Efficacy and Economics of Precision Soil Sampling Strategies for Site-Specific Soil pH Management in Peanut

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Soil pH affects the amount of nutrients that are available to all plants. Peanut perform best in a soil pH range of 6.0 - 6.5, where soil nutrients are readily available. Most agriculture fields in Georgia have a significant amount of soil variability including soil type and texture. Precision soil sampling strategies, grid- or zone-based, are commonly used to determine areas in the field for site-specific application of soil amendments and nutrients. Grid size and spatial layers used to delineate zones for soil sampling can impact the accuracy of soil pH map and consequently the prescription map used for variable-rate application. This study compares the efficacy of commonly used grid sizes (1.0, 2.5, 5.0, 7.5, 10.0 ac) in Georgia, as well as two different spatial data layers, Electrical Conductivity (EC) and Soil Brightness Index (SBI), for zone-based strategies to determine the most cost-effective precision soil sampling strategy. The study was conducted in four production fields across South Georgia in 2022. Sampling grids were created for all fields in sizes of 1.0, 2.5, 5.0, 7.5, 10.0 ac. Soil samples were collected within each grid size using a point sampling method. Zones were created using spatial data layers and soil samples were collected within each zone. The zone maps were used to create six different sampling scenarios, where 50%, 25%, 20%, 15%, 10% and 5% of the total amount of soil sampling points were used. For example, in Field 2 there were 163 total sampling points across all strategies, and for EC 50% 81 of those 163 points were used to create the prescription map. Correlation analysis was conducted to determine relationships between all grid sizes and zones compared to the combination of all grid points (assumed as actual spatial variability). Economic analysis was conducted to determine the strategy that was most cost-effective, while also capturing the maximum spatial variability in the field. The 1.0 ac, EC 50%, EC 20%, SBI 50%, and SBI 25% sampling methods all produced a prescription map that was at least 90% on target to the actual spatial variability, on average. The single composite sample method was found to be the least economical as it resulted in only 34% of lime on target to the actual needs of the field. Choosing the most efficient soil sampling method for variable rate lime in peanuts is important to the grower’s bottom line. Soil sampling may seem to be an easy way to cut cost, but this research shows grid soil sampling conducted at 1.0 ac grids reduced the amount of over or under fertilization. Management zones prove to have potential to be both efficient and economical as even as low as 5% of the total soil sampling points resulted in nearly 80% of the lime being applied correctly. Future research will be conducted to expand on the creation of management zones using other spatial layers.