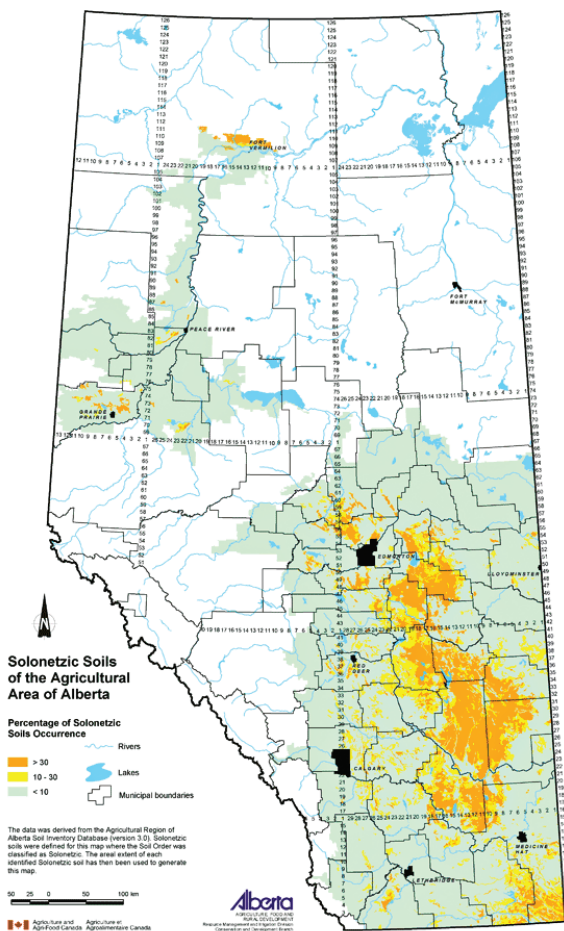


# AITF Biochar Initiative

## Evaluating the Ameliorative Potential of Biochar in Solonchic Soils in Alberta

### Introduction

Solonchic soils represent about 30% of the arable land in Alberta. Solonchic soils develop in regional groundwater discharge areas where the groundwater has passed through saline marine shales. These soils have B horizons that are very hard when dry, swelling to a sticky, compact mass when wet. Poor soil structure, porosity, aeration and water holding capacity in the root zone affects crop performance on all solonchic soils.



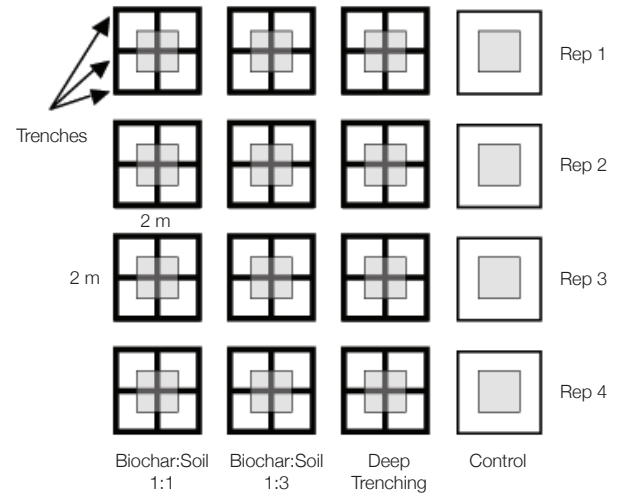
Biochar, a product of waste biomass carbonization, has potential to ameliorate solonchic soil properties by contributing a considerable amount of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  carbonate salts which can replace  $\text{Na}^+$  on the exchange sites similar to chemical amelioration with conventional gypsum application or liming. Porosity and infiltration rates in the Bnt horizon will also be increased.

### Study Objective

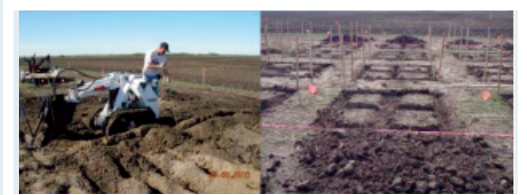
The objective of this study is to determine crop response to incorporation of straw biochar into the Bnt horizon at two different rates in comparison to deep trenching.

### Methodology

- Field trial established in June 2010
- Three treatments – deep trenching, Bnt mixed with biochar in a 1:1 ratio (~60 t/ha), and Bnt mixed with biochar in a 1:3 ratio (~30 t/ha)



- The A horizon was removed from all treatments in a criss-cross pattern prior to sub-soiling with a tracked trencher 60 cm deep and 10 cm wide.
- In the Biochar:Soil 1:1 and 1:3 treatments the Bnt horizon was mixed with biochar in the appropriate volume ratios and returned to the trench



- Oats were seeded in late June 2010, 2011 and 2012 and harvested in September from 1m<sup>2</sup> area in middle of the plot
- Air dried samples were weighed for total biomass, then thrashed to extract seed and determine grain yield and 1000 seed weights



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## Biochar Characteristics

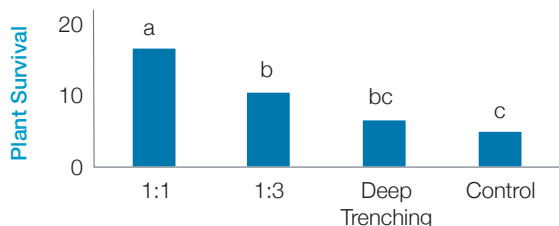


### Typical Characterization Results for Wheat Straw Biochar

| Tests                 | Average (d.b.) |
|-----------------------|----------------|
| Volatiles (%)         | 5.0            |
| Ash (%)               | 18.5           |
| Fixed Carbon (%)      | 76.5           |
| Aeration Porosity (%) | 26.0           |
| WHC (%)               | 59.0           |
| Total Porosity (%)    | 85.0           |
| pH                    | 9.7            |
| EC (mS/cm)            | 1.2            |
| Carbon (%)            | 65.6           |
| Nitrogen (%)          | 1.1            |

## 2010, 2011 and 2012 Results

- 1:1 plots were healthier and showed more vigor after initial germination in 2010 than all other treatments
- High variability in plant performance among replications was observed in 2010 and 2011 – likely as a result of weeds and inherent variability of solonchic soils
- 1:1 biochar:soil treatment had the highest above-ground biomass yields in 2010, 2011 and 2012, however the effect was not statistically significant in the 1st growing season
- Treatment effects were significant in 2011 for plant survival, biomass, seed yield, 1000-seed weight, and plant height (largely due to differences in plant survival between treatments).



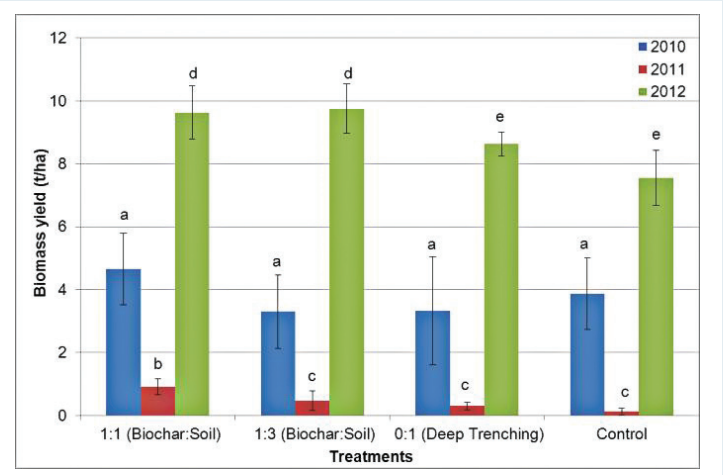
Control

Deep Trenching



1:3 Biochar:Soil

1:1 Biochar:Soil



## Conclusions

- Increased biomass, plant survival, seed yield and 1000 seed weights were observed and quantified in the 1:1 biochar:soil treatment indicating biochar addition to solonchic soils can increase productivity
- Additional sites need to be established and evaluated to verify results
- The exact mechanisms of the soil improvement need to be further explored through soil analysis

Put our expertise to work for you:

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