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Interpreting Soils Maps

K.L. Wells

A knowledge of the nature and characteristics of soils on a farm is basic to farm planning so as to properly match crops and soils and minimize the effect of soil variation on crop production and economic return. This information also provides a realistic basis for estimating crop yields on a field-by-field basis, a planning step necessary in estimating anticipated costs and returns. Detailed soils maps which have been prepared by soil scientists identify the various soil series which occur on the landscape, and show the slope of the landscape on which they occur, as well as the amount of topsoil (degree of erosion) present. Soil survey reports containing these maps also include detailed descriptions of soil profiles, which can be used as a basis for determining crop production capability for the different soil mapping units.

Source of Soils Maps

The best source of soils maps is from published county soil survey reports. The USDA-Natural Resource Conservation Service (NRCS) in cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet and the Kentucky Agricultural Experiment Station is responsible for Kentucky's soil survey program and publishes a comprehensive report for each county which has been mapped. Currently, there are reports for 95 counties in Kentucky. These reports are the best and most comprehensive published information available on the
identification, occurrence, physical and chemical properties, and use interpretation of soils in those counties.

In counties without published soil survey reports, a generalized soil association map of the county is available which can provide some information about the more widely occurring soils in the county. Also, soils maps of individual farms are quite often available. Many farmers or previous landowners currently are or have been cooperators with NRCS. If so, more than likely an NRCS soil scientist has surveyed the farm tract and prepared a soils map for it. This map is part of the conservation plan which NRCS provides to individual cooperators, and along with the interpretative information the conservation plan contains, is the next best source of detailed soils information.

Using a Soils Map

For farm management purposes, the use of a soils map should be (1) to determine what specific soils occur on a land tract and in each individual field, (2) to determine the suitability of those specific soils for production of the crop intended, and (3) to determine best suited cultural and management practices for the intended crop on specific soils. In using a published soil survey report, the land tract in question first needs to be located. This is not difficult to do if the number of the map sheet it exists on is first determined by referring to the index of map sheets. Once the correct map sheet is identified, the specific field, farm, or land tract can be located. Since the soil maps are drawn on aerial photographs of the landscape, this shouldn't be difficult if the location on the map sheet is correctly oriented with respect to highways, streams, and other landmark features identified on the map. Quite often, particularly if the survey report has been published within the past several years, field boundaries can be readily identified. Once located, the correct field or farm boundary should be outlined with a pen to facilitate easy future reference.

Soils have been identified on the landscape by soil scientists and are delineated on the map as soil mapping units. Symbols are shown on the map for each mapping unit delineated, and can be keyed-out on the
soil legend to determine the name of the soil series, texture of the surface horizon, slope of the landscape, and degree of erosion. The descriptive information contained about each mapping unit can be used to determine its physical and chemical characteristics and how these characteristics are likely to affect productivity of and management practices best suited for specific crops. The survey report contains an index of soil mapping units, referencing the specific descriptions for each mapping unit. These descriptions indicate the major physical and chemical characteristics that would influence plant growth. Additionally, the more recent reports include land use suitability interpretations in these descriptions. Survey reports also include detailed soil profile descriptions of each soil series in the county, and tables which show percolation rate, available water holding capacity, texture, and many other useful agronomic and engineering properties of the soils.

Accounting for Different Soils in the Same Field

Fields rarely occur which contain only one soil mapping unit. There are usually two or more different mapping units present. Because of this, characteristics of the profile of each mapping unit should be examined to determine how well crop roots can grow. Based on this information, a judgment should then be made about the rooting volume of the soils present in the field. Although fertility and acidity of the plow layer can be adjusted, little can be done about naturally occurring restrictions in the soil profile below plow depth. Preferably, all soils in the field can be managed alike (most producers do this anyway, regardless of soils differences). This is practical if subsurface profile features of the different soils are not greatly different. If they are, changing field boundaries may be justified. Soils with root growth restrictions in the profile, such as a fragipan within 24-28 inches of the surface, a high water table, bedrock within 36 inches of the surface, or low water holding capacity, will not per-
soils with no root growth limitations, even though they may all have highly fertile plow layers.

**Developing Economically Efficient Crop Production Systems**

Land is initially the most limiting resource to consider in setting up a farm production system aimed at maximizing returns. This is because soil, its topographical features, and its physical and chemical properties are largely fixed. Little can be done about them except to manage soil fertility and erosion control. Over the long run, crop production will be directly influenced by the nature and character of the soils which occur in each specific land tract. For this reason, the most basic step in designing a farming operation is to evaluate the soil characteristics which affect crop growth. By following the steps outlined below, a farm plan can be developed which will make the land resource as least limiting as possible on ultimate economic returns.

1. **Inventory the land tract** - Use a soils map to determine what soils are present and which of their characteristics influence crop growth. Rooting depth will likely be the most important. If there are 36 to 42 inches of depth without any root-restricting barrier, the soil has the potential to produce nearly any climatically adapted crop. Profile features which limit volume of soil from which plant roots can extract nutrients and water are such things as bedrock, water table, surface layers too compact for roots to grow through (claypans, plowpans or traffic pans, or fragipans), or subsurface layers with adverse chemical properties (strongly acid subsoil). Soil texture is also of great importance because of its influence on plant available water holding capacity.

   The objective of this step is to identify the soil types in a land tract and evaluate their characteristics which affect crop growth as a basis for establishing field boundaries.

2. **Lay out field boundaries** - This step is necessary for potential maximum returns because: (a) the field
is the basic management unit of a farm, and (b) fields should be laid out to include soil mapping units which can be managed somewhat alike. The nature of individual fields is what will determine cropping systems and levels of agronomic production of the whole farm operation. Slope of the landscape is probably the single most important factor in establishing field boundaries. Establishment of field boundaries should represent a practical compromise between the effect of slope and differences among soil types. The item of ultimate importance is that the basic management units (fields) of the farming operation are being established.

(3) Benchmark soil fertility of fields - After field boundaries are established, a thorough job of soil sampling should be done to determine acidity level and content of plant-available phosphorus and potassium. Knowing the results of reliable, representative soil samples from each field on the farm is necessary each year for top production. A field record book is a great help for tabulating costs and returns from each field. After a few years of keeping field records, more precise decisions can be made on allocating money available for production costs each year.

This is one of the best ways to determine where to spend production money in such a way as to maximize profits.

(4) Design a cropping system to best utilize land - After laying out boundaries, fields should be categorized according to their suitability for use, such as (a) continuous row-crop land, (b) rotation land (short-term and/or long-term rotations between hay and row crops), and (c) permanent pasture land. Crops are then allocated to these fields on the basis of the highest value crop to the best land (continuous row-crop land) and progressively down to the lowest value crops to land which can be used the least intensively (long-term rotation land or permanent pasture land).

Summary

Use of soils maps makes it possible to best utilize the soil resource to its natural productive capability, and make land as least limiting as possible on whole farm productive potential. Logically planning agricultural land
use involves the following steps: (a) **Taking inventory of the land resource.** This involves use of soils maps to determine what soils are present, where they occur, and their physical and chemical characteristics which affect plant growth.

b) **Establishing field boundaries.** Inclusion of soils which can be managed somewhat similarly within the same field boundary minimizes the effect of adverse naturally occurring soil characteristics on field productivity.

(c) **Soil testing of each field.** Annual expenses for lime and fertilizer are often the largest out-of-pocket production costs. Knowing soil test levels within each field provides the basis for using lime and fertilizer in the most economical manner.

(d) **Matching crops to soils.** Development of a cropping system to match high value crops to fields with the greatest production potential provides for maximum economic crop production.

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Extension Soils Specialist