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Enhanced Biochar for Soil Reclamation Co-Produced by a Drop-In Biofuels Process; Award No. DE-SC0022445

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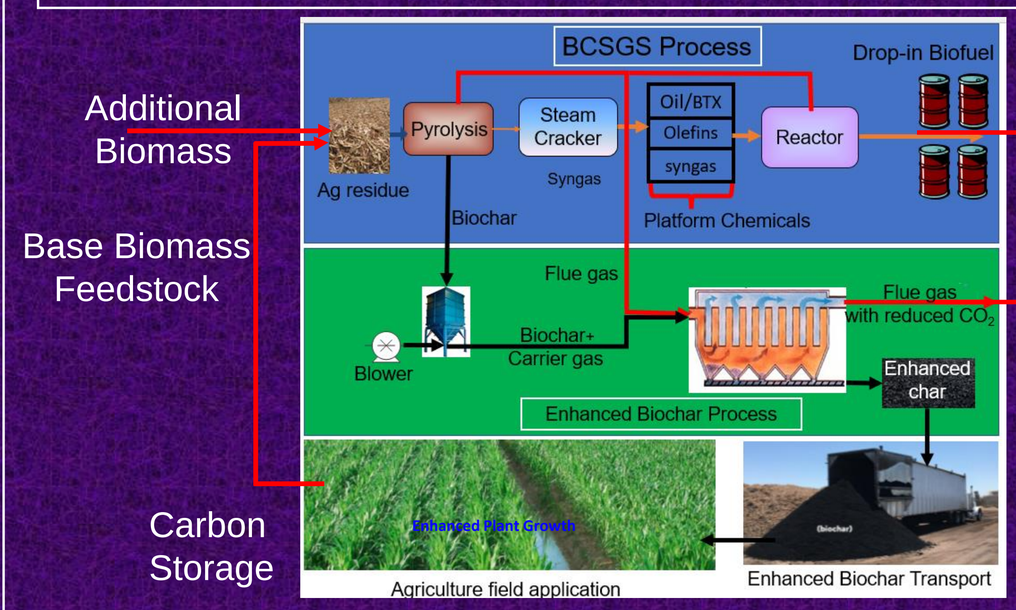
Problem

- Biochar from biomass can be used to sequester carbon in soil, but costs are high and stability in soil not optimized
- Drop-in renewable fuels from biomass can be produced, but costs are high

Solution

- Co-producing biochar with biofuels lowers biochar cost
- Enhanced biochar produced by processing biochar and capturing CO_2 can neutralize acidic soil, improve soil fertility and water-holding capacity to promote plant growth and increase farmer revenue

Leverage Altex patented lower-cost biofuels process that coproduces enhanced biochar at low cost



Project Objectives

1. Test biochar for growth enhancement of lettuce and Poinsettias in pots in greenhouses under Controlled Environment Conditions
2. Scale up and build and test a 0.5-ton per day EBSR enhanced biochar production system
3. Test the biochar for growing corn and wheat field crops.
4. Evaluate the benefits of EBSR and develop commercialization and technology transfer plans that will facilitate rapid commercialization of the technology

Work Completed to Date

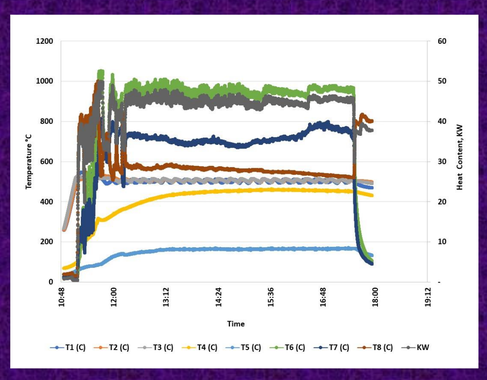
0.5 tpd pyrolysis system

Bag house CO_2 enhancement

Filter Bags

Biochar Shipment to Un. of Tennessee

Reactor Thermal Profiles



Biochar Characteristics

Biochar	N	P	K	pH	Ca CO_3 eq	O:C ratio
Wheat Straw	0.98	0.3	2.05	8.1	8.10	.20
Corn Stover	1.41	0.32	3.88	9.6	11.2	.12

Total installed capital cost of EBSR plant (Capacity 210,000 tons/year biochar)

Equipment	Installed cost
Cost of rotary Cooler (KWS Company)	$2,410,200
Cost of bag house with enhanced carbon injector (LDX solutions)	$2,300,000
Total capital cost	$4,710,200
Depreciation/year	$471,020
Capture Capital Cost/ton	$2.24

Total variable cost of EBSR plant (Capacity 210,000 tons/year of biochar)

Fixed O&M cost, injector with bag house	$100,000
Variable O&M cost, injector with bag house	$25,000
Fixed O&M cost, Rotary Cooler	$95,386
Variable O&M cost, Rotary cooler	$25,000
Total variable cost/year	$245,386
Total variable cost/ton	$1.17

Field Tests at Un. Tenn. Station

- Biochar enhanced lettuce growth by up to five times the control lettuce plant growth
- 10%, 20% and 40% biochar peat replacement tested with potted plants
- Higher biochar content did not affect the germination rate, but resulted in delayed germination.
- Irrigation water leachate showed biochar had extra water holding capacity.

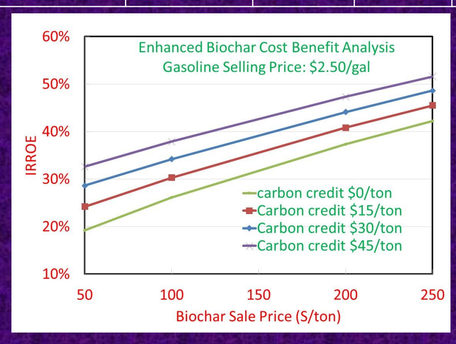
- Biochar enhanced Poinsettia plant growth by over a factor of two .
- 10%, 20% and 40% biochar peat replacement tested with potted plants
- The liming potential and growth performance of the corn stover biochar was very high.
- Dry matter yields tended to be much higher for the corn stover biochar.

Corn Growth at 30 Days

Techno-economic Benefits

Biofuels Plant Characteristics	
Plant Size, dry ton/day	2,000
Plant Size, BPSD	2,692
Plant Size, Millions gpy	41.27
Plant availability	82%
Capital Investment, $MM	$155.5
Feedstock Cost, $/dry ton	$55.00
Char Sales Price, $/ton	30
Performance	
IRROE%	18.10
Fuel Sales Price, $/GGE	$2.50
Feedstock type	Ligno Biomass
D/E Ratio	60/40
Equity Outlay, $ Million	$62.19
Plant Lifetime	20
Interest Rate	6%
Loan term, years	20
Depreciation Schedule	20yrs SL
Income Tax Rate	35%

Type of plant	Capital cost, Million $	Fuel price, $/gal	Biochar price, $/ton	IRR
Biofuel plant	155.5	2.50	30	18.1
Biofuel Plant with EBSR	163.14	2.50	56	18.1



With carbon credits for biochar, IRR can be up to 50% with a pay back period of ~2 years

Collaborators

Organization	Role
Altex Technologies Corporation	Prime contractor, technology developer and commercialization lead
University of Tennessee	Sub contractor for testing performance of biochar under CEA and open field
International Fertilizer Development Center	Consultant, commercialization partner
LARTA	Commercialization Partner

Contact

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