


**Recycled Organic Matter (ROM) Compost  
Quality: Chemical, Biological and  
Microbiological Traits**


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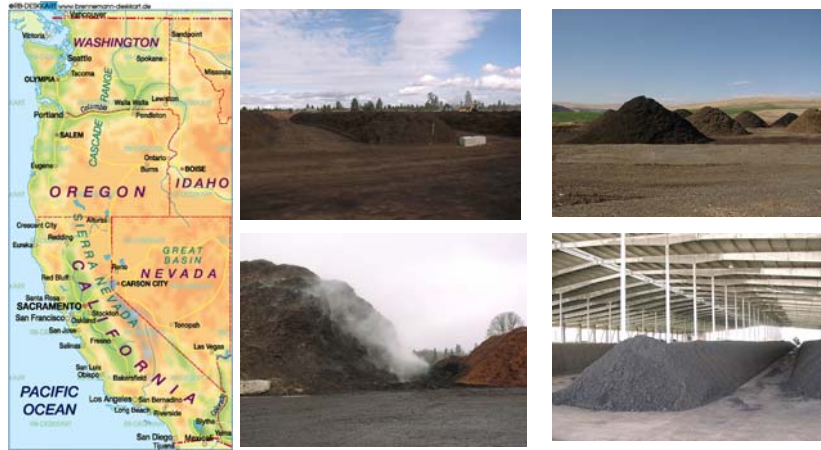
## Background of Study

- Rapid increase in green composting due to landfill reduction mandates.
- Concerns for “UREC” - *Unavoidable Residue of Environmental Contamination*
- Increase use of compost by consumers and in professional certified organic farming.
- Detection of *E. coli* in food-chain crops from soil~manure~compost sources.



# 94 Facilities Studied 25,000 to 120,000m<sup>3</sup> yr<sup>-1</sup>

3 state regions where recycling of organic matter is exceptional.



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## Microbiology Methods

- *Salmonella* species MPN
  - EPA #1682 (avail. 2/2003; adopted March 2006)
- Fecal Coliform MPN
  - EPA # 1680 adopted 2006
- *Escherichia coli* MPN
  - EPA 1680 + SM # 9221F
- Fecal Streptococcus SM 9230 B
- *Listeria* spp. Modified FDA-BAM



SM= Standard Methods; BAM= Bacteriological Analysis Manual (online) FDA USEPA Methods Updated; MPN = *most probable number*

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## *E. Coli* O157:H7 Isolation in ROM

> procedure selects for O157 three times\* in process



1) Compost Bags w/mTSB



2) Dynabead Activity



3) Mixed colony ChromAgar



4) Oxoid Spotting & Indole Reaction

Lahti et al. (2003) Appl. Env. Microbiology 69:554-561



## Levels of salinity, cress performance phthalates, PAH's in green composts

MEAN ( Min - Max )

	Salinity dS m <sup>-1</sup>	Cress Bio- mass rel %	Phthalate µg / kg	PAH µg / kg
<b>Region I</b> (WA) n=34	6.2 (0.4 - 24)	46.7 (16 - 102)	103 (1 - 2,245)	156 (1 - 2,653)
<b>Region II</b> (OR) n=30	3.2 (0.2 - 11)	93.3 (45 - 160)	2,275 (127 - 17625)	566 (1 - 3,722)
<b>Region III</b> (CA) n=30	6.1 (1.2 - 17)	55.4 (21 - 108)	5,373 (142 - 20424)	1,628 (28 - 5,840)



## Overall ROM Compost Traits:

n = 94 ( 2.2 million m<sup>3</sup> year<sup>-1</sup> capacity )

	Moist	pH	OM	TN	CN	NH3	NO3	NO2	Salt	Germ%	% Cress	Solvi%
<b>MEAN</b>	17.1	7.4	49.6	1.3	24.5	651.7	228.8	25.9	5.5	97.8	60.4	6.1
<b>MEDIAN</b>	77.0	7.5	47.9	1.3	20.0	125.5	1.3	1.0	4.4	100.0	58.0	7.0
<b>MIN</b>	50.0	4.9	20.8	0.2	8.1	1.0	0.1	0.1	0.2	65.0	16.0	3.0
<b>MAX</b>	50.1	9.0	93.1	3.0	78.4	7228.0	6094.2	1159.8	24.2	110.0	160.0	8.0
<b>Criteria</b>	>55	>8	>50	<1	>25	>1000	<100	>25	>5	>90	<50	>7
<b>Meet criteria</b>	14	23	39	24	30	19	62	9	36	76	37	46
<b>as % of total</b>	16%	26%	44%	27%	34%	22%	70%	10%	41%	86%	42%	52%



Errata: Col 1, moisture mean is 50.0; min is 17.1



## Hygiene Overview of ROM composts

MEAN ( Min - Max )

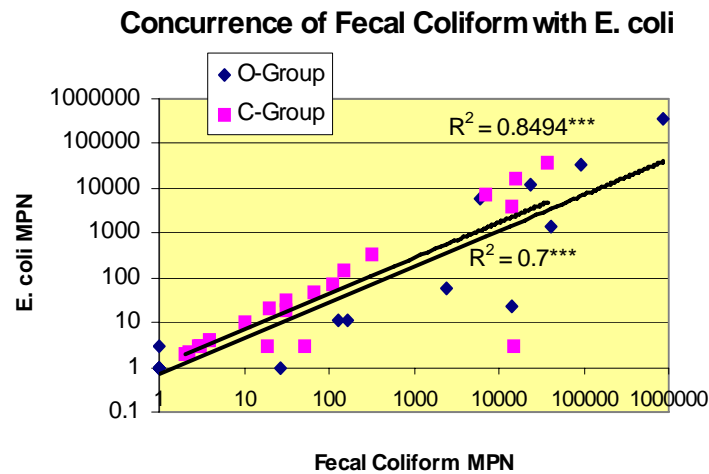
	<i>Salmonella</i> (+) (-)	<i>E. coli</i> log MPN g <sup>-1</sup>	<i>E. coli</i> O157:H7 (+) (-)	not passing EPA-Rule§
<b>Region I</b> (WA) n=34	n.d.	2.1 (0.2 – 7.4)	not tested	23%
<b>Region II</b> (OR) n=30	Pos (1)	1.9 (0.4 – 6.6)	POS (1)	44%
<b>Region III</b> (CA) n=30	Pos (1)	2.3 (1.9 – 7.3)	POS (2)*	20%

§ US EPA CFR40-Chap 503 developed for sludge and adopted by 23 states for any compost

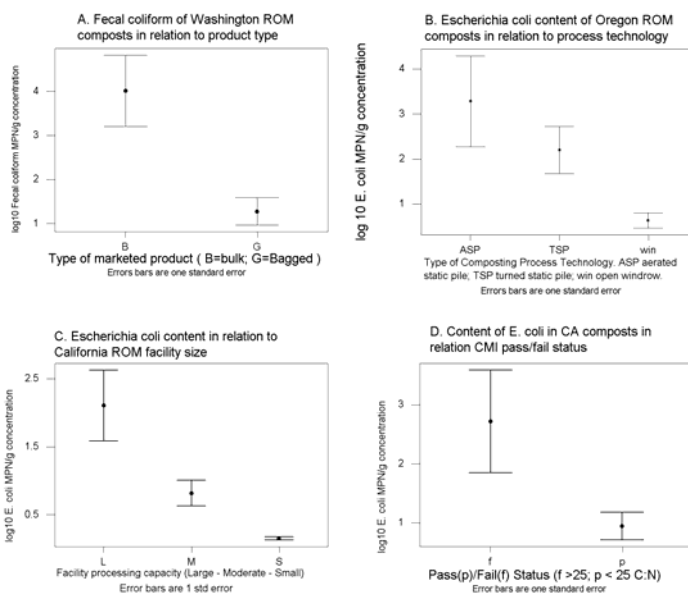
\* Re tested; all positive up to MPN 140,000 g<sup>-1</sup>



## High $r^2$ of 70-85% between pathogen indicators



## ANOVA: pathogens / facility traits



## Conclusions

- PAH, Phthalate levels (UREC) increase with increasing urbanization, but at low levels.
- Bagged composts *more hygienic* than bulk.
- Facility volume/yr correlates positively with pathogen content of final composts.
- *Windrow methods* best performance in hygiene compared to ASP, SP and others
- Maturity-Index<sup>‡</sup> with 3-factors could be good predictor of hygiene quality.

‡ CA Maturity Index: (1) C:N (2) Cress-Test (3) + NH<sub>4</sub>:NO<sub>3</sub> Ratio of CO<sub>2</sub>-output.



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## Remarks



- The disappointment: ROM composts have very mixed analytical traits - difficult to judge quality.
- Probably most green composts are not suitable for professional growing without further processing.
- *Toxigenic E. coli O157:H7* found in ROM at 3 facilities and in re-tested samples. *Could be dangerous if applied to food-chain soils.*
- USA approach with ROM leaves regulation largely to the marketplace: are standards on the horizon?



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 <p><i>Composting: Quo Vadis?</i></p>	<p><b>Woods End Laboratories inc</b></p> <p>USDA-APHIS approved MAP certified <i>Service in USA, UK, Central America &amp; S. America</i></p> <p>Mount Vernon Maine USA 04352</p>
<p><b>THANK YOU!</b></p>	<p><i>mailto: lab@woodsend.org</i> <a href="http://www.woodsend.org">www.woodsend.org</a></p> <p>13 </p>