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Instrumentation System for Variable Depth Tillage

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Outline

- Background and Objectives
- Instrumented deep tillage implement development
- Operation strategy
- Preliminary field evaluation
- Summary
- Video

Background

- Local maximum soil mechanical resistance (plow pan) commonly occurs at a particular depth
- Deep tillage is necessary to control soil compaction
- Variable depth tillage is a precision agriculture technique implemented to reduce energy consumption and to increase productivity of crop production

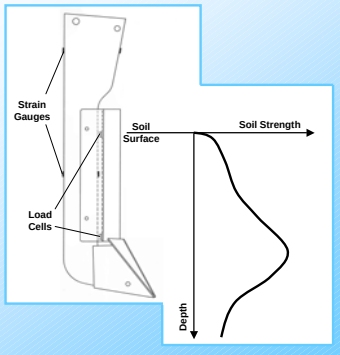
Past Experience

- Real-time draft control
- Mapping spatial and depth variability of mechanical soil resistance
- Predicting plow pan depth using electrical conductivity and other measurement techniques
- Variable depth tillage according to “prescription” maps or sensor inputs

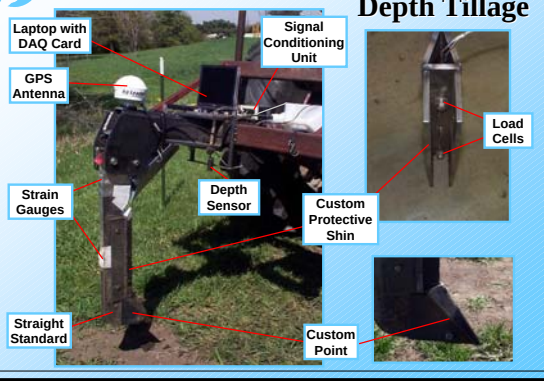
Objective

- Develop an instrumentation system based on a commercial implement for deep soil tillage that can identify changes in soil mechanical resistance with depth and guide itself to the appropriate operation depth in real time

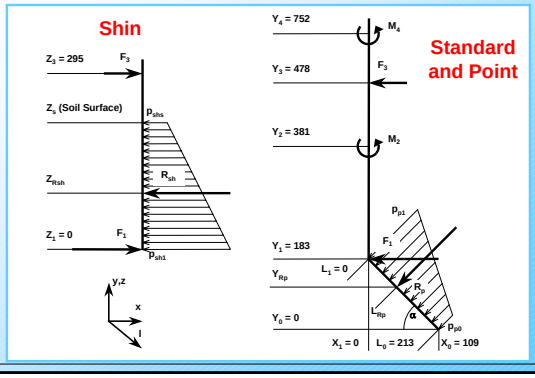
Hypothesis



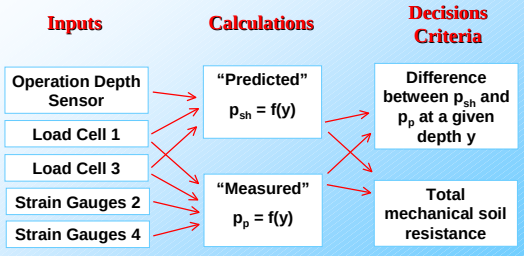
Instrumentation System for Variable Depth Tillage



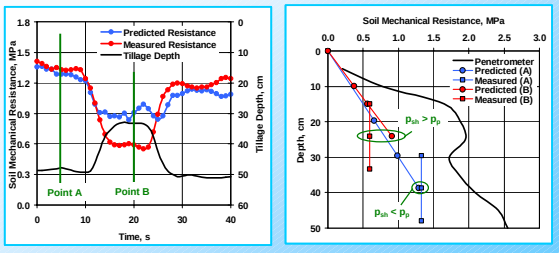
Free Body Diagram



Operation Strategy

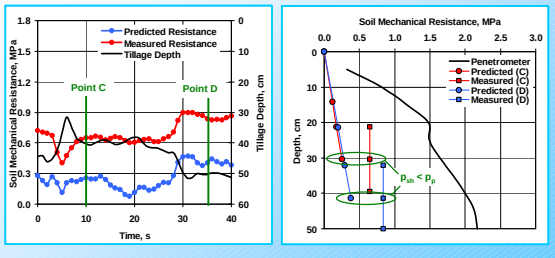


Compacted Test Plot



Preliminary Field Test

No-till Field



Preliminary Field Test

Summary

- A prototype instrumentation system for variable depth tillage has been developed
- Two linear distributions were used to calculate both measured p_p and predicted p_{sh} soil mechanical resistance pressure applied to the point
- Additional field tests are needed to develop the algorithm for closed-loop control in real time.