Soil Management Zone Determination By Yield Stability Analysis And Classification

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Introduction

Identifying soil management zones within a field has traditionally been a hurdle when applying precision agriculture practices to a crop production system. Crop yields typically vary over space and time, thus determining consistent yield patterns that may reflect soil influences can be difficult. One approach is to use long-term yield data to attempt to identify yield patterns. Blackmore (2000) proposed a simple, empirical method for classifying stable yield areas of a field. Discriminant analysis can then relate yield classes to soil or topographical factors. The resulting function determines what variables may be used to classify a location and then predict yield behavior where yield data may be limited. The combination of spatiotemporally stable yield classes and discriminant analysis to determine which soil-topographical properties separate those yield classes can give producers and agronomists insight into developing efficient and effective soil management zones.

Objectives

- Classify consistently low, average, and high yield zones
- Determine if soil/topographical properties differed among zones
- Determine which soil/topographical properties could classify field locations

Materials and Methods

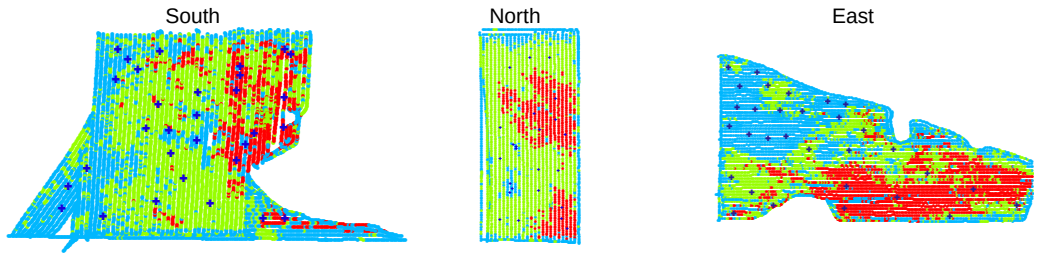
Yield Zone Determination
-Point-yield data for four years were spatially joined
-Individual yearly data normalized
-Coefficient of variation (CV) determined across years.
-Zones
  -CV ≤ 30 – consistent
    - High (normalized average >120) (CH)
    - Average(80 < normalized average < 120) (CA)
    - Low (normalized average < 80) (CL)

Soil/Topography Characterization
-Analyzed for Ca, Mg, K, P, Zn, pH, total C, total N, texture, elevation, slope, and plan and profile curvature.

Statistics
-ANOVA – soil/topographical property differences between yield groups
-Stepwise Discriminant Analysis – soil/topography/yield group relationships.
-Discriminant Analysis - develop and cross-validate soil variable classification function

Results

Stable yield classification zones of the South, North, and East Fields



Soil and topographical parameters that were significantly different between yield zones in South, North, and East fields.

Field	Soil/Topography Properties						
South	Mg	pH	% Sand	% Clay	Elevation		
North	Mg	pH	K	% Sand	% Clay	Elevation	
East	Ca	Mg	pH	Total C	% Sand	% Clay	Slope

Soil and topographical parameters affecting yield for the South, North, and East fields.

Field	Soil Factors			Topographical Factors	
South	Clay	Sand	Mg	Slope	Plan Curvature
North	Sand	K	pH		
East	pH	Clay			

Cross-validation classification accuracies of the linear discriminant functions developed for soil sampling positions in the South, North, and East fields.

	Predicted Yield Class		
Actual Yield Class	Consistent- High	Consistent-Average	Consistent-Low
	% Classification		
		South	
Consistent- High	81.9	18.2	0.0
Consistent-Average	23.5	70.6	5.9
Consistent-Low	0.0	33.3	66.7
		North	
Consistent- High	87.5	10.0	12.5
Consistent-Average	10.0	70.0	20.0
Consistent-Low	0.0	16.7	83.3
		East	
Consistent- High	100.0	0.0	0.0
Consistent-Average	10.0	60.0	30.0
Consistent-Low	0.0	16.7	83.3

Selected References
Blackmore, S. 2000. The interpretation of trends from multiple yield maps. Computers Electron. Agric. 26:37-51

This paper was recently published as:
Cox, M.S. and P.D. Gerard. 2007 Soil Management Zone Determination by Yield Stability Analysis and Classification. Agron. J. 99:1357-1365