Smoke into Biochar

Safe Burn Practices for Recovering Biochar for Use in Soil and Compost

Biochar

Have you heard about the benefits of Biochar? Biochar is charcoal that you can add to soil or compost. It helps retain moisture and nutrients and it promotes beneficial microbes in soil. Biochar can be expensive to buy, but if you have burn piles, you can make your own biochar and have a cleaner, safer fire as well.

There are five requirements you need to follow if you want to make biochar in your burn pile. These principles will also ensure that your fire is as smoke-free as possible:

1. Use only dry wood
2. Burn small brush separately from thicker logs (greater than 4" in diameter)
3. Make small piles that are loose with good airflow and no dirt. A good pile size is four to six feet in diameter and four to six feet tall
4. Light the piles on the top
5. Have a water hose nearby so you can quench the fire and save the charcoal

YOU CAN KEEP SMOKE OUT OF THE ATMOSPHERE

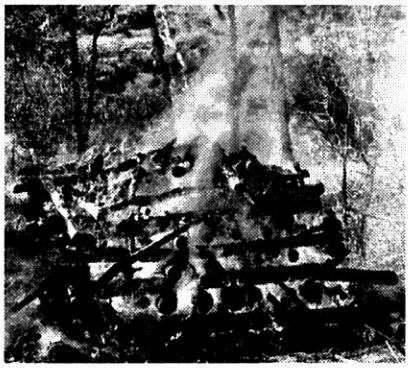
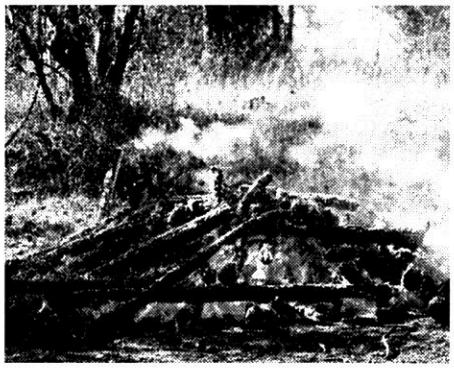
THE CARBON THAT WOULD HAVE GONE UP IN SMOKE STAYS IN THE BIOCHAR!

Small brush burns quickly when dry. You need to consolidate it as it burns down and put it out with water before it burns to ash. Three brush piles this size made one cubic yard of biochar. Biochar sells for between $200 - $400 a cubic yard.

Wilson Biochar Associates • PO Box 1444 • Cave Junction, OR 97523 • 541-218-9890

Basic Procedure for Making Biochar in Burn Piles

1. Separate small brush and branches from larger wood. Recover pieces above 4" for use as firewood or burn in a separate pile. Make piles that are 4-6 feet in diameter and 4-6 feet tall.
2. Allow the wood to dry before burning.
    - Up to 2 inches in diameter: dry 30 days
    - 2—6 inches in diameter: dry 60 days
3. If rain threatens to wet your piles before you can burn them, cover them with a tarp.
4. Get your burn permit and make sure it is not too windy to burn. Follow all safety rules for pile location and clearing around the pile.
5. Safety First - Have your water source ready and live before you light the pile. Have rakes, shovels, leather gloves and other safety equipment on hand. Dress properly.
6. Before lighting, place a one-foot thick layer of densely-packed, very dry, very small kindling on top of the pile.
7. Light on top with a match or with a propane torch. A propane torch makes it easy.
8. Your pile will burn slowly at first, but soon the entire pile will be blazing. You will find that the top-down method of burning is much faster than other methods.
9. Be careful around the flames. They will put out a lot of heat. But the flames will burn up all the smoke, so your burn pile is clean and won't annoy your neighbors with smoke.
10. As the flames die down, use a rake to push unburned material to the center of the pile.
11. When the pile has collapsed into a bed of glowing coals, put it out with water.
12. Make sure the coals are completely out by spreading them thin to cool and adding more water as needed.
13. When it is stone cold and completely out (best to wait several days) add your biochar to a compost pile. You can also use it in chicken coops and animal barns to absorb odors while the biochar gets charged with nutrients for your soil.

This procedure can work with bigger material as well, even hard to burn material like old lumber and bigger logs. The logs in the picture are between 3 and 6 inches thick. Just make sure there is air space between the pieces, the material is dry, and there is no dirt. Light it on top, and put it out with water. *(Note: all the smoke in the third picture comes from one branch that is sticking up out of the hot zone.) Keep everything in the hot part of the fire and you will not see smoke.)*

For More Information about Biochar:
www.wilsonbiochar.com
or contact Kelpie Wilson: kelpiew@gmail.com

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Pasture Field Trial Report for Morrison/Fontaine Farm

Pasture condition: hayfield has been mowed in July for most of the last 25 years and grass hay bales removed. Trial block is located in convex slope configuration that is drier and receives less runoff from upslope compared to concave portions of pasture. Convex slopes are mostly occupied by weeds (crab grass, moss, dandelion, plantain, and grasses) with less than 10% perennial grass and clover cover. A soil analysis (**Table 1**) indicated low levels of N, K and Boron.

Table 1: Hayfield Soil Test, December, 2015. AgSource Labs

			ppm								% cation saturation						ppm			
OM%	Nitrate N	NH4	P (weak B)	K	Mg	Ca	S	soil pH	buffer index	CEC	K	Mg	Ca	Na	Mg (meq/ 100g)	Ca (meq/ 100g)	Mn	Zn	Fe	B
4.9	9	16	36	88	240	1200	19	5.1	6.2	16.7	1.4	11.1	33	0.6	2	6	37.1	1.3	76.5	0.23

Goals:

Establish perennial forage plants for wildlife, improve soil fertility by adding lime, fertilizer and seed. Improve soil fertility, neutralize acidity, and increase moisture-holding capacity and tilth with biochar and biochar compost additions (plus fertilizer and lime). Determine impact of biochar. Determine soil and forage improvement costs for 3 to 8 acres of degraded hayfield.

Experimental design:

Our experiment tested five treatments with three replicates. The 3-meter x 3-meter treatment areas (approximately 10 ft x 10 ft) were arranged as shown in **Table 2**. Blocks are oriented perpendicular to slope gradient of approximately 7%. Slope was tilled with a rototiller along fall line and rolled after seeding with 4-wheeler perpendicular to slope.

Table 2: 15m x 9m Randomized Block Treatments

Block 1	Lime + 16-16-16		Biochar Compost + lime		Biochar + 16-16-16 + lime		Lime	Control
Block 2	Biochar + 16-16-16 + lime		Lime		Control		Lime + 16-16-16	Biochar Compost + lime
Block 3	Lime + 16-16-16		Biochar + 16-16-16 + lime		Biochar Compost + lime		Lime	Control

Treatment Codes:

Lime	L	white (color flags on bamboo stakes in NE corners of treatments)
Lime + triple 16	L16	orange
Biochar + lime + triple 16	CL16	yellow
Biochar Compost + lime	BL	black + yellow
Control	C	pink

Fertilizer application rates:

- Lime - 2t/ac (110 lb/1200sf excluding control plots) or approximately 2 x 50# bags/1200 sf of treatment area. ***I used 1.8 - 50# bags of prilled CaCO3 and applied with a drop spreader.*** ("If SMP buffer pH for lime is 6.1-6.5, apply 1-2t/ac" -- recommendations from J. Hart et al, 2000 reprint, OSU Ext. Fertilizer Guide 63, *Pastures Western Oregon and Western Washington*) (BpH = 6.2, 10-Dec-2015)
- 16-16-16 -- 267 lb/ac (10 oz/100 sf treatment) or ~3.7 lbs/600 sf of treatment area (See figure 1 fertilizer rate calculation. "Broadcast 40 lb N/ac at planting"). I spread 10 oz per treatment using a volume sample of appropriate weight.
- Boron – "If Boron is below 0.7 ppm apply 2-3 lb B/ac and mix thoroughly with other fertilizers"

Other inputs:

- Tetraploid annual rye (Italian Ryegrass recommended by Woody Lane but not available this spring), Dutch white clover (Red clover) and Boston Plantain – 1 lb: 1 lb: 1/2 lb (@ 50lb/ac rate = 1.7 lb/1500sf)
- Triple 16 fertilizer, 10 oz/100 sf treatment
- Prilled Limestone, 100 lbs.
- Boron 2-3 lb/ac (1.1 oz for 1200 sf: (2.5)(1200)(16)/43560). Will spray dilute Solubor before flowering sometime in May.
- Glacial rock dust ~1cf to be mixed with the 6 biochar and biochar compost treatment areas (50# bag).
- Rock dust was unevenly distributed between six treatments with double volume on Block #3 biochar + fertilizer + lime treatment, lower volumes on biochar compost + lime treatments, and with little volume on Block 2 biochar compost + lime treatment
- Biochar treatment: biochar made in small kilns from fir and pine slash removed from the land
- Biochar was made in flame cap kilns
- Biochar Compost treatment: Biochar/alfalfa soup made with the biochar. Soup prepared in January, drained and applied on April 5. See recipe, below.

Biochar Compost Recipe (soup)

- 1/3 cy of crushed biochar
- 50 lbs alfalfa pellets
- 2 qt worm castings
- 2 c molasses
- water

Table 3: Analysis of Biochar Compost (OSU Lab, 8-29-17)

	pH	EC, dS/m	C %	N %	C:N ratio	NO3-N (ppm)	NH4-N (ppm)	Active C (ppm)	Respiration ng CO2-C/g soil/day
Biochar alfalfa compost	8.5	3.557	67.3	1.59	42.3	803	18.9	612	11.711

Biochar Application Rates and Assumptions

- Biochar and charcoal application rate: 1/10 cubic yard per 100 square feet treatment area (3 x 5 gallon buckets = 2.34 cf/100sf treatment)
- Volume estimate for charcoal amendment volume: 1 cy/1000 sf is equal to approximately 5 to 10% of soil volume for till layer between 3 and 4 inches deep (2.5 cf = 16 gallons).
- For example, 1 cy/1000sf = 500 cf/ 27cf/cy = .054 cy (6" till layer) or 5.4 % charcoal amendment volume in a 6" till layer.
- Three 5-gallon buckets were applied per 100 sf treatment area (2.5cf = 16 gallons)

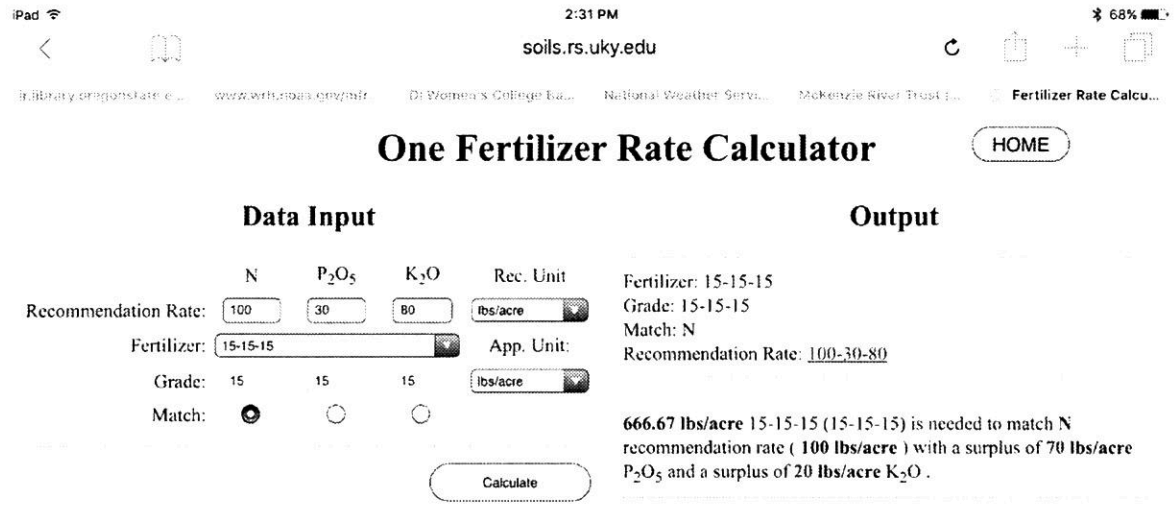


Figure 1: Fertilizer rate calculation (40Lb/ac N = 667 (100 lb N rate in calculation below) x 0.4 = 267 lb triple 15/ac triple 16)

Measurements

Buffer strips cut after dry standing condition reached in August using a lawn mower + grass catcher, and grass collected was discarded. Then foliage remaining inside treatments was cut and collected with mower for each of the 15 treatments areas. Weighed air-dry samples with a hanging scale with 10-gram precision. Soil samples were taken and sent to AgSource Lab for soil analysis, and to OSU Lab for microbial and active carbon analysis.

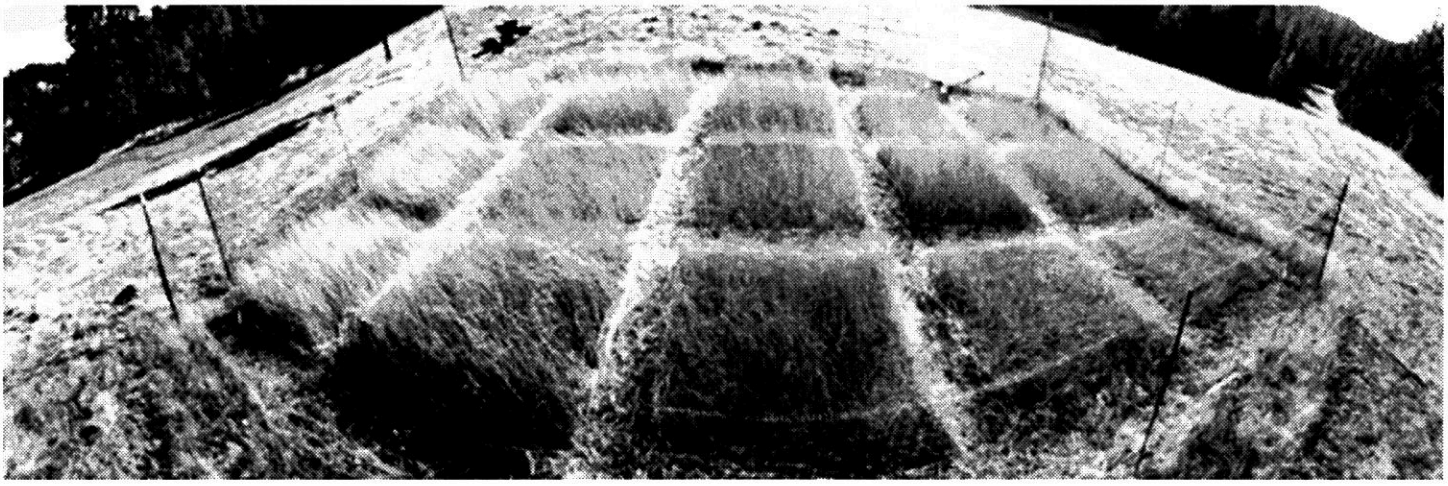
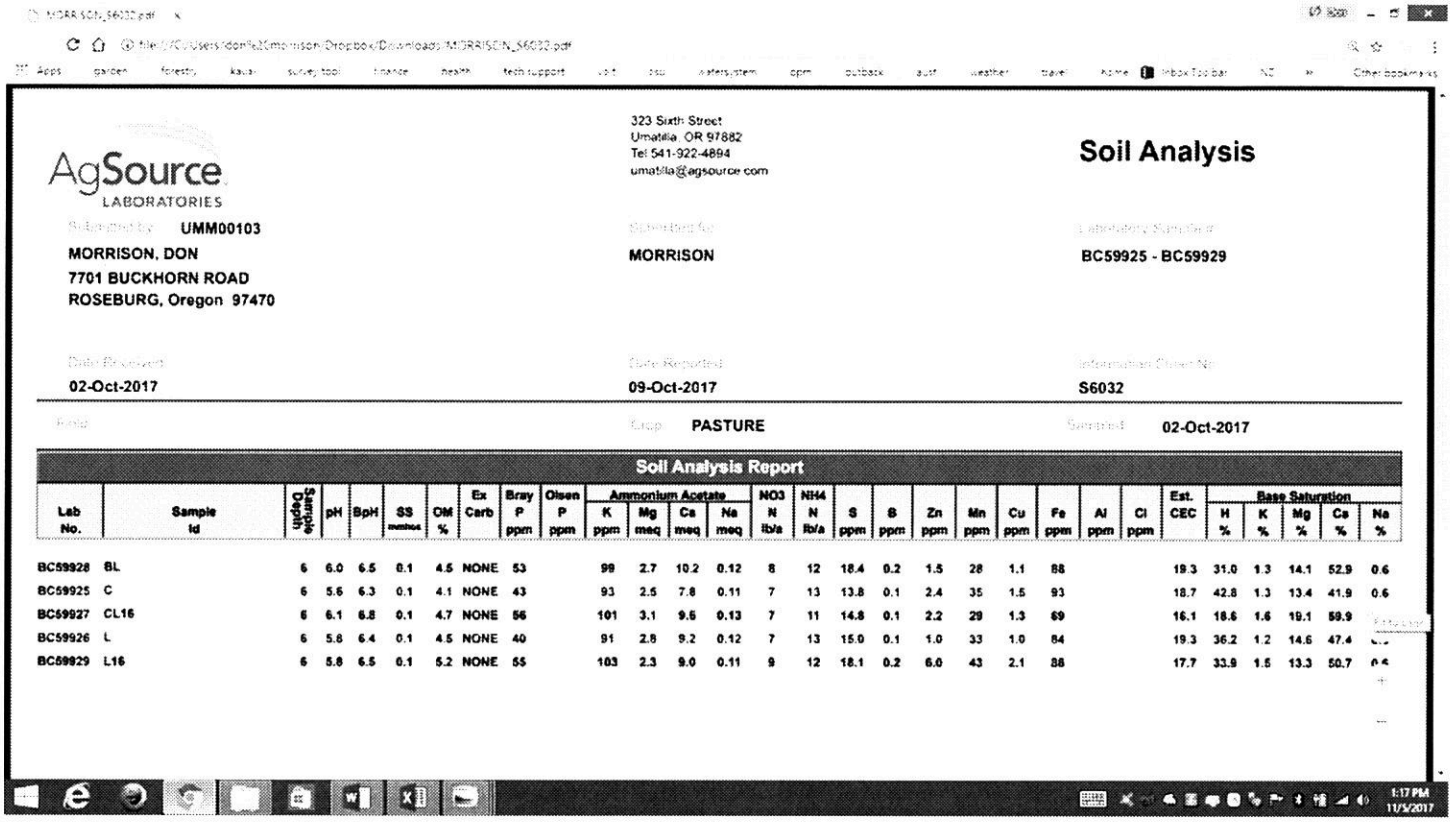


Figure 2: Treatment plots with buffer strips mowed before the harvest and weighing of 5 treatments x 3 replicates



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Soil Analysis

Submitted by: UMM00103
MORRISON, DON
7701 BUCKHORN ROAD
ROSEBURG, Oregon 97470

Submitted for: MORRISON

Laboratory Sample #: BC59925 - BC59929

Date Received: 02-Oct-2017

Date Reported: 09-Oct-2017

Information Sheet No: S6032

Field: Crop: PASTURE

Sampled: 02-Oct-2017

Soil Analysis Report

Lab No.	Sample Id	Sample Depth	pH	BpH	SS mmhos	OM %	Ex Carb	Bray P ppm	Olsen P ppm	Ammonium Acetate K ppm	Mg meq	Ca meq	Na meq	NO3 N lb/a	NH4 N lb/a	S ppm	B ppm	Zn ppm	Mn ppm	Cu ppm	Fe ppm	Al ppm	Cl ppm	Est. CEC	Base Saturation H %	K %	Mg %	Ca %	Na %
BC59928	BL	6	6.0	6.5	0.1	4.5	NONE	53		99	2.7	10.2	0.12	8	12	18.4	0.2	1.5	28	1.1	88			19.3	31.0	1.3	14.1	52.9	0.6
BC59925	C	6	5.6	6.3	0.1	4.1	NONE	43		93	2.5	7.8	0.11	7	13	13.8	0.1	2.4	35	1.5	93			18.7	42.8	1.3	13.4	41.9	0.6
BC59927	CL16	6	6.1	6.8	0.1	4.7	NONE	56		101	3.1	9.6	0.13	7	11	14.8	0.1	2.2	29	1.3	69			16.1	18.6	1.6	19.1	59.9	
BC59926	L	6	5.8	6.4	0.1	4.5	NONE	40		91	2.8	9.2	0.12	7	13	15.0	0.1	1.0	33	1.0	84			19.3	36.2	1.2	14.6	47.4	
BC59929	L16	6	5.8	6.5	0.1	5.2	NONE	55		103	2.3	9.0	0.11	9	12	18.1	0.2	6.0	43	2.1	88			17.7	33.9	1.5	13.3	50.7	

Figure 3: Soil Analysis of 5 treatments

Visual observations suggest a response to both liming and fertilization, Figure 4. This was affirmed by harvest data, Figure 5.

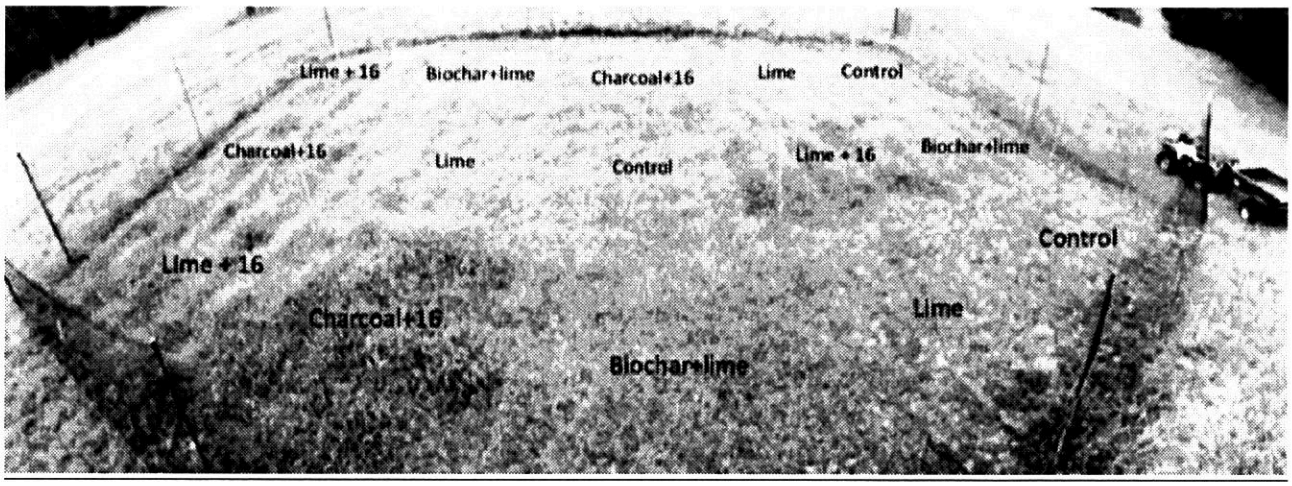

Figure 4: May 28, 2017. Note: charcoal is biochar. Biochar is biochar compost.

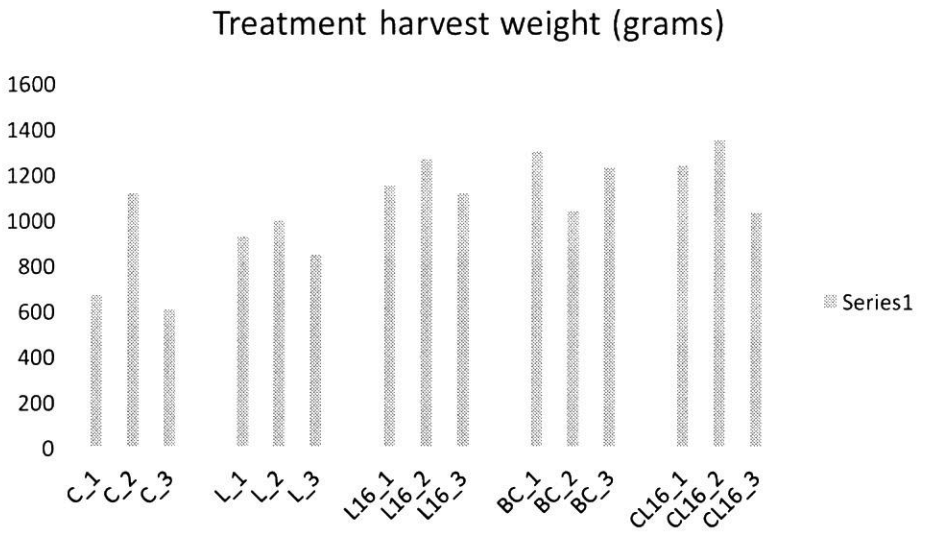

Figure 5: August 30 harvest weights

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Central Analytical Laboratory
Crop and Soil Science Department
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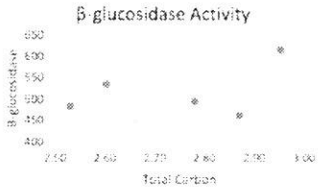
Functional Carbon Soil Analysis Results

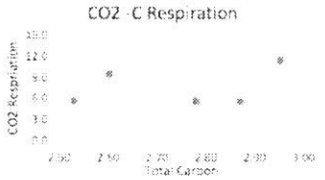
Name:	Don Morrison
Contact for results:	dmorrison200@gmail.com
Date submitted:	10/3/2017
Date delivered:	11/3/2017
Group number:	218100

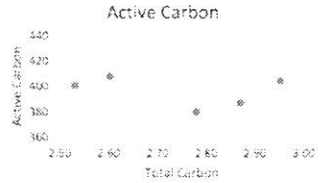
Sample Identification		%	pH Units	%	nmol/g soil/h	µg CO_2-C/g soil/day	mg active C/kg dry soil
Customer ID	Lab ID	Moisture	pH	Total C	β-glucosidase activity	CO_2-C Respiration	Active Carbon
Control	1	14.6	6.56	2.53	483	5.7	401
CL16	2	14.8	6.74	2.87	462	5.6	387
L	3	13.8	6.66	2.78	495	5.7	380
BL	4	14.6	6.95	2.60	535	9.5	408
L16	5	15.0	6.62	2.95	615	11.5	405

Moisture	Determined gravimetrically on fresh samples
pH	1:1 water:soil - This was not requested, you will not be charged
Total C and N	Dry Combustion - This was not requested, you will not be charged
B-gluc	Extracellular enzyme activity as measured with fluorescence
CO2 respiration	Carbon respiration rate determined by 24 hr burst CO2 measurement after rewetting - Franzluebbers 1996
Active Carbon	Potassium permanganate reduction reaction with readily oxidizable carbon

Oregon State University







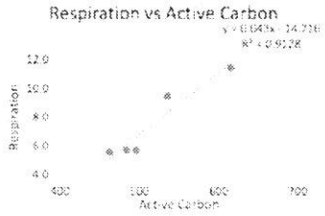


Figure 6. Respiration, enzyme analysis and active carbon results

Next Steps

- OSU will help us analyze results and do statistical analysis
- Application will be repeated in Spring 2018. This is intended to be a long-term field trial

Pictures