



Uncertainty in the profitability of fertilizer management based on various sampling designs.

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Many farmers sample their soil to measure the concentrations of plant nutrients, including phosphorus (P), so as to decide how much fertilizer to apply. Now that fertilizer can be applied at variable rates, farmers want to know whether maps of nutrient concentration made from grid samples or from field subdivisions (zones within their fields) are merited: do such maps lead to greater profit than would a single measurement on a bulked sample for each field when all costs are taken into account?

We have examined the merits of grid-based and zone-based sampling strategies over single field-based averages using continuous spatial data on wheat yields at harvest in six fields in southern England and simulated concentrations of P in the soil. Features of the spatial variation in the yields provide predictions about which sampling scheme is likely to be most cost effective, but there is uncertainty associated with these predictions that must be communicated to farmers. Where variograms of the yield have large variances and long effective ranges, grid-sampling and mapping nutrients are likely to be cost-effective. Where effective ranges are short, sampling must be dense to reveal the spatial variation and may be expensive. In these circumstances variable-rate application of fertilizer is likely to be impracticable and almost certainly not cost-effective. We have explored several methods for communicating these results and found that the most effective method was using probability maps that show the likelihood of grid-based and zone-based sampling being more profitable than a field-based estimate.