

Compost Quality Considerations by End Use

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Compost Quality and Markets

“Beauty is in the eye of the beholder.”

Compost quality is in the eyes of the end user.

You can ask, “What kind of waste material do I have to compost?”

Alternatively, you should ask, “What kind of end product do I want to produce?”

Organic Gardening Magazine's "Exposé of Bagged Composts

- Blind test of several bagged compost products
- Performed several chemical and biological tests of these composts (WERL)
- Found gross inconsistencies between bag claims and compost quality tests

Lessons Learned

- Consumer has no clue what's in the bag
- Consumer does not know proper applications for specific compost type
- Unfounded claims may come back to bite the compost producer, either regulation-wise or economically

Emerging Approach

Develop quality standards
according to specific end uses

General Categories of End Use

- Agronomic
- Horticultural
- Urban/suburban landscaping
- Turf
- Forestry
- Land reclamation/bioremediation
- Land fill cover

CA Performance

Requirements Characteristics

- Source of available nutrients
- Source of beneficial organisms
- Appropriate for seed germination or transplants
- Will not introduce weed seeds or pathogens or contaminants
- Enhances soil water holding capacity, soil structure, drainage, nutrient retention capacity
- Does not significantly increase soil salinity

Likely Grower Applications of Compost

- Peat substitute (container mixes)
- Soil conditioner (source of organic matter)
- Slow release source of nutrients
- Disease suppression
- Mulch

Compost Types

- Not all are created equal
- What goes in (feedstocks) often determines what comes out
- Quality depends on process used, duration of composting and manner of use

Quality Measure	GH or Nursery Crops	General Use (bagged or bulk)	Soil Amend. (veg or fruits)	Mulch
Plant growth response	++	++	++	-
Nutrient content	-	+	+	-
pH/Sol. salts	++	++	+	-
Color/odor	+	++	-	+
Biol. stability or maturity	++	++	+	-
Particle size	++	+	+	+

-, +, ++ low, mod., high importance

Source: Sullivan and Miller, 2001

Quality Standards Programs

- US Composting Council's Seal of Testing Assurance (STA) Program
- Woods End Research Lab's Solvita Seal of Approval and Quality Control Registration Programs
- California Compost Quality Council
- Oregon's Yard Waste Compost Quality Standards

Solvita Compost Quality Seal of Approval Program

- Validation process that issues certificate of approval of compost batches for specific end uses
- Categories of use include:
 - seed starter
 - container mix
 - garden (general field use) compost
 - topsoil blend
 - mulch
 - natural fertilizer

Key Quality Parameters for Seal of Approval

Compost Category	pH, moisture	Maturity index	Organic matter	Soluble salts	Minerals	Density	Plant growth
Seed starter	✓	✓	✓	✓	✓	✓	✓
Container mix	✓	✓	✓	✓	✓	✓	✓
Garden compost	✓	✓	✓	✓	✓		✓
Topsoil blend	✓	✓	✓	✓			✓
Mulch	✓		✓	✓		✓	
Natural Fertilizer	✓				✓	✓	✓

Source: Woods End Research Lab, Inc. 2001

Evaluation of Composts Before Use

- pH
- Soluble salts
- Moisture content
- Ash content
- % OM, C:N ratio
- Available nutrients: $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$, P, K, Ca, Mg, micros
- Heavy metals, possible contaminants
- Particle size, bulk density, water holding capacity
- Maturity (germination or plant growth test)
- Biological stability
- Potential for disease suppression ??

Chemical Properties

pH of Composts

- Ranges from 5.0 to 8.0
- Addition of composts can affect soil pH
- Need to know plant pH requirements
- High pH composts may have pronounced effect on calcium levels
- Composts affect pH differently than minerals and soils

Soluble Salts

- Measured in dS/m or mmhos/cm
- Excessive salts can damage plants
- Manures higher -- yard waste lower
- Avoid high salt (above 10 dS/m) composts

Tolerable Salt Levels

- 6 dS for fruits and vegetables
- 4 dS for most turf species
- 3 dS for ornamental species
- 1 dS for “salt sensitive” species (e.g., geraniums)

Available Nutrients

- N in in organic form must be mineralized to NO_3 and NH_4 for plant use.
- Analyze total N + water soluble nitrate and ammonium.
- Need to know available nutrient levels to make correct decisions about supplemental fertilizing and liming.

Assessment of N Availability

- High concentrations of ammonium-N indicate immature compost
- Saturated media extract ammonium-N should be less than 40 ppm
- Test compost or compost blend **BEFORE** selling or using

Trace Elements/Heavy Metals

- Regulated by U.S. EPA and the State
- Presence does not mean that the product is unsafe
- Certain elements are needed by plants in trace amounts (Fe, Zn, Cu)
- Check for plant available concentrations

Fertility Analysis: Saturated Media Extract

Test	Desirable Range
pH	5.6-7.0
Soluble salts (mmhos/cm)	2.0-3.5
Nitrate-N (ppm)	100-200
Ammonium-N (ppm)	<40
Phosphorus (ppm)	6-9
Potassium (ppm)	150-200
Calcium (ppm)	180-350
Sodium/Chloride (ppm)	<150

Fertility comparisons between mineral fertilizers and composts

Material	Advantages	Disadvantages
Mineral Fertilizers	<ol style="list-style-type: none">1. Convenient2. Transport and handling costs are lower3. Quick crop response	<ol style="list-style-type: none">1. Easily leached2. Continuous use may lead to breakdown of soil structure3. Supply major nutrients only
Composts	<ol style="list-style-type: none">1. Improve soil structure2. Controls erosion3. Supplies wide range of nutrients4. Hygienic disposal of pathogenic waste	<ol style="list-style-type: none">1. Dilute nutrient source2. High transport costs3. May be difficult to apply evenly4. High C:N ratios may rob soil N

Physical Properties

Water Holding Capacity

- Ability of the compost to hold water
- Measured as a percentage of dry weight
- Translates to potential reductions in irrigation amount and frequency

Bulk Density

- Weight per unit volume of compost
- Used to convert compost application rates from tonnage to cubic yards
- Used to determine volume transported
- 800 - 1,000 lbs. per cubic yard preferred

Moisture Content

- Measures amount of water in the product
- Affects bulk density and transportation costs
- Dry (35% or less) can be dusty and hard to spread
- Wet can be too clumpy
- 50 - 60% preferred -- ranges from 30 to 60%

Organic Matter Content

- Measure of the carbon content in the compost
- Expressed as percentage of dry weight
- Need to know to determine application rates to the landscape
- Range 30 - 60% with 40-50% preferred

Particle Size

- Desired size depends on compost's intended use or customer's specification
- Yard waste at 1/4" could not be used as a mulch while 1" screenings could be used

Biological Properties

Pathogens

- If starting new operation or use of new feedstocks, test for pathogens
- Coliform bacteria, Salmonella
- Giardia, cryptosporidium

Biological Stability

- Measure microbial respiration under optimal moisture, temperature conditions
- High respiration= high activity= unstable
- Low respiration=low activity= stable
- Measure of potential to produce phytotoxic effects and/or nutrient tie-up

Growth Screening

- Indicates presence or absence of phytotoxic substances
- Includes germination , root elongation, and pot tests
- New test for herbicide toxicity
- Bioassays for disease suppressiveness
- Consider screening for viable weeds

Comparison of Compost to other Planting Media

	Compost	Organic Soil	Native Peat	Sphagnum Peat
% Org. Matter	46	12	74	97
pH	7.4	7.5	5.2	4.2
Sol. salts	2.2	0.6	0.3	0.07
Bulk density	32	70	14	7
WHC %	227	53	428	1307
CEC (meq/100g)	17	14	4	3

Source: Alexander, 2001

Mulch Vs. Compost

Mulch

- Soil surface cover of raw or partially decomposed bark, wood
- Controls weeds
- Moderates soil temperatures
- Reduces erosion
- Retains soil moisture by retarding evaporation
- Particle size is 1/2" or greater
- Should not be incorporated into the soil.

Compost

- Product of controlled biological decomposition.
- Humus-like substance, stable biologically
- Can be incorporated or surface applied
- Particle size 1/2" or less
- **Can be used as a mulch but mulch cannot be used as compost.**

Supplier Requirements

- Produce the compost that meets the end use
- Supply/produce a consistent product
- Have an on-going testing/quality assurance program
- Supply testing data to end users
- Provide good customer service
- Possess adequate storage
- Assure prompt and reliable delivery
- Provide technical assistance regarding end use

Useful References

- Field Guide to Compost Use, The U.S.Composting Council, 1996.
- Heuser, Charles W. and Patricia E. Heuser, eds. Recycling and Resource Conservation: A Reference Guide for Nursery and Landscape Industries, Pennsylvania Nurserymen's Association, Harrisburg, PA. 1994.
- Cornell Composting web page (Cornell Waste Management Institute)
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- California Integrated Waste Management Board's web site.