



# Soil Compaction Sensor Systems – Current Developments

*Viacheslav I. Adamchuk*

*Abbas Hemmat*

*Dept. of Biological Systems Engineering  
University of Nebraska – Lincoln (USA)*

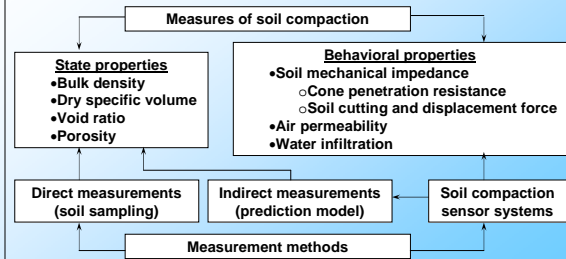
*Dept. of Farm Machinery  
Isfahan University of Technology (Iran)*

*Abdul M. Mouazen*

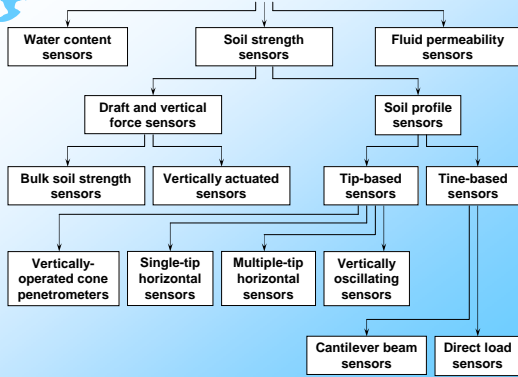
*Dept. of Natural Resources  
Cranfield University (UK)*



## Soil Compaction Measurements



## Soil compaction sensor systems

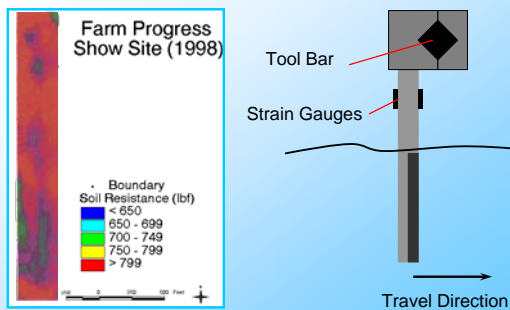


## Soil Mechanical Impedance

- Soil mechanical impedance (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
  - Spatial pattern (delineation of problematic areas)
  - Depth effect (definition of problematic locations)



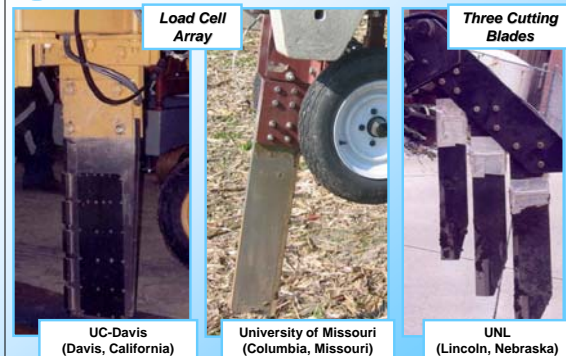
## Soil Mechanical Resistance Mapping

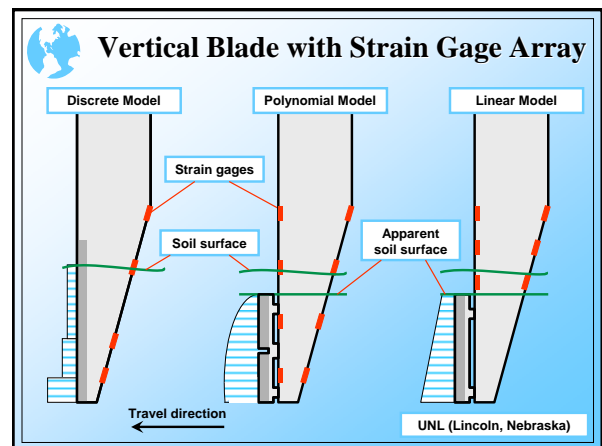
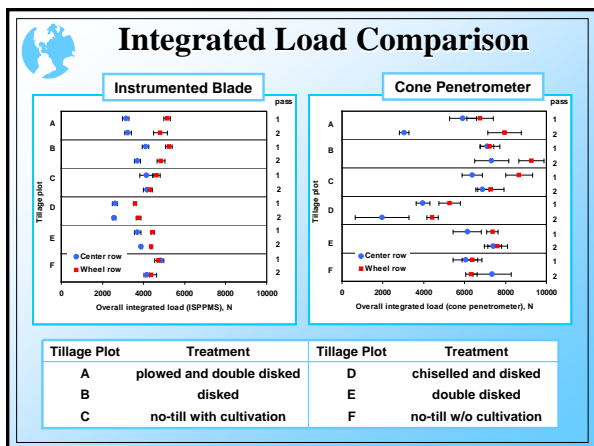
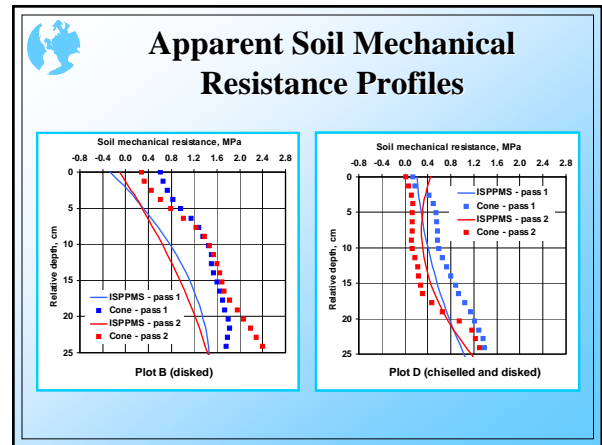
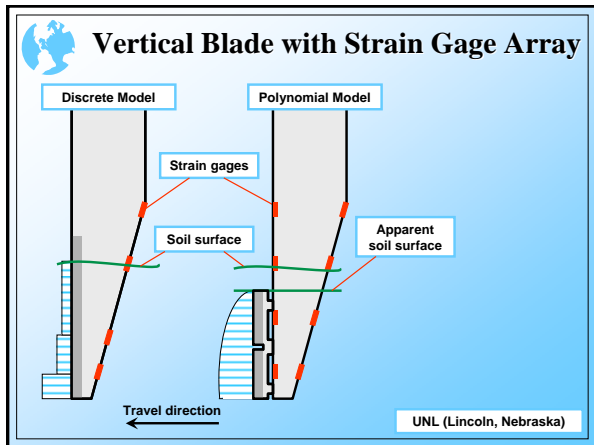
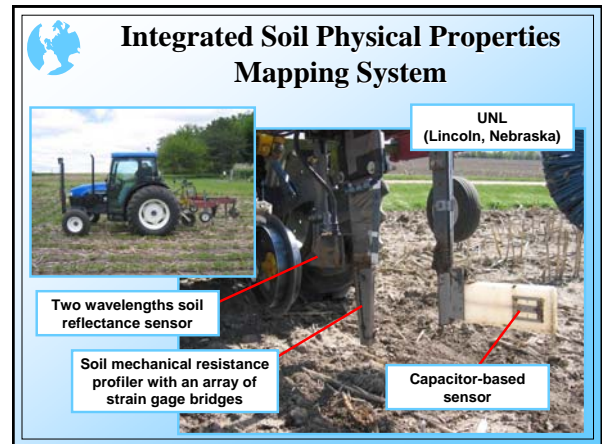
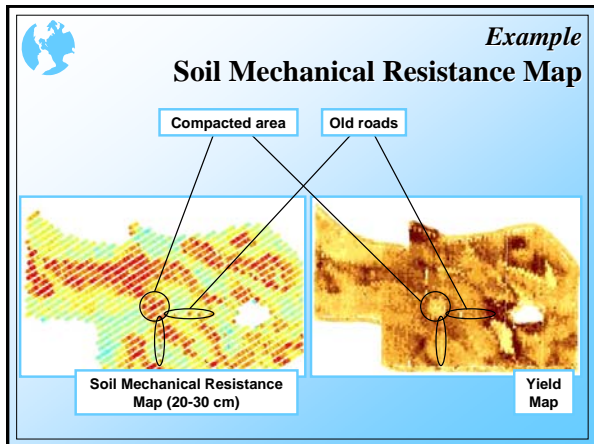


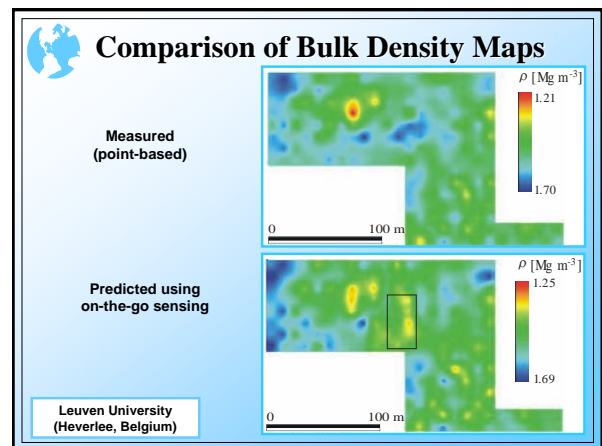
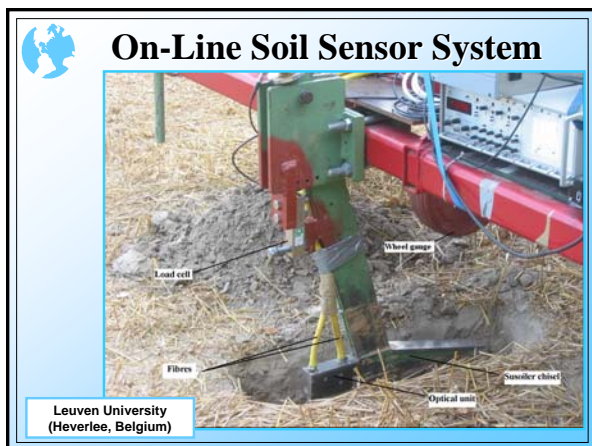
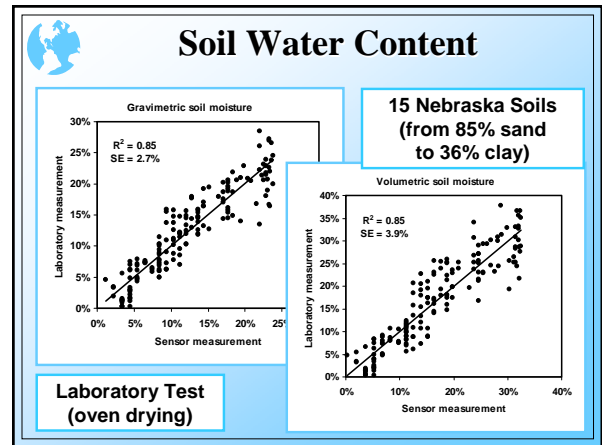
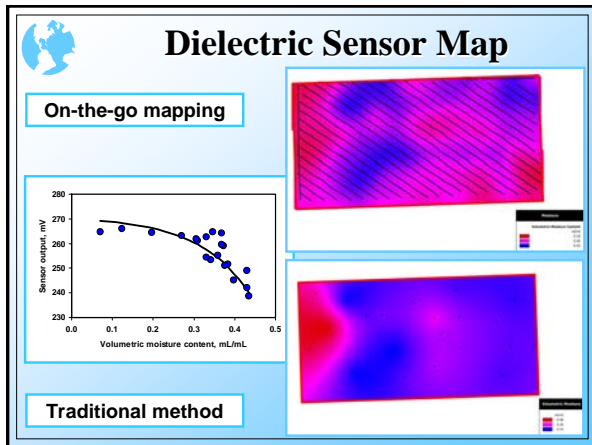
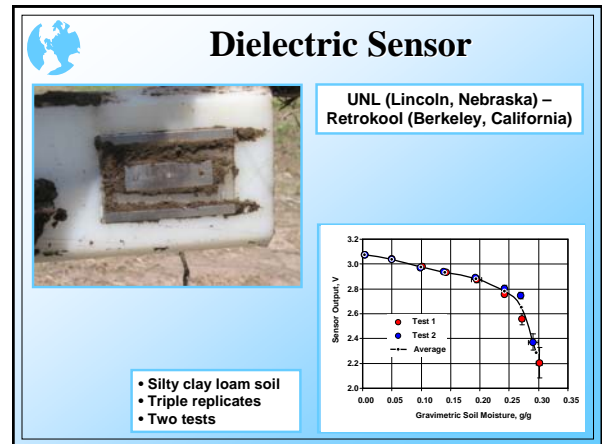
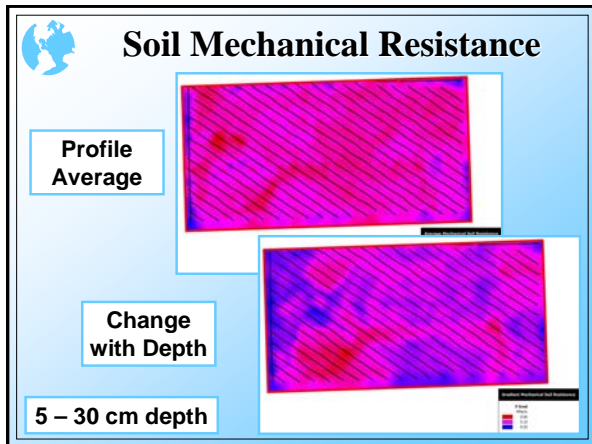
Purdue University (West Lafayette, Indiana)

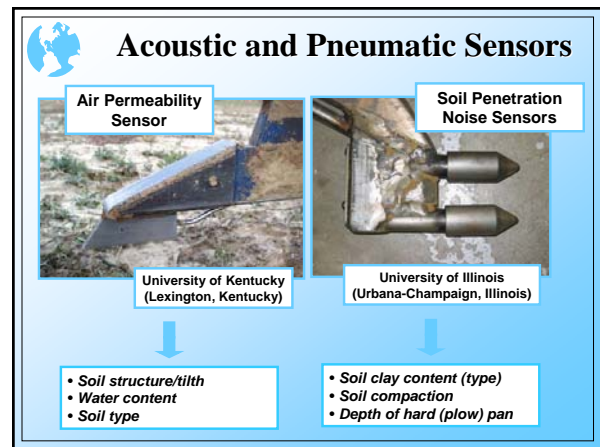
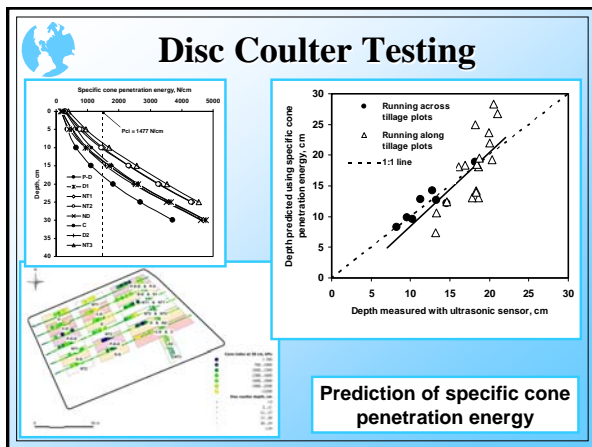
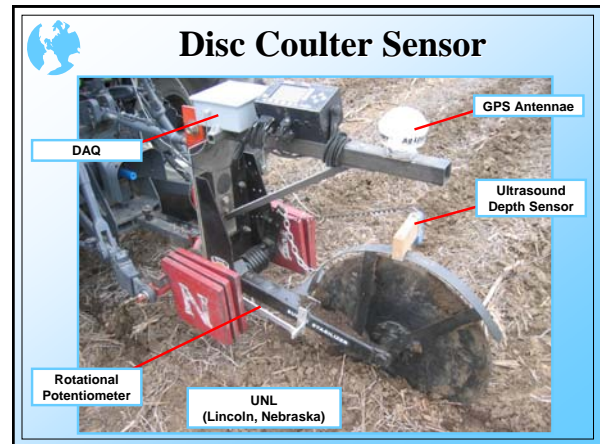
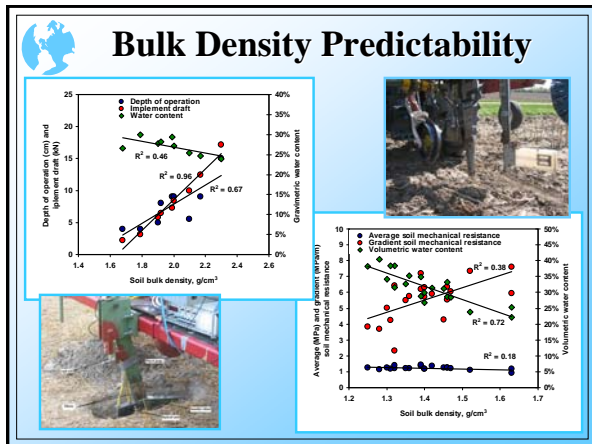


## Profiling Tools









- ## Final Thoughts
- Sensor fusion is critical to identify potentially compacted areas of a field
  - Soil mechanical resistance sensors reveal behavior effect of certain soil state
  - Soil failure mechanics is affected by operation depth, speed and instrument geometry
  - Maps produced using compaction sensor systems can be used to pursue various site-specific management strategies
  - The first step toward standardization may include systems classification and definition of operation parameters

