Soil Test Phosphorus Variability: Grid Sampling

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Typically one composite soil sample is collected from each field on a farm. However, sometimes there can be large variability within a field because of different soil types, different manure or fertilizer application rates, or historical differences in cropping patterns or other management practices. In these cases, the average soil test level obtained from a composite sample may be masking significant areas of the field that may be quite different from the average. Nutrient deficient or environmentally excessive areas of the field may not be detected.

One approach to this potential problem is to use a more intensive soil sampling scheme such as grid sampling, in which many samples, each representing one to five acres, are taken within a field and analyzed separately. A less intensive and usually more practical approach referred to as smart sampling or zone management refers to dividing a field into several sampling areas based observable parameters such as soil type.

To test the value of these alternative approaches, and to assess the variability within a field, we selected an 18-acre alfalfa field on one of the cooperating farms and established 40 sampling points on a 150 x 150-ft grid. (See Figure 1). Thus, each sample represented approximately ½ acre. The sampling pattern of cores at each sampling point is shown in Figure 2. The coordinates of each sampling point were established using GPS so that the soil test results could be mapped (Figure 3).

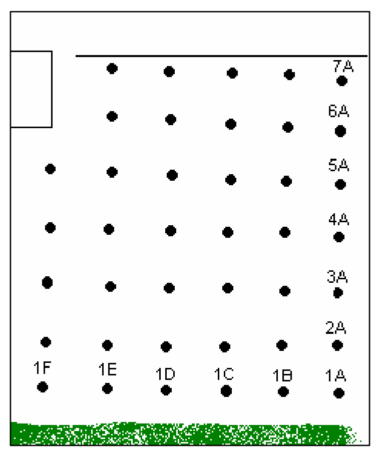

Figure 1. Grid sampling pattern for 18-acre field with 150-ft spacings.

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Soil test results (Modified Morgan's extractant, UVM lab) for Available Phosphorus showed a field average of 5.1 ppm P, a value within the Optimum range for which the UVM recommendation would be 20 lb P_2O_5 per acre. However, STP for individual samples ranged from 0.9 to 11.1 ppm. Soil test P showed distinct field areas that were below Optimum (<4 ppm), Optimum (4-7 ppm), and above Optimum (>7 ppm) (Figure 4). Recommended application rates for these three areas would be 60+, 20, and 0 lb P_2O_5 per acre. While applying fertilizer or manure to meet these specific recommendations would require a variable-rate applicator, it might be reasonable to made rough adjustments by applying a higher rate on the left third of the field and avoiding application in the larger high-testing area.

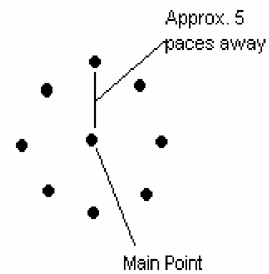

Figure 2. Pattern of cores for each sampling point.

Figure 3. Project assistant Laura Hanrahan identifies sampling point with GPS instrument.

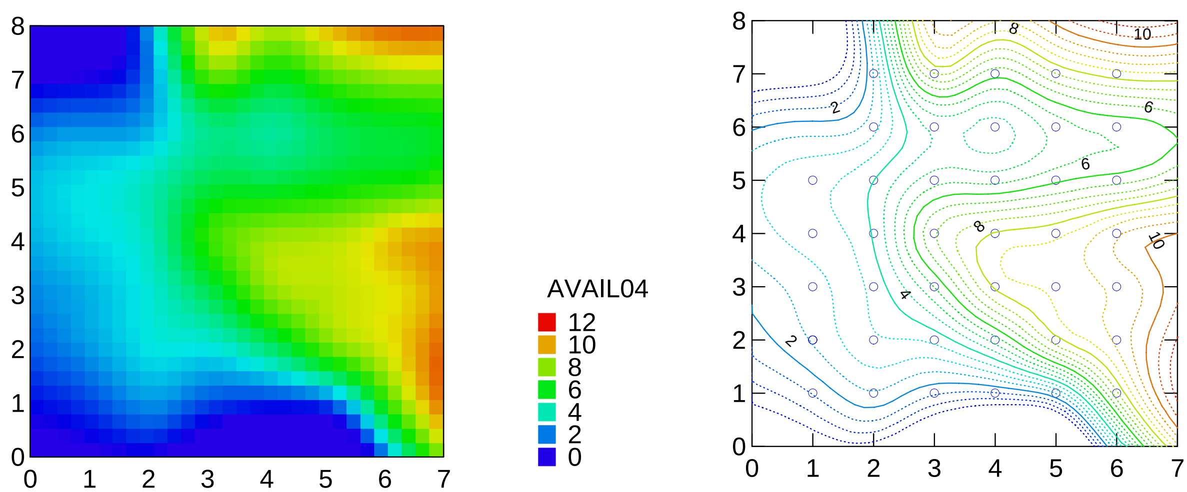

Figure 4. Grid soil sampling results for Available P (ppm) presented in two different mapping formats.

Such intensive sampling on ½ acre grids is too time-consuming and expensive to be done on a commercial scale. A less intensive grid sampling approach, using two to three acre sample areas, would be less expensive but would still require six to ten samples for the field. A more practical approach would be to define nutrient application or management zones based other observable or measurable properties such as past crop or manure history, slope, or soil type. Referring to the soil survey map of the field (Figure 5), logical management areas might be 1) the gently sloping fine sandy loam soil (MrB); 2) the steeper loam soils (MrC and NsC), perhaps including the Elmwood soil (ElB) because of it's nearby landscape position; and 3) the Vergennes clays. Sampling these three areas would result one management zone with little or no P fertilizer need (1), another with a moderate P need (2), and a third (3) with variable P soil test levels, probably averaging intermediate to the others. While this approach is far from perfect, it would result in P application closer to P crop need than treating the field as one unit, and it would avoid excessive P application (and wasted fertilizer $) where it is not needed.

Figure 5. Soil survey map of sampled field. Cw Covington/Panton silty clays; ElB Elmwood fine sandy loam; MrB Melrose fine sandy loam, 3-8% slope; MrC Melrose fine sandy loam, 8-12% slope; NsC Nellis extr. Stonly loam, 3-15% slope; VgB Vergennes caly, 2-6% slope; VgC 6-12% slope.