The 9th ECPA (Lleida, Spain)
July 9, 2013

Effect of Sampling Patterns and Interpolation Methods on Prediction Quality of Soil Variability Mapping

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Background

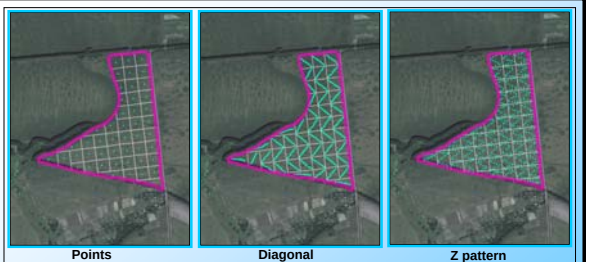
- Often, suitable adaptive soil sampling is more informative and cost-effective than systematic soil sampling
- Due to its robustness, systematic soil sampling is still the most popular approach
- Point sampling (grid center or stratified) is more popular than composite sampling due to cost restrictions
- Semi-automatic soil sampling equipment allows for minimizing cost differences
- What is the best way to use this equipment?

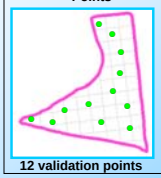
Semi-Automatic Soil Sampling

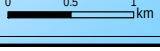
Compared Strategies

- Sampling pattern
  - Center grid point sampling (Points)
  - Diagonal grid cell sampling (Diagonal)
  - Z pattern grid cell sampling (Z pattern)
- Interpolation
  - Ordinary Kriging (Kriging)
  - Inverse-distance weighting (IDW)
  - Nearest neighbour (Tiling)
  - Field average
- Grid size
  - 1 ha (experiment and simulation)
  - 5 ha (simulation only)
- Soil properties
  - N, P, K (experiment)
  - ECa (simulation)

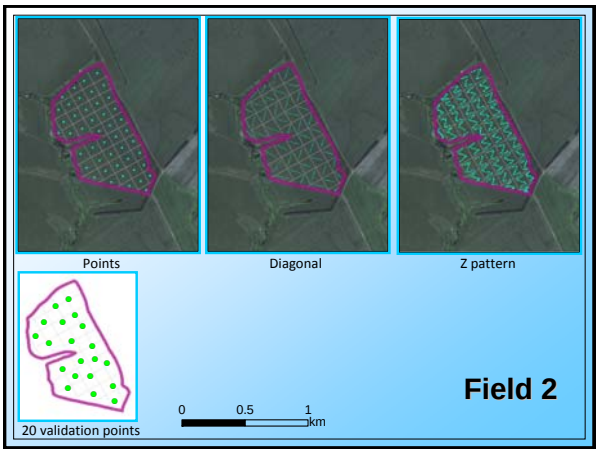
Experimental Fields

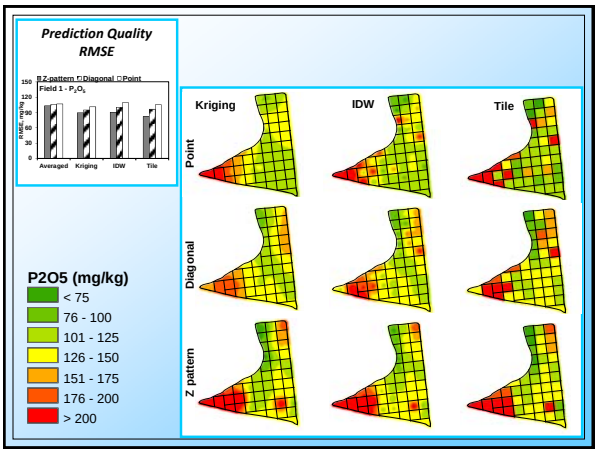


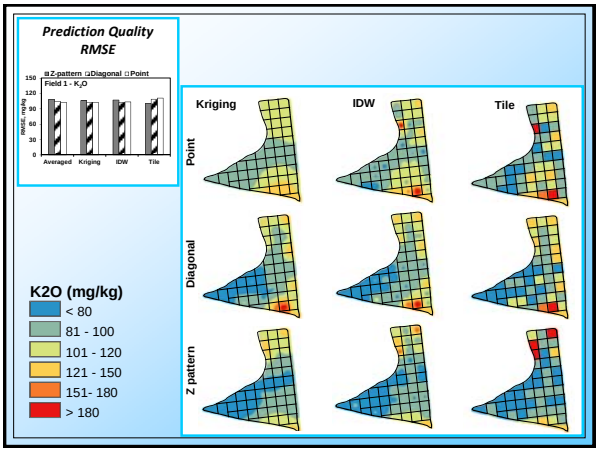


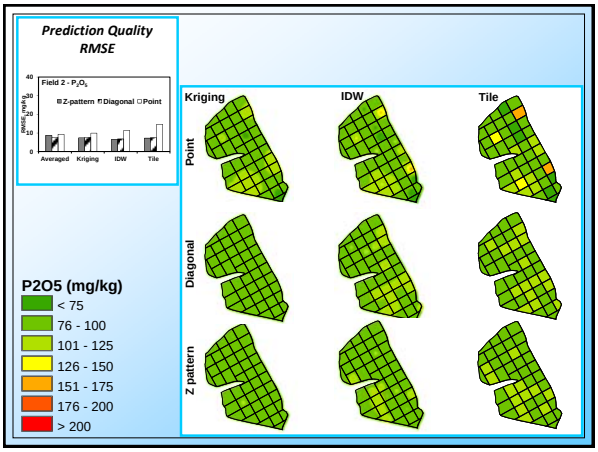


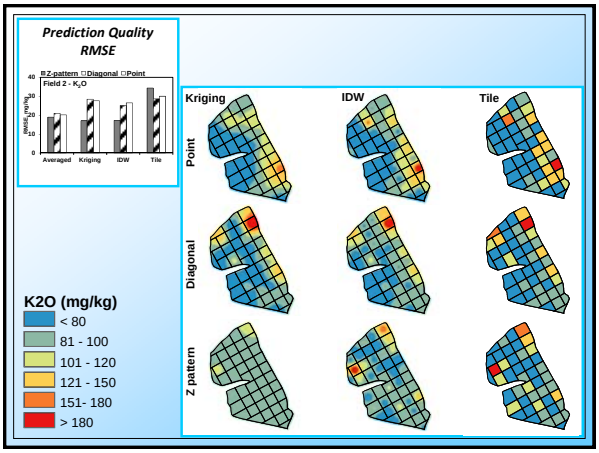
Field 1

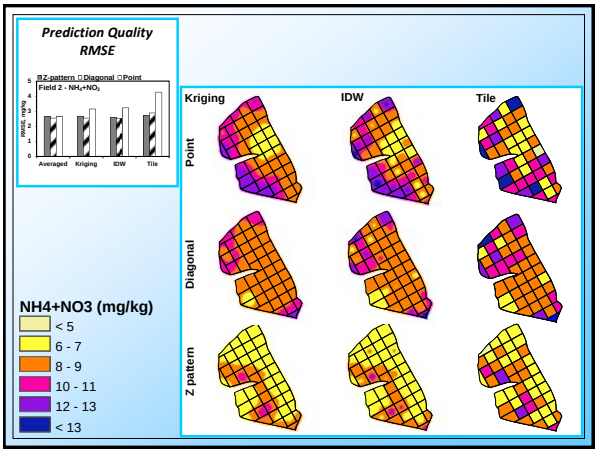

Points
Diagonal
Z pattern
20 validation points
0 0.5 1 km
Field 2

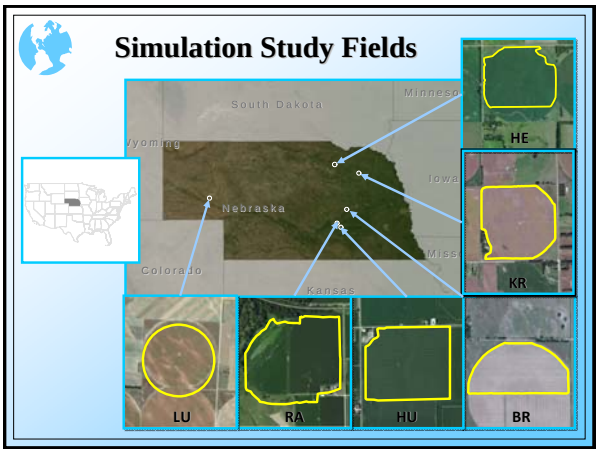

Prediction Quality
RMSE
Z-pattern Diagonal Point
Field 1 - P2O5
Averaged Kriging IDW Tile
Kriging
IDW
Tile
Point
Diagonal
Z pattern
P2O5 (mg/kg)
< 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
> 200

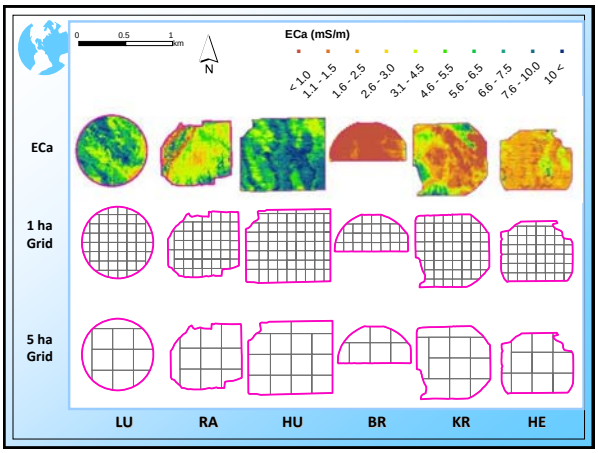

Prediction Quality
RMSE
Z-pattern Diagonal Point
Field 1 - K2O
Averaged Kriging IDW Tile
Kriging
IDW
Tile
Point
Diagonal
Z pattern
K2O (mg/kg)
< 80
81 - 100
101 - 120
121 - 150
151- 180
> 180

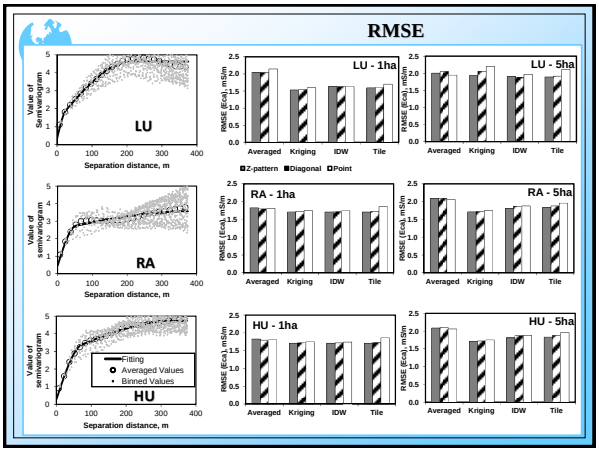

Prediction Quality
RMSE
Field 2 - P2O5
Z-pattern Diagonal Point
Averaged Kriging IDW Tile
Kriging
IDW
Tile
Point
Diagonal
Z pattern
P2O5 (mg/kg)
< 75
76 - 100
101 - 125
126 - 150
151 - 175
176 - 200
> 200

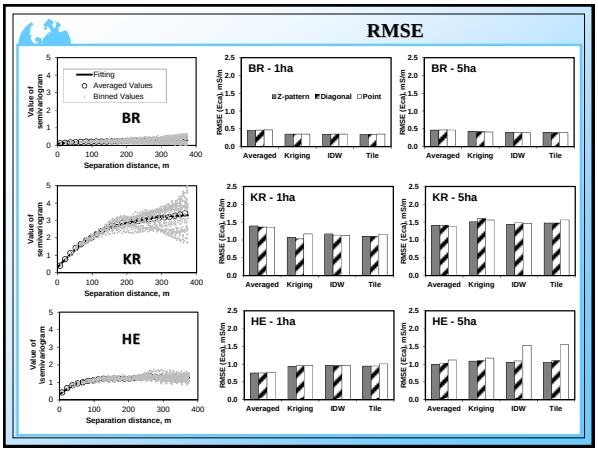

Prediction Quality
RMSE
Z-pattern Diagonal Point
Field 2 - K2O
Averaged Kriging IDW Tile
Kriging
IDW
Tile
Point
Diagonal
Z pattern
K2O (mg/kg)
< 80
81 - 100
101 - 120
121 - 150
151- 180
> 180


Prediction Quality
RMSE
Z-pattern Diagonal Point
Field 2 - NH4+NO3
Averaged Kriging IDW Tile
Kriging
IDW
Tile
Point
Diagonal
Z pattern
NH4+NO3 (mg/kg)
< 5
6 - 7
8 - 9
10 - 11
12 - 13
< 13









Conclusions

- **A larger sampling grid reduced the potential to uncover low-range variability**
- **Although none of the alternative methods produced significantly smaller RMSE estimates throughout the study, in many cases z-pattern-grid-cell sampling, with either ordinary kriging, or IDW interpolation, indicated a tendency to provide lower prediction errors than other types of sampling or tiling**
- **Point-based sampling with tiling resulted in a few cases with the weakest predictions**
- **The presence of a spatial structure was an important component for an interpolated thematic soil map that results in more accurate information than the field average map**

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