

Biochar Market Development and Product Registration

Presented by:

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Subjects

- **Current Realities of the Biochar Marketplace** *(my POV)*
- **Registration Basics**
- **Labeling Basics**
- **Certified Organic ‘Listing’**



Perspective

**Biochar production and market expansion.....
Learn from history of compost, AD, worm castings,
humic acid industries/markets in the USA**



Need to follow a similar path....

- **Professionalism,**
- **Science over 'fluff',**
- **Understand economics of process and usage**



Industry Advancing through Large-Scale Technology Providers (or 'Really Small' Producers)?



Typical with 'waste management' technologies

Either way, market expansion often lags...AD in Europe and US

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Current Biochar Markets Bolstered by...



USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

Soil Health Key Points

unlock the SECRETS IN THE SOIL

What's critical about soil health now?

1. World population is projected to increase from 7 billion in 2013 to more than 9 billion in 2050. To sustain this level of growth, food production will need to rise by 70 percent.
2. Between 1982–2007, 14 million acres of prime farmland in the U.S. were lost to development.
3. Improving soil health is key to long-term, sustainable agriculture.

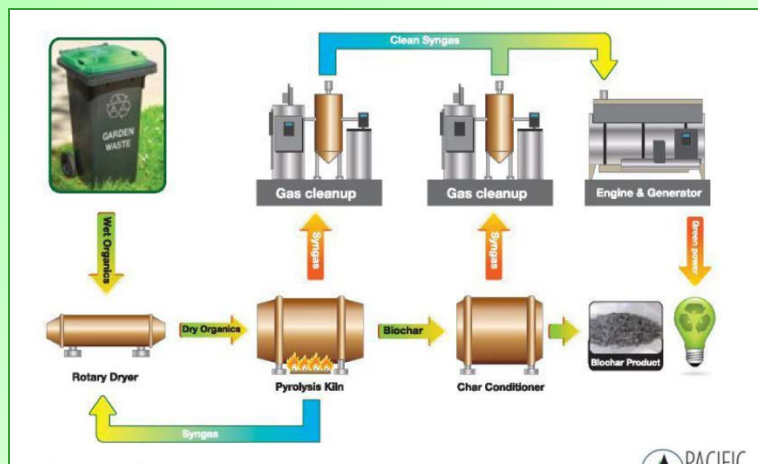


- **Interest in soil health, cannabis production, retail packaged soils**
(...but don't get delusions of grandeur !!)

Confusion in the Marketplace

What is Biochar?

- Need to define it 'as an industry'...
- What is 'real' biochar? (BBQ ashes?)
- Which products provide expected/proven benefits?



Labs Standards Established?

	Dry Basis Unless Stated: Range		Units	
Moisture (time of analysis)	#DIV/0!	% wet wt.		ASTM D1762-84 (105c)
Organic Carbon	#DIV/0!	% of total mass		Dry Combust-ASTM D 4373
Hydrogen/Carbon (H:C)	#DIV/0! 0.7 Max	Molar Ratio		H dry combustion/C(above)
Total Ash	#DIV/0!	% of total mass		ASTM D-1762-84
Total Nitrogen	0.00	% of total mass		Dry Combustion
pH value	0.00	units		4.11USCC:dil. Rajkovich
Electrical Cond. (EC20 w/w)	0 mmhos/cm	dS/m		4.10USCC:dil. Rajkovich
Liming (neut. Value as-CaCO3)	#DIV/0! percent	%CaCO3		Rayment & Higginson
Particle Size Distribution	ASTM D 2862 granular		Basic Soil Enhancement Properties	
< 420 um	#DIV/0!	percent	Results units/meth. Meth.	
420 - 2380 um	#DIV/0!	percent	Potassium	
2380 - 4760 um	#DIV/0!	percent	Total (K)	#DIV/0! mg/kg B
> 4760 um	#DIV/0!	percent	Available (K)	#DIV/0! mg/kg C
All units mg/kg dry unless stated: Range of Meth. Det.			Phosphorus	
	Results	Max. Levels	Limit (ppm)	Method
Arsenic (As)	#DIV/0!	12 to 100	0.15	E
Cadmium (Cd)	#DIV/0!	1.4 to 39	0.005	E
Chromium (Cr)	#DIV/0!	64 to 1200	0.015	E
Cobalt (Co)	#DIV/0!	40 to 150	0.25	E
Copper (Cu)	#DIV/0!	63 to 1500	0.5	E
Lead (Pb)	#DIV/0!	70 to 500	0.1	E
Molybdenur (Mo)	#DIV/0!	5 to 20	0.6	E
Mercury (Hg) (ppb)	#DIV/0!	1k to 17k*	0.160 ppb	EPA 7471
Nickel (Ni)	#DIV/0!	47 to 600	0.05	E
Selenium (Se)	#DIV/0!	1 to 36	0.25	E
Zinc (Zn)	#DIV/0!	200 to 7000	0.1	E
Boron (B)	#DIV/0!	Declaration	1	TMECC
Chlorine (Cl)	#DIV/0!	Declaration	0	TMECC
Sodium (Na)	#DIV/0!	Declaration	5	E
			Total Nitrogen (N) 0.00 mg/kg KjN	
			Ammonia(NH4-N) #DIV/0! mg/kg A	
			Nitrate (NO3-N) #DIV/0! mg/kg A	
			Organic (Org-N) #DIV/0! mg/kg calc.	
			Volatile Matter #DIV/0! % dw D	
			Butane Act. #DIV/0! g/100g dw	
			Surface correlation #DIV/0! m2/g d. wt.	
			Methode A Rayment & Higginson	
			B Enders & Lehmann	
			C Wang after Rajan	
			D ASTM D1762-84	
			E EPA3050B/EPA 6010	

k = 1000

Starting, but not there yet....



**US Composting
Council**

*Seal of Testing
Assurance*

Standardized Testing Methods



- Need to establish standardized testing methods (*agreed upon*).....
composting industry (TMECC and STA program assisted)

Important Parameters for Compost

Compost Parameters	Reported as
pH	N/A
Soluble salts	dS/m (mmhos/cm)
<i>Primary plant nutrients</i>	%, as-is (wet) & dry weight basis
Nitrogen	Total N
Phosphorus	P ₂ O ₅
Potassium	K ₂ O
Calcium	Ca
Magnesium	Mg
Moisture content	%, wet weight basis
Organic matter content	%, dry weight basis
Particle size	Screen size passing through
Stability (respirometry)	mg CO ₂ -C per g TS per day mg CO ₂ -C per g per day
Maturity (Bioassay)	
Percent emergence	% (average)
Relative seedling vigor	% (average)
Select Pathogens	PASS/FAIL (Per US EPA Class A standards, 40 CFR § 503.32(a))
Trace metals	PASS/FAIL (Per US EPA standards, 40 CFR § 503.13, Table 3)

What do we test for in order to compare products and determine expected results?

Standardized Testing Required to...

Actual Comparison of Compost to Other Horticultural/ Agricultural Products

	Compost ¹	Organic Soil ²	Native peat ³	Canadian peat ⁴	Aged chicken manure
Organic matter (%)	46.00	12.00	74.00	97.00	43.00
pH	7.40	7.50	5.20	4.20	-
Soluble salts (mmhos/cm)	2.23	0.64	0.31	0.07	15.10
Bulk density	32.16	70.22	14.26	6.98	39.32
Moisture holding capacity	227.00	53.00	428.00	1307.00	166.00
Cation exchange capacity (meg/100g)	17.30	13.60	4.00	3.10	-

Field Guide to Compost Use, US Composting Council, 1996

1 = biosoils/yard trimmings
2 = organic Florida muck soil
3 = Florida reed sedge peat
4 = Canadian sphagnum peat moss

Understand your product vs. competing products

What can the product actually replace?

What are realistic applications / markets (economics)

Compost Comparative Data

Primary Feedstock	Wood Compost	MSW Compost	Yard Trimmings Compost	Cotton Boll Compost	Cattle manure Compost
PHYSICAL					
Moisture Content (%)	28.3	36.1	30.7	38.4	29.8
Total Solids (%)	71.8	64.2	69.4	61.8	70.2
CHEMICAL					
pH	5.9	7.4	7.4	8.1	8.9
EC (dS/m)	0.3	6.4	4.0	4.2	12.1
PO ₄ -P (mg/L)	2.0	1.3	1.1	86.3	45.6
TKN (% w/w)	0.3	2.0	1.0	1.5	2.2
NO ₃ -N (mg/kg)	5.5	355.3	447.0	78.0	19.8
NH ₄ -N (mg/kg)	1.2	14.0	9.5	61.7	1835.5
NH ₄ -N / NO ₃ -N (Ratio)	2.0	5.0	0.0	0.0	36.0
Fe (mg/kg)	4,734	8,896	11,300	3,645	5,285
C:N (Ratio)	161.0	10.9	12.0	15.0	12.2
CCE (% w/w)	2.8	16.4	-	5.0	9.1
BIOLOGICAL					
Seedling Emergence (%)	99.0	95	100.0	100	5
Seedling Vigor (%)	5.5	71.0	97.6	90.0	1.0
CO ₂ Evolution (mg/gTS/d)	0.5	0.6	0.7	0.9	2.0
Salmonella (MPN/g dw basis)	0.0	0.0	5.8	3.1	1.5
T. Coliform Bacteria (MPN/g dw basis)	1,400	10.8	4.0	5.4	1.8

Compost is not compost, varies based on feedstock, processing, etc.

Biochar Comparative Data

	% Moisture of Biomass	% Biochar + Ash Left	Butane Activity	% OM in Biochar	% Ash in Biochar	% Carbon in Biochar	Neutralizing Value as % CaCO ₃	Carbonate Value as % CaCO ₃
						(estimated @ 90% of OM)		
Biosolids	7.1	67.1	1.8	14.2	85.8	12.8	13.8	12.6
Foodwaste	84.9	32.2	4.4	49.3	50.7	44.4	25.8	21.9
Greenwaste	10.9	46.2	4.3	49	51	44.1	24.1	17.9
Ground Pallets	14.4	26.2	14.6	29.1	70.9	26.2	27	21.6
Redwood Fines	12.4	46.4	4.7	26.2	73.8	23.6	9.3	4.5
Redwood (new)	17	33.5	11	76.2	23.8	68.6	17	13.1
Rice Waste	39.5	52.8	3.6	23.3	76.7	21	16.5	9.9
Wood chips	6.9	28.7	10.5	70.3	29.7	63.3	20.6	15.6
Wood shavings	17.9	24.4	13	72.4	27.6	65.1	16.7	13.3

F. Shields, Gabilan Laboratory - 550°F min, 1 hour

BIOCHAR IS NOT BIOCHAR - Variability based on feedstock, production technique, temperature, etc. Products are not the same, need to be able to test using standard methods to better understand

Improve Sales & Marketability

Helps when products possess the appropriate characteristics:

'fit for purpose' and/or of general good quality



Must define...



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Compost Specs for Landscaping

-----General Range-----

Parameters ¹	Reported as (units of measure)	Turf Establishment, Planting Bed Establishment, Backfill Mix	Mulch
pH ²	pH units	6.0 - 8.5	5.5-9.0
Soluble Salt Concentration ² (electrical conductivity)	dS/m (mmhos/cm)	Maximum 10	Maximum 10
Moisture Content	%, wet weight basis	30 – 60	25-60
Organic Matter Content	%, dry weight basis	30 – 65	>30
Particle Size	% passing a selected mesh size, dry weight basis	98% pass through 3/4” screen or smaller	99% pass through 3” screen, >25% passing 3/8” screen
Stability ³ Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	< 8	N/A
Maturity ³ (Bioassay) Seed Emergence and Seedling Vigor	%, relative to positive control %, relative to positive control	Minimum 80% Minimum 80%	
Physical Contaminants (inerts)	%, dry weight basis	< 1	<.1

Leads to easier specification (for usage), especially on larger public projects...

Compost Specs for Erosion Control

Parameters ^{1,6}	Reported as (units of measure)	Filter Berm to be Vegetated	Filter Berm to be left Un- vegetated	Surface Mulch to be Vegetated	Surface Mulch to be left Un- vegetated
pH ²	pH units	5.0 - 8.5	N/A	5.0 - 8.5	N/A
Soluble Salt Concentration ² (electrical conductivity)	dS/m (mmhos/cm)	Maximum 5	N/A	Maximum 5	Maximum 5
Moisture Content	%, wet weight basis	30 – 60	30 – 60	30 – 60	30 – 60
Organic Matter Content	%, dry weight basis	25 – 65	25-100	25 – 65	25-100
Particle Size	% passing a selected mesh size, dry weight basis	<p>Minimum:</p> <ul style="list-style-type: none"> 100% passing 3" (75 mm), 90% passing 1" (25mm), 70% passing 3/4" (19mm), <p>Between:</p> <ul style="list-style-type: none"> 30-75% passing 1/4" (6.4mm). <p>Maximum:</p> <ul style="list-style-type: none"> particle size length of 6" (152mm) <p>(no more than 60% passing 1/4" (6.4 mm) in high rainfall/flow rate situations)</p>	<p>Minimum:</p> <ul style="list-style-type: none"> 100% passing 3" (75 mm), 90% passing 1" (25mm), 70% passing 3/4" (19mm), <p>Between:</p> <ul style="list-style-type: none"> 30-75% passing 1/4" (6.4mm). <p>Maximum:</p> <ul style="list-style-type: none"> particle size length of 6" (152mm) <p>(no more than 50% passing 1/4" (6.4 mm) in high rainfall/flow rate situations)</p>	<p>Minimum:</p> <ul style="list-style-type: none"> 100% passing 3" (75 mm), 90% passing 1" (25mm), 65% passing 3/4" (19mm), <p>Maximum:</p> <ul style="list-style-type: none"> 75% passing 1/4" (6.4 mm) particle size length of 6" (152mm) 	<p>Minimum:</p> <ul style="list-style-type: none"> 100% passing 3" (75 mm), 90% passing 1" (25mm), 65% passing 3/4" (19mm), <p>Maximum:</p> <ul style="list-style-type: none"> 75% passing 1/4" (6.4 mm) particle size length of 6" (152mm)
Stability ³ Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	< 8	N/A	< 8	N/A
Physical Contaminants (man- made inerts)	%, dry weight basis	< 1	< 1	< 1	< 1

Leads to ease of purchase (help buyers), and identify best products for specific applications

Pacific Biochar

Standard Price Sheet for Spring 2016

Free delivery available in CA with full truckload purchases!
Otherwise, listed prices are FOB Willows, CA, 95988



Blacklite

This biochar material is created purely from softwood forestry residues. It is sustainably produced in CA with capacity to consistently deliver large volumes. It is highly porous, adsorptive, and has great water holding capacity. The gradation is ¼" minus, the bulk density dry is 1.5 pounds per gallon and it is delivered with 50% moisture content for safety and ease of handling. *Ingredients: Biochar*



BlackLite Mix #6

Beyond plain biochar, our Mix #6 cultured blend is fantastic for use as a component of potting blends. The unique biological activation process that we have developed results in a biochar material that is charged, matured, and instantly ready to help your soil produce vigorous plants. *Ingredients: Biochar, Worm Castings, Rice Bran. (About 90% biochar by volume)*



Dense Mix

Moist biochar rolled in microfine basalt rock powder, blended with rice bran and worm castings then given time to mature. The biochar acts as a catalyst for microbial activity and housing for beneficial fungi, allowing minerals to become available faster. This material is particularly good for re-invigorating tired or abused soils. *Ingredients: Biochar, Microfine Basalt Rock Powder, Rice Bran, Worm Castings. (About 70% biochar by volume)*

Custom Blended Orders Available Upon Request.
Free Consulting Available for Application Optimization.

www.pacificbiochar.com | sales@pacificbiochar.com | 808.936.3484

Varying products based on application (market/use)



...It's starting



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Confusion in the Marketplace



It's not a magical product ! (SCIENCE-BASED)

Focus on realistic claims / proven benefits?



Verified Vermicompost Benefits

1. Improves soil structure and porosity
2. Increases moisture infiltration and permeability, and reduces bulk density of heavy soils
3. Improves the moisture holding capacity of light soils
4. Improves the cation exchange capacity (CEC) of soils
5. Supplies organic matter
6. Aids the proliferation of soil microbes
7. Supplies beneficial microorganisms to soils and growing media
8. Encourages vigorous root growth
9. Allows plants to more effectively utilize nutrients
10. Enables soils to retain nutrients longer
11. Contains humus
12. Buffers soil pH
13. Source of macro and micro nutrients
(for fertilizer registered products, not soil amendment registered products)

***Must identify
provable benefits!***

***Allowable label
claims based on
state, application
rates, etc.***

***National
organization
should establish
list with AAPFCO***



Biochar - Advantages

- Enhanced plant growth
- Suppressed methane emission
- Reduced nitrous oxide emission (estimate 50%)
- Reduced fertilizer requirement (estimate 10%)
- Reduced leaching of nutrients
- Stored carbon in a long term stable sink
- Reduces soil acidity: raises soil pH
- Reduces aluminum toxicity
- Increased soil aggregation due to increased fungal hyphae
- Improved soil water handling characteristics
- Increased soil levels of available Ca, Mg, P, and K
- Increased soil microbial respiration
- Increased soil microbial biomass
- Stimulated symbiotic nitrogen fixation in legumes
- Increased arbuscular mycorrhizal fungi
- Increased cation exchange capacity

*From scientific text...how many of these claims can we REALLY make?
(Is there enough scientific back-up, legal claims, relevant to buyers?)*



Biochar Claims from Existing Labels

- Improve soil tilth and aeration
- Boost soil biodiversity
- Increase nutrient and water retention
- Stimulate and promote beneficial microbes and fungi
- Reduce off gassing of CH₄ and NO₂
- Increase pH and reduce liming needs
- Accelerate composting process

- From actual label.....which claims provable, which relevant to 'buyer' ? WHICH ONES WILL BE DEEMED ALLOWABLE?

- AAPFCO – all written (and spoken) word = a labelling claim



Biochar Claims from Existing Labels

- **Healthier soil = Better yields**
 - Vegetables and flowers are bigger and more abundant. Encourages micro-organisms to thrive in your soil. Increases nitrogen and other important nutrients.
- **Drought resistance**
 - Retains water better than compost and peat moss
- **Long-lasting love for your soil**
 - Biochar benefits the soil for 100's of years
- **Reduces Global Warming...Seriously!**
 - Biochar returns carbon back to the soil that would've been released as CO₂ into the atmosphere. Also called carbon sequestration, this “carbon negative” process helps stop global warming.

From actual label....(problem claims)

Labels and sales data should not be an academic exercise, must lead to sales, not cause a 'stop sale'



Valuing Products

- **Must work to monetize product benefits**
 - Depends on product characteristics
 - Real and perceived value
 - Other....

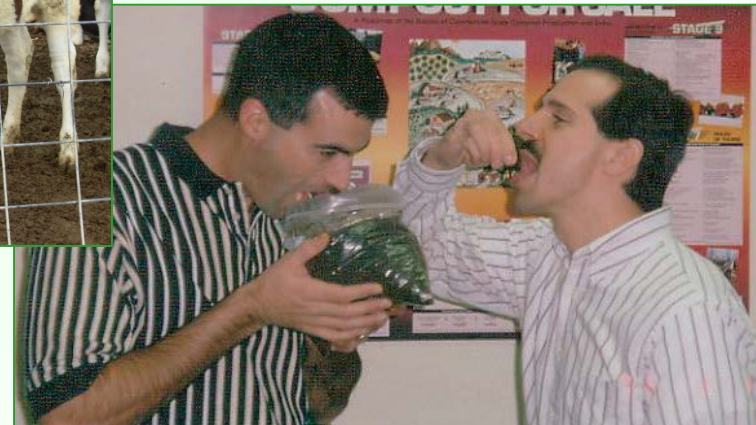


Just because university research proves benefits, doesn't mean the industry will readily accept them ! (commercialization)

Not always straight forward...



Markets and Applications



Various markets are being established, but are 'early days' (need more people knocking on doors)

Key Elements in Market Research and Development

- **Production/facility**
- **Product development research**
- **Market research**
- **Promotion**
- **Education**
- **Sales / distribution**

**Industry needs to take market development seriously...
expand usage, raise value...*



AAPFCO

Organization of State DOAs

- Work together on issues affecting State DOAs regarding the distribution of feed, lime, fertilizers, and soil amendments

- Involve *industry* in discussions
- Goal: uniformity from state to state
- Create *model* legislation & regulation, labeling law



State regulations affect how we 'legally' approach the market

Regulatory Background

- **48 states have fertilizer laws (not HI or AK), 38 have soil amendment laws**
 - **Biochar currently considered a soil amendment**
- **Individual State DOA's decide what you can and cannot state on the label**
 - **Regulation will be based on the State in which your facility is located and the states in which you distribute product**
 - **Biochar producers / marketers have to register product in all states that product is distributed, and meet their labeling and distribution regulations**

Related Regulation

- Typically, State DOAs (*Control Officials*) regulate the distribution of products, not their production
 - Can regulate product quality (e.g., heavy metals, pathogens, etc.) *'Adulteration'*
 - Regulate labeling text (during the registration process) *'Also adulterated if it doesn't meet claims'*
 - Claims (benefits), terms, units of measure, other
 - Providing any nutrient data, technically, makes your product a fertilizer

**Some States have gotten very conservative about labeling claims, especially with soil amendments / conditioners*



Current Registration Options

- **Register as soil amendment**

- No nutrient claims (unless dual registration), volume vs. weight, must negotiate label claims

- **Register as fertilizer**

- Sell by weight, moisture content vs. nutrient claims, etc.

- **Dual registration** – few states (e.g., PA, IL)

- **Don't register?** *(OK, until you get caught)*

Related Definitions

Soil Amendment – (commonly referred to a Soil Additive or Soil Conditioners), means any substance or a mixture of substances which is intended to improve the physical, chemical, biochemical, biological or other characteristic of the soil, except fertilizer, agricultural liming materials, unmanipulated animal manures, unmanipulated vegetables manures, pesticides and other materials exempt by regulation.

MANY STATES WILL REQUIRE UNIVERSITY RESEARCH TO PROVE CLAIMS

CLAIMS MUST BE TRUTHFUL, BASED ON SUGGESTED APPLICATION RATES

Related Definitions

Fertilizer – any substance containing one or more recognized plant nutrient(s) which is used for its plant nutrient content and which is designed for use or claimed to have value in promoting plant growth, except unmanipulated animal and vegetable manures, marl, lime, limestone, wood ashes and other products exempted by the regulation by the _____.

Specialty Fertilizer – a fertilizer distributed for non-farm use.

MAY HAVE TO PROVE NUTRIENT RELEASE / PLANT AVAILABILITY



Related Definitions

T-101 Biochar - is a solid material obtained from thermochemical conversion of biomass in an oxygen-limited environment (pyrolysis) containing at least 60% carbon. Feedstocks may be composed of crop residue, wood or other forest waste, and animal manures. Materials transported in salt water, painted, or treated with preservatives are not permitted. When listing biochar in an ingredient statement, the feedstock shall be designated by prefixing the term biochar with the feedstock from which it was produced; i.e. poultry litter biochar, green waste biochar, papermill biochar, etc. When more than one feedstock is involved, all feedstocks greater than 10% of the total volume are to be listed by decreasing volume. Their uses include soil amendments.

Registration Costs

- Fees associated with registering both soil amendments and fertilizers vary from state to state
- There may be a registration fee per product or company and/or a tonnage fee (known as an inspection fee).
- Often you pay both a registration fee (*typically* ranging from \$0 to \$250/product and a tonnage fee (*typically* ranging from \$0 to \$0.90/ton).



Biochar Labels

What needs to be on the label?

What cannot be on the label?

Bagged product = Bag is label

Bulk product = Literature, B/L is label



Biochar Distributed as a Soil Amendment

- **Uniform Soil Amendment Bill**
 - Brand name
 - Net weight (or volume)
 - Guaranteed analysis – ingredient statement
 - Purpose of product (benefits/claims)
 - Directions for application
 - Name and address of applicant

Other text allowable, claims, etc.

‘The more states, the more hassles’





Product are on the market, which are 'registered'?



Biochar

Distributed as a Fertilizer

- **Uniform State Fertilizer Bill**
 - Brand (product name)
 - Grade (e.g., 0-0.5-0.5)
 - Guaranteed analysis – chemical breakdown (e.g., WIN, WSN)
 - Directions for use for fertilizer distributed to the end user
 - Name and address of registrant/licensee
 - Derivative statement – source of nutrient
 - Net weight (IMPERIAL AND METRIC UNITS)



Biochar

Distributed as a Fertilizer

- **Other stuff**

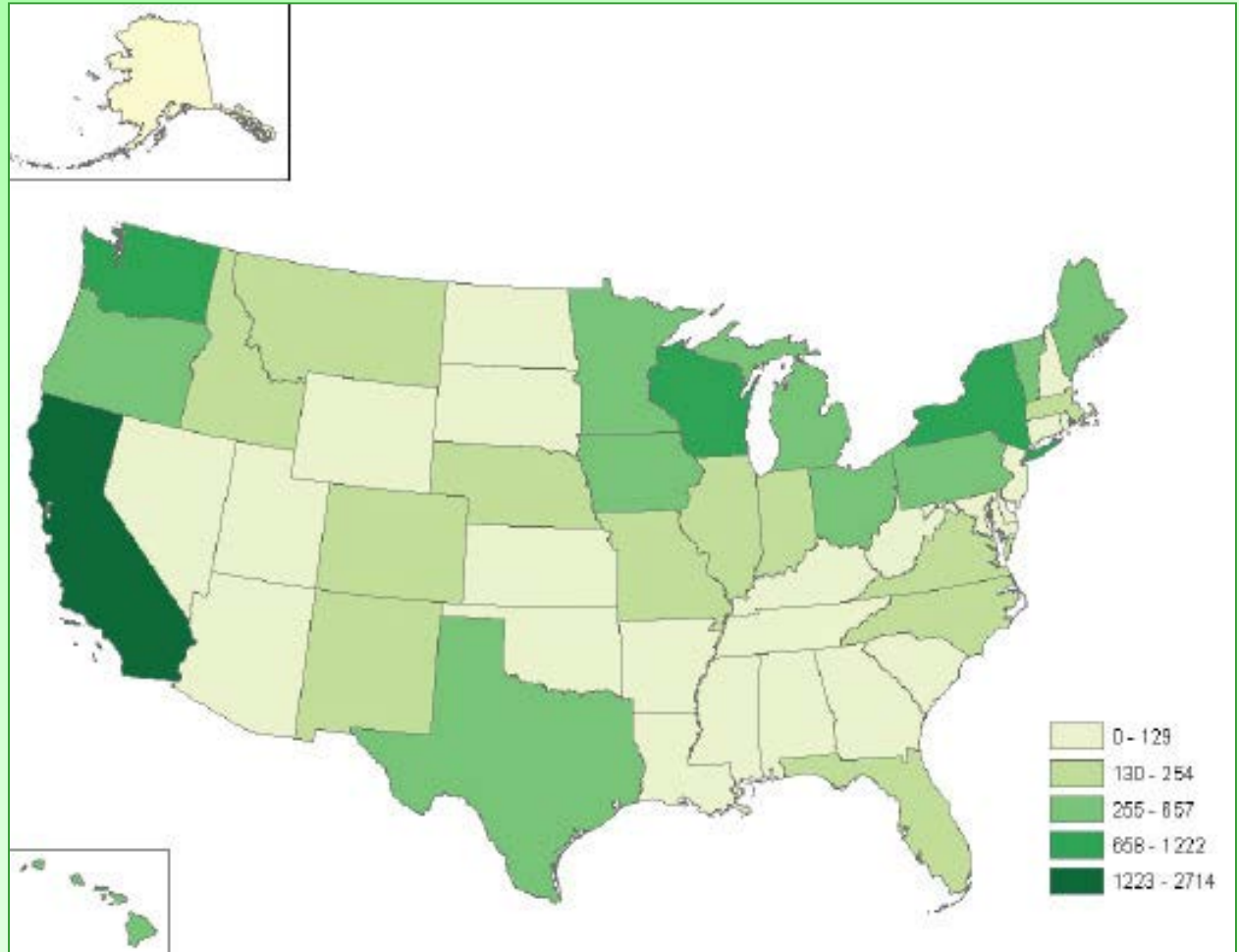
- Heavy metal statement and testing – west coast states primarily
- *Apply only as directed.....statement*
- Allowable claims and terms on labels are based on historical product research, product type being registered (fertilizer vs. soil amendment), whim of individual State/Control Official
- No pesticidal or unproven claims!
(University research) Careful microbial claims



Certified and Exempt Organic Farms

TOP 10 STATES

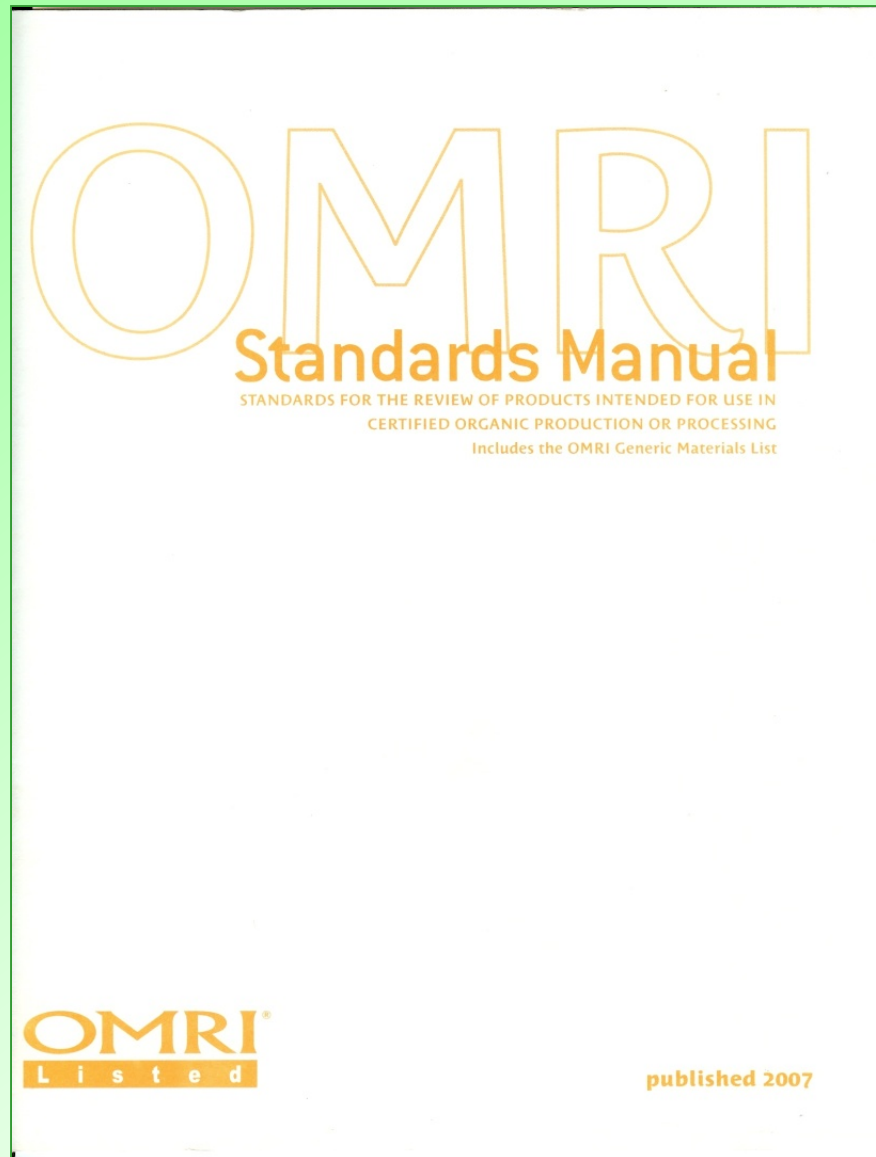
1. **California** - 2,714
2. **Wisconsin** - 1,222
3. **Washington** - 887
4. **New York** - 827
5. **Oregon** - 657
6. **Pennsylvania** - 586
7. **Minnesota** - 550
8. **Ohio** - 547
9. **Iowa** - 518
10. **Vermont** - 467



EXPANDING ! (Gardeners also want).....so



OMRI Listing



Allows for easier usage on certified organic farms



Ashes

Status: Allowed

Class: Crop Fertilizers and Soil Amendments

1. Description: **Wood ash** must be produced exclusively from untreated and unpainted wood. Wood stove ashes must not be generated from burning of colored paper, plastic, or other prohibited materials. Excessive applications of ash can cause pH and nutrient imbalances. See ASH – PLANT OR ANIMAL.

2. Description: **Ash from plant and animal sources only.** Ashes from burning minerals, manure, or prohibited materials are prohibited. See also MANURE ASH.

Is no 'biochar' term.... Listed as 'ash'



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Ashes

Status: **Prohibited**

Class: Crop Fertilizers and Soil Amendments

Specifically ash from **burning manure**. See Glossary for definition of "manure."

Products will be allowed (as an ash) primarily based on its feedstock (ingredients)

REMEMBER - OMRI has no labeling authority (so just because they approve it, doesn't mean it's a legal label)



12 BEST REASONS ~ To Use Black Owl Biochar

"B.O.B." is a made from virgin wood waste from sustainably-managed forests.

- 1) ENHANCES (S.O.M.) Soil Fertility Permanently
- 2) INCREASES Land Productivity & Value
- 3) ENRICHES Soil Ecosystem - Beneficial Soil Biota, Microbes & Fungi which Feed Plants & Aerate Soil
- 4) MEDIATES Water Conditions for Soil, Resulting in Percolation & Aeration Improvement
- 5) OPTIMIZES Water-Holding Capacity
- 6) IMPROVES pH of Acidic Soils
- 7) BOOSTS Cation Exchange, Restoring Struggling Soils & Plants
- 8) RETAINS Nutrients ~ Eliminates Nutrient Runoff, Less Fertilization Needed
- 9) INCREASES Seed Germination
- 10) AUGMENTS Plant Size, Vigor, Blooms & Yield
- 11) IMPROVES Texture & Tillth
- 12) FREE of Seeds, Weeds & Manure

Gold Star Benefits

When incorporated into soils, Black Owl Biochar offsets human-made carbon emissions.

While compost releases CO₂ & other GHGs (such as methane & nitrous oxide) in its decaying process, biochar locks in organic benefit to the soil, prevents off-gassing & offsets GHGs from the atmosphere. B.O.B. also accelerates the composting process & minimizes odors associated with it.

It also sequesters methane & nitrous oxide (a byproduct of nitrogen fertilizers) when added to soil. Nitrous oxide is a more potent GHG gas than carbon dioxide.

Biochar is a "WIN-WIN-WIN" for the soil health, plant production & the environment.

Join us today in our "10,000 Car Challenge". We hope to offset the annual emissions of at least 10K cars over the next year. With your purchase, your contribution will be registered.

"If you could continually turn a lot of organic material into biochar, you could, over time, reverse the history of the last two hundred years."

Bill McKibben 350.org

OMRI LISTED
For Organic Use

*Produced by Growers for Growers
(Use with Organic or Traditional Fertilizers)

Crop Fertilizers and Soil Amendments Contaminant Requirements

- **Heavy Metals**

- As / 10ppm, Cd / 20 ppm, Pb / 90 ppm

- **Pathogens**

- 1,000 MPN Fecal Coliform
 - 3 MPN Salmonella / 4 grams



Conclusions

- **Industry needs more product development and market research** (cost to produce vs. market value, applications)
- **Understand market – don't ASS-U-ME** overall marketability or product value.... *Be realistic with expected values*
- **Do a proper 'due diligence' – do the RESEARCH !** – market and product development, study and invest, product placement
- **Market/Sell using scientific proof**
- **Match product with application**
- **Properly register for sale (consider certifying, Listing)**
- **Industry must start to standardize to allow growth**
 - **Learn from history of related products / industries**

Questions?

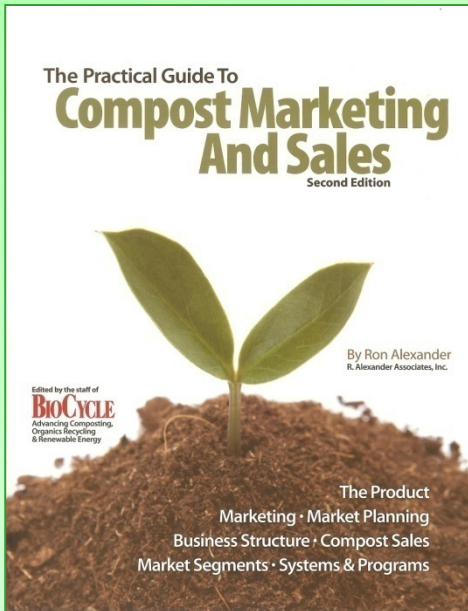
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