SOIL SAMPLING BY GRID VERSUS UNIVERSITY OF TENNESSEE STANDARD RECOMMENDATIONS

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Abstract

Three sites were soil sampled by each of three different soil sampling strategies (1) standard University of Tennessee approach, (2) Grid Center approach, (3) Grid Point approach. Different results were obtained from each of the sampling strategies. Results differed both in extent of area found in each soil test interpretation category and in the geographic location in the field where specific soil test categories occur. All sites were found to be fairly uniform (high or medium testing) in P and K by any of the soil sampling strategies. Soil pH appeared to vary more than P and K, with grid sampling techniques identifying some areas at each of the three sites having pH values much lower and potentially yield limiting than the field average. Fertilizer or lime needs were both increased and decreased by the use of grid sampling strategies.

Introduction

New strategies of soil sampling fields have been examined[1,2] by those considering precision agriculture and compared[3,4,5] to conventional approaches. These strategies are supposed to result in better identification of soil test variability so that lime or fertilizer applications can be more precisely formulated and applied to meet crop needs.

Objectives

The purpose of this soil sampling effort was to compare results obtained by three different sampling strategies: (1) University of Tennessee recommendations[6], (2) Grid Center approach, (3) Grid Point approach. University of Tennessee recommendations call for a composite of at least 20 cores taken at random in an area no more than about 10 acres. A grid center approach would divide this area into smaller units (1 to 3 acres; 2 acres for this study) with at least 20 cores pulled within each unit. A grid point approach would take a composite of about 8 cores at selected intervals (300 foot for this study) in a grid fashion throughout the field and use a statistical approach to draw soil test level boundary lines between sampled points.

Methods

Three sampling areas ranging from 10 to 20 acres were chosen to compare results obtained when sampling the same area by different strategies as previously described. Field 1 had been in a corn-soybean rotation, field 2 in continuous cotton and field 3 in a corn-cotton rotation.

Soil samples were pulled at each field using each sampling strategy and analyzed for P, K and pH by the University of Tennessee laboratory. For 10 acres, this required 1 sample by the University of Tennessee recommendation, 5 samples by the Grid Center approach and 12 samples by the Grid Point approach. Analytical results were plotted on area maps and the percent of a field testing in each soil test category was determined for each sampling strategy.

Results and Discussion

Table 1 shows the range of soil test values obtained as a result of each sampling strategy. The greatest range in variability for P, K and pH was identified by the grid point sampling strategy at each site. However, results for grid center and grid point approaches were very similar to each other.

In field 1, the use of grid sampling strategies (Table 2) increased the amount of phosphorus recommended by identifying a large part (83-87%) of the field falling in the medium category as compared to the U.T. approach which found the whole field (100%) to test high in P. The greatest increase in areas needing more P was realized by the grid point strategy. All of the field fell within either the medium or high categories for P and K by any of the sampling strategies.

The amount of potassium needed for field 1 decreased when using a grid sampling approach as 18-33% of the field (Table 2) identified by the U.T. approach as medium in K tested high by grid sampling. Also, the geographic location of part of the area testing medium in K (data not shown) differed depending upon whether a grid point or grid center sampling strategy was used. This may result because to large a grid was chosen for sampling or two narrow a radius (10 ft.) was used to obtain the composite sample at each sampling point. The greatest increase in K recommended (more area identified as medium instead of high testing) came from the grid center strategy.

Field 2 was found to be very uniform in P and K. By any sampling strategy (Table 3), all results were in the high category for P and K. Grid sampling did not impact recommendations for P and K amendments to field 2.

Field 3 (Table 4) tested mostly high in phosphorus by all sampling strategies. Grid point sampling identified one small area (1.4%) that tested medium near the field edge. Grid sampling strategies decreased the amount of potassium

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recommended by identifying 70 to 90% of field 3 falling within the high range as opposed to 50% identified by the U.T. strategy. The greatest reduction in potassium recommendation was realized with the grid point approach.

Grid sampling strategies for determining lime needs (Table 5) resulted in both decrease (Field 1,2) and increase (Field 3) in the amount of the field needing to be limed. For fields 2 and 3, the geographic location (data not shown) of a part of the area identified as needing lime differed depending upon whether a grid point or grid center sampling strategy was used. Again, this may have resulted because of the reasons previously listed above for potassium in field 1.

Summary

Different results were obtained from each of three soil sampling strategies. Results differed in both amount of area identified in each soil test interpretation category and in the geographic location in the field where specific soil test categories were found.

Three sites sampled were found to be fairly uniform in P and K levels with all sites testing within the medium or high categories by any of the soil sampling strategies. Grid sampling strategies indicated some variability in P and K levels at 2 out of the 3 sites tested.

Soil pH appeared to vary more than P and K, with grid sampling approaches identifying some areas at each of the 3 sites having pH values much lower and potentially yield limiting than the field average.

Fertilizer or lime needs were both decreased and increased by use of grid sampling strategies.

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Table 1. Range in Soil Test Values as Determined by Three Soil Sampling Strategies.

	Field 1 (12 acres)			Field 2 (10 acres)			Field 3 (20 acres)		
	P[1/]	K[1/]	pH	P[1/]	K[1/]	pH	P[1/]	K[1/]	pH
U.T.[2/]	40	160	5.9	44	280	6.0	52-68	150-190	6.1-6.2
G.C.[3/]	28-40	100-170	5.9-6.2	44-52	170-220	5.9-6.5	44-72	140-250	5.7-6.2
G.P.[4/]	24-40	110-200	5.5-6.2	36-76	210-320	5.1-6.5	24-84	110-250	5.3-7.2

1/ lbs/acre by Mehlich I
2/ only field 3 was large enough to require more than one composite sample by U.T. recommendations.
3/ Grid Center
4/ Grid Point

Table 2. Field 1 (12 acres) Percent of Field Found in Each Soil Test Level for Phosphorus and Potassium by Three Soil Sampling Strategies.

Soil Test Category	Phosphorus			Potassium		
	-------Sampling Strategy--------					
	U.T.[1/]	G.C.[2/]	G.P.[3/]	U.T.	G.C.	G.P.
Very High	0	0	0	0	0	0
High	100	17	13	0	33	18
Medium	0	83	87	100	67	82
Low	0	0	0	0	0	0

1/ U.T. recommended strategy.
2/ Grid Center Strategy.
3/ Grid Point Strategy.

Table 3. Field 2 (10 acres) Percent of Field Found in Each Soil Test Level for Phosphorus and Potassium by Three Soil Sampling Strategies.

Soil Test Category	Phosphorus			Potassium		
	----------Sampling Strategy----------					
	U.T.[1/]	G.C.[2/]	G.P.[3/]	U.T.	G.C.	G.P.
Very High	0	0	0	0	0	0
High	100	100	100	100	100	100
Medium	0	0	0	0	0	0
Low	0	0	0	0	0	0

1/ U.T. recommended strategy.
2/ Grid Center Strategy.
3/ Grid Point Strategy.

Table 4. Field 3 (20 acres) Percent of Field Found in Each Soil Test Level for Phosphorus and Potassium by Three Soil Sampling Strategies.

Soil Test Category	Phosphorus			Potassium		
	----------Sampling Strategy----------					
	U.T.[1/]	G.C.[2/]	G.P.[3/]	U.T.	G.C.	G.P.
Very High	0	0	0	0	0	0
High	100	100	98.6	50	70	95
Medium	0	0	1.4	50	30	5
Low	0	0	0	0	0	0

1/ U.T. recommended strategy.
2/ Grid Center Strategy.
3/ Grid Point Strategy.

Table 5. Percent of Field Needing Lime as Identified by Three Soil Sampling Strategies.

	Field 1 (12 acres)	Field 2 (10 acres)	Field 3 (20 acres)
U.T.[1/]	100	100	0
G.C.[2/]	67	40	30
G.P.[3/]	40	22	46

1/ U.T.
2/ Grid Center
3/ Grid Point