From Grid Soil Sampling to Management Zones in the Southern High Plains

Grid soil sampling from 0.5 acre to 2.5 acre-grid has been used by researchers and 2.5 acre-grid is used by commercial fertilizer applicators to produce soil test maps for specific nutrients. Variable-rate fertilizer application technology has been available for several years now, and commercial applicators provide this service on the Southern High Plain of Texas as well. Grid-soil sampling has received much criticism as a practice that a producer could not be able to do profitably. Therefore, there has been much interest in "management zone" – based soil sampling from all over the USA and overseas. Our approach in the soil fertility group at the Texas Agric. Exp. Stn in Lubbock is, for research purposes, to take 0.5 acre-grid soil samples in the first several years of our program. We hypothesize that a basis for "management zone"-based sampling will develop from the intensive sampling.

Fig. 1 and 2 shows two 27-acre fields that we are doing precision agriculture research in. The approximately 60 points marked "full data set" represent 0.5 acre grid (irregular, due to circular row) points where we took soil samples (two cores per point) at depths of 0-6, 6-12, and 12-24 inches. Soils were analyzed for routine nutrients such as NO_3, P, K, organic matter, Ca and pH. Management zones are delineated by blue lines at each site. These consist of three landscape positions at Lamesa and two soil types at Ropesville. These are based on historical yield trends, where specifically, at Lamesa, the greatest yields in most years are observed in the bottomslope, and the lowest yields are usually in the south-facing sideslope. Presumably re-distribution of water is the main reason for higher yields in the bottomslope. Historically, at Ropeville, lower yields are observed in the calcareous Portales soil compared to the Amarillo soil.

Fig. 1. Half-acre-grid soil sampling and four sub-samples per zone, AGCARES, Lamesa, TX

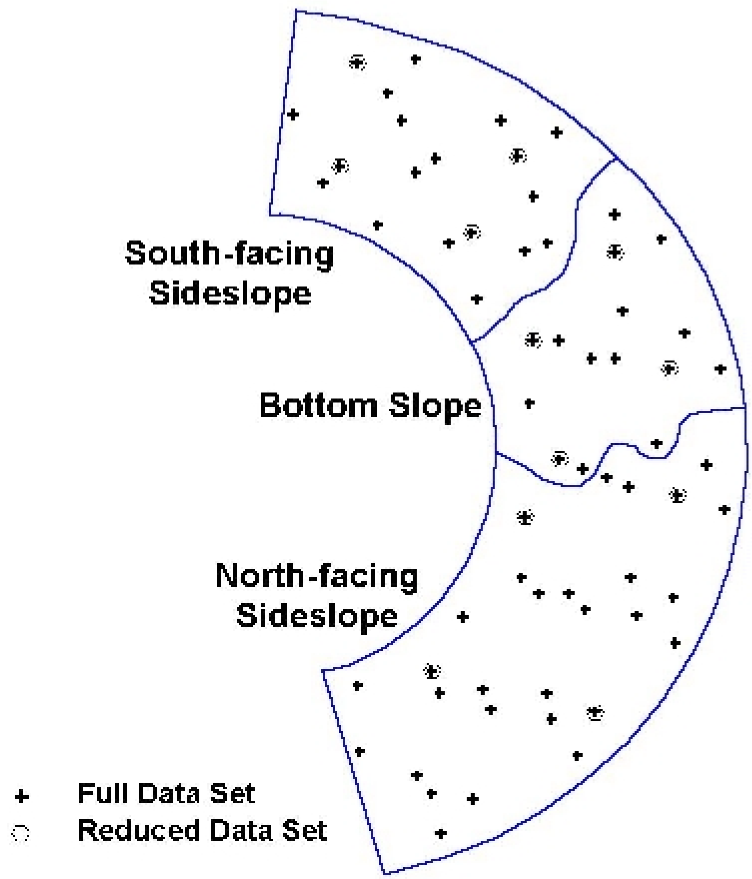
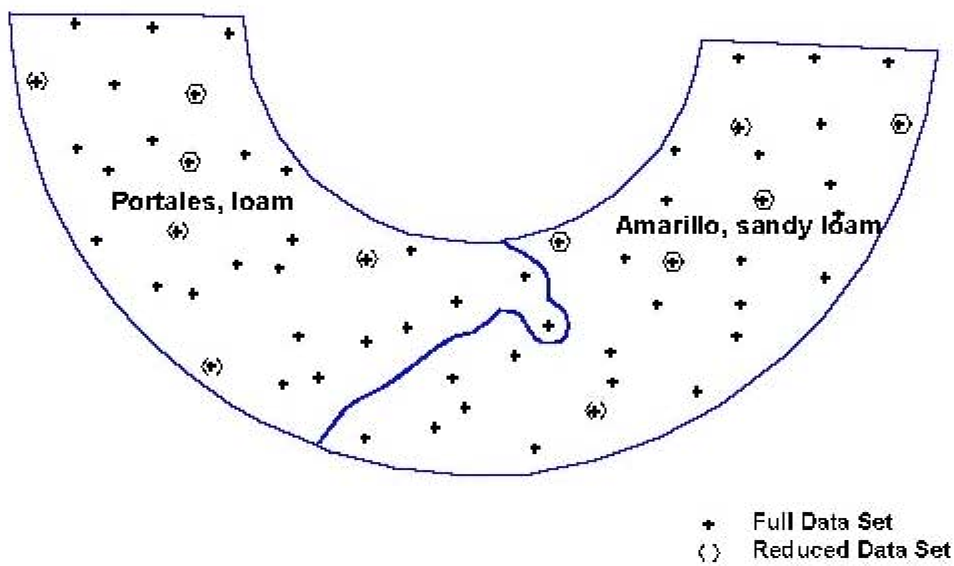


Fig. 2. Half-acre-grid soil sampling and six sub-samples per zone, Ropesville, Lamesa, TX



To see if a modest number of soil samples could be taken from each management zone to adequately represent the zone, we chose four of the original points from the “full data set” from each zone at Lamesa and six points per zone from the full set at Ropesville. As Table 1 and 2 indicate, the means of the soil properties for each zone are similar with either sampling method. In terms of the yield data for 2000, the differences between zones at Lamesa was consistent with the historical trends (Table 1). At Ropesville, on the other hand, yields were similar between the two zones/soil types. Phosphorus fertilizer response, however was observed in the Amarillo soil at Ropesville, but not in the Portales soil (data not shown).

In summary, prior knowledge by farmers can help delineate candidate management zones based on soil type and or landscape position in the Southern High Plains. Yields may not differ between the zones every year, but this does not take away the advantages of managing by zone. Specifically, four to six soil samples can be taken from each zone and composited, so that one soil sample from each zone can be sent to a state or private soil testing laboratory for analysis. This means in our examples three composite samples for analysis from Lamesa and two from Ropesville, compared with ten samples from each 27-acre site if 2.5-acre grid soil samples were taken. Besides the benefits of simpler, targeted soil sampling, the management zone approach has the advantage that producers can apply different rates of fertilizer to a small number of zones. This would especially be doable, even without variable-rate equipment, if certain zones’ soil tests recommend no fertilizer application. With this past years sharp rise in fertilizer prices, reducing the amounts of fertilizer applied per field, without hurting yield, is something producers would desire.

Table 1. Selected soil properties for "management zones" at 27-acre site in Lamesa, TX

	--North-facing sideslope --		-------- Bottomslope ------		---South-facing sideslope --	
	Full sampling	Reduced sampling	Full sampling	Reduced sampling	Full sampling	Reduced sampling
Ca[1]	758	715	708	697	755	783
P[1]	16.7	13.0	16.2	20.0	18.0	17.7
NO_3-N[2]	16.9	17.5	15.8	13.8	8.6	7.4
Lint yield[3]	636		699		552	

[1]ppm, 0- 6 in. sample
[2] lb/acre, 0-24 in. sample
[3]lb/ac, 0.002 ac hand-picked samples on 0.5-ac grid

Table 2. Selected soil properties for "management zones" at 27-acre site in Ropesville, TX

	------------ Portales loam -----------		----------- Amarillo sandy loam -----	
	Full sampling	Reduced sampling	Full sampling	Reduced sampling
Ca[1]	4531	4586	1823	1752
P[1]	20.0	20.2	17.0	19.0
NO_3-N[2]	14.2	14.8	13.0	13.2
Lint yield[3]	611		613	

[1]ppm, 0- 6 in. sample
[2] lb/acre, 0-24 in. sample
[3]lb/ac, 0.002 ac hand-picked samples on 0.5-ac grid