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FIELD VARIATION OF SOIL ACIDITY

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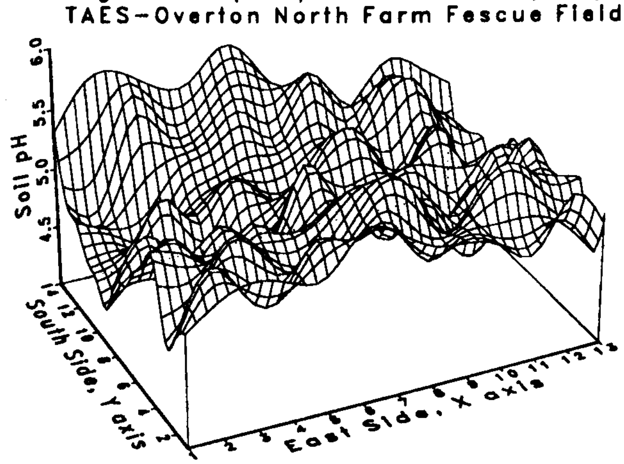
Background. Production agriculture in the United States has become competitive and costly. Land resources are becoming restrictive and environmental concerns are increasing. To stay competitive, a producer must cut unnecessary production costs, while maintaining yield or target objectives. Fertilizer and limestone are major inputs and cost factors to the forage producer. Under application can result in nutrient deficiencies that reduce yields and produce inferior forage quality. Over application may lead to slightly higher production levels, but at a higher per unit input cost, and could lead to environmental problems with surface runoff or leaching pollution. Generally, a producer soil samples an entire field as a production unit, regardless of changing soil types. A representative sub-sample is analyzed to obtain limestone and fertilizer recommendations. A single limestone and/or fertilizer rate is applied over the entire field, based on these recommendations. Within this field may be areas of under and over application, in addition to areas receiving proper treatment. To define field variation of soil acidity, an experiment was conducted on approximately 18.5 acres of a Thomas fine sandy loam soil. This area had been in forage production for several years, with limestone and fertilizer applied uniformly as needed. A composite sample was taken as a producer would normally do, randomly taking cores from across the field. The area was also intensively sampled at 50 foot spacings, in a grid pattern across the entire area and all samples analyzed for pH.

Fig. 1 Soil pH Spatial Variability Map
TAES-Overton North Farm Fescue Field



Research Findings. The results of the soil pH from the overall soil sampling showed a pH of 5.1. However, results from the intensive soil samples showed pH ranging from 4.1 to 6.0. Figure 1 graphically depicts the variation in soil pH of one area of the experiment. Each single unit on the X and Y axis represents a 50 foot spacing at which soil samples were taken. The variation in soil pH in this 10-acre area is clearly shown. An average limestone rate of 1 ton/acre was determined as the optimum to increase the pH on this sandy soil to approximately 6.0. Based on the results of the intensive sampling, the application of 1 ton of lime/acre would have resulted in less than one-half (43%) of the area receiving the proper lime rate. Seven acres of the original 18.5 acres or 38% would have received an over application, and 3.5 acres or 19% would have received an under application. This results in 57% of the field area receiving a misapplication.

Application. Although it is realized a producer would be unable to soil sample fields as intensively as described, attention should be given to changing soil types, topography, and land use. The findings presented above are from a small area which had been uniformly limed and fertilized, yet pH's varied approximately 2 units. Therefore, areas not utilized similarly do need to be sampled and treated separately. For example, pastures, which could have some nutrient recycling through manure, should be sampled and treated separately from hay pastures, in which nutrients removed by the forage are taken from the field in the hay. Also, pastures overseeded in legumes should be sampled separately from pastures overseeded in grasses, or those with no winter cover crop. Sampling these areas separately could result in better crop production. Limestone research in East Texas has repeatedly shown ryegrass and legume yield and quality increases as soil is limed to pH 5.5 and above. Applying variable limestone rates to create a more uniform soil pH would not only increase yield in a field, but also produce a higher quality forage. Creating proper pH ranges would make essential nutrients more available for plant uptake. Although this situation describes only soil pH variability and subsequent liming, savings in fertilizer cost, and improved forage quantity and quality could also be realized with intensive sampling and subsequent variable fertilizer application.