Biochar as a Soil Amendment for Field Crop Production

Purpose:

Biochar is generated by heating organic materials with limited oxygen (pyrolysis), similar to the way charcoal is produced out of wood. The feedstock for this process may be wood, crop residues or manure, and the nature of the final product will vary depending on the feedstock and the speed and temperature of the pyrolysis. This process generates volatile compounds that may either be burned to generate heat for the pyrolysis process, or captured as a liquid or gaseous fuel.

There is great interest in biochar as a soil amendment, since the carbon in the biochar may be retained in the soil for longer periods than the carbon from raw organic matter, providing the opportunity for carbon sequestration. It has also been documented that biochar enhances the productivity of highly weathered tropical soils through improved moisture and nutrient retention, as in the *Terra preta de indio* soils of the Amazonian basin. This preliminary trial was undertaken to assess whether the same benefits might be found for crop production in Ontario.

Methods:

Biochar treatments were applied to a field site near Shakespeare in the fall of 2009, and the corners of each plot marked using a hand-held GPS unit. The previous crop was winter wheat underseeded to red clover. The field was fall plowed following the biochar application, then conventionally tilled in the spring of 2010 and planted to corn. Crop management, including fertilizer applications, was even across the entire field. Corn grain yields were measured using a calibrated weigh wagon.

Trials included the following treatments:

Treatment	Description
On-farm biochar	Slow pyrolysis biochar prepared on-farm from wheat straw, applied at approximately 5 tons/acre
C-Quest™ Low Rate	Commercial fast pyrolysis char from wood waste, applied at approximately 7 tons/acre
C-Quest™ High Rate	Commercial fast pyrolysis char from wood waste, applied at approximately 14 tons/acre

These treatments were not replicated, so the only comparison possible is whether the biochar had any impact on crop yields, but not whether the individual treatments were different from each other. The biochar is also extremely dusty, so there was significant drift from the target areas during application. This issue will need to be addressed if biochar is to have a place in crop production in Ontario.

Results:

2010 was an excellent growing season for corn in this area, with ample heat and rainfall. Field observations during the growing season did not reveal any differences in corn growth or development between the treated and untreated areas.

Yield results, averaged across the three treatments, are shown in Table 1. Because the field had been plowed following the biochar application, the corn rows ended up at an angle to the biochar plots so while the plots are dominated by the named treatment there is the potential for some interference from the neighbouring treatment.

Table 1: Yield and quality results from Biochar application.

Treatment	Yield (bu/ac)	Moisture (%)	Density (lb/bu)
Check	213.0 (7.6)	19.3 (0.4)	55.7 (1.0)
Biochar	213.1 (2.9)	19.2 (0.3)	55.9 (0.9)
	ns	ns	ns
Values in brackets are Standard Deviations ns = not significant			

No impact was evident from the biochar treatment on yield, grain moisture or bushel weight of grain corn.

Next Steps:

While the initial results did not show any advantage to the biochar application on crop productivity, these plots should be monitored during the 2011 growing season when the field will be planted to soybeans.

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