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Kenneth L. Wells

University of Kentucky

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Developing Efficient Crop Production Systems

by

K. L. Wells
Extension Soils Specialist
University of Kentucky

Land is initially the most limiting resource to consider in setting up a farm system aimed at maximizing returns. This is because soil, its topographical features, and its physical and chemical properties are largely fixed. There is little which can be done about them except to manage soil fertility and control erosion. Over the long run, crop production from any land tract will be directly influenced by the nature and character of the soils in that land tract. For this reason, the most basic step in initiating or redesigning a farming operation is to get an evaluation of the soil characteristics of a land tract which affect crop growth. Taking such information into account in laying out fields and developing cropping systems based on this ensures that land capability is not a major limitation to potential economic returns.

The logical steps to follow in doing this are:

Inventory the land tract. The objective of this step is to identify the soil types in a land tract and evaluate their characteristics which affect crop growth. Use a soils map to determine what soils are present and what characteristics they have which influence crop growth. The most important thing to determine is the depth to which roots can grow. If there are 36-42 inches of depth without any root-restricting barrier, the soil has the potential to produce nearly any climatically adapted crop in Kentucky. Profile features which limit the volume of soil from which plant roots can extract nutrients and water are such things as bedrock, a water table, subsurface layers too compact for roots to grow through (claypans, machinery or traffic...
pans, fragipans), or subsurface layers with adverse chemical properties (acidity, salinity).

**Lay out field boundaries.** This is the basic step which is necessary for potential maximum returns because: a) the field is the management unit of a farm, and b) fields must be laid out to include soil types which can be managed somewhat alike. In this process, the basic management units (fields) of the farming operation are being established which will determine cropping systems and potential levels of agronomic production of the whole farm operation. It should be recognized, however, that soils occur on the landscape in such a fashion that it will rarely be possible to lay out a field boundary which includes only one soil type. Consequently, most fields will include differing types. Slope of the landscape is probably the most practical factor to consider in establishing field boundaries. About the best which can be done is to use common sense in laying out field boundaries which represent a practical compromise between the effect of slope and differences among soil types.

**Benchmark soil fertility of farm management units (fields).** After field boundaries are established, a thorough job of soil sampling should be done to determine acidity levels and residual contents of phosphorus and potassium. Knowing the soil test results of reliable, representative soil samples from each management unit on the farm is necessary to decide if, and if so, how much lime and fertilizer 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 available money among production costs each year. With current trends in production costs and market returns, this represents one of the best ways to determine where to spend production money in such a way to plan for maximum profit margins.

**Design a cropping system to best utilize your land.** After laying out boundaries, fields should be classified as being (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 with the least intensive use potential (long-term rotation land or permanent pasture land).

Most farm tracts in Kentucky are likely to contain a mixture of such acreage, and are usually limited by the amount of continuous row-crop or short-term rotation land available. A cropping system to maximize high quality feed production on an "average" land tract in Kentucky would likely consist of a relatively modest acreage double-cropped to corn and wheat for silage; short-term rotations of corn (silage or grain) - wheat (silage or grain) and 2 years of red clover (hay). Variations of this are 2 years of corn and wheat followed by 2 years of red clover, or perhaps long-term rotations containing corn followed by several years of alfalfa. If there is an abundance of short-term rotation acreage, alfalfa acreage is often increased in this category. Development of no-till corn production techniques over the past several years has increased the amount of corn which can be grown without undue risk of erosion. About the best that can be done with the
land best suited for permanent pasture is to establish a good fescue or bluegrass sod on it and keep it improved by renovating with clover on acreage over which machinery can safely be used. If there is need for short-term increased forage production from fescue fields, timely top dressings with nitrogen fertilizer can also be used.

Where land quality makes cash grain farming possible on large acreages, the 3-crop in 2-year rotation (corn-wheat-soybeans) represents an excellent cropping system. If no-tilled, this rotation provides excellent erosion control and moisture utilization in addition to the benefits of crop rotation.

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Extension Soils Specialist