IOWA STATE UNIVERSITY
Department of Agricultural and Biosystems Engineering

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Grain Cart Compaction Impact

Client: John Deere Intelligent Solutions Group; Urbandale, IA

Problem Statement

- Soil compaction poses a large threat in potential yield reduction in row crop operations across the globe.
- The tractor and grain cart is the heaviest piece of machinery pulled through a field, making it the most likely to leave highest level of compaction.

Objectives

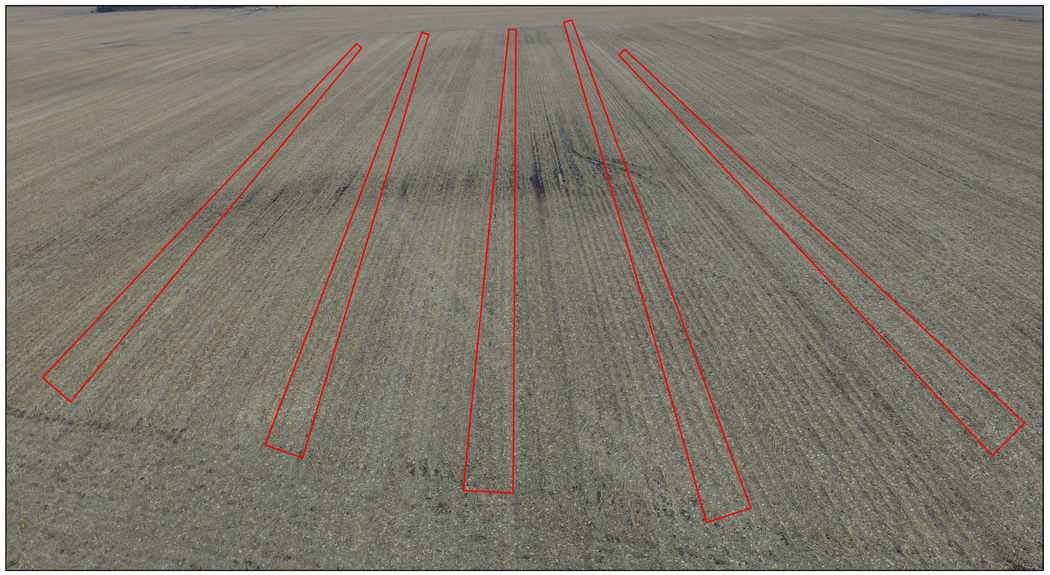
- Correlate soil compaction caused by grain cart traffic to potential crop yield loss
- Use aerial imagery to help visualize impact behind compaction
- Analyze difference in crop root growth at different levels of compaction

Constraints

- Budget – covered by John Deere
- Timeline – data gathered before the ground freezes
- Materials – Penetrometer, drone, John Deere Operations Center

Scope

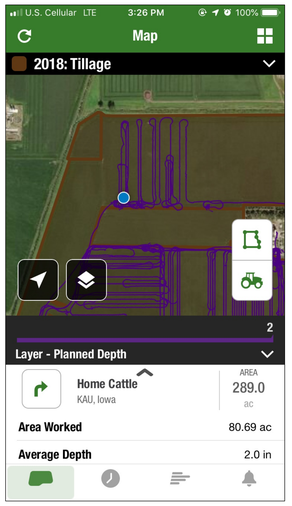
- The scope is to measure the impact of compaction caused by grain cart activity in row crop operations.



Drone footage of field where red outlined areas represent grain cart path. Inside outline, soil pressure averaged 75 PSI. Outside grain cart path, average compaction level was 25 PSI.

Tracks on grain carts are popular to help decrease compaction level by spreading out the weight.

Corn stalk and root structure shown to visualize the negative effect of compaction on root growth



John Deere Operations Center mobile app helps document and analyze in field data for better future decision making.

Methods

- Traveled to field to measure soil pressure in and out of grain cart path
- Utilize John Deere Operations Center capabilities for in-field data
- Plant growth boxes to show root growth and plant health at different compaction levels

Proposed Solutions

- Eliminate miscellaneous grain cart and semi truck activity when not necessary
- Adjust seeding rates and crop input methods to accommodate economic loss from yield reduction of high compaction areas
- Connect John Deere Operations Center to changing real-time grain cart weight levels

Major Outcomes

- Translate yield impact of crop from compaction caused by grain cart
- Show the difference in root growth in different levels of soil compaction
- Find economic impact of compaction caused by grain cart

Benefit to Client

- Possible confirmation of theory behind grain cart compaction
- Help John Deere to better understand and visualize compaction levels to be better informed on the subject

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