Influence of Soil Sampling Grid Size on Application Accuracy and Economics of Site-Specific Soil pH Management in Peanut Fields

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UNIVERSITY OF GEORGIA EXTENSION

GEORGIA Precision Ag

Introduction

- Proper soil pH management is important to attain high peanut yield and quality. Many agricultural production fields in the southeastern U.S. have large inherent soil and nutrient spatial variability which requires utilizing precision soil sampling methods such as grid or zone sampling for site-specific nutrient applications.
- While more efficient ways to develop and use zones for soil sampling are still being explored, grid-based soil sampling remains the most common strategy by consultants and growers due to ease of implementation.
- To reduce soil sampling costs, most peanut growers are trending towards larger grid sizes. However, an increase in grid size also means increased potential for under- and over-application (Wollenhaupt et. al., 1994).
- A thorough understanding of the lime application accuracy and costs associated with different grid sizes is important to determine which grid-based precision soil sampling strategies are efficient and cost-effective.

Hypothesis

Grid size will impact the lime application accuracy and cost. Smaller grid sizes can accurately depict the spatial soil pH variability in peanut fields and ensures proper site-specific soil pH management.

Objective

To assess the application accuracy and costs associated with different grid sizes for site-specific soil pH management in peanut fields

Methods

Precision Soil Sampling –

- 9 fields ranging in size from 20 to 94 acres in the coastal plains of Georgia were used for this study.
- Grid soil sampling was conducted within each field using grid sizes of 1.0, 2.5, 5.0, 7.5, and 10.0 acres.
- Spatial soil pH and variable-rate lime prescription maps from soil test results for each grid strategy were created using AgLeader SMS software.

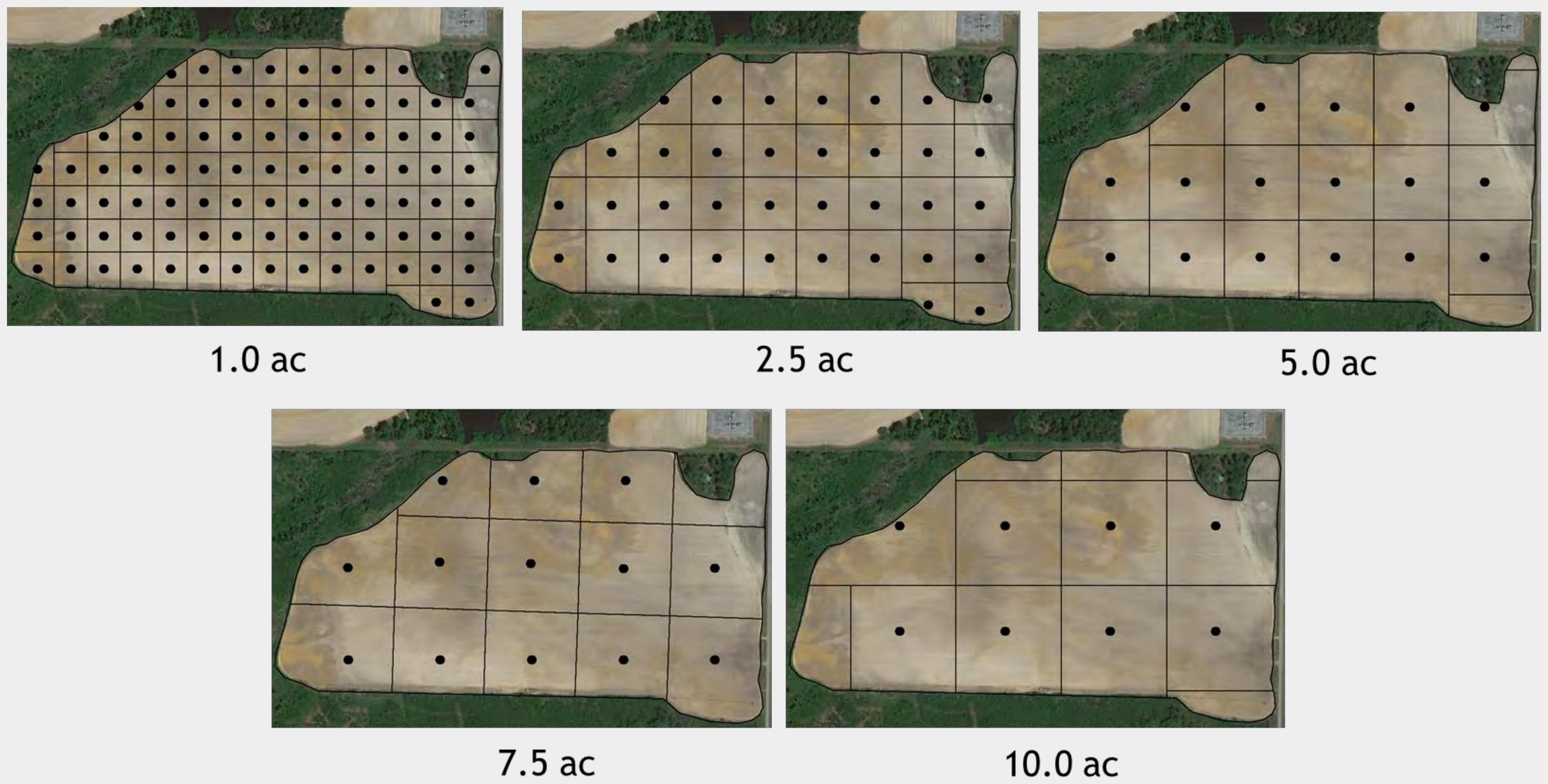

Figure 1. Soil sampling maps showing different grid sizes used in this study for one of the fields. The total number of sampling points vary between different grid sizes and among the fields. Data from all soil samplings were combined and assumed to represent actual spatial variability within each field.

Economic Analysis –

- Spatial correlation and accuracy analysis for different strategies were performed using JMP Pro 15.
- The total amount of lime required for each grid strategy was computed using AgLeader SMS.
- The cost of soil sampling associated with each strategy along with the lime cost ($50 per ton) were used to perform the economic analysis.

Results

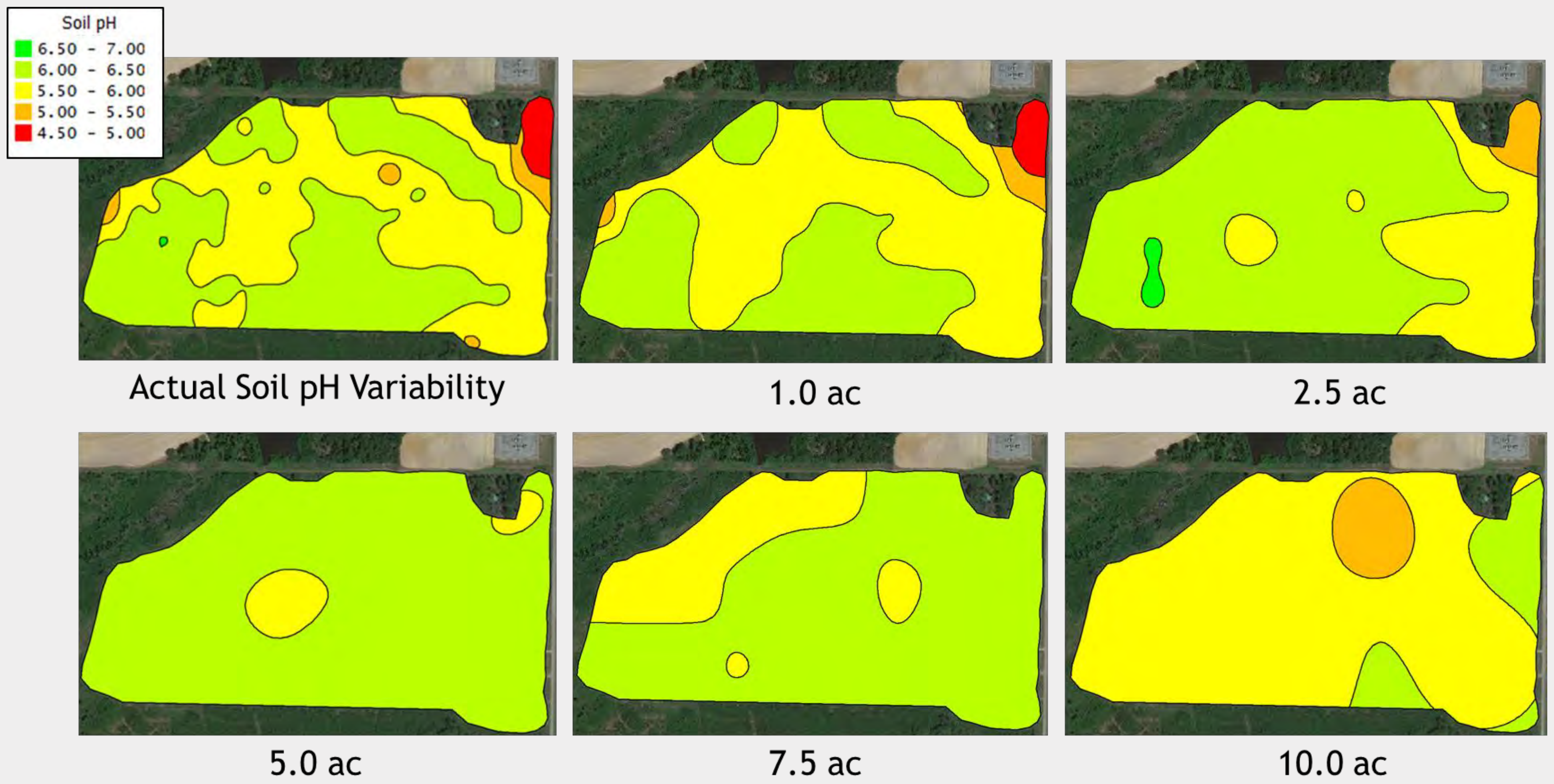

Figure 2. Soil pH maps generated from soil test results based on grid sizes of 1.0, 2.5, 5.0, 7.5 and 10.0 ac for one of the fields used in this study. The map representing (assumed) actual soil pH variability in this field is also presented to visualize the differences between spatial pH variability depicted by different grid sizes.

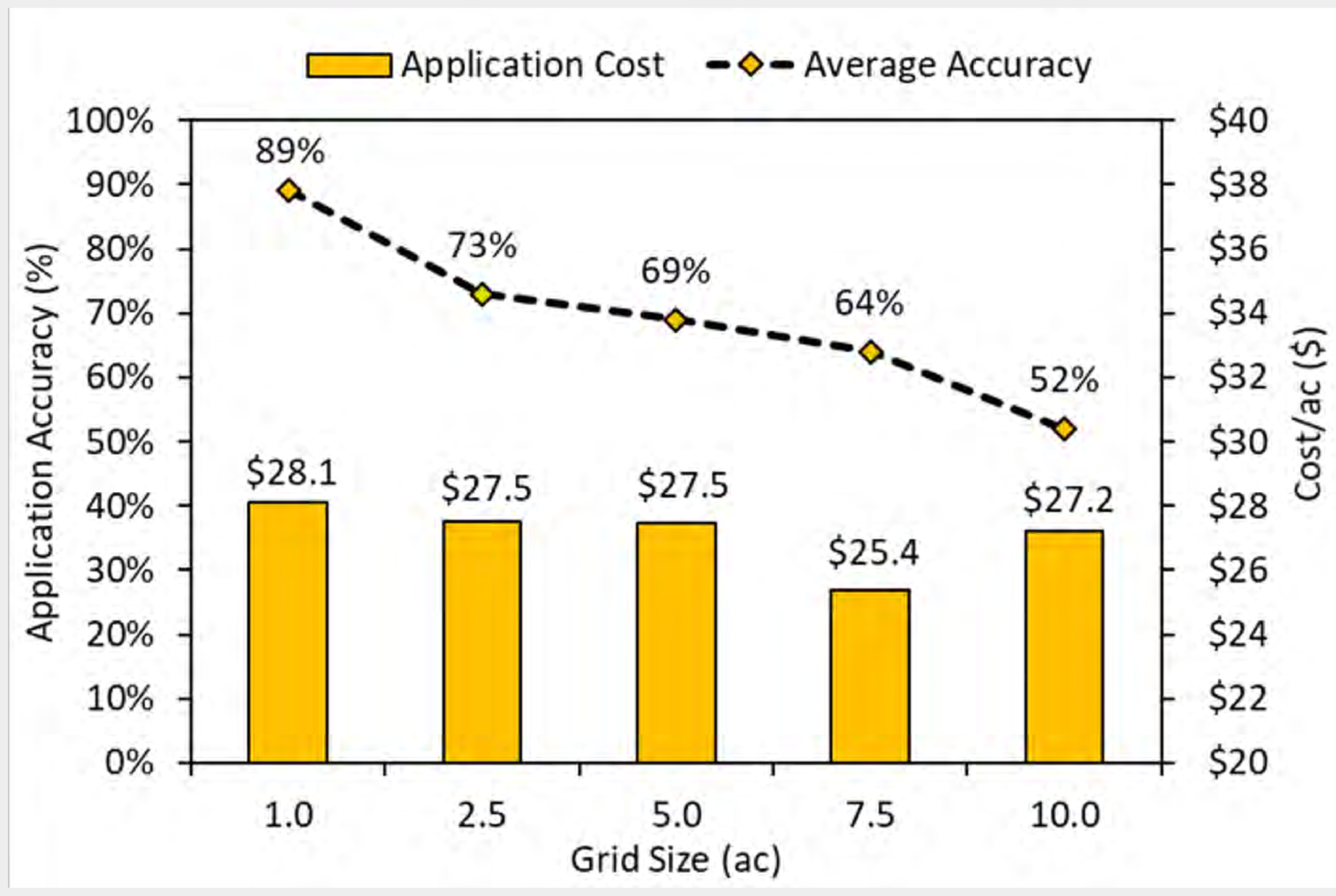

Figure 3. The dotted line displays the lime application accuracy associated with different grid sizes used in the study. The bars represent the application lime cost ($/ac) for each grid size. Data presented here is averaged across all nine fields. The total application costs include labor costs of soil sampling ($4 per acre) charged by the consultants, lab fees for analyzing the soil samples ($6 per sample) and the cost of the material (lime) computed from the amount of lime recommended by each grid size strategy and the lime cost ($50 per ton).

Conclusions

- Highest lime application accuracy (>85%) was observed for the 1-ac grid size in all the fields followed by the 2.5 ac grid size (>70%). The larger grid sizes of 5.0, 7.5 and 10.0 ac exhibited more than 20% reduction in application accuracy compared to the 1-ac grid size.
- The total lime application costs were comparable ($25.4 - $28.1 per acre) among different grid sizes regardless of the observed differences in the application accuracy.
- The results showed that precision soil sampling on smaller grid sizes (1.0 or 2.5 ac) can ensure proper site-specific soil pH management in peanut fields while also being cost-effective.
- Future studies will be focused on comparing the application accuracy and economics of different zone-based precision soil sampling strategies for the coastal plain soils in the southeastern US.

Acknowledgements

Thanks to the Georgia Peanut Commission for funding this project, the collaborating growers for their cooperation and the UGA Precision Ag team for assistance with data collection.

References

Wollenhaupt et. al. (1994). Mapping Soil Test Phosphorus and Potassium for Variable-Rate Fertilizer Applications. J. of Prod. Agric., 7:441-448.