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Soil Testing: Improving Reliability

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Late summer is a good time to check forage and row crop fields for possible nutritional problems and to make plans for fall soil sampling. "Problem" areas can be identified for selective sampling and the test results can be used to plan fertilizer and lime expenses for the next crop production season. Fields scheduled for tobacco, small grain and/or double cropping need to be sampled first in order to determine lime, phosphorus (P) and potassium (K) needs before fall application.

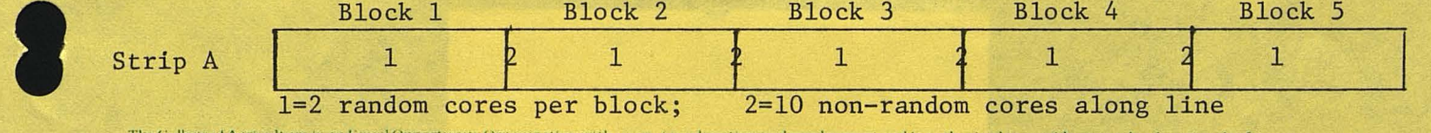
Soil Test Results and Crop Nutritional Needs

The relationship between soil testing and crop nutrition can be difficult to understand. Two questions that often arise are: (1) "How well does the test result reflect the area sampled?; and (2) Should I put on more fertilizer than that recommended on the basis of the soil test as insurance against poor crop performance?" Though these questions are related, the first is largely a question of accuracy and the second, a dilemma of interpretation resulting from a negative conclusion to the accuracy question.

Soil Sampling

The accuracy of fertilizer recommendations based on soil test results depends on properly sampling the field. Improper sampling is often the largest single factor causing inaccurate soil test results. As field soils are rarely uniform, an "average sample" is hard to get and there may be disagreement between two sampling periods. Changes in tillage and crop rotation systems, differential soil erosion patterns, and uneven lime and fertilizer applications contribute to this problem.

An example of how sampling affects soil test results for P on 0-6 inch cores from a small area 300 feet long by 120 feet wide is shown below. The area was divided into 3 strips (300'x40', labelled A,B,C) and each strip was divided into 5 blocks (60'x40'). In the first sampling scheme each strip was sampled by randomly taking 2 cores from each block and mixing those 10 cores together (30 cores for the area). In the second scheme a non-random 10 core sample was taken on the dividing line between each block, for a total of 4 separate samples per strip (120 cores for the area). A diagram for strip A is shown below:



1=2 random cores per block; 2=10 non-random cores along line

The average soil test values for the entire area are nearly the same for both sampling approaches (Table 1). But the range in individual strip test values shows the variation in nutrient availability even in this small farm field area.

Table 1. Soil Test Values and Fertilizer Phosphorus Recommendations for Full Season Soybeans as Influenced by Sampling Method.

Sampling Method	Strip A	Strip B	Strip C	Strip Range	Area Ave.	Fertilizer Rec. Range	Fertilizer Rec. Area Ave.
	------ P soil test value ------					-- lb P_2O_5/A --	
1=1 random composite	18	22	17	17-22	19	65-55	60
2=4 non-random composites	14	28	13	13-28	18	75-45	65

The range in strip test values widens with non-random sampling despite the fact that 4 samples were tested for each strip. The fertilizer recommendation for any single strip was closer to the average for the whole area if that strip was randomly sampled.

Fertilization rates greater than those recommended by soil test are not advisable because: (1) fertilizer recommendations based on soil test are more than adequate for average climatic and management conditions, (2) the crop response to available nutrients follows the law of diminishing returns. Additional fertilizer will give less additional yield per unit of added fertilizer, and in those parts of the field where available nutrient levels are adequate, no yield benefit will result. If more intensive management practices such as irrigation are being used, then more intensive sampling can be justified and fields containing smaller areas with different nutrient levels may justify the extra time required to apply different fertilizer rates to those areas. Otherwise it will be more profitable to fertilize the entire field at a rate based on random sampling, than to overfertilize a major portion of the field. More detailed information on soil sampling is contained in UK publication AGR-16.

Plant Analysis

Plant tissue analysis can give a more complete picture of crop nutritional status and can monitor soil tests. A single plant grows in 10 to 40 times the amount of topsoil contained in a single soil core. Tissue analysis can only indicate if the nutrition program has been successful, not how much fertilizer is needed. UK publication AGR-92 gives details on plant tissue sampling.

Conclusions

In summary, there are several ways to improve soil test reliability: (1) pull a soil sample that represents the field and reflects the way the field is to be fertilized, (2) keep a good field record of crop history, prior sample test dates and results, tillage, and lime and fertilization practices, and (3) use plant tissue analysis to confirm or check the effectiveness of your soil fertilization program.

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