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Assessment of Soil Mapping Value
Part II - Potential Profitability

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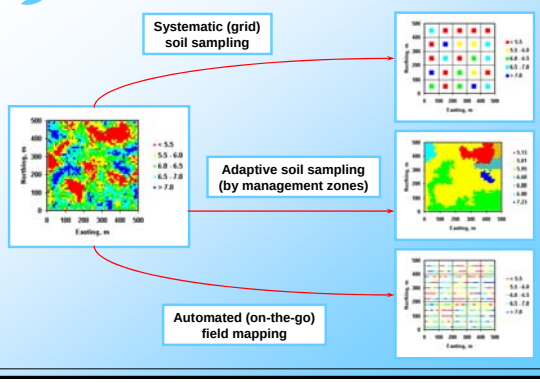
Background

- Accurate soil maps are required to implement site-specific crop management
- Quality of information is highly dependent on data acquisition methods
- Estimation error defines the quality of information (addressed in Part I)
- There is a need to relate estimation error and potential economic benefits (Part II)
- Cost of data acquisition and processing should not exceed the information value defined by the potential economic benefits

Soil Mapping Methods



Mobil Sensor Platform (MSP)

Estimation Error

Spatial variance (semivariogram model)

Variance of estimation error

Measurement error variance

$$\sigma_E^2 = \left(\frac{1+n_G}{n_G}\right)\sigma_G^2 + \frac{1}{n_M}\tau^2$$

Number of random cores

Number of measurements

$$Estimation\ \ Error \sim N\left(0,\ \sigma_E^2\right)$$

Objectives

- Develop a comprehensive model for predicting the potential agro-economic effects of different levels of soil mapping errors while pursuing a variable rate soil treatment
- Use soil pH management (variable rate liming) as an example
- Use numeric analysis methods to remove any model inputs restrictions

Numeric Prediction Model

Input 1
Event 1 – 20%
Event 2 – 50%
Event 3 – 30%

Input 2
Event 1 – 40%
Event 2 – 60%

Output
Sequence 1 – 8%
Sequence 2 – 12%
Sequence 3 – 20%
Sequence 4 – 30%
Sequence 5 – 12%
Sequence 6 – 18%

Report
Unique Sequence 1 – 28%
Unique Sequence 2 – 54%
Unique Sequence 3 – 18%

- **Every combination of independent input events can provide one and only one output with probability equal to the product of probabilities of events involved**
- **Some outputs can be obtained though more than one combination of input events**

Model Input Modules

Field distribution of the actual soil test level

Relationship between actual and estimated soil test level

Effect of chemical application on the level of soil test

Potential crop performance (net return) for a given soil test level

Model Parameters

Income = f (Soil pH) — **Soil pH = f (True pH, Lime, Probability)**

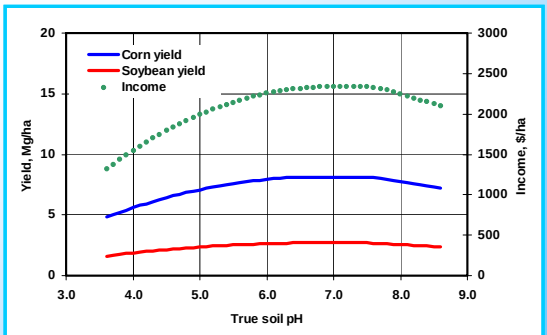
NRCL = f (Income, Cost) — **True pH = f (Probability)** — **Lime = f (Estimated pH)**

Cost = f (Lime) — **Estimated pH = f (True pH, Probability)**

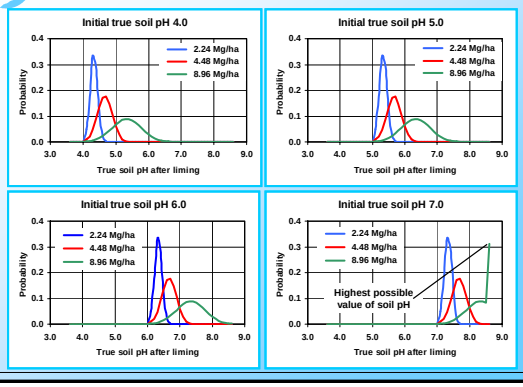
$$NRCL = \frac{Pc}{1+d}Yc_1 + \frac{Ps}{(1+d)^2}Ys_2 + \frac{Pc}{(1+d)^3}Yc_3 + \frac{Ps}{(1+d)^4}Ys_4 - C_L \cdot Q_L$$

NRCL = Net return over cost of lime	d = annual discount rate
Pc = price of corn	Yc = corn yield
Ps = price of soybean	Ys = soybean yield
C_L = cost of lime	Q_L = prescribed lime application rate

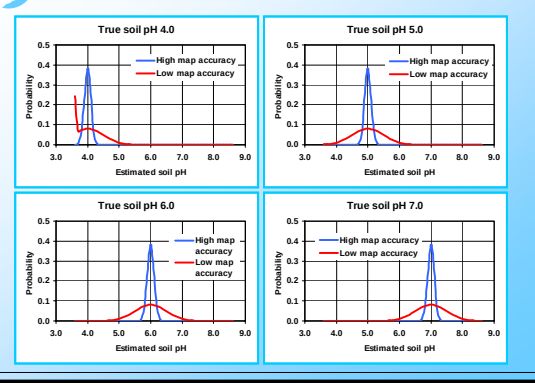
Crop Response and Potential Income



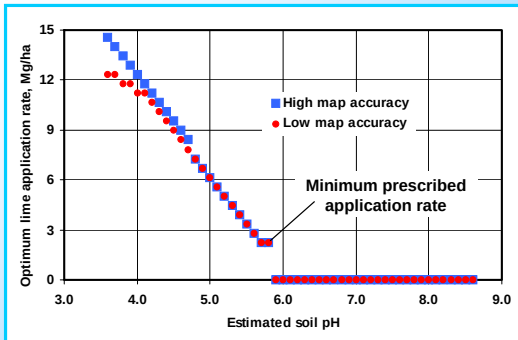
Lime Effect



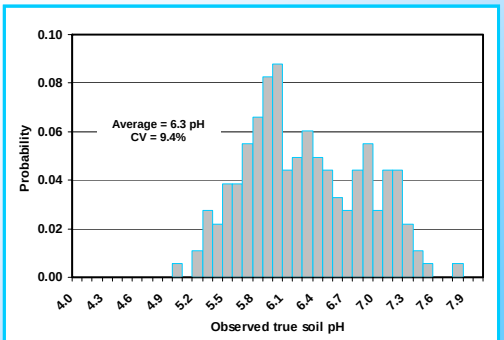
True and Estimated Soil pH



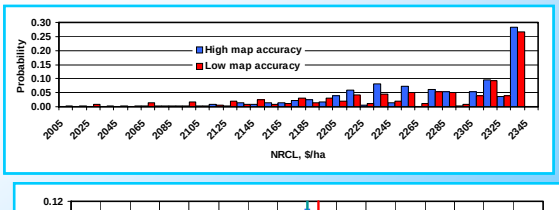
Optimum Lime Application Rate

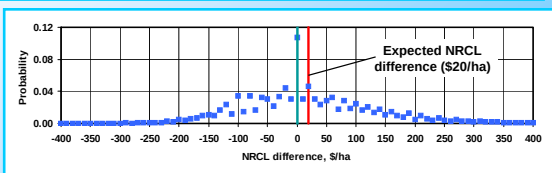


Distribution of True Soil pH

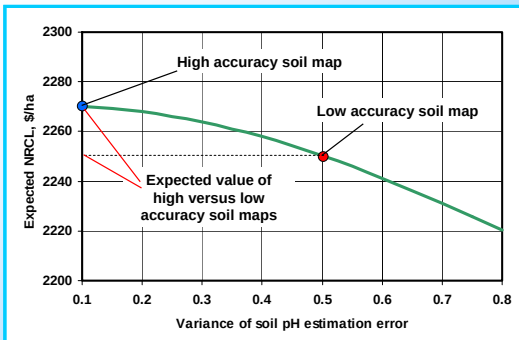


Model Output (NRCL)



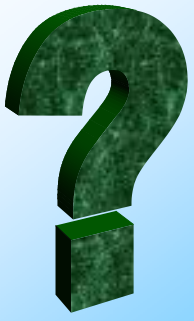


Expected NRCL



Conclusions

- **A comprehensive numeric model can be used to predict potential agro-economic effects of different soil mapping techniques**
- **Model inputs have to be defined to represent realistic relationships between parameters involved**
- **The dependency of model output from soil mapping error (or other model inputs) can be used to quantify the potential for a particular site-specific soil management strategy**



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