Subsoil Injection of Concentrated Organic Pellets

L. A. Leskiw, P Ag and T.B. Zeleke, PhD

Paragon Soil & Environmental Consulting Inc.
Edmonton, AB
Subsoil compaction

- A growing problem
- More persistent
  - Minimum freeze/thaw and wetting/drying
  - Minimum biological processes
Subsoil compaction

- **Subsoiling alone**
  - Prone to recompaction

- **Subsoiling + OM**
  - Increases roots and bio processes
  - Decreases compressibility
  - Creates sustainable pores - macropores
Our approach

- Break a compacted layer and inject OM pellets
  - Increase rooting depth
  - Nutrients – efficiency + pool
  - Water infiltration and storage
  - Sustainable structure

- Why pellets?
  - Transportation, application consistency
  - No pathogens and weeds
10 to 20 t/ha injection

- **Agricultural** - increase in biomass and yield
  - Moisture and nutrient uptake efficiency
  - 3-5 yrs of organic fertilizer
- **Environmental**
  - Carbon sequestration
  - Waste management option (Water and air quality - reduce NO$_3$ to runoff, particulates, ammonia, odour)
- Expedites reclamation of problem sites
Environmental benefits

- Carbon sequestration

![Graph showing carbon sequestration over time](image)
Technology development

- Bench scale research
- Crop response studies – green house
- Field trials - ‘08 and ’09 sites
- Injection system
- Air permeameter for monitoring soil structure
Bench scale tests: compaction, subsoiling, and pellet injection
Pellet processing
Green house crop response study
Green house crop responses

First crop - barley

Second crop - Canola
Field calibration:
rate, depth, speed, etc
Preliminary field trials: depth, rate, speed, etc
Results so far - ‘08 and ‘09

Control = C  Subsoiled = SS  Subsoiled + Pellets = SP
Results so far - ‘08 and ‘09
2008 plots - first season

**Site F - Barley (two rows)**

- Plant height (cm)
  - C: 65
  - SS: 70
  - SP: 75

- Yield (g m$^{-2}$)
  - C: 200
  - SS: 300
  - SP: 400

**Site H - Barley (two rows)**

- Plant height (cm)
  - C: 75
  - SS: 80
  - SP: 85

- Yield (g m$^{-2}$)
  - C: 1000
  - SS: 1200
  - SP: 1600
2008 plots - first season

Ashmont - wheat

- Plant height (cm)
- Yield (g m⁻²)

Petes - Barley (two rows)

- Plant height (cm)
- Yield (g m⁻²)
2008 plots - first season

R & W Sites - Forage yield

Yield (g m\(^{-2}\))

- C
- SS
- SP

- a
- a
- b
2008 plots - second season

Site F - Barley

- Plant height (cm)
  - C
  - SS
  - SP

Site W1 - Barley

- Yield (g m$^{-2}$)
  - C
  - SS
  - SP

Petes - Canola

- Yield (g m$^{-2}$)
  - C
  - SS
  - SP
2009 plots - first season

Site W09 - Barley

- Plant height (cm)
- Yield (g m²)

Field 2 - Barley

- Yield (g m²)

KROK - Barley

- Yield (g m²)
2009 plots - first season

A - Canola

Yield (g m⁻²)

C  SS  SP

0  250  500  750  1000  1250
Results so far - ‘08 and ‘09

- Crop response – significant in ’08
  - 20 to 30% increase in yield and biomass
  - Root development

- Poor soil moisture in ’09 affected trial results

- Both ‘08 and ’09 sites are expected to show even higher response in 2010 if moisture condition is good

- Soil structure monitoring in 2010+
New sites - TransCanada

- Established in July 2009
- South Edmonton
- Significant responses are expected from TCPL3 and 4
- Higher bulk density and clay
New sites - TransCanada

- Lower OM and total N
Pellets and Roots, Oct.
Pellets and roots in subsoil
Abundance of roots around pellets
Consortium members and partners

- Government institutes
- University
- Oil and gas operators
Thank you