. Note: A very weak ball falls apart in one bounce of the hand. A weak ball falls apart in 2 – 3 bounces.
4. Compare observations with Figures 1 through 4.

Example for a Uniform Soil Profile

USDA, Natural Resources Conservation Service, National Engineering Handbook, Section 15.

Sample Depth (inches)	Soil Layer Thickness (inches)	USDA Texture by Layer	Field Capacity (percent)*	AWC for Layer (inches)**	Water Available (inches)	Water needed to get to 100% field capacity (inches)
6	0 – 12	Sandy Loam	30	1.4	0.42	0.98
18	12 – 24	Sandy Loam	45	1.4	0.63	0.77
30	24 – 36	Loam	60	2.0	1.20	0.80
42	36 - 48	Loam	75	2.0	1.50	0.50
			Totals	6.8	3.75	3.05

***Estimated by feel and appearance**
**** From Soil Survey**

Result:

- AWC in the 48” root zone at 100% field capacity is …… 6.8 inches
- Current estimated water available for plant use …… 3.7 inches
- Net irrigation requirement or need …… 3.1 inches

Figure 1 - Fine Sand and Loamy Fine Sand Soils

Percent available: Currently available soil moisture as a percent of available water capacity.

Available Soil Moisture Remaining	**Appearance of soil**
0-25 percent available	Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure.
25-50 percent available	 Slightly moist, forms a very weak ball with well-defined finger marks; light coating of loose and clustered sand grains remains on fingers.
50-75 percent available	 Moist, forms a weak ball with loose and clustered sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon.
75-100 percent available	 Wet, forms a weak ball, loose and clustered sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon.
100 percent available	Wet, forms a weak ball, moderate to heavy soil/water coating on fingers, wet outline of soft ball remains on hand.

Klocke and Fischbauch, from United States Department of Agriculture, Natural Resource Conservation Service, *Estimating Soil Moisture by Feel and Appearance* (Program Aid 1619)

Figure 2 – Sandy Loam and Fine Sandy Loam Soils

Percent available: Currently available soil moisture as a percent of available water capacity.

Available Soil Moisture Remaining	**Appearance of soil**
0-25 percent available	Dry, forms a very weak ball, clustered soil grains break away easily from ball.
25-50 percent available	 Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away.
50-75 percent available	 Moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color will not stick.
75-100 percent available	 Wet, forms a ball with wet outline left on hand, light to medium staining on fingers, makes a weak ribbon between the thumb and forefinger.
100 percent available	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers.

Klocke and Fischbauch, from United States Department of Agriculture, Natural Resource Conservation Service, *Estimating Soil Moisture by Feel and Appearance* (Program Aid 1619)

Figure 3 - Sandy Clay Loam, Loam, and Silt Loam Soils

Percent available: Currently available soil moisture as a percent of available water capacity.

Available Soil Moisture Remaining	**Appearance of soil**
0-25 percent available	Dry, soil aggregations break away easily, no staining on fingers, clods crumble with applied pressure.
25-50 percent available	 Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few clustered soil grains break away.
50-75 percent available	 Moist, forms a ball, very light staining on fingers, darkened color, pliable, and forms a weak ribbon between the thumb and forefinger.
75-100 percent available	 Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger.
100 percent available	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers.

Klocke and Fischbauch, from United States Department of Agriculture, Natural Resource Conservation Service, *Estimating Soil Moisture by Feel and Appearance* (Program Aid 1619)

Figure 4 - Clay, Clay Loam, and Silty Clay Loam Soils

Percent available: Currently available soil moisture as a percent of available water capacity.

Available Soil Moisture Remaining	**Appearance of soil**
0-25 percent available	Dry, soil aggregations separate easily; clods are hard to crumble with applied pressure.
25-50 percent available	 Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, and clods flatten with applied pressure.
50-75 percent available	 Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger.
75-100 percent available	 Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger.
100 percent available	Wet, forms a soft ball, free water appears on soil surface after squeezing or shaking, thick soil/water coating on fingers, slick and sticky.

Klocke and Fischbauch, from United States Department of Agriculture, Natural Resource Conservation Service, *Estimating Soil Moisture by Feel and Appearance* (Program Aid 1619)

References:

Klocke, Norman L., P. E. Fischbach, Estimating Soil Moisture by Appearance and Feel, Publication G84-690-A, 1998, Nebraska Cooperative Extension Service.

National Engineering Handbook, Part 650, Chapter 15, 1997, United States Department of Agriculture, Natural Resources Conservation Service.

Program Aid Number 1619, Estimating Soil Moisture by Feel and Appearance, 1998, United States Department of Agriculture, Natural Resources Conservation Service.

Risinger, Michael, A. W. Wyatt, K. Carver, Water Management Note, Estimating Soil Moisture by Feel and Appearance, 1985, High Plains Underground Water Conservation District No. 1.

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