

# Using Quality Residuals To Build Soil



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# First things First:

## Know Crop Requirements & Test Soil

- Test soil nutrients
- Test amendments or know sources
- Organic Material-Can you have too much
- pH
- Know crop requirements

# Why use Amendments

- \* To increase Soil Organic Matter Content \*
  - Which increases Water holding Capacity
  - Provide nutrients for soil borne organisms
  - Improves soil Health
  - Reduces Fertilizer Demand
  - Provides some nutrients and minerals
  - Helps Soils Suppress Disease
- \*Healthy Soil = Healthy Plants

# Beneficial Use Determination(BUD)

NYS DEC Issues a BUD for Material that has value.

Q. Will the residual provide benefit for its proposed use without harm to the plant/animal or the environment.

GRAS-Generally Regarded as Safe

How Do We Determine the Best  
Uses for Residuals?

Use Our “Waste” as the  
**Resource It Is!**

# Amendments are Comprised of Endless Feedstock and Combinations

- Wood Chips
- Used Animal Bedding
- Food Processing Waste
- Spoiled Feed
- Recalled Organics
- Bio-Diesel Residual
- Digested Solids

# Feedstock Continued

- Food Prep
- Trimmings & Spoilage
- Produce
- Pressings & Pummace
- Butcher Waste
- Whole Animals
- Dairy Processing
- Residuals
- Sludges

# Properties of Amendments Considerations

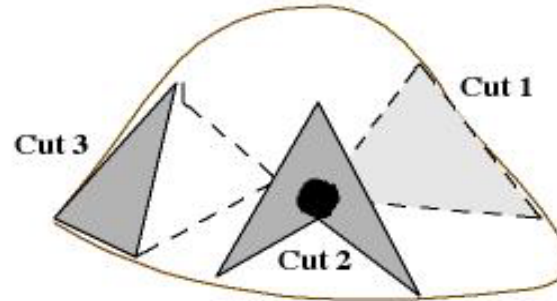
- Unprocessed or Raw
- Aged
- Processed to add value
- May Serve as a fertilizer
- Organic Matter
- Regulated or not
- Application Dates



# Sampling Scenario to Evaluate Amendment

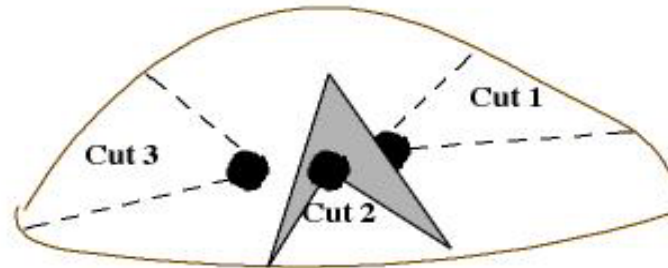
Pile Type: **Circular Heap**

three cuts share common core area.



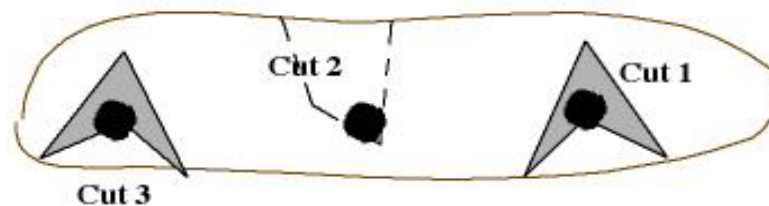
Pile Type: **Oblong Heap**

three cuts do not share core area but are close to each other..



Pile Type: **Windrow**

three cuts do not share common core area at all.



Graphic by  
Woods End  
Research Lab

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# Compost Characteristics

**Feedstock:** Dairy cow manure, wood chips, sawdust, leaf and yard waste

**Date of Analyses:** 06/24/01, 7/14/01, 12/06/01

## General Characteristics

	<b>Average</b>
Maturity	6
Organic Matter	41.6%
Weed Seeds/Litre	2
Density	48 lb/ft <sup>3</sup>
Solids	23%
C:N Ratio	17.5
pH	8.34
Conductivity	2.19

## Nutrients (???) \*A and M?

Total Nitrogen (N)	1.3%
Total Phosphorus (P)	0.5%
Total Potassium (K)	0.7%
Total Calcium (Ca)	4.07%
Total Magnesium (Mg)	0.71%

## Metals

Copper	31.6 ppm
Iron	9603.8 ppm
Zinc	158.2 ppm
Arsenic	5.6 ppm
Cadmium	3.1 ppm

## Plant Response

<i>Lepidium sativum</i> germination	98.5 %
<i>Lepidium sativum</i> weight	52.0 %

How do we determine what characteristics to analyze?

# NYS DEC Rules for Metals Content in Residuals

Materials shall not exceed the following levels and be expressed in parts per million(ppm) on a dry weight basis.

As	Ba	Cd	Cr	Cu	Pb	Hg	Mo	Ni	Zn
41	1000	10	100	1500	250	10	54	200	2500

# Manure Compost

- High in Organic Matter ?
- Low in contaminants
- Little garbage or inerts
- Can be high in P
- Pharmaceuticals
- Maturity



# Quality Issues

- Low Nutrient
- High Carbon
- Organic Matter
- Chemicals-pesticides

# Farm Comparison

	<b>pH Range</b>	<b>Fecal Coliform</b>	<b>Weed Seed</b>	<b>Maturity</b>	<b>Chloride</b>	<b>Copper</b>
<b>Large Farm Data (over 500)</b>	<b>6.8-8.5</b>	<b>Low</b>	<b>Low</b>	<b>6-7</b>	<b>100-6000</b>	<b>High if used</b>
<b>Small Farm Data (under 500)</b>	<b>6.5-8.5</b>	<b>Low</b>	<b>Low</b>	<b>6-7</b>	<b>1000-2000</b>	<b>Low</b>
<b>Poultry</b>	<b>6.5-9.3</b>	<b>Low</b>	<b>Low</b>	<b>Low (due to ammonia)</b>	<b>40-11000</b>	<b>Low</b>

Raw Manure



Composted Manure

# Digested Solids







# Parallel Digesters



Solids---  
What Now?





- Manure Solids or DMS
- Supply Crop Nutrients
- Do we need to Further Stabilize?



# Composting Bedded Pack

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# Manure Compost Samples

Average values for selected analytes

	<b>pH</b>	<b>% Organic Matter</b>	<b>Fecal Coliform MPN/g (range)</b>	<b>Weed Seeds Count/L</b>
<b>1A (n=6)</b>	<b>7.8</b>	<b>67</b>	<b>&lt;2 to 800</b>	<b>1</b>
<b>2B (n=4)</b>	<b>7.7</b>	<b>28</b>	<b>&lt;2 to 2</b>	<b>1</b>
<b>3F (n=6)</b>	<b>8.5</b>	<b>68</b>	<b>17 to 3500</b>	<b>0</b>
<b>3FB (n=4)</b>	<b>8.3</b>	<b>55</b>	<b>&lt;2 to 11</b>	<b>0</b>
<b>4G (n=4)</b>	<b>7.9</b>	<b>24</b>	<b>&lt;2 to 140</b>	<b>3</b>
<b>4GB (n=4)</b>	<b>7.9</b>	<b>25</b>	<b>140 to 1700</b>	<b>8</b>
<b>5H (n=4)</b>	<b>7.8</b>	<b>57</b>	<b>11 to 700</b>	<b>0</b>
<b>6PB (n=4)</b>	<b>7.9</b>	<b>87</b>	<b>1300 to 28000</b>	<b>0</b>
<b>7WA (n=5)</b>	<b>6.5</b>	<b>38</b>	<b>&lt;2 to 300</b>	<b>6</b>
<b>8WI (n=6)</b>	<b>7.8</b>	<b>43</b>	<b>&lt;2 to 2</b>	<b>98</b>

# Metal Results

	<b>As</b>	<b>Cd</b>	<b>Cu</b>	<b>Hg</b>	<b>Pb</b>
<b>1A</b>	<b>&lt;2.3</b>	<b>2.1</b>	<b>509.3</b>	<b>0.023</b>	<b>17</b>
<b>2B</b>	<b>6.3</b>	<b>1.6</b>	<b>34.9</b>	<b>0.039</b>	<b>24</b>
<b>3F</b>	<b>&lt;2.3</b>	<b>2.4</b>	<b>529.0</b>	<b>0.029</b>	<b>19</b>
<b>3FB</b>	<b>&lt;2.3</b>	<b>2.4</b>	<b>265.0</b>	<b>0.029</b>	<b>29</b>
<b>4G</b>	<b>18</b>	<b>3.6</b>	<b>28.9</b>	<b>0.024</b>	<b>56</b>
<b>4GB</b>	<b>29</b>	<b>3.6</b>	<b>30.1</b>	<b>0.057</b>	<b>58</b>
<b>5H</b>	<b>34</b>	<b>4</b>	<b>366.0</b>	<b>0.05</b>	<b>17</b>
<b>6PB</b>	<b>17</b>	<b>2.8</b>	<b>32.0</b>	<b>0.026</b>	<b>&lt;8</b>
<b>7WA</b>	<b>5.7</b>	<b>1.7</b>	<b>26.1</b>	<b>&lt;0.02</b>	<b>20</b>
<b>8WI</b>	<b>23</b>	<b>2.2</b>	<b>777.7</b>	<b>0.032</b>	<b>20</b>
<b>NYS Soil</b>	<b>&lt;9</b>	<b>0.2</b>	<b>20</b>	<b>0.1</b>	<b>15</b>
<b>NYS 360</b>		<b>25</b>	<b>1000</b>	<b>10</b>	<b>250</b>

(dry basis unless specified) (units ppm)

# NYS Composts vs. Guidelines for Topsoil Mix

## Organic Matter

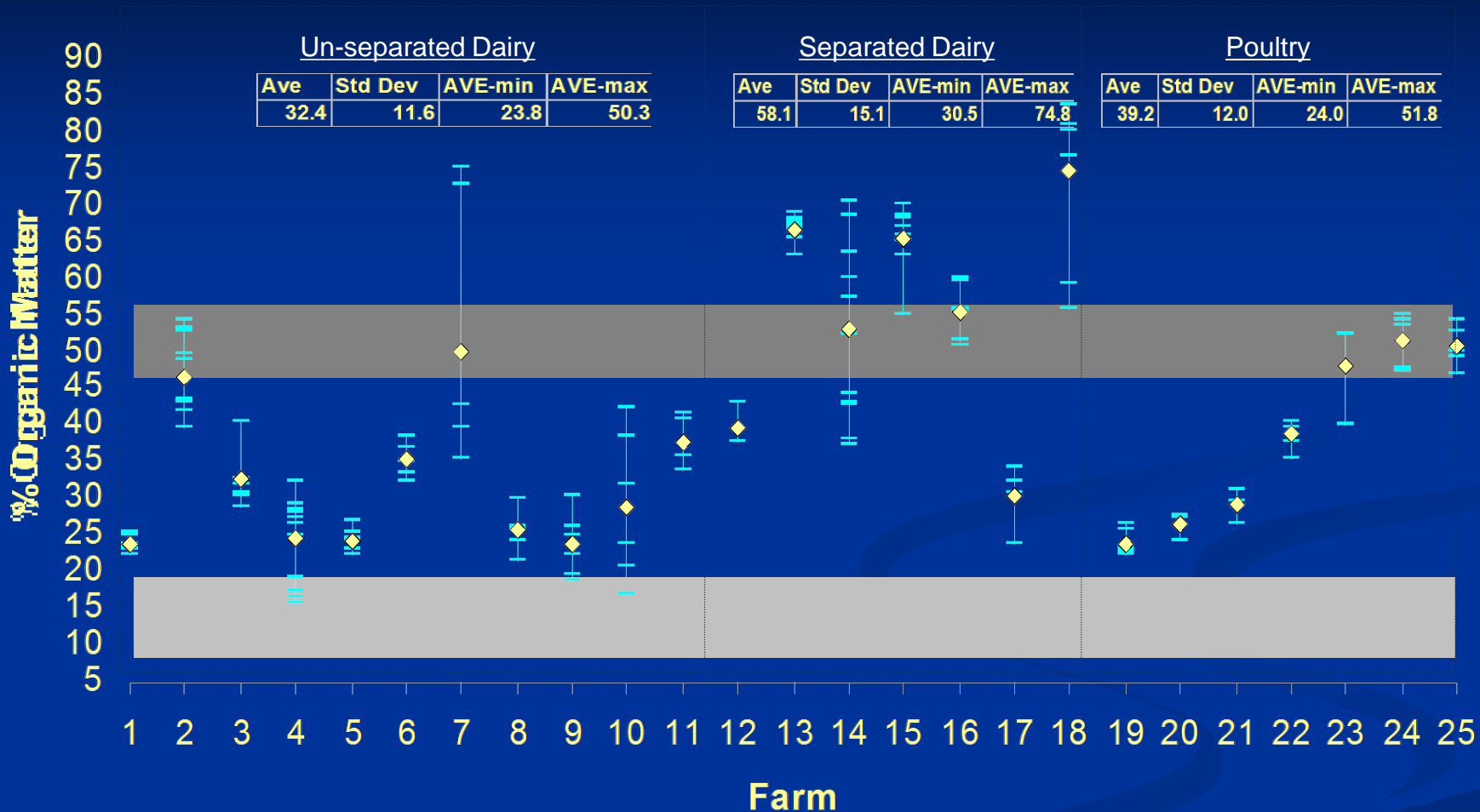


Figure 1. Suggested ranges of % organic matter for use in topsoil mix from Rodale - light shaded area (8% - 20%) and USCC - dark shaded area (50% - 60%). Diamonds indicate average value and tick marks represent single sample values. Bars show range of values.

# Comparison of CNAL analysis for charred paper residuals with (PR Char) and without (PRNL Char) lime to paper residuals with (PR) and without (PRNL) lime as produced.

	Dry Matter Basis										
Sample ID	pH	Salts	OM (%)	Total N(%)	NH <sub>4</sub> -N (mg/kg)	NO <sub>3</sub> -N (mg/kg)	P <sub>2</sub> O <sub>5</sub> (%)	K <sub>2</sub> O (%)	Total C (%)	C:N Ratio	
PR Char	10.1	0.9	18.16	0.49	1.33	1.80	0.56	0.5	29.37	59.6	
PRNL Char	9.9	0.6	25.71	0.63	1.17	1.06	0.51	0.6	59.22	93.7	
PR	12.2	0.2	93.49	2.59	87.86	5.61	0.46	0.4	80.67	31.2	
PRNL	7.9	0.6	128.9	1.7	99.35	93.25	0.67	3.0	112.4	66.1	
	Dry Matter Basis										
Sample ID	Na (mg/kg)		Fe (mg/kg)		Cu (mg/kg)		Zn (mg/kg)		Al (mg/kg)		Mn (mg/kg)
PR Char	853		6063		41		123		6377		245
PRNL Char	1110		8566		82		131		9560		456
PR	948		3924		112		101		3459		253
PRNL	387		2294		103		45		2586		377

# Corn Trials in Washington Co.



Seedling corn on July 7, 13 days after planting.



Corn on July 30 when mid-season soil samples were taken. Notice that the corn across the plots is quite uniform.





Conclusion:  
Un-limed paper mill fiber spread during the spring of corn planting does not compete with field corn for nitrogen, but rather releases it.

September 20, leaves below the ear were bent, It was determined to be drought damage, not nitrogen deficiency.

# Paper Fiber

Soil nitrate, pH and OM did not show any correlation to paper fiber rates. This was probably due to the erratic weather through the growing season and the associated dynamics of organic matter decomposition. Although replication was reduced from excess rain, a clear trend in silage yield was seen as the application rate of paper fiber increased from 0 tons/acre to 30 tons/acre. Due to erratic weather through the growing season, other conclusions could not be made. Continued addition of PR to field corn may be of benefit for yield.

Paper mill residuals differ depending on the process and associated chemicals needed to create the paper for the intended use.

# Leaf & Yard Residuals

Inerts- garbage

Herbicides/Pesticides

Lead

Salt Level





# Composting Bedded Pack

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# Biosolids



# Biosolids Compost

- Inerts
- Chemical Contaminant
- Bacteria
- Viruses
- Drugs
- Change in feedstock
- Use Limitations



# Questions Organic Buyers/Users might Ask

1. What feedstock are used?
2. Are Copper Sulfate or Formaldehyde used on farm?
3. Are pesticides and herbicides used? For what use?

# Questions Buyers Might Ask (con' t)

4. How long is material composted, and by which method?
5. Has hay or bedding been imported from midwest or west?
6. \*\*\*\* Has compost been tested? Are results available?



# Spreading Compost Product





**Application to 1:1 ROCK SLOPE**  
2" compost mulch w/native seed mix  
Barton Creek Development – Austin, TX  
**AUGUST 17, 2002**

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**8 MONTHS LATER**  
**IRRIGATION INSTALLED, NEVER USED**

**APR 17 2003**

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# Hydro-seed with Road Kill Compost/Soil Mix

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JAN 11 2005



Filter Tubes Installed for Storm Water Protection



# Tree Establishment





3 years without amendment



3 years with

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# Landscaping Project





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# Recycling Organics Makes Good Sense!

Healthy Soils =  
Healthy Food!

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