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# Water Relationships of Kentucky Soils

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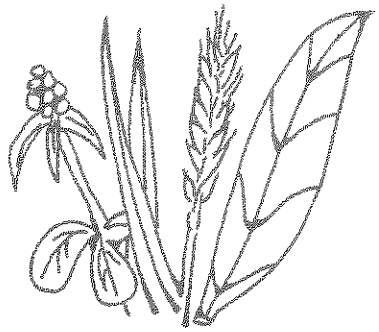
# Soil Science News & Views



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## Water Relationships of Kentucky Soils

Ronald E. Phillips and Grant W. Thomas

Plant water stress is the most limiting single factor in crop production in Kentucky. It almost always occurs sometime during July and/or August even though it's variability makes it hard to predict. Even though the 1979 growing season was an exception to this generalization the 1980 growing season was a vivid reminder of this fact especially in Western Kentucky.

The degree or severity of plant water stress depends largely upon the amount and availability of soil water. If plant roots can extract sufficient water from the soil to satisfy potential evapotranspiration, then plant-water stress does not occur. But when they cannot extract sufficient water to satisfy potential evapotranspiration, then plant-water stress does occur. The degree or severity of plant-water stress depends on how much and how fast water is transpired by plants with respect to how fast and how much water is taken up by plant roots.

### Soil Water Deficit in Kentucky

Although it can be used to predict risk of drought, the soil water deficit during the growing season does not necessarily indicate the severity of plant-water stress because this does not take into account the distribution of rainfall or runoff. But since it is the cause of drought when it does occur, the nature of the soil-water deficit is helpful in determining crop production strategy. From May 1 through September 30, the soil water deficit (evapotranspiration minus rainfall, long-time average) is about 5.5 inches in Western Kentucky and about 1.3 inches in the Bluegrass Region. Soils on which row crops are grown in Western Kentucky, in general, have about one inch more plant extractable water in the 36-inch rooting depth than does the Maury silt loam in Central Kentucky. This helps in making up the water deficit (evapotranspiration minus rainfall) during the growing season.

For the last four years, University of Kentucky soil scientists have monitored the soil water content of several soils from Lexington to Murray. These soils include Maury silt loam located in Fayette County; Shelbyville silt loam and Lowell silty clay loam located in Shelby County; Huntington silt loam located in Hancock County; Zanesville and Crider silt loams located in Caldwell County; and Grenada and Calloway silt loams located in Calloway County. The Huntington silt loam is located in the Ohio River flood plain; crops grown on this soil seldom ever suffer from water stress because of a permanent water table located within the rooting depth.

The remainder of these soils do not differ much in plant extractable water, holding around 6.0 inches within the top 36-inch depth. However, the Maury silt loam holds hardly as much (5.2 inches within the top 36-inch depth). Although these soils differ a lot in total water held, they do not differ much in total plant extractable soil water. Recent studies by the U.S.D.A. indicate that soils throughout the U.S.A. (excluding shallow soils) differ little in total plant extractable water regardless of texture. These data were obtained under field conditions with growing crops and is in direct contrast to what has been thought from previous measurements made on sieved, disturbed samples in the laboratory.

Many soils on which row crops are grown in Western Kentucky have fragipans that usually occur below a depth of 20-25 inches (examples: Zanesville, Grenada and Calloway silt loams). Severe surface erosion on these soils can result in the fragipans being nearer the soil surface. Since fragipans percolate water more slowly than do the overlying layers, a perched water table often forms in these soils following periods of rainfall. This can be harmful or helpful to the crop depending upon the situation. It can be harmful at normal planting dates of corn and/or soybeans because the soils are often too wet and too cool to safely plant and because the pan helps to induce the excessive water conditions that lead to denitrification of available nitrate nitrogen. On the other hand, the pan can be helpful during July and August when evapotranspiration is greatest because soil water that would normally drain through the 36-inch rooting depth may be held above the pan and thus be used by the plant.

The no-tillage system of producing row crops can be helpful in reducing the degree or severity of plant-water stress. Soil scientists at the University of Kentucky have found that the crop residue mulch associated with no-tillage crop production conserves about 6 inches of soil water during the growing season (average of four years data). These data were for corn growing on Maury silt loam soil located in Fayette County. Since there is not much that we can do to change the plant extractable water of soils, it is important that soil water be conserved from evaporation. No-tillage with a surface mulch is an efficient way to do this.



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