Stop #12: Effects of Biochar on Turf Establishment

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Introduction:

Biochar is a form of charcoal that can be made from lawn clippings and other carbon waste. Biochar persists in the soil for years, reducing the need for water and fertilizer without the need for further intervention. Projected work at this site will quantify tall fescue water use when planting into soil amended with biochar and greenwaste or biosolids compost. Initial results regarding the effect of biochar and compost incorporation on establishment rates of tall fescue are presented, along with results from the first year of drought stress currently underway.

Objectives:

1) Measure effects of biochar and compost incorporation on turf establishment rates.
2) Evaluate biochar and compost's ability to reduce turfgrass irrigation requirements.

Treatments:

Water use study:
The experiment is a split plot design, with subplots of either Full (80% of ETo) or reduced (50% of ETo), and main plot treatments of biochar or compost (see treatment list and plot plan on following page). Tall fescue was seeded on May 5, 2014 at a rate of 8 lbs/1000 ft^2, and topdressed in fall 2014. All plots were irrigated sufficiently during the establishment phase. Drought stress was induced on May 4, 2015 in the reduced irrigation plots. Turf quality, clipping yield, root growth, and water use efficiency will be measured and correlated with irrigation regime and soil amendment.

Results:

- There was no statistical difference in establishment rate between grasses grown in untreated and biochar-amended soils.
- Grasses grown in compost-amended soils took longer to fully establish, but reached comparable levels of coverage.
- The rate of biochar or compost amendment did not significantly affect establishment rate.
- Root measurements collected at the beginning of drought stress show that those plots treated with either 4 or 2 inches of composted greenwaste as well as those treated with 2 inches composted greenwaste and biochar demonstrate the greatest rooting depth, while amendment with 2 inches of composted biosolids reduced rooting depth compared to control plots (Fig.1).
- Amendment with 2 inches composted greenwaste also increased root volume compared to controls (Fig.2).

- Under reduced irrigation, plots amended with 1 ton/acre biochar had increased clipping yields compared to all other treatments and control.
- Compost amended plots showed increases in soil moisture compared to control plots beginning 6/15/2015. The most consistent improvements were achieved with both composted greenwaste treatments, the composted biosolids treatment, and the combined compost and biochar amendment (Fig. 3).
- On the rating date of 6/30/2015, visual quality was improved compared to controls with all biochar amendments, 2 inches composted greenwaste, and the combined biochar and compost amendment under deficit irrigation.
- NDVI data consistently demonstrate reduced plant health and appearance with composted biosolids treatment beginning 6/30/2015. On 8/24/2015, the 5 ton/acre biochar and combined biochar and compost amendments also reduced NDVI compared to controls.
- Turf cover as measured by digital image analysis shows that, on 7/27/2015, composted biosolids reduced coverage under both high and low irrigation rates, though this reduction was very small (approximately 1%).

Summary:

- The most consistent effect of compost amendments was an increase in soil water content. Under drought conditions this would be especially desirable.
- Combined biochar and compost amendments result in increased soil water content and rooting depth.

Plot Plan and Treatment List

(North)

Block 1	Irrigation Treatment B							
	F	C	B	G	D	E	H	A
	Irrigation Treatment A							
	E	B	H	F	D	A	G	C
Block 2	Irrigation Treatment B							
	C	H	E	B	G	A	D	C
	Irrigation Treatment A							
	E	G	A	C	F	B	H	D
Block 3	Irrigation Treatment B							
	E	C	A	B	H	D	G	F
	Irrigation Treatment A							
	G	E	B	A	H	D	F	C
Block 4	Irrigation Treatment B							
	B	A	C	D	H	F	E	G
	Irrigation Treatment A							
	B	H	D	E	A	C	G	F

Irrigation Treatment	
A	80% ET_o
B	50% ET_o

Amendment Treatment	
A	Control
B	1 Ton/Acre Biochar
C	5 Ton/Acre Biochar
D	10 Ton/Acre Biochar
E	2 Inches Composted Biosolids
F	2 Inches Composted Greenwaste
G	2 Inches Composted Greenwaste + 5 Ton/Acre Biochar
H	4 Inches Composted Greenwaste

Figure 1: Root length by soil amendment, collected 5/04/2015

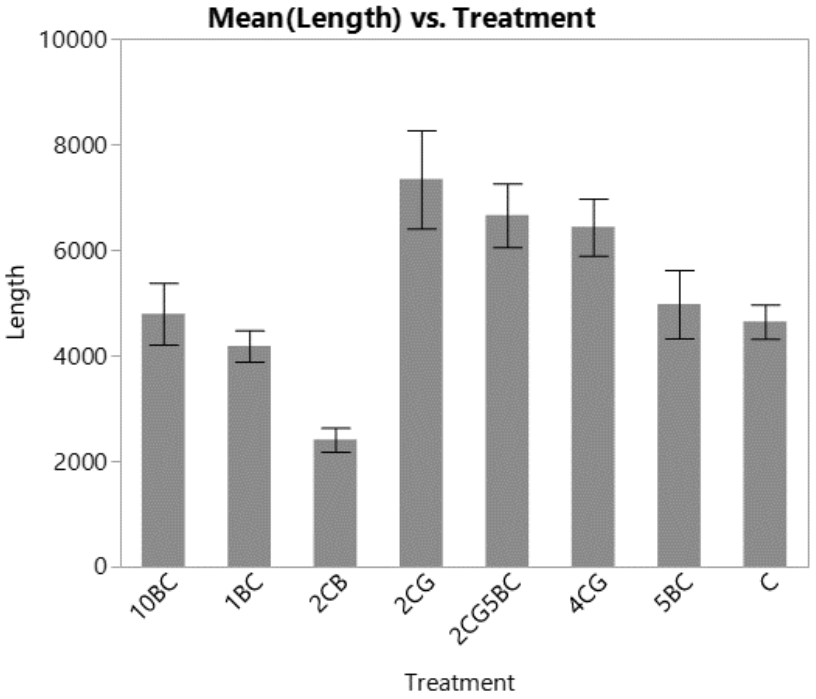
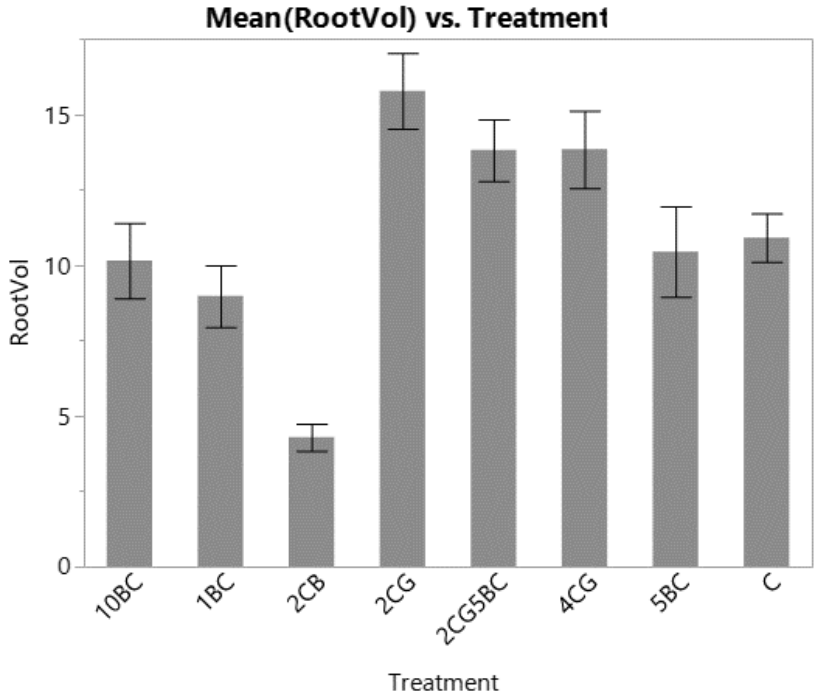


Figure 2: Root volume by soil amendment, collected 5/04/2015



Key	
CL: Control low irrigation	2CBL: 2 inches Composted Biosolids Low Irrigation
CH: Control high irrigation	2CBH:2 inches Composted Biosolids High Irrigation
1BCL: 1 ton/A Biochar low irrigation	2CGL: 2 inches Composted Greenwaste Low Irrigation
1BCH: 1 ton/A Biochar high irrigation	2CGH: 2 inches Composted Greenwaste High Irrigation
5BCL: 5 ton/A Biochar low irrigation	2CG5BCL: 2 Inches Composted Greenwaste plus 5 ton/A Biochar Low Irrigation
5BCH: 5 ton/A Biochar high irrigation	2CG5BCH: 2 Inches Composted Greenwaste plus 5 ton/A Biochar High Irrigation
10BCL: 10 ton/A Biochar low irrigation	4CGL: 4 inches Composted Greenwaste Low Irrigation
10BCH: 10 ton/A Biochar high irrigation	4CGH: 4 inches Composted Greenwaste High Irrigation

Figure 3: Soil moisture comparison between compost and control plots beginning 6/15/2015