Evaluation of the Early Remedial Impacts of Grassland Set-Asides on Soil Physical Properties

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Background

- The Grassland Set-Aside Stewardship Program is the only active program in Canada providing farmers with payment for placing agriculture land into set-aside.
- Grassland set-asides (GLSA) are seeded with a grass and legume mix and taken out of production for 1-4 yrs.
- The GLSA program is located in the Fraser River Delta (FRD) of British Columbia (Fig.1). This region has a humid climate and fine textured Gleysols. Soils are susceptible to compaction and sometimes high salinity.
- The establishment of GLSA on farmland is thought to help restore soil physical properties; however, uncertainties persist on the rate of restoration.
- The objective of this on-going study is to evaluate the effects of GLSA on soil physical properties relative to regularly managed fields (CROP). Here we present data after a single season of GLSA establishment.

Methods

- Baseline conditions were assessed before any treatments were established (Apr 2015) on 9 sites (Fig. 1). Fields were sampled at 3 additional times from the same 4 subplots.

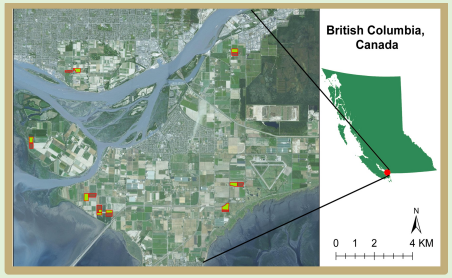

Figure 1. Map of research sites located in the Fraser River Delta (FRD) of British Columbia, Canada. Source: S.S. Paul.

- GLSA were seeded with a standard mix and the CROP treatment included various crop types (potato, legumes, grains).
- Soil physical properties evaluated include: aggregate stability (0-7.5cm), bulk density and aeration porosity (3 depths from 0-30cm).
- Data were analyzed using the nlme package in R. Significance indicated by * ($\alpha = 0.05$) and + ($\alpha = 0.10$).

Results

Regional Trends

- Soil physical properties fluctuated seasonally and were somewhat improved in the GLSA relative to the CROP in September 2015 and April 2016.
- The largest difference in mean weight diameter (MWD) of aggregates (Fig. 2) was observed in April 2016 (GLSA 1.50 ± 0.20 & CROP 1.27 ± 0.18 mm)

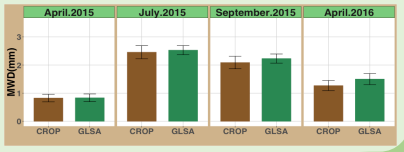

Figure 2. MWD of water stable aggregates on GLSA and CROP treatments.

Crop Type Influence

- The effect of various crop types on soil physical properties was observed following the harvesting of fields (September 2015).
- The stability of aggregates in potato fields was significantly lower than in GLSA (p=0.09) (Fig.4).

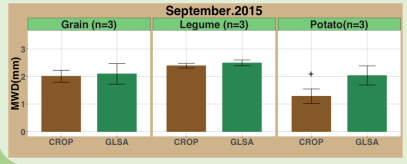

Figure 4. MWD of water stable aggregates by crop type in September 2015.

- Bulk density was similar in GLSA & CROP (Fig.3). Aeration porosity was significantly higher in GLSA at the 0-7.5cm (p= 0.04) and 7.5-15cm (p=0.09) depths in September 2015.
- Large variability was observed in both treatments.

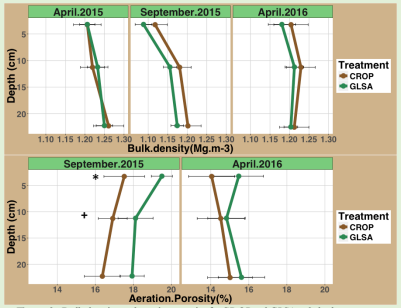

Figure 3. Bulk density and aeration porosity for CROP and GLSA at 3 depths.

- Bulk density was highest in potato fields (Fig.5) and significantly greater than paired GLSA at the 15-30cm depth in September 2015 (p=0.09).
- Aeration porosity was significantly lower in potato than GLSA at all three depths (p=0.08; 0.09; 0.10).

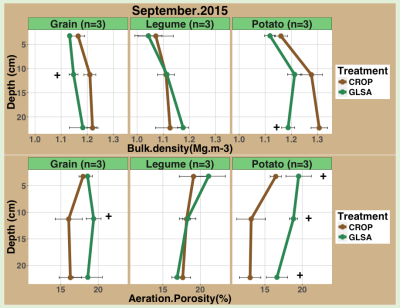

Figure 5. Bulk density and aeration porosity for GLSA and crop type in September 2015.

Discussion

- These preliminary data indicate differences between GLSA and regularly managed CROP during the 1st yr of GLSA establishment. The management for potatoes appears to be driving these early trends.
- The negative effects of potato production on physical properties was expected as management and harvesting practices are quite intensive for this crop.
- Variability in GLSA establishment and biomass among sites were also noted (Fig. 6). Future work will attempt to identify baseline physical and chemical soil properties which will help explain effects of GLSA.

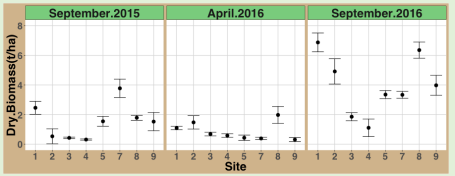

Figure 6. Total GLSA aboveground biomass at each study site.

- Above biomass increased substantially in GLSA fields during the 2016 season. These fields will continue to be monitored for physical soil properties.

Conclusions

EARLY TRENDS

- **Aggregate stability** ↑ in GLSA relative to CROP.
- **Bulk density** ↓ in GLSA relative to CROP.
- **Aeration porosity** ↑ in GLSA relative to CROP.
- **Large variability** in both treatments.
- **Potato management** appears to be most destructive to physical properties and is likely driving these early differences.

WHAT'S NEXT

- Continue monitoring soil physical properties over the 4 year GLSA establishment period.
- Identify the influence of baseline soil physical and chemical conditions on GLSA establishment and soil properties.
- Monitor the influence of GLSA on soil organic carbon.

a place of mind
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