High Intensity Soil Mapping for Hydropedology and Precision Agricultural Research

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Introduction

- Hydropedology and precision agriculture research require high intensity soil maps (map scale > 1:5000) for investigating site-specific water movement across the landscape, and site-specific crop management.
- We hypothesized that for the complex of shallow and deep soils (e.g., Opequon-Hagerstown complex), the dryer crop yield patterns together with geophysical investigations, field soil coring, soil-landscape modeling, expert knowledge and laboratory characterizations can be used for high intensity soil mapping.

Materials & Methods

Site Description

- Depth to bedrock: Opequon series: < 0.5m; Hagerstown series: > 1m.
- Winter wheat yield potential: Opequon series: 2688 kg/ha; Hagerstown series: 4032 kg/ha.

Key to Soil Series

- Depth to bedrock: Opequon-Hagerstown complex, and four second order soil mapping units (Fig. 1)

Key to Soil Map Units

- 6.2-ha PA winter wheat field including two soil series: Hagerstown and Opequon-Hagerstown complex, and four second order soil mapping units (Fig. 1) for investigating site-specific water movement across the landscape, and site-specific crop management.

Results

- Second order soil mapping units are inappropriate for site-specific water studies and site-specific crop management primarily due to the lowest purity compared to the first order and high intensity soil map units, the misplacement of soil boundaries and the misname of map units.
- High intensity soil map units have the highest potential for site-specific crop management compared to first and second order soil map units.
- The dry-year crop yield spatial patterns provided guidance for high intensity mapping of the complex of shallow and deep soils.

Acknowledgement: This project was funded by the USDA-CSREES National Research Initiative (H2000-30110-12547). We thank Jordan Rajan, Mike Kruskula and Chuck Walter for excellent field assistance in the instrument installation and soil moisture sampling.

Conclusions

- Second order soil map units are inappropriate for site-specific water studies and site-specific crop management primarily due to the lowest purity compared to the first and high intensity soil map units, the misplacement of soil boundaries and the misname of map units.
- High intensity soil map units accounted for the spatial patterns of crop yield and soil moisture in the crop root zone when soil types were the dominant control, while first and second order soil map units are insufficient.
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Effects of different order soil map units on crop yield & soil moisture in the crop root zone (0 to 25cm)

Table 1. Summary of results for dry-year crop yield spatial patterns

<table>
<thead>
<tr>
<th>Soil Map Unit</th>
<th>Crop Yield (kg/ha)</th>
<th>Soil Moisture (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Order Soil Map</td>
<td>High Intensity</td>
<td></td>
</tr>
<tr>
<td>Second Order Soil Map</td>
<td>High Intensity</td>
<td></td>
</tr>
<tr>
<td>High Intensity Soil Map</td>
<td>High Intensity</td>
<td></td>
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</tbody>
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