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Comparison of Two Alternative Methods to Map Soil Mechanical Resistance On-the-Go

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Background

- Soil mechanical resistance is an indicator of soil physical conditions and is frequently related to compaction
- It is expressed in units of pressure and represents the force, normalized by the projected frontal (base) area, required to move the soil-engaging element through soil media
- Determining soil mechanical resistance using a standard cone penetrometer is time consuming
- Several different prototype soil sensors have been developed for on-the-go mapping



Background

- These prototypes measure soil mechanical resistance represented as:
 - An overall estimate (draft)
 - A discrete-depth soil profile
 - A functional relationship with depth
- Soil Strength Profile Sensor (SSPS) measures soil mechanical resistance at five discrete depths
- The instrumented blade of the Integrated Soil Physical Properties Mapping System (ISPPMS) was developed to map parameters of a linear relationship between soil mechanical resistance and depth

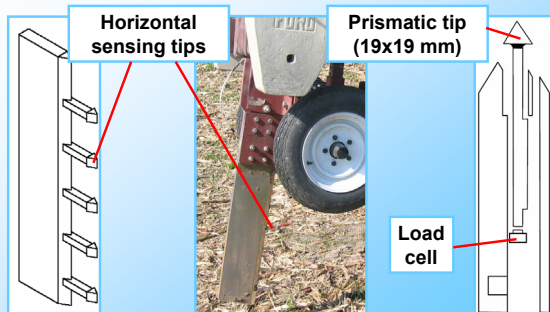


Objectives

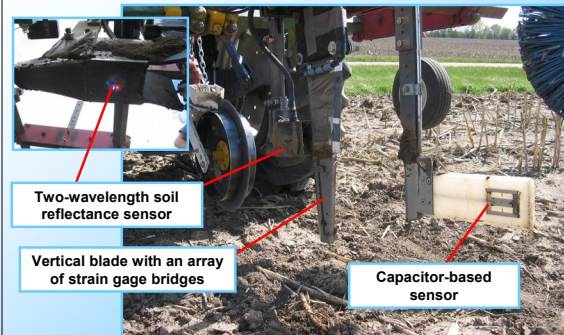
- Compare two different methods for on-the-go mapping of soil mechanical resistance using data obtained in a single 13.5-ha agricultural field
- Compare both methods with the standard cone penetrometer measurements

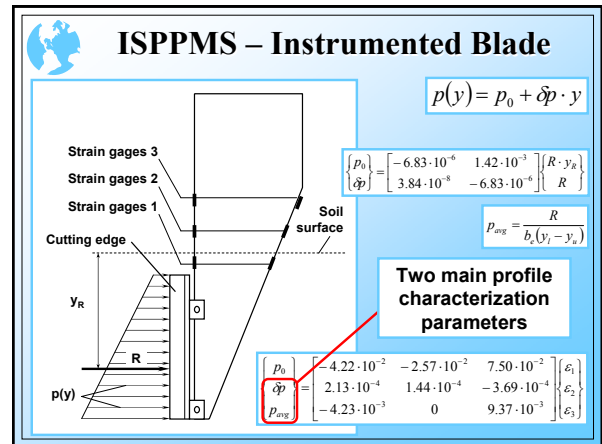
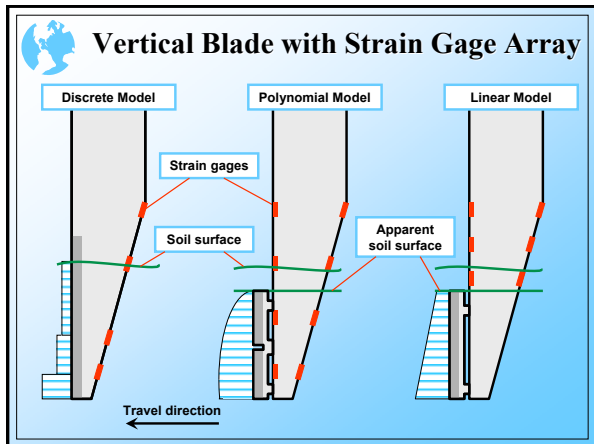


Soil Strength Profile Sensor (SSPS)



Integrated Soil Physical Properties Mapping System (ISPPMS)





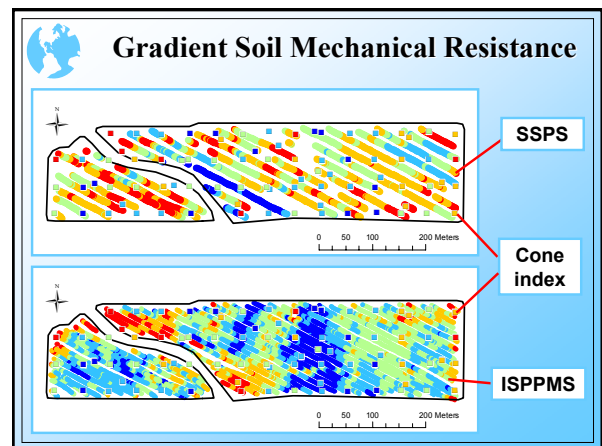
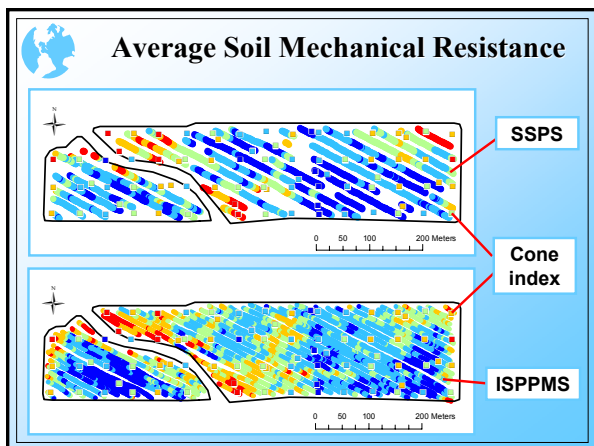
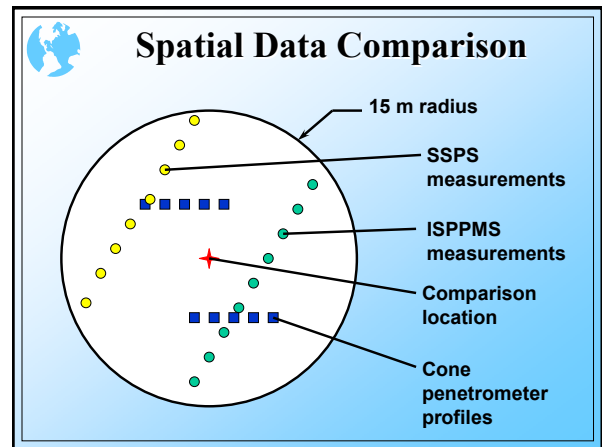
Data Layers

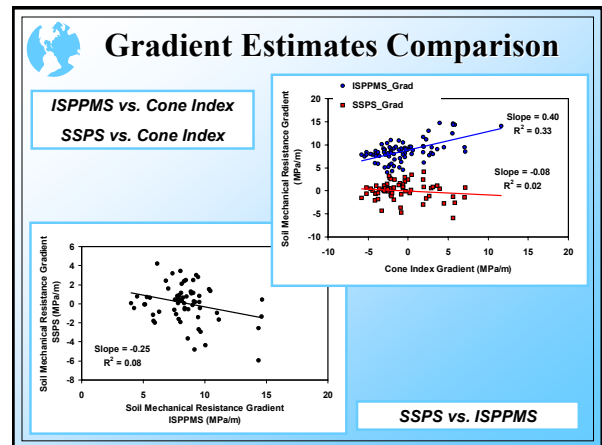
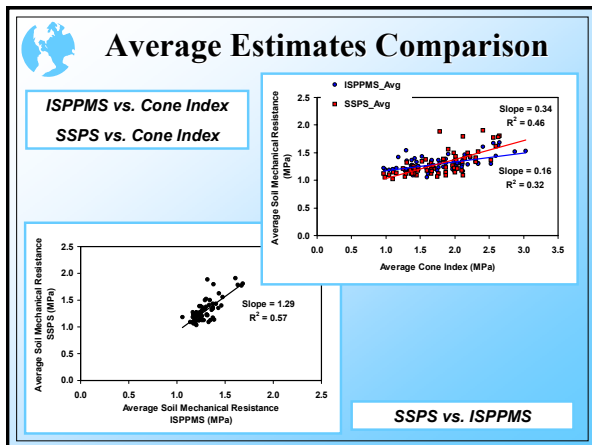
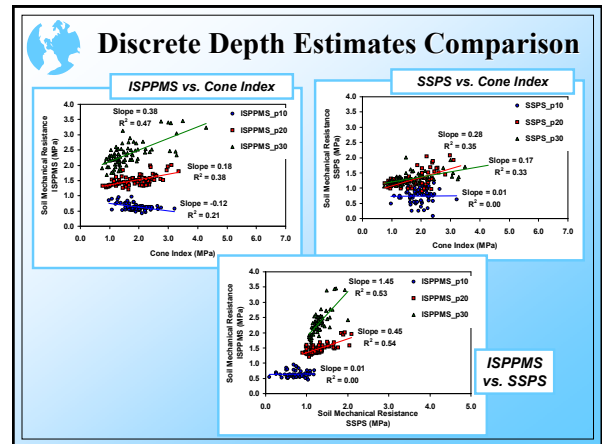
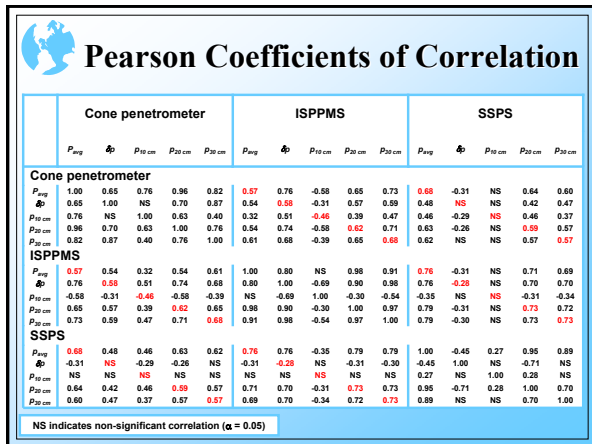
Overall estimates (ISPPMS):

- p_{avg} = average soil mechanical resistance normalized by the base area, MPa
- δp = depth gradient of soil mechanical resistance, MPa/mm

Discrete estimates (SSPS):

- p_{10} = discrete value at 10 cm depth, MPa
- p_{20} = discrete value at 20 cm depth, MPa
- p_{30} = discrete value at 30 cm depth, MPa





- ## Summary
- On-the-go mapping of soil mechanical resistance allows delineation of field areas with relatively hard or soft cultivated layer of soil
 - Estimates of soil mechanical resistance attained using cone penetrometer and on-the-go sensing approaches are different in nature, but are related
 - Measurements produced by both on-the-go sensors followed a similar field pattern and were correlated with $R^2 = 0.57$.
 - Applications of discrete depth and generalized model sensing methods may be different
 - The agronomic value of soil profiles near-surface (5 - 30 cm) is yet to be determined

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