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Field Testing and Optimization of Soy Based Dust Control Agents

by
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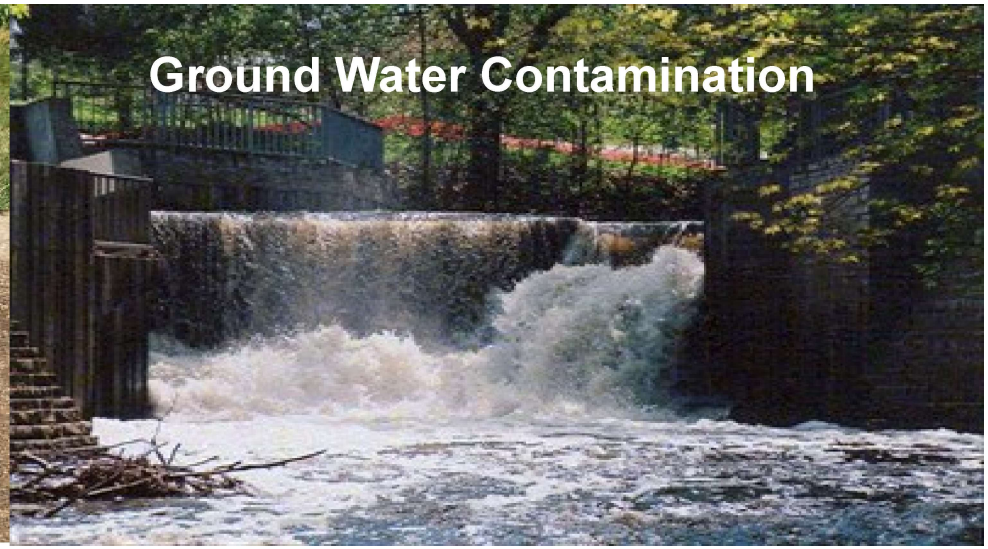
Summary

- The need for better road dust control agents
- Development of soy-based dust control at NDSU
- Field test results
- Current and future projects

The Problem

- Fugitive road dust is hazardous to people, livestock and crops
- Current widespread use of magnesium and calcium chloride create environmental concerns and cause corrosion to vehicles and infrastructure
- Chlorides typically require two applications per year and fail in low humidities

Calcium Chloride Run Off

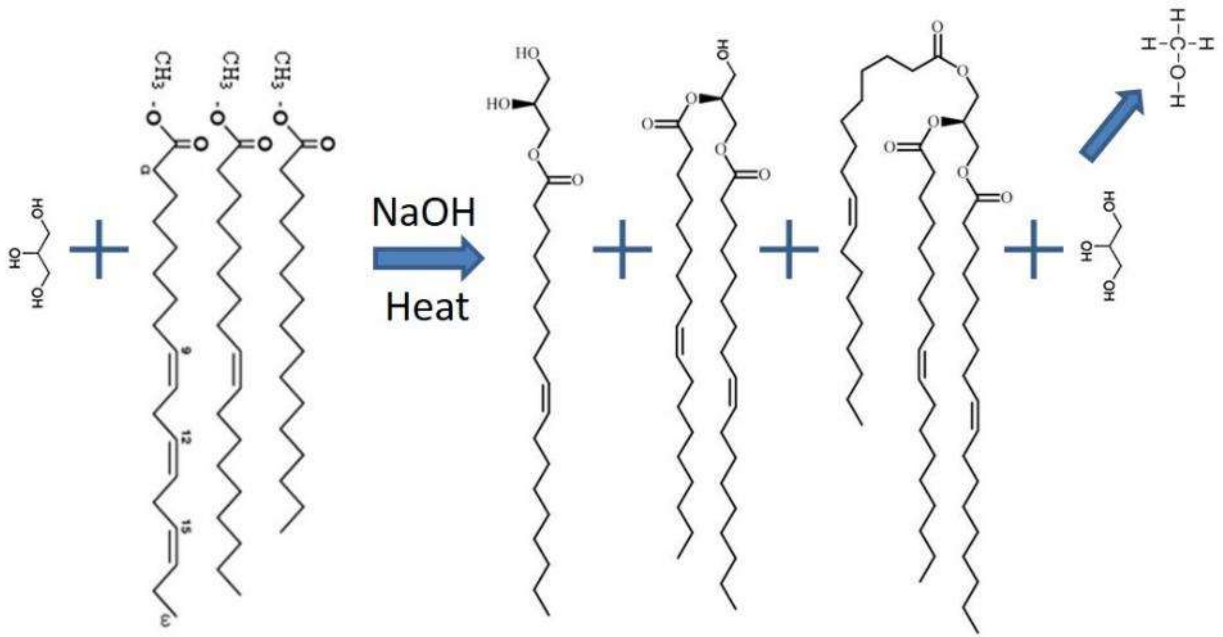


Ground Water Contamination

Soy-Based Benefits

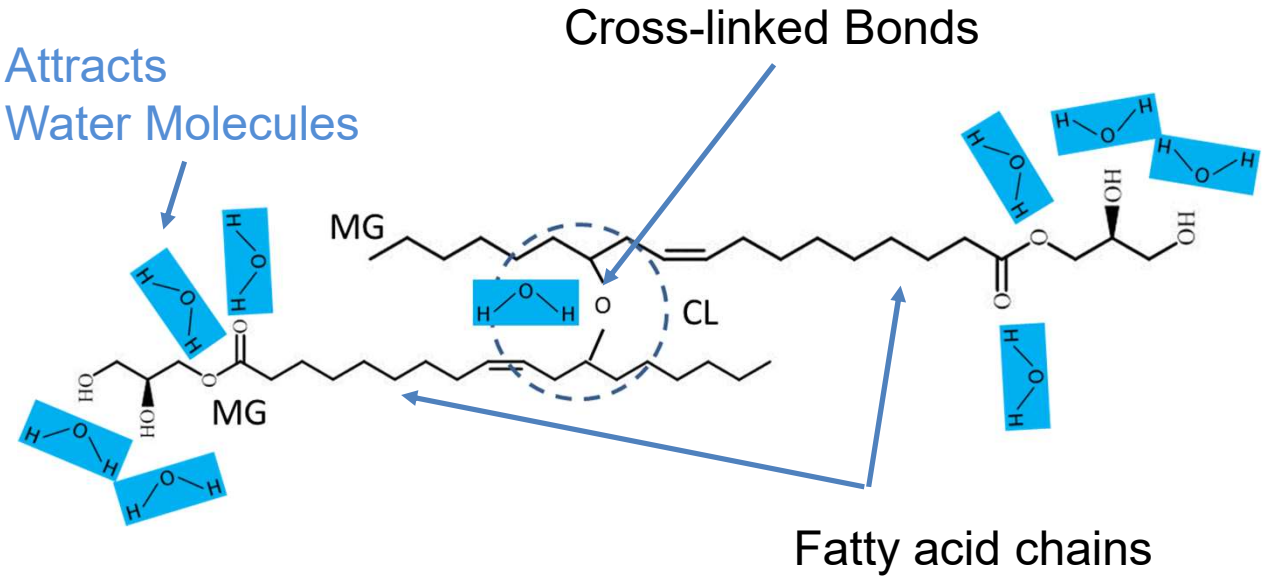
- Non-corrosive, non-toxic, and biodegradable
- Drop-in replacement for chlorides- ***can use existing trucks***
- Does not accumulate in lakes and streams
- Can reduce gravel road maintenance costs by stabilization
- Increased demand for midwestern agricultural products

Material Description



Glycerol + Soy Biodiesel or oil → Mono, Di and Triglycerides

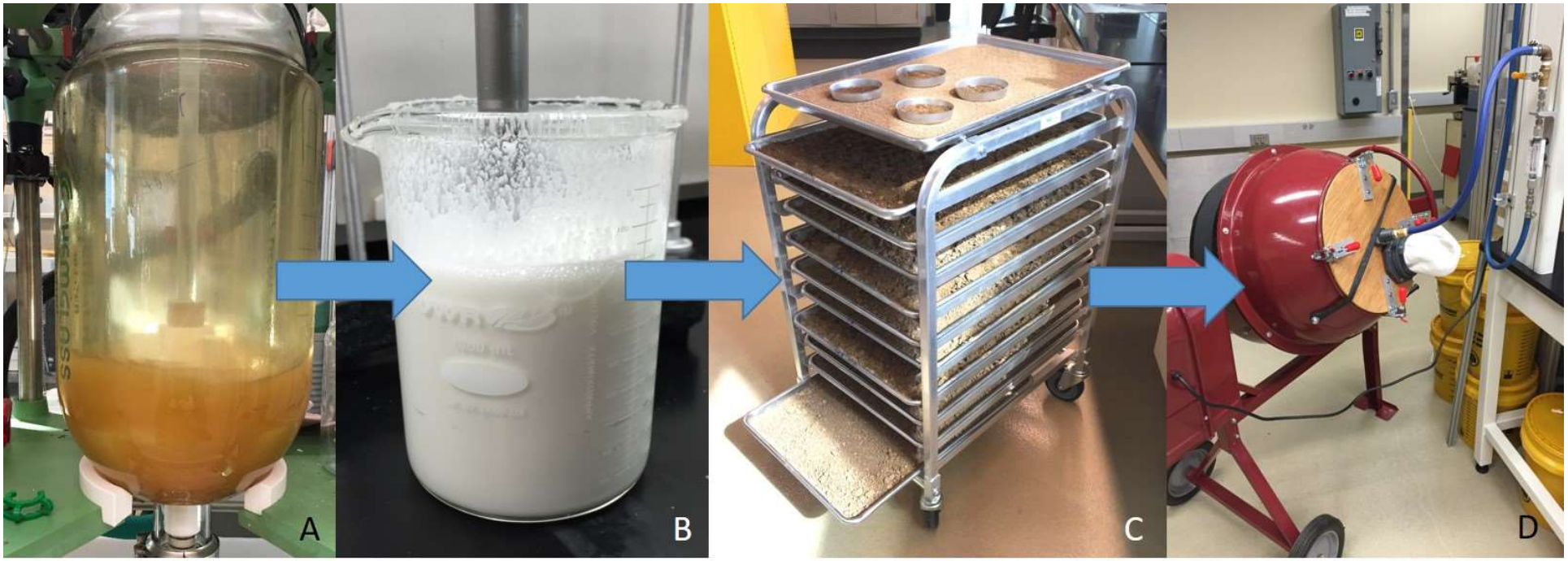
Mode of Action



- Aged material has >10x increase in molecular weight due to cross-linking
- Binds dust particles together
- Remains pliable, does not harden

Early Lab Development

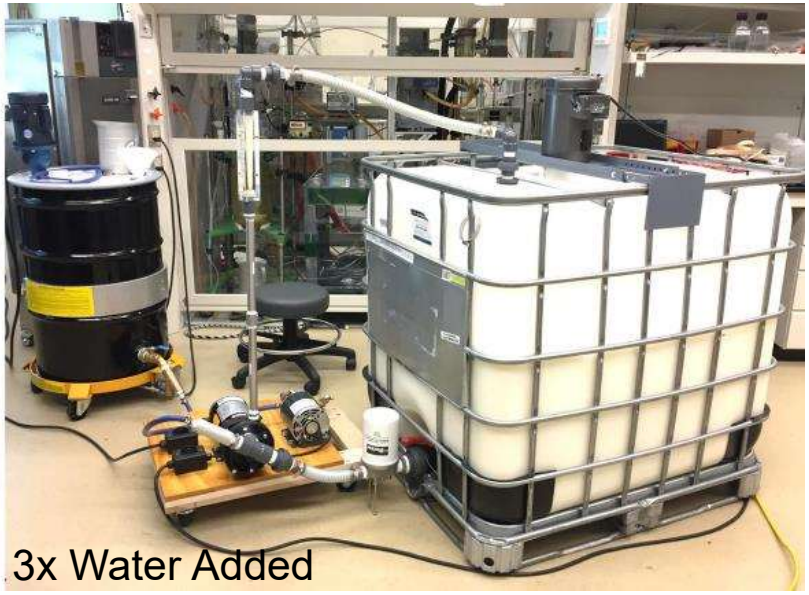
Synthesize Emulsify in Water Treat Gravel Measure Dust



Road Test Prep

Dual Reactors

Emulsification



3x Water Added

1,100 gallons of product

Road Test Application

Application day 0.5 gal/yd^2

Eight days later after 2 inches of rainfall
No visible run-off

Application Day

Road Test Results

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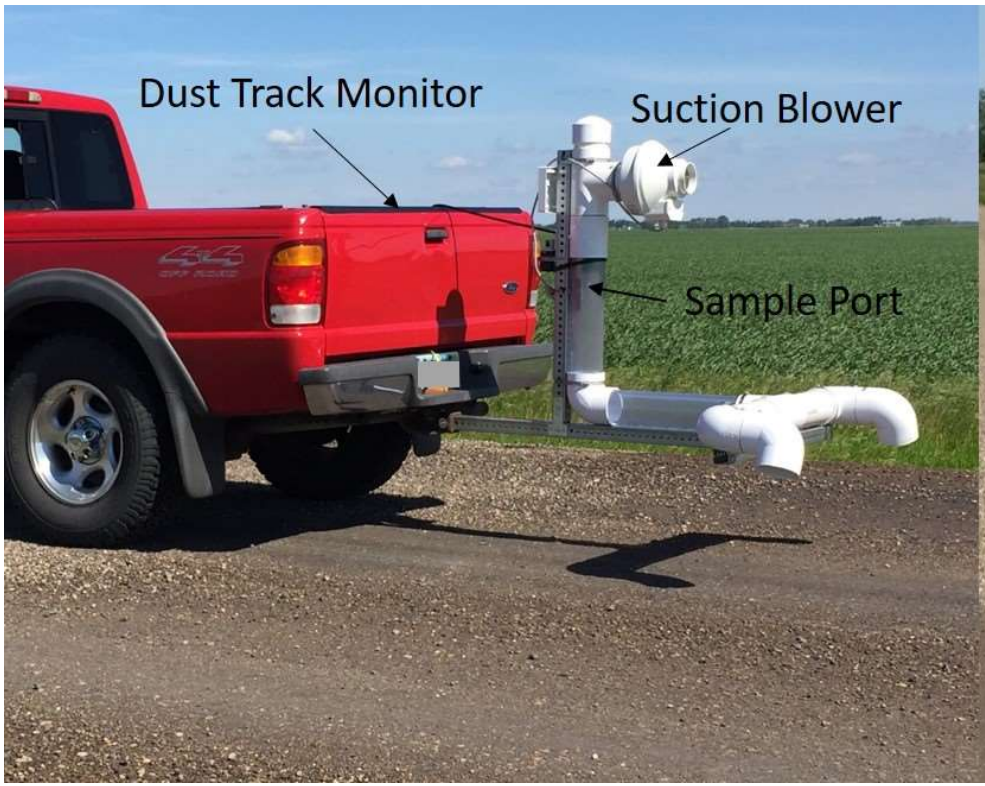
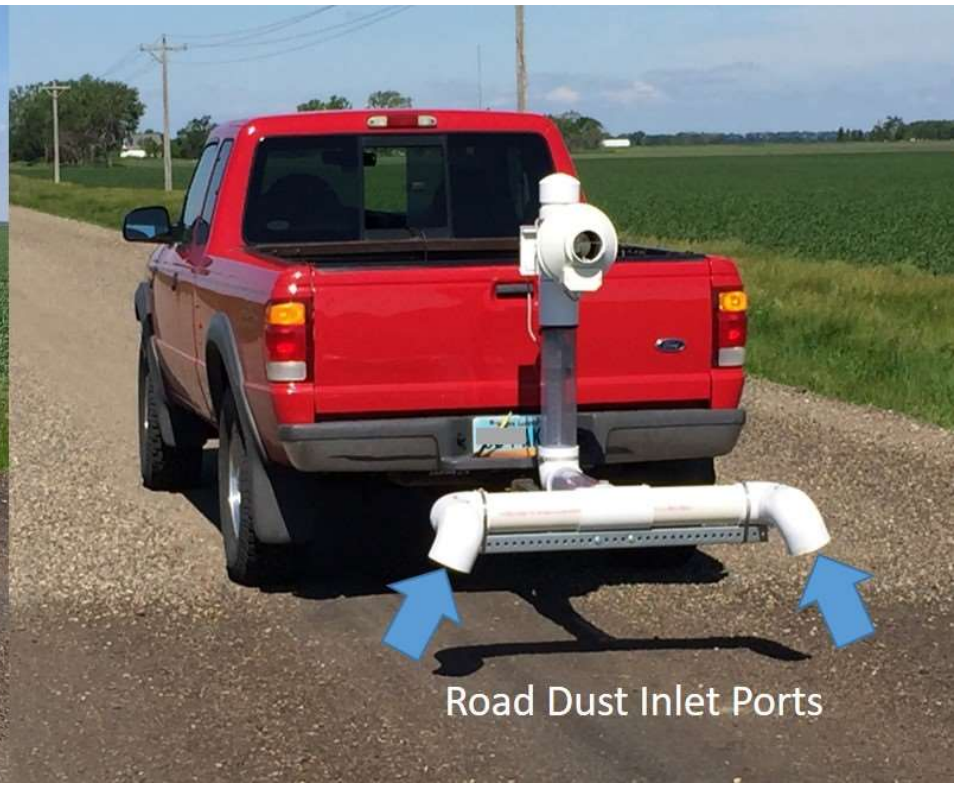
Real Time Dust Meter

DUSTTRAK II AEROSOL MONITOR 8532

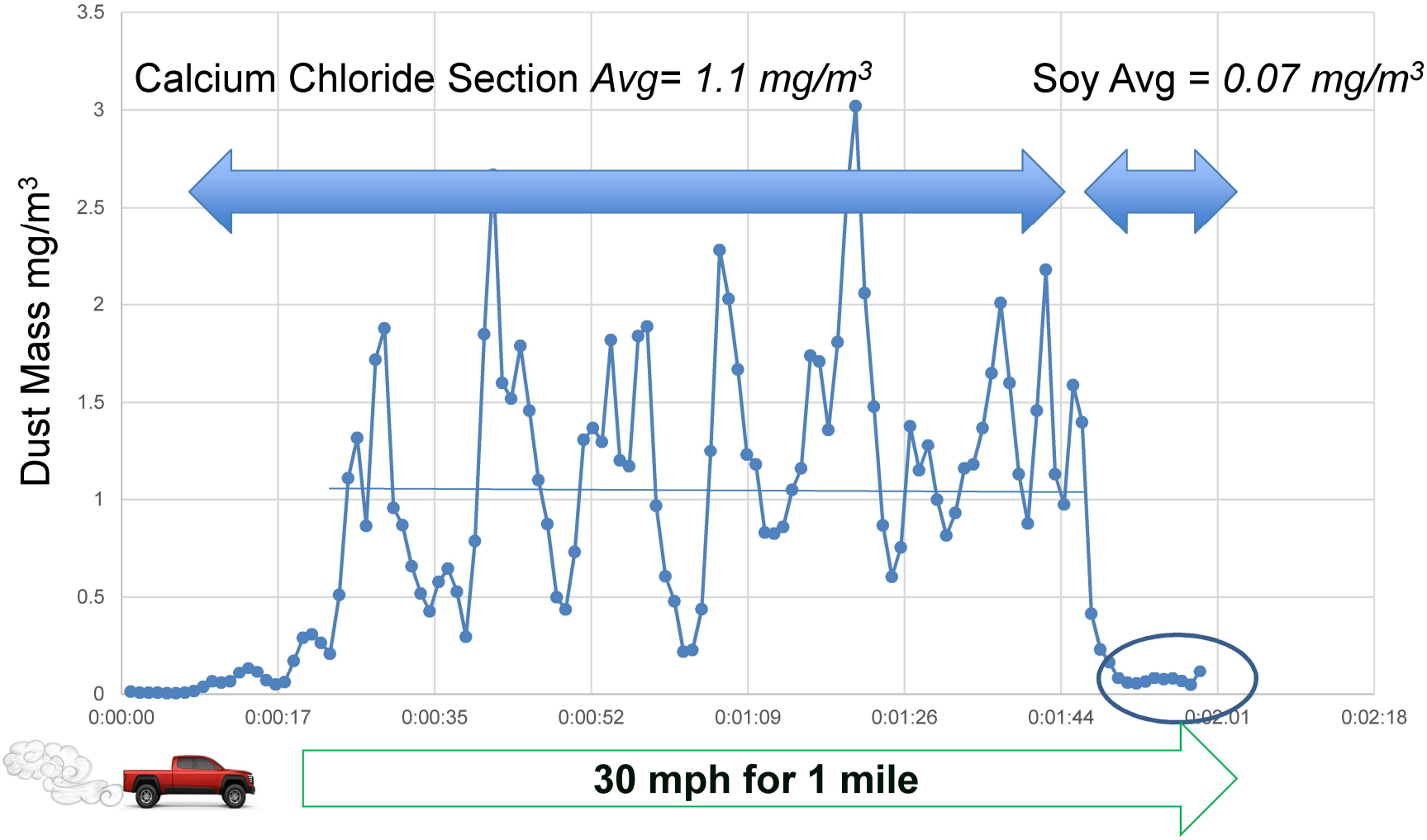
Road Dust Measurement





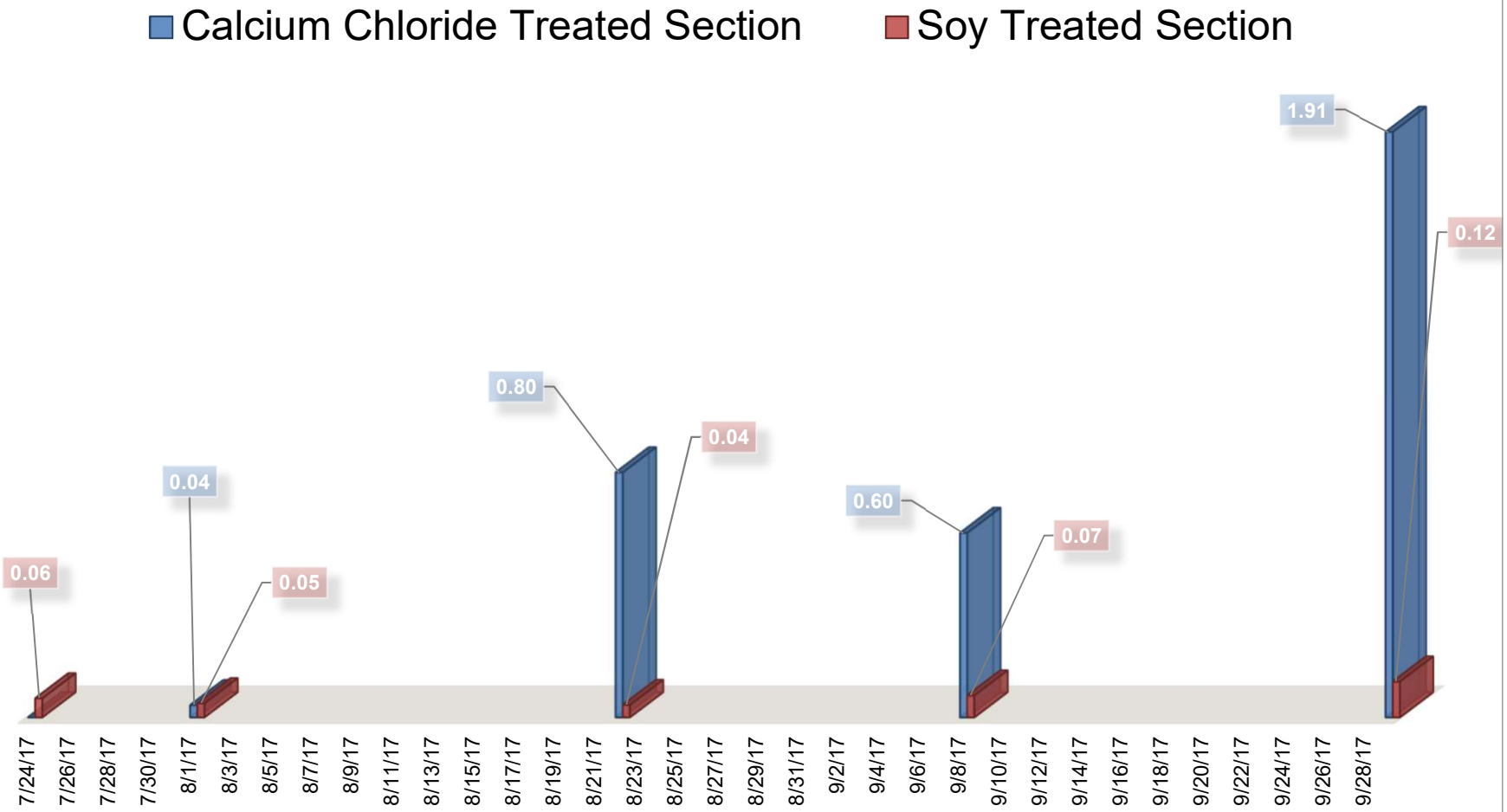
September 8 Road Dust Data

70 deg F, 30% Relative Humidity, PM 4



AVERAGE ROAD DUST

mg/m^3

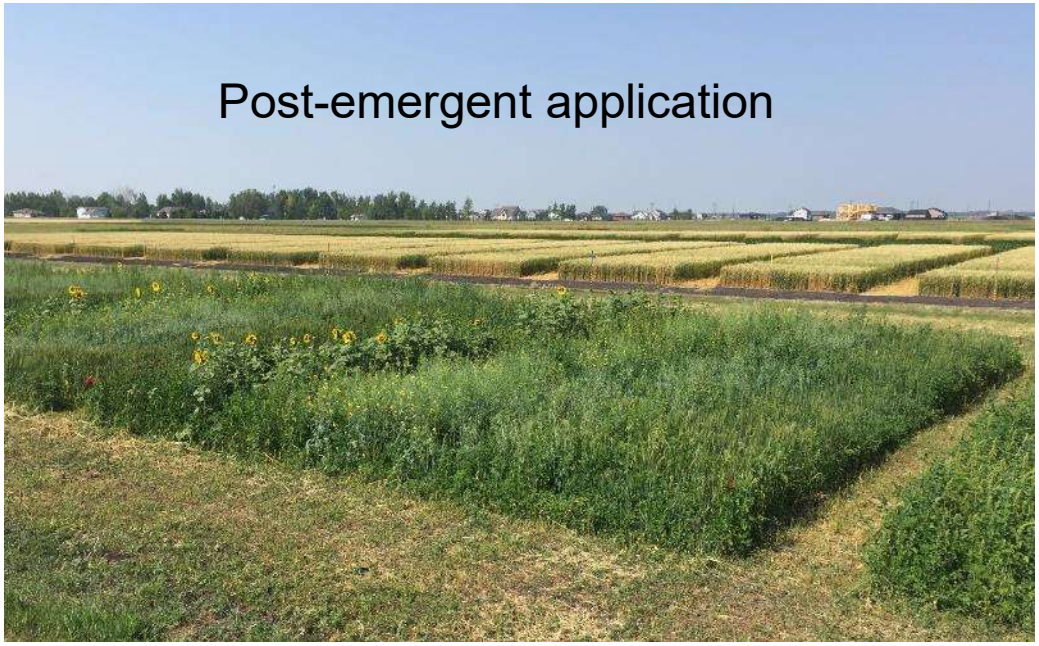


Crop Toxicity Testing

Pre-emergent application

No toxicity compared to control

Post-emergent application

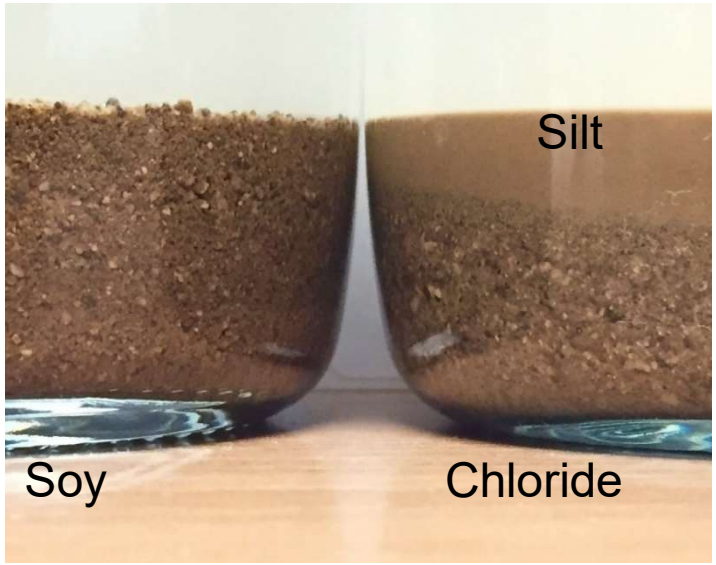


No toxicity due to wind drift

Crops tested; Wheat, Oat, Canola, Lentil, Soybean, and Sunflower

Preliminary Findings

- Minimal road dust after 10 months
- Stabilizes the road base and retains fines
- Does not wash away in the rain
- Performs better than calcium chloride
- Doesn’t kill plants
- Winter carryover
- Rejuvenates reclaimed asphalt

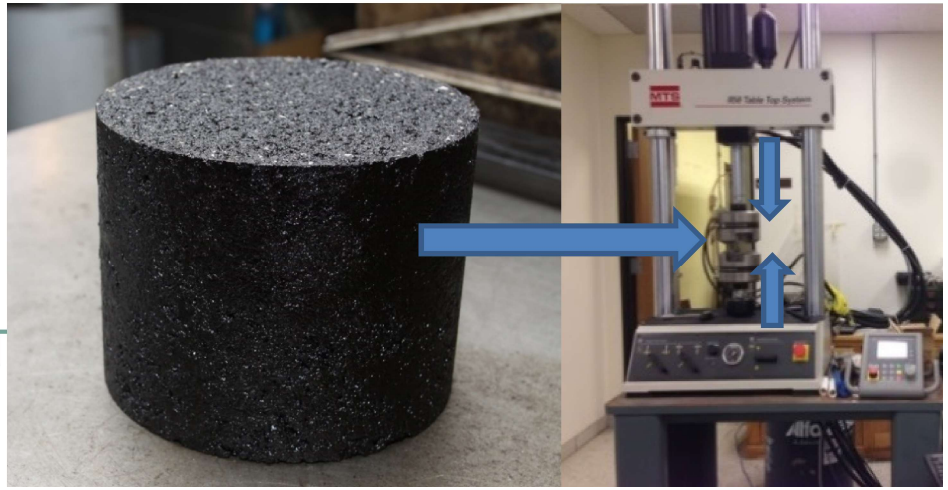


Road Surface in March (10 Months)

Current Research

North Dakota Soybean Council – *Study RAP rejuvenation*

- Test the properties of soy treated RAP in the lab
- Partnering with Dr Ying Huang, NDSU Civil Engineering
- **Obtain data to allow for a field test in the future**



Current Research

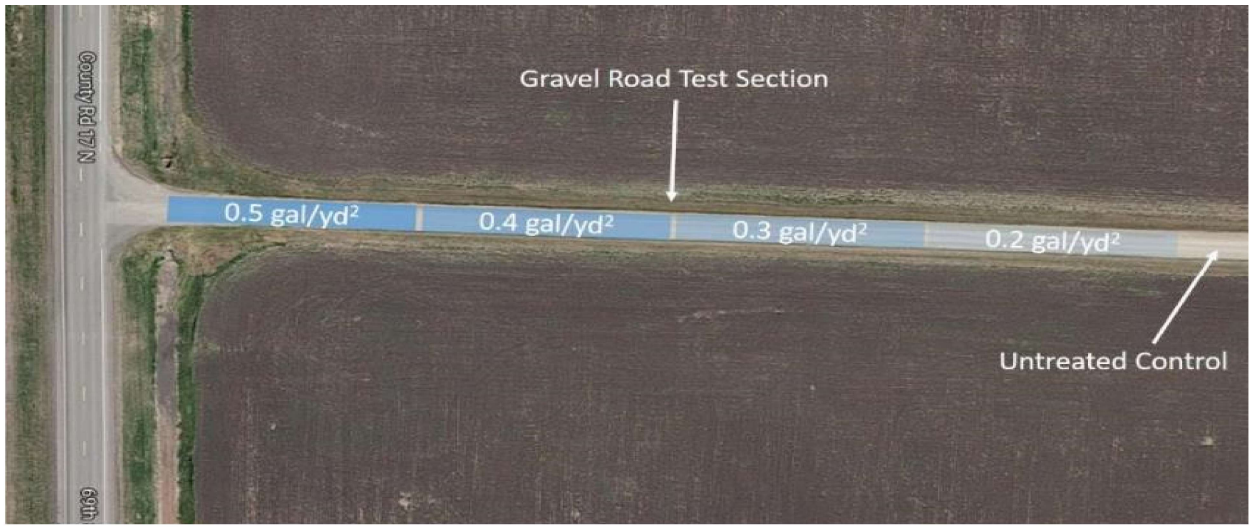
United Soybean Board - *Scale up the manufacturing and reduce costs*

- Optimize the synthesis using low cost, raw materials
- Identify bulk material suppliers
- Scale up batch size to 5,000 gallons
- 1-2 year project

Current Research*

ND DoT Transportation Innovation Program – *Road test to optimize application*

- Perform a road test on gravel road (no RAP)
- Optimize the rate of application
- Measure performance against chloride



* TRIP project delayed 2 years until a qualifying section of road is available

Conclusions

- Our soy-based product has shown great promise in early testing
- A market survey revealed a lot of interest from people in the industry
- More work needs to be done to optimize the manufacturing
- Additional field demonstrations are planned (locations TBD)
- Future field trial for treated RAP is desirable
- Cooperation from state and local DoT officials necessary for success

Acknowledgements

North Dakota Soybean Council
Our World Is Growing.

UNITED SOYBEAN BOARD™

GLACIER DUST CONTROL

GREAT SEAL OF CASS COUNTY 1873 1874

Cass County DoT

NDDOT
North Dakota
Department of Transportation

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