LABORATORY TEST INTERPRETATION

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Total Solids / Moisture / Water Holding Capacity: There is no absolute moisture level which is correct or ideal for biological processing, since ideal moisture for any material depends on the objective of processing. For aerobic biodegradation (composting), the optimal moisture is a specific proportion (60-80%) of the sample's water holding capacity (WHC) during the active period of degradation. The Woods End report gives WHC% on a dry and as is basis. To gauge optimal moisture the "squeeze-test" when conducted carefully reflects accurately the relative relationship of water to the sample's water holding capacity. A low organic matter material (e.g. 30% OM), is adequately wet at only 30 to 40% moisture. A high organic sample, typical of a fresh compost mix, will require from as high as 65% to be ideally moistened. Water holding capacity diminishes during biodegradation, due to loss of organic content, and thus the ideal level of moisture will likewise diminish. For biological anaerobic processing to biogas, desired moisture ranges from 95% down to 70% for "dry fermentation" systems. In reading the report make sure the two sets of numbers are compared.

pH and **free Carbonates (CO_3^-)**: The pH of waste and composts must be cautiously interpreted as it is not a static property and can be misinterpreted. Lime and ash-treated wastes and those high in ammonia may have a temporarily very high pH. In conjunction with elevated pH (over 7.5), free lime (total and soluble carbonates) are often present. The lab measures free-carbonates semi-quantitatively on a scale of none, low, med and high (1-2-3-4). The significance of the presence of free carbonates is frequently underestimated in composts. If significant free carbonates are present, this will hold the pH up and an ideally moderate to low pH (< 7.5) may not be attainable until the carbonates are neutralized by natural action over time. However, if the pH is elevated due to ammonia instead of carbonates, then the high pH reported may be less of a concern since ammonia converts to acid nitrate upon nitrification. Ideally, the pH of finished compost should be neutral to slightly acid (6.0 – 7.5) while the ideal range for biogas reactors is slightly higher at (7.0 - 8.5). Carbonate containing materials do possess lime neutralization potential that should be factored into land application programs.

ORGANIC MATTER - Volatile Solids - Ash - Carbon: The combustible content or "volatile solids" (VS) fraction consists of C-H containing compounds and is measured by total weight loss from furnace combustion. The lab may also measure total-carbon by direct combustion, in which case inorganic carbonates present may cause a positive error. Woods End routinely employs the VS-combustion method since the Ash content is an important trait by itself. With VS methods the carbon content is estimated as 54% of VS based on regression equations with corrected direct carbon combustion. There is no absolute ideal level of carbon or organic matter, and the quantities must be viewed in relation to the age of a material, its nitrogen content, and its intended use. For purposes of composting and digestion it is helpful to report the initial OM or VS and contrast it with the same determined at later points, or to report CO_2 release of CH_4 as a percent of the total VS. This gives an idea of the extent of decomposition. Organic matter may appear lower than expected due to incorporation of soil or sand during processing. The OM test is the basis for determining the sample C:N ratio (see later).

NITROGEN: total-N, organic-N, ammonium, nitrate, nitrite: Nitrogen exists in many states within the same material, and thus the quantity and form is important to interpreting overall condition. Woods End uses modern combustion equipment for TN which includes all N from nitrate, ammonium and organic-N form. This N value is employed to calculate the CN based on analysis or estimation of carbon from organic content. After this we look at soluble forms of N that may be present. There are many forms of labile, unstable nitrogen including ammonia, amines and urea, which decompose readily and are normally shown as ammonium-N (NH_3 + NH_4). For composts, it is normal to find a small ammonia fraction and possibly elevated nitrate (NO_3) once the material matures, so it has a very low NH_3:NO_3 ratio. Absence of oxygen in fresh wastes and manures tends to preserve unstable ammonium forms of nitrogen, or may cause nitrate to reduce to nitrite a more unstable and toxic form. Woods End reports the % total nitrogen which is immediately soluble, useful where fertilization is concerned. Also reported is the amount of ammonium-nitrogen which is volatile as ammonia vapor (NH_3) based on a standard pH algorithm, and subject to immediate loss. Volatile NH_3 values exceeding 15% of total-N are unusually high. Such samples, based on pH, will be analyzed in the lab in a fresh state to prevent N-loss from drying. If a sample possesses a medium to low pH (<7.8) ammonia losses are negligible. Concerning nitrogen release over the season, one should estimate this by considering the climate and the sample's intrinsic rate of decomposition (for example, as determined in a respiration test). Research indicates that nitrogen release from manures and digestate applied to soil may vary from 20% up to 75% and for composts from as low as 5 to not more than 35%, of total-N.

Water Soluble Organic Carbon (WSOC); Water Soluble N (WSN): A new tested recently added, WSOC and WSN shows the amount of actually water extractable carbon and nitrogen, measured by direct liquid combustion on state-of-art equipment. For WSOC the results are corrected for dissolved inorganic carbon. The WSN value includes all forms of soluble nitrogen including ammonium, nitrates, nitrites and amino-N. The soluble organic N fraction has been found to often represent as much as one-half the total soluble nitrogen in composts (and soils). The significance of the WSOC value is that this represents undecomposed soluble organics and is indicative of compost instability. Source ingredients for composts often contain levels of WSOC > 10,000 ppm which declines towards a stable point of <2,000 when compost is finished. This fraction of WSOC can be directly related to presence or absence of pathogen indicators since the absence of readily available substrate by nature of low WSOC indicates reduced likelihood of pathogen survival.

CARBON:NITROGEN (C:N) RATIO: Total C:N is used to assess the initial condition of a mix prior to composting and to determine the completeness or extent of decomposition. The theory is that fully composted material should have a CN around 10-12 (the ratio found in stable soil humus and bacterial cells). Thus, if one knows the start point and that a material has undergone breakdown, C:N can accurately reflect decomposition. Compost may be finished anywhere around a C:N of 17 or lower, unless coarse woody material remains- and this is dependent on lab sieving techniques. In some regions, a product is not considered to be a compost unless the C:N is less than 25:1. The C:N ratio applied indiscriminately or dogmatically to fresh compost formulas may lead to over calculation of needed carbon. Loss of nitrogen during composting may make the total C:N appear to level-off or even *increase*.

WATER SOLUBLE CARBON:NITROGEN (C_s:N_s) RATIO: This value shows the actual soluble carbon to soluble N ratio, which may be higher or lower than the total C:N ratio reported above. If the WS CN ratio is less than 10 this is a good sign that the material will not immobilize nitrogen upon soil addition. If the WS CN is high or greater than the total C:N ratio, this is a caution that the material is not fully decomposed.

MINERALS- Phosphorus, Potassium, Calcium, Magnesium, Sodium, Manganese, Zinc: These minerals are reported in their total forms from acid digestion. The fraction of the total which is actually available to plants after soil incorporation is a variable that depends on age of material, pH and other factors. In the case of potassium and sodium experience has shown that more than 80% of the total is likely to be immediately available, whereas with phosphorus, calcium and magnesium the availability will range from as little as 25% up to about 75%. More P, Ca and Mg are available under acidic soil conditions. An optional test can be performed to determine the official amount of available P. For estimating the amount of nutrients available the first season, we suggest you take 50% of the P, Ca and Mg figures and 85% of the K and Na figures.

SALINITY, CONDUCTIVITY, TDS: Salinity, conductivity and total-dissolved solids are interrelated traits of compost dependent on presence and concentration soluble elements that conduct electricity. Soluble salt level (salinity) in a sample is estimated based on measurement of the electrical conductivity of a saturated paste extract (SP). Factors that contribute to salinity are sodium, potassium, chloride, nitrate, sulfate, ammonia, and VOA. Composts that are under 2 (sat paste) may be generally used for all purposes (depending on other test traits); however composts that exceed a conductivity of 2 must be increasingly diluted before use, depending on the levels. Low levels are expected for potting or seedling mix composts (<2). Low salinity may also indicate a lack of available minerals, while high salt levels are caused by appreciable amounts of soluble minerals which in direct contact to soils and plant may inhibit biological activity or can cause problems with land application particularly under dryland and greenhouse conditions.

Evaluation of SALINITY in Compost, Sat. Paste (SP), mmhos/ cm = dS/m				
< 1.0	1 - 2	2 - 5	5 - 10	> 10
V - LOW may be used as direct substitute for soils	M - LOW topsoil substitute, container media	MEDIUM dilute 2- to 5-fold for most applications	M - HIGH dilute 3- to 10-fold for most applications	V - HIGH use only at low application rates
Salinity Based on 1:5 Extract Tests mmhos/cm = dS/m				
< 0.4	0.4 - 1	1 - 2	2 - 4	> 4

It has become more common to use 1 : 5 extracts for estimating Salinity of compost, and it is important that these values be interpreted more carefully based on the more diluted result, as seen in the table for 1:5.

INERT (“OVERS”) CONTENT: Oversize matter that does not pass a 1/4” standard sieve (6.5mm) when vigorously rubbed is excluded from analyses (except fresh density - see below) and is reported as *inert matter*. In certain tests the EU standard 10mm (3/8”) sieve is used but this size is considered extreme for finished compost. Oversize matter includes wood chips, stones and man-made metals, plastic and glass. The percentage of 1/4” overs is useful in reporting particle size and is the first step in some standards where overs are required to be at or below a certain level.

RESPIRATION RATE, gravimetric: (Carbon-Dioxide Evolution): CO2 testing originated in Germany in the 1950’s and was developed to aid understanding soil fertility and stability and maturity of degraded organic matter. Woods End reports respiration decomposition in two ways. The carbon evolved *in relation to total carbon* indicates freshness or stability of organic matter (see table below). The total quantity of carbon evolution *in relation to wet weight* indicates the potential for self-heating and weight/volume reduction. The Solvita test indicates respiration in relation to as-is volume, important for understanding field behavior. All results must be taken into account in order to properly understand compost condition and behavior. The lab procedure is based on capturing carbon-dioxide during static incubation (usually at 24-hr) at a warm (e.g. 34°C) temperature, or by the Solvita system. Samples that are received dry are re-moistened before testing, and equilibrated.

Relative Stability	High	Med - High	Medium	Med - Low	V - Low
C-loss,% of Total C	< 0.2	0.2 — 0.8	0.8 — 1.5	1.5 — 2.5	> 2.5
mg CO_2-C / g VS	< 1.0	1 -- 4	4 -- 8	8 -- 13	> 13
Self-Heating Potential	V-Low	Low	Medium	High	V-High
Solvita Value	7-8	5-6	3-4	2-3	1-2

Interpretation of maturity-stability is based on Woods End’s own extensive research. Interpretation of self-heating is based on correlation trials between compost and its actual heating, seen in the following table and figure. Stability results from advanced humification acting to reduce the rate of decomposition. Self-heating is dependent on rate of decomposition in relation to the total quantity or mass. If the content of organic matter is high enough, (or if the pile is too large), even a low relative rate can still translate into some heating and oxygen deprivation.

DEWAR SELF-HEATING TEST: This test is based on an early German method for determining “compost ripeness” by measuring reheating in a dedicated 1-liter laboratory Dewar flask. The method provides information that differs from other stability tests, for it allows positive feedback from self-heating to act on the test result- in other words, compost generates respiration to heat, and the heat may cause increased microbial activity until a plateau is attained, called the Tmax. The accuracy of the test is dependent on maintaining constant ambient conditions, proper flasks, and correct moisture. Two schemes for interpretation are recognized, as below indicated:

Max Temp (TMax ^{o}C) in Flask*	Original CLASS OF STABILITY	DESCRIPTION OF STABILITY (based on EU std)	Max Temp (TMax ^{o}C) in Flask*[a]	Class	Recommended Interpretation
< 30 ^{o} C	V	Finished	0 – 25^{o}	A	mature, stable
30.1 - 40^{o} C	IV	Curing compost			
40.1 - 50^{o} C	III	Moderately active	25.1 – 45^{o}	B	Mesophilic, active
50.1 - 60^{o} C	II	Very active, immature			Thermophilic, v.
> 60^{o} C	I	Fresh, raw waste	> 45.1 ^{o}	C	active

a. Max temp assuming ambient is 20^{o} C. Test invalid if ambient > 25^{o}

DENSITY (bulk density): The lab measures density as it is received, employing a gravity factor for packing to simulate a pile depth of four feet. The result may be reported as lbs/cu.ft and lbs/cu.yd. The fresh density of compost gives a good indication of *porosity*, which determines the rate that air and oxygen can move through a pile, either by natural or mechanical ventilation or by diffusion. Active compost should have a porosity—*i.e.* percent air volume— of 40 - 60% to ensure adequate oxygenation, depending on pile size, oxygen demand rate, and ventilation. Porosity of most compost can be estimated from the reported density according to the following table:

Density lbs/cu.yd.	400	750	1100	1450	1800
Porosity, % Air Volume	80	60	40	20	0

HEAVY METALS: Trace elements and metals in composts are of environmental significance as a means to interpret contamination of recycled wastes by industrial by-products such as battery leakage, PVC softeners and chemicals that infiltrate MSW, sludge and other debris for a variety of reasons. In the USA metals in organic waste are only partly regulated at the local and federal level in dependence on the content of sludge or based on quantities recycled annually at a site (consult local rules). The USEPA limits are widely applied by individual states for regulation of all organic wastes but certain states and organizations apply more stringent "Class-AA" rules which take precedence (see Table for Class AA compost). For interpreting levels in non-sludge composts it is recommended to use the international EU-CEN standards instead of USEPA 503 as the latter presumed application limits from high N materials would be the primary bar for use-rate, which is not the case for normal composts, used sometimes at extremely high rates. The EU clean compost metal limits are in comparison based on field evidence for normal levels of metals attainable when clean source-separated waste composting is conducted and are therefore useful to interpret contamination. Metal limits in composts that exceed the EU clean column below most likely have significant metal input from man-made sources.

Heavy Metal Interpretation for Class-AA, EU BioComposts and US Sludge Rule

Arsenic	As	20	**23**	41
Chromium	Cr	600	**100**	1,200
Lead	Pb	150	**150**	300
Nickel	Ni	210	**50**	420
Boron	B	-	**300***	na
Selenium	Se	18	**25**	36

‡ Type 1, Class A, or AA such as in NY or WA states

VOLATILE FATTY ACIDS (VFA) and ODOR-INDEX: The presence of organic acids is measured as C2-C6 short-chain fatty acids and may include any or all the following: lactic, acetic, propionic, butyric, iso-butyric, valeric, iso-valeric and caproic. VFA's are indicators of fermentation reactions due to incomplete oxidation and often result in objectionable odor as well as harmful plant effects, but also represent positive methane potential, as a major pathway to CH4 is via acetic acid. The presence of VFA's (if the pH < 6) will reduce compost activity very dramatically, but not fermentation. Woods End's experience enables interpreting VFA level as an indication of compost inefficiency, potential phytotoxicity, viability for methane biogas production and also odor potential, the latter based on the chemical odor index for each acid which yields an overall odor ranking, shown with each report. For quality interpretation, the following levels are suggested:

VFA Rating	V-Low	Med-Low	Medium	High	V-High
ppm, windrows	< 200	200-1,000	1,000-4,000	4,000-10,000	>10,000
ppm, In-Vessel	< 1,000	1,000 - 4,000	4,000-10,000	10,000-25,000	>25,000

SOLVITA® PROTOCOL: The Solvita test measures both CO_2 and ammonia (NH_3) volumetrically in the headspace of compost. It can be quantified with use of a digital spectrometer. The results in 4-hrs may be used singly to estimate CO_2-respiration and ammonia volitization, or together as a *maturity index*. Using the two sets of results for ammonia (NH_3) and carbon-dioxide CO_2 the intersection grid below (Chart A) gives the Maturity Index. Chart B is used to infer the status of compost.

A

SOLVITA Ammonia Test Result is:		SOLVITA Carbon Dioxide Test Result is: 1	2	3	4	5	6	7	8
5	very Low / No NH_3	1	2	3	4	5	6	7	8
4	Low NH_3	1	2	3	4	5	6	7	8
3	Medium NH_3	1	1	2	3	4	5	6	7
2	High NH_3	1	1	1	2	3	4	5	6
1	Very High NH_3	1	1	1	1	1	2	3	4

Chart B: the amount of carbon dioxide inside the compost vessel after 4-hrs corresponding to the amount of oxygen consumed in this same period. This facilitates an estimation of the oxygen depletion potential. Values less than 4 on the Index scale indicate a compost that cannot be aerobically stored in large piles for any length of time.

B

SOLVITA MATURITY INDEX	STAGE OF COMPOSTING PROCESS as Indicated by Solvita Maturity Index	Aeration Status: CO_2 in 4 hr or O_2 depletion	MAJOR CLASS
8	Highly matured, well aged, good for all uses	**< 0.20%**	"FINISHED" COMPOST
7	Well matured, cured, ready for most uses	**0.55**	
6	Compost curing; ready for some uses	**1.0**	Post Active
5	Curing can be started; limited uses	**2.0**	Limit - Very Active
4	Compost in moderately active stage	**4.0**	Highly Active - very O_2 depleting
3	Very active compost; not read for most uses	**7.5**	
2	Very active, fresh compost	**14.0**	odorous - "RAW" Waste - extremely O_2 depleting
1	Fresh, raw compost; extremely unstable	**>20**	

Ammonia Color No:	1	2	3	4	5
Compost Condition	----- Extremely Active ----		Active	Curing	Stable
Potential Phytotoxicity is:	Very High	High	Medium	Slight	None
Noxious Hazard	Extreme	Severe	Moderate	Slight	None
ppm of Gas in 4-h test ‡	>20,000	8,000	2,500	800	<100
N-loss potential §	V. High	M High	Moderate	Low	V Low- None

PHYTOTOXICITY and Seedling Growth Response: Phytotoxicity or poor plant response from compost can result from several unrelated factors. A phytotoxicity test is generally assumed to deal with growth effects due to incomplete composting. These effects can be caused by high oxygen demand, free-ammonia, and presence of volatile organic acids. Other unrelated effects include heavy metal content and salinity. The importance of the phytotoxicity tests using actual plants as opposed to mere interpretation of analytical data is that the plant tests do not always necessarily correlate with quantitative lab tests which may not clearly indicate a potential for phytotoxicity. Furthermore, the application of composts to soils and for potting-mix formulation requires verified absence of toxicity factors. Woods End has standardized a phytotoxicity procedure using cress and wheat seedlings in a blended peat based mix, designed to eliminate salinity as a negative growth factor. Germination rate and seedling biomass are reported as % of a control and are judged as follows:

> 90	IV — Non-Inhibitory	> 95	V — Excellent
80 – 90	III — Moderately Inhib.	80 – 95	IV — V. Good
70 – 80	II — Very Inhibitory	70 – 80	III — Fair
< 70	I —Extremely Inhib.	40 – 70	II — Poor
		< 40	I — Extremely Poor

PATHOGENIC ORGANISMS/ Indicator Microbes: The content of potential human pathogens depends on the treatment and age of any biosolids or organic waste material. EPA regulates content of potential pathogens in biosolids (sludge) based on available technology studies (not based on Risk Analysis). In many cases, the same regulations are applied by states to determine safety of food waste or other composts, similar to extrapolation used with the metals limits of EPA. Woods End can provide details of the regulations for each state. The pathogen tests required under EPA-503 rule include *Salmonella (or)* fecal *Coliform* (and in certain cases) *Helminth Ova* and *Enteric viruses*. The EPA 503 specified procedure is started on samples received within 24 hrs of sampling. Results are reported per unit gram or 4g of total solids, as most-probable-number (MPN) or plaque-forming-units. Materials containing more than 1000/g fecal coliform or 3 units/4g *Salmonella* are not acceptable as type A EPA materials.

Compost and organic amendment hygiene is of great significance for end-use food production (and consumer handling). Woods End's view is that it is unacceptable to have detectable *E. coli* or *Salmonella*, or fecal coliform greater than 1,000 MPN/g. The USDA has established cleanliness standards for compost teas, which are also examined by Woods End. The limits are < 135 cfu/ 100 ml *E. coli*. *Any* compost containing appreciable *E. coli* (>100 MPN) should be examined for *E. coli 0157:H7* which should be non-detectable at < 0.02 cfu / g (< 1 /50g).

PATHOGENS and PATHOGEN INDICATORS

fecal coliform	Common indicator for presence of fecal matter from warm blooded mammals	sludge; compost	EPA: USA; WHO
Salmonella	pathogenic organism shared by domestic livestock and humans	food; sludge; compost	FAO; EPA; EU; OMRI
E. coli	A fecal coliform; common indicator of warm-blooded fecal matter; includes many pathogenic forms	food; sludge; compost	FAO; EPA; EU; OMRI
E. coli 0157:H7	highly pathogenic strain of *E. coli* infectious at very low doses	food	FDA
fecal streptococcus* & *Enterococcus	very strong fecal indicators; more resilient than fecal coliforms in environment	water; sludge; compost	EPA; EU
C. perfringens	Pathogenic spore-forming obligate anaerobe of fecal origin	water testing; irrigation water	
Listeria spp	Widespread in environment surviving cool temperatures; some strains highly pathogenic; associated with food poisoning, miscarriages and meningitis	cooked food; milk	-

MATRIX Classification - Compost classification is performed by means of a statistical multi-array using actual analytical test results. This is one of the only means to determine what a compost is best used for. The array scores the goodness of fit or “match” within a best use category. There are 6 types of use recognized. The minimum level score to meet any category is 75%. Multiple category listings are possible. Scores <75% are registered as Quality Control composts. Please request separate information for this.

MATRIX CLASSIFICATIPON OF COMPOSTED MATERIALS

CATEGORY or Grade	SIGNIFICANCE OF CATEGORY	Primary Parameters examined
Nutrient (fertilizer)	high analysis product, somewhat unstable useful for field application; may be odorous and powdery-dry	N-P-K moisture pH density, salinity
Garden Grade	moderate analysis with stable traits and no pathogens used at fairly high rates safely in gardens and as a blend for other mixes.	OM, stability nutrients
Potting Mix Grade	High porosity very stable with moderate available nutrients for starting seedlings	salinity, nutrients stability
Container Mix Grade	More dense but well drained, moderately stable and low-salinity for use in large pots	density, drainage, stability salinity
Top-Soil Replacement	Dense, very stable, low salinity and low OM content useful for soil replacing	density, salinity stability
Mulch Grade	Very course, low nutrient, low pH, low salinity, high CN used as soil cover	CN, OM, pH, salinity

COMPOST ANALYTICAL PROCEDURES

Physical Parameters	Units	METHOD REFERENCE ¶
Density, Water Holding Capacity (WHC)	lbs/yd^3 g/cc	ASA-41. WEL
Total Solids (alt. Moisture Content)	g 100g TS	MAP
Dewar Self-Heating	Tmax in °C	BGK; WEL
Man-Made Inerts, Plastic, Glass, metal	g 100g TS	*CSU Published Paper, BGK method*
Chemical Parameters		
pH, saturated paste	- log H$^-$	EPA 150.1; MAP
Volatile Organic Acids (VOA, VFA)	mg kg TS	SM 5560C / HPLC-UV
Cation Exchange Capacity (CEC)	cmol / kg	ASA 41-2.2
Conductivity (EC), saturated paste/slurry	dS m	MAP; BGK
Volatile Solids (VS) (Loss on Ignition)	VS dm	*modified* TMECC 03.02
Organic Matter (OM)	VS-TKN%	(LOI - Total-N)
Total Nitrogen (TN)	TKN% dm	Combustion ASTM, MAP
Ammonium Nitrogen (NH_3 + NH_4)	NH_4-N ppm	SM4500-NH3G
Nitrate and Nitrite Nitrogen	NO_3-N, NO_2-N ppm	MAP
P K Ca Na Mg Cl Fe Mn Cu Zn Cr Pb Cd Ni Al As B Hg Mo Se	mg kg TS mg kg TS	SM, MAP
Biological & Microbiological Parameters		
Respiration Rate (CO_2-Evolution) DRI-ASTM (Oxygen Consumption) Oxitop	CO_2-Cmg g TS day mg O_2 g VS hr mg O_2 g VS 3d	BGK, ASA-SSSA ASTM-5975-96 CEN Draft
Solvita Test for CO_2-respiration and NH_3-volatilization**	0 - 8 CO_2 1 - 5 NH_3	Approved in CA, CT, TX, FL, IL, ME, MN, NJ. NM OH, WA
Salmonella (EPA 503) *Fecal Coliform* (EPA 503) *E. coli* *E. coli 0157:H7* *Fecal Streptococcus* *Clostridium perfringens* *Listeria* spp.	MPN 4g TS cfu g TS MPN g TS MPN g TS MPN g TS cfu g TS MPN g TS	EPA #1682 EPA #1680 EPA 1680 + SM9221F *modified* FDA BAM SM9230B *modified* FDA BAM *modified* FDA BAM
Cress Test, Phytotoxicity	% of Fafard Control	OECD, ACSD, BGK
Disease Suppression	% inhibition	Hoitink, Krause et al.
Lemma spp. (Duckweed) Toxicity Test	% inhibition	modified after SM 8211-A.
Viable Weed Seeds	>0.8 / liter	BGK
Herbicide BioAssay	0 - 5 severity scale	Bull. Env. Contam. Tox., CSU 2006

TEST METHOD REFERENCES

AOAC - Official Methods of Analysis 17th Edition (2004) Official Fertilizer Tests	ASA-SSSA - Methods of Soil Analysis, American Society of Agronomy, Soil Sci. Soc., Madison WI
ASTM- American Society of Testing Methods, Philadelphia published on-line; *Biodegradability Tests, Stability tests*	BAM- Bacteriological Analysis Methods On-Line
ACSD - Association of Swiss Composters, Methods Manual (2003)	EPA-600 - Methods for Chemical Analysis of Water and Wastes. US EPA (RCRA)
BGK - Bundesgűtegemeinschaft Kompost (Germany Compost Association) Test Methods Manual 1998; *Biological tests, Self-heating, Cress/Barley tests*	OECD - Guidelines for Seedling Emergence and Seedling Growth Test #208, phytotoxicity
MAP- Manure Methods of Analysis. NCR-13, Universitv of Wisconsin A3769 (2003)	SW-846 - Test Methods for Evaluating Solid Waste USEPA 1987 (NPDES)
SM - Standard Methods for the Examination of Water & Wastewater, 20th ED. Water Env Federation. fatty acids, TDS, phytotoxicity, lemma toxicity	WEL - Woods End Laboratories Standard Operating Procedure Manual - Internal Document
TMECC- Test Methods for Examination of Compost. (2002-DRAFT) Privately published Industry m annual from U.S.Compost Council	Peer Review journals: CSU - Compost Science Utilization; Bulletin Environ-mental Contamination and Toxicity