Using Humified Compost as the Foundation to Soil Health

By Joel Clifton



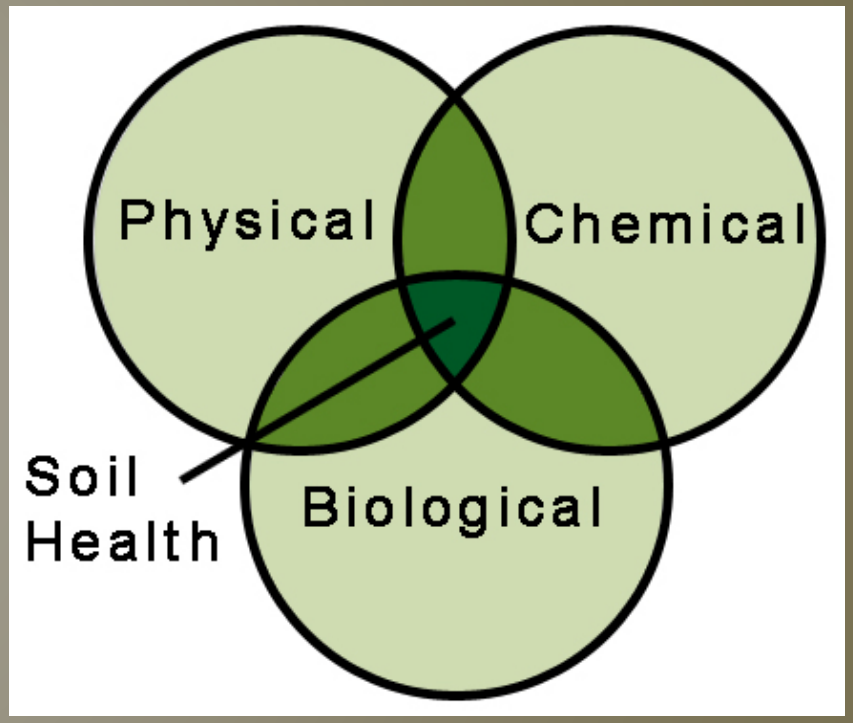
Why Do We Need Compost?



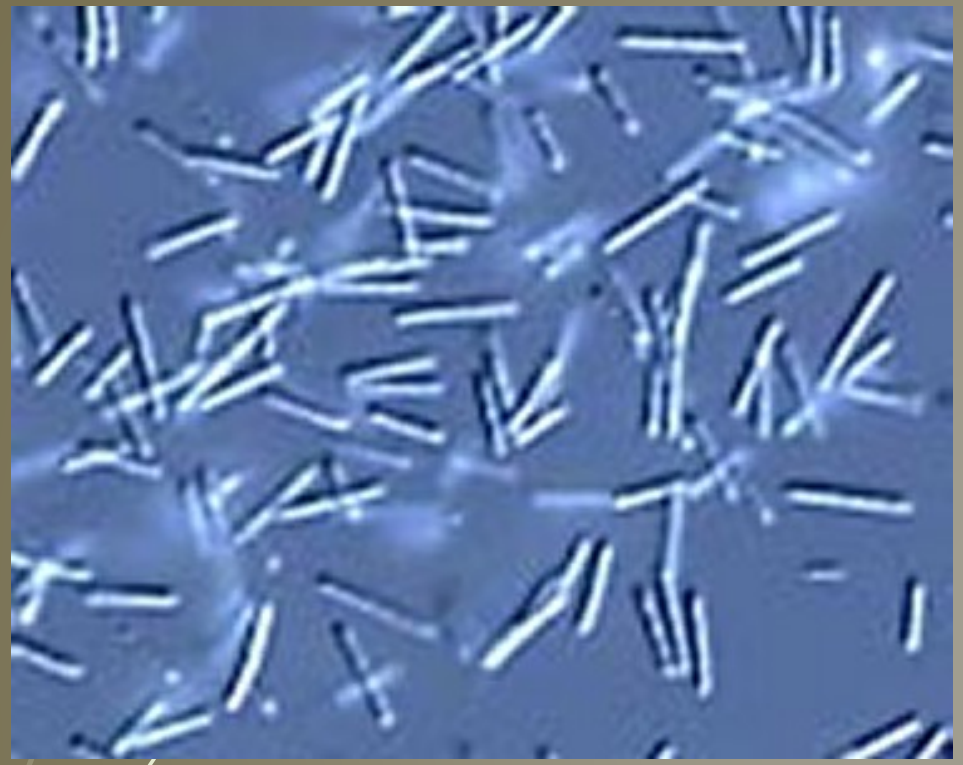
Healthy Soil Ecosystem

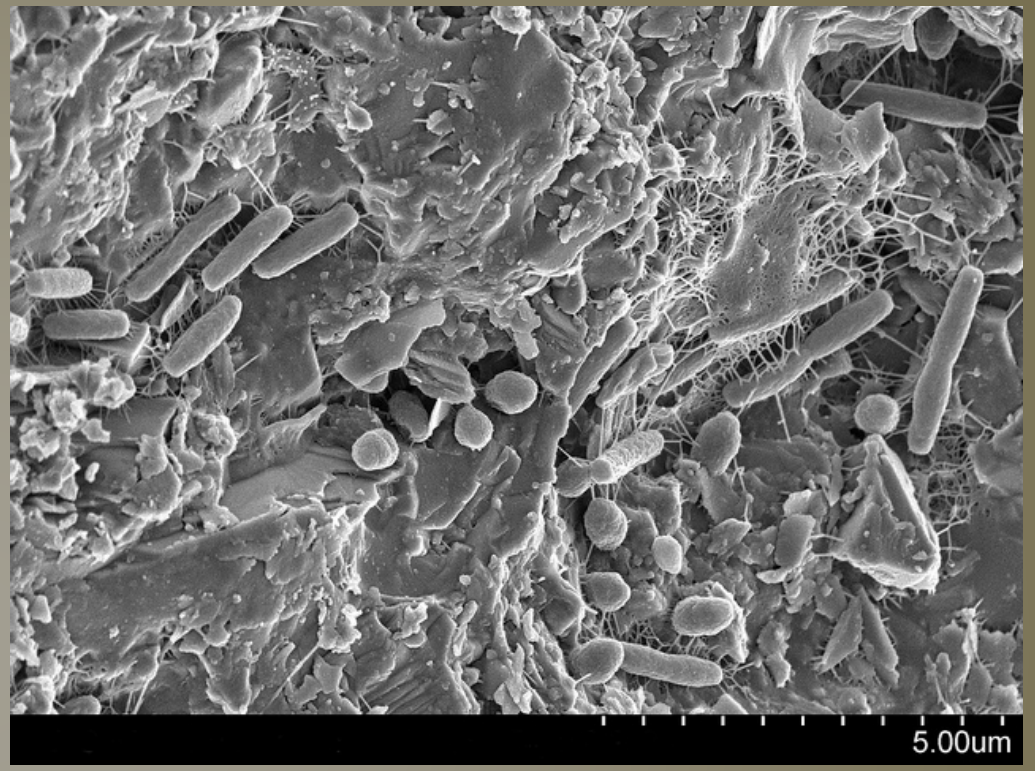
- "The capacity of soil to function as a vital living system to sustain biological productivity, maintain environmental quality, and promote plant and animal health" – Doran, J.W. and Parkin, T.B. (1996). Quantitative indicators of soil quality: a minimum data set

- Interdependent relationships of organisms living in a community.
- Plants need microbes; microbes need plants



HEALTHY SOIL = HEALTHY PLANTS = HEALTHY YOU





Bacteria

A teaspoon of productive soil contains between 100 million and 1 billion bacteria!!





Fungus

One acre, six inches deep, contains 2,400 lbs. of fungus!

Largest organism in the world is a fungus. *Armillaria ostoyae* in Oregon is 2,384 acres (4 sq. mi.) large. – *Scientific American 2007*

"Microherd"

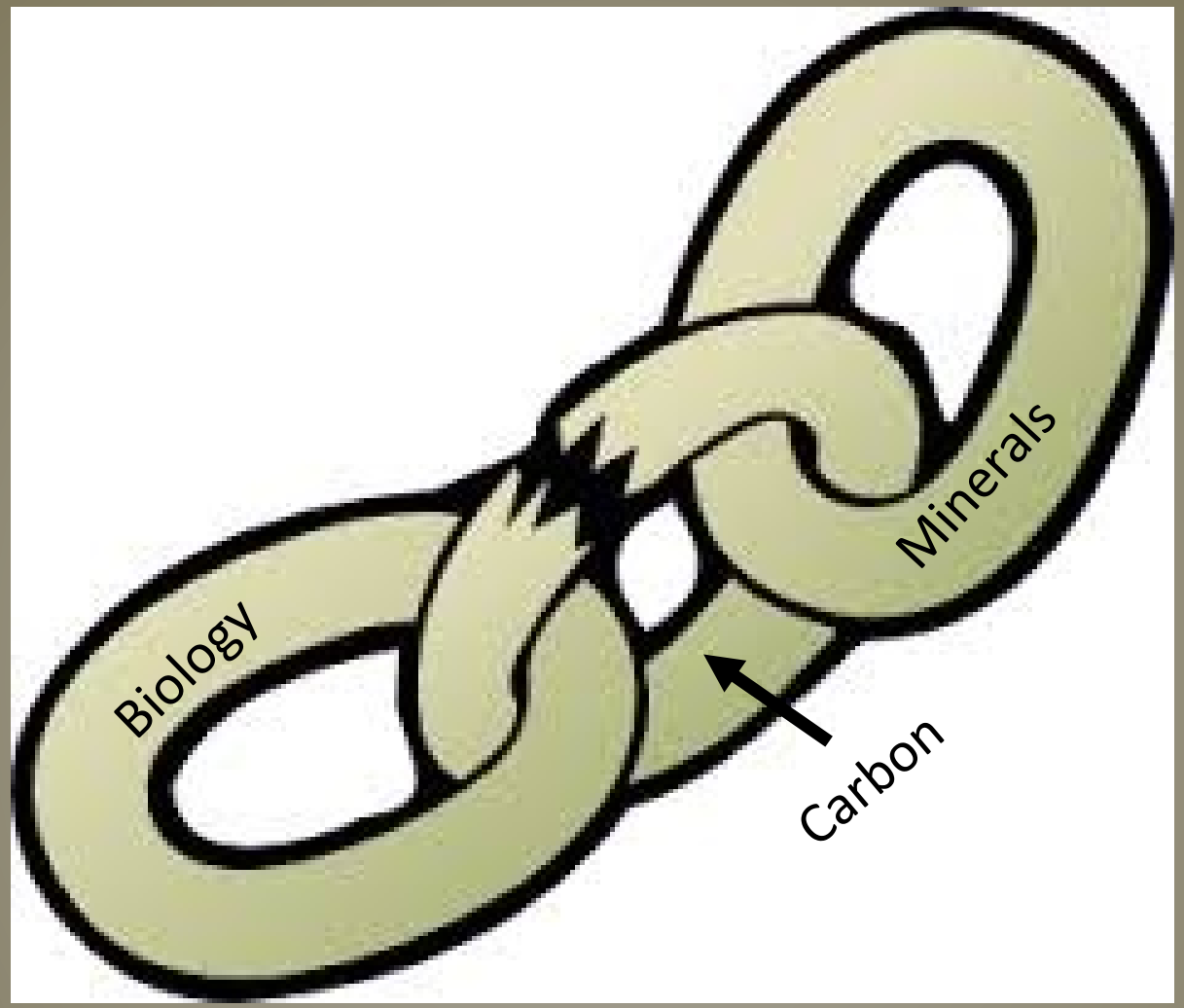
- The weight of the microbiology in an acre of soil weighs about 10,000 lbs., or the equivalent of two adult elephants!
- Think of the soil biology as Livestock
- If a farmer is managing a herd of cattle above the ground, they are also managing an equal sized "microherd" of biology underneath the ground





CARBON!!

What Fuels the “Engine?”



Identify weakest link

BENEFITS OF HUMIFIED COMPOST

- Increased CEC of the soil.
- Increase in carbon content of soil.
- Improved crop growth.
- Deeper and more active root system.
- Higher quality pasture and crops.
- Soil conditioning for seed bed.
- Increase in soil microbe populations.
- More effective use of water.
- Capacity of soil to retain more moisture.
- Better soil structure.



http://farmingfocus.com.au/benefits-of-humified-compost/

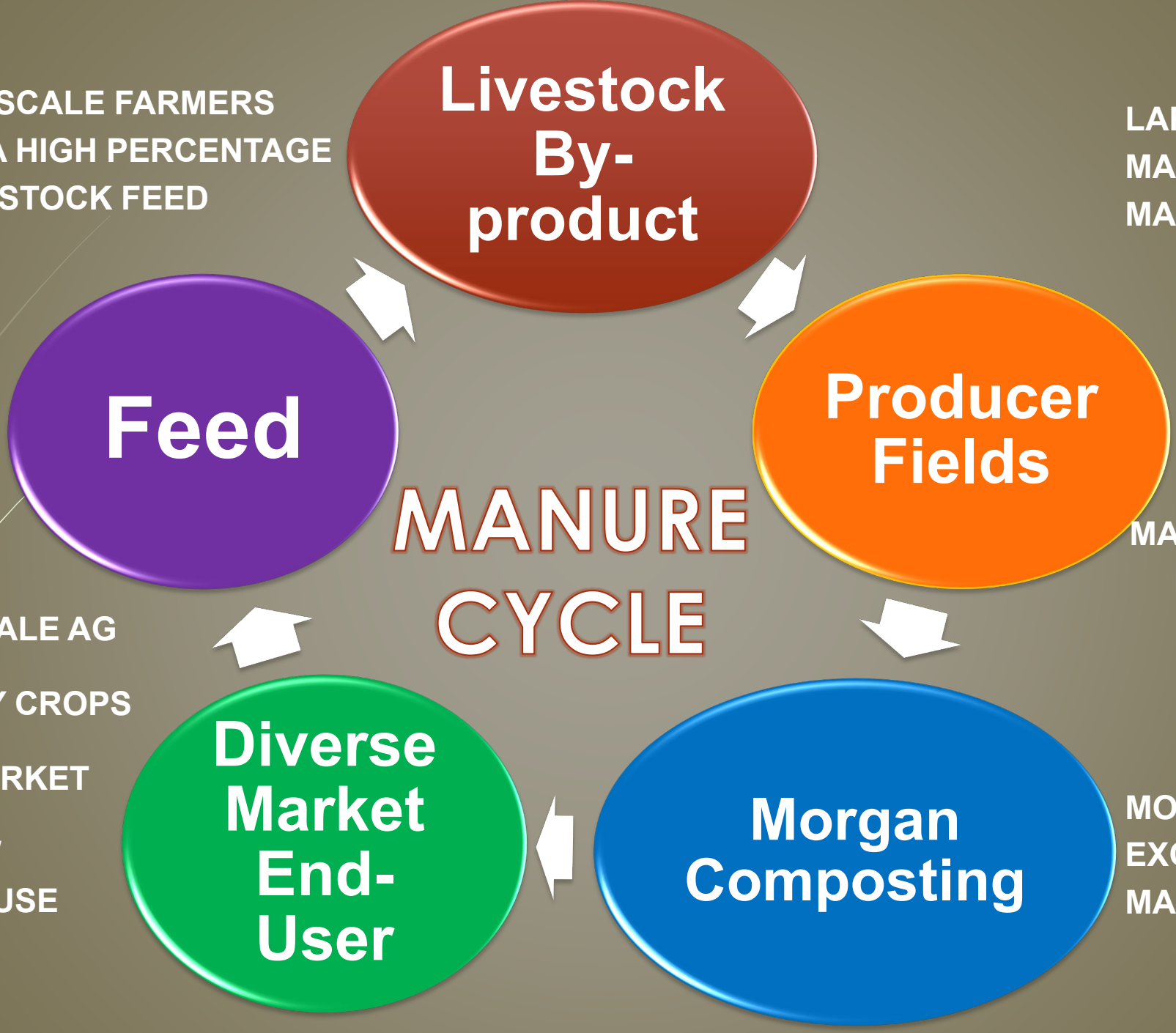
All Compost Isn't Just Compost

- Through changes in the recipe, we can customize compost to fit needs

Any Biomass Can be Composted

- Animal Waste
- Food Waste
- Paper Waste
- Leaves/Yard Waste

MANURE CYCLE



LARGE SCALE FARMERS GROW A HIGH PERCENTAGE OF LIVESTOCK FEED

LARGE VOLUMES OF MANURE REQUIRE MANAGEMENT

MANURE PRODUCED ON FARM GOES BACK TO PRODUCER'S OWN FIELDS

MORGAN'S BUYS ANY EXCESS MANURE TO MAKE COMPOST

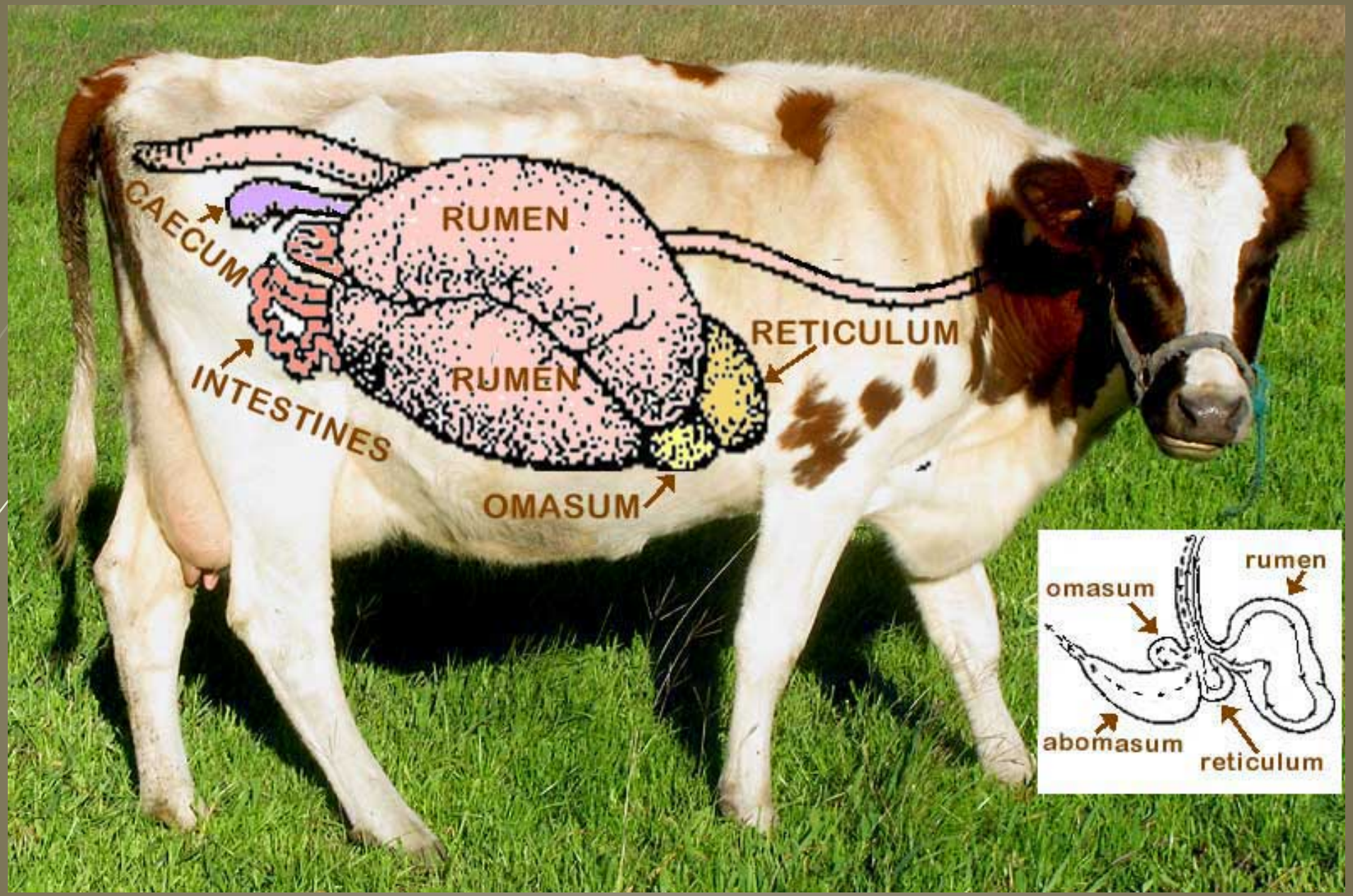
- LARGE SCALE AG
- SPECIALTY CROPS
- RETAIL MARKET
- NURSERY / GREENHOUSE

There is a fine line that we walk

- Financial Stability and Environmentally Conscience
- The Overall Goal
  - Finding a way to balance Agroecology **WHILE** maintaining good Economic Profiability

Compost Factors

- Carbon
- Nitrogen
- Oxygen
- Moisture
- Biology


CAECUM
RUMEN
RETICULUM
RUMEN
INTESTINES
OMASUM
rumen
omasum
abomasum
reticulum

Why should there be healthy biology within a windrow?



- Primary Decomposers
  - Breakdown Dead Matter
- Clean up Contaminants
- Eliminate Pathogens
- Cycle Nutrients
- Aid in Plant Growth

- Manage organic materials from farms, renewable energy plants, and food waste
- This creates compost that is nutrient balanced, biologically productive, and a stable soil amendment

For Sustainability – Source Inputs LOCALLY

Identify Your Local Resources

The Browns - Carbon

- Wood chips
- Mulch
- Shredded Bark
- Sawdust
- Waste Paper

The Greens - Biomass

- Manure
- Food Waste
- Yard Waste
  - Leaves
  - Grass Clippings

You Will Need Access to Adequate…

Air

Farm implements that can aerate the compost

Moisture

Compost heats

- You may need to add moisture back into the system

Two Scientifically Valid Methods

AERATED STATIC COMPOST

One large pile instead of rows, with pipes running through the middle for adequate air circulation. Suitable for yard waste, food scraps, and paper products.

THERMOPHILIC COMPOST

Turned composting that maintains aerobic conditions at a minimum of 130 °F (55 °C) for 15 days (which do not have to be consecutive), with a minimum of five turnings, and is followed by adequate curing.

Time to Make Compost!

1. Layer Your Inputs According to Your Recipe
2. Monitor your compost
    1. Temperatures reached
    2. Days at the temperature
    3. Dates you aerated
3. Length of Time for Decomposition



DAIRY DOO® Compost

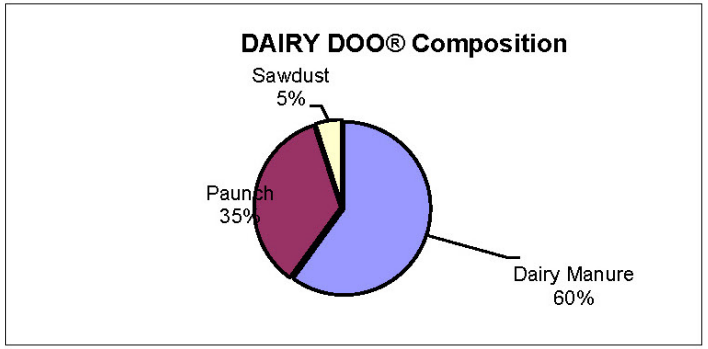
Morgan Composting, Inc

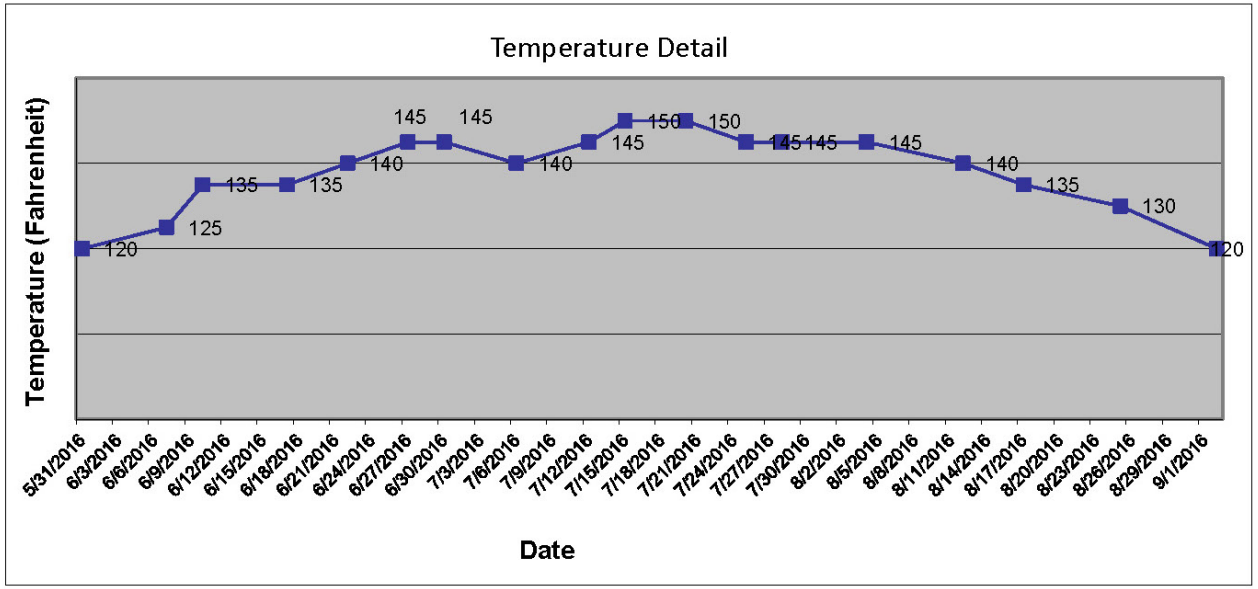
DAIRY DOO®

Completing the Cycle

Build Date
5/26/16

Windrow 1





Poultry Compost

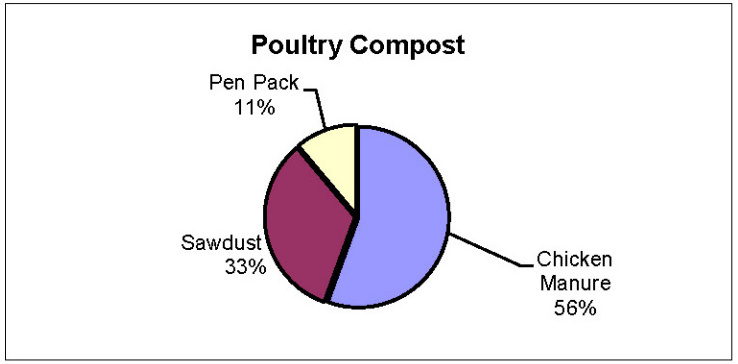
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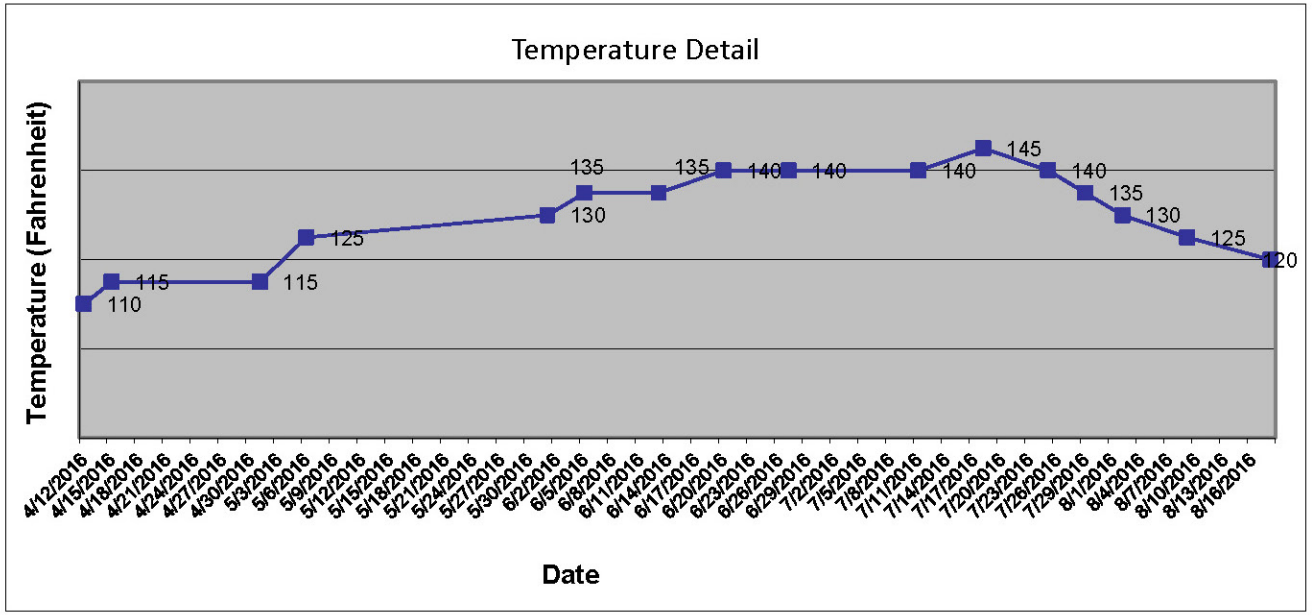
DAIRY DOO®

Completing the Cycle

Build Date
4/15/16

Windrow 1





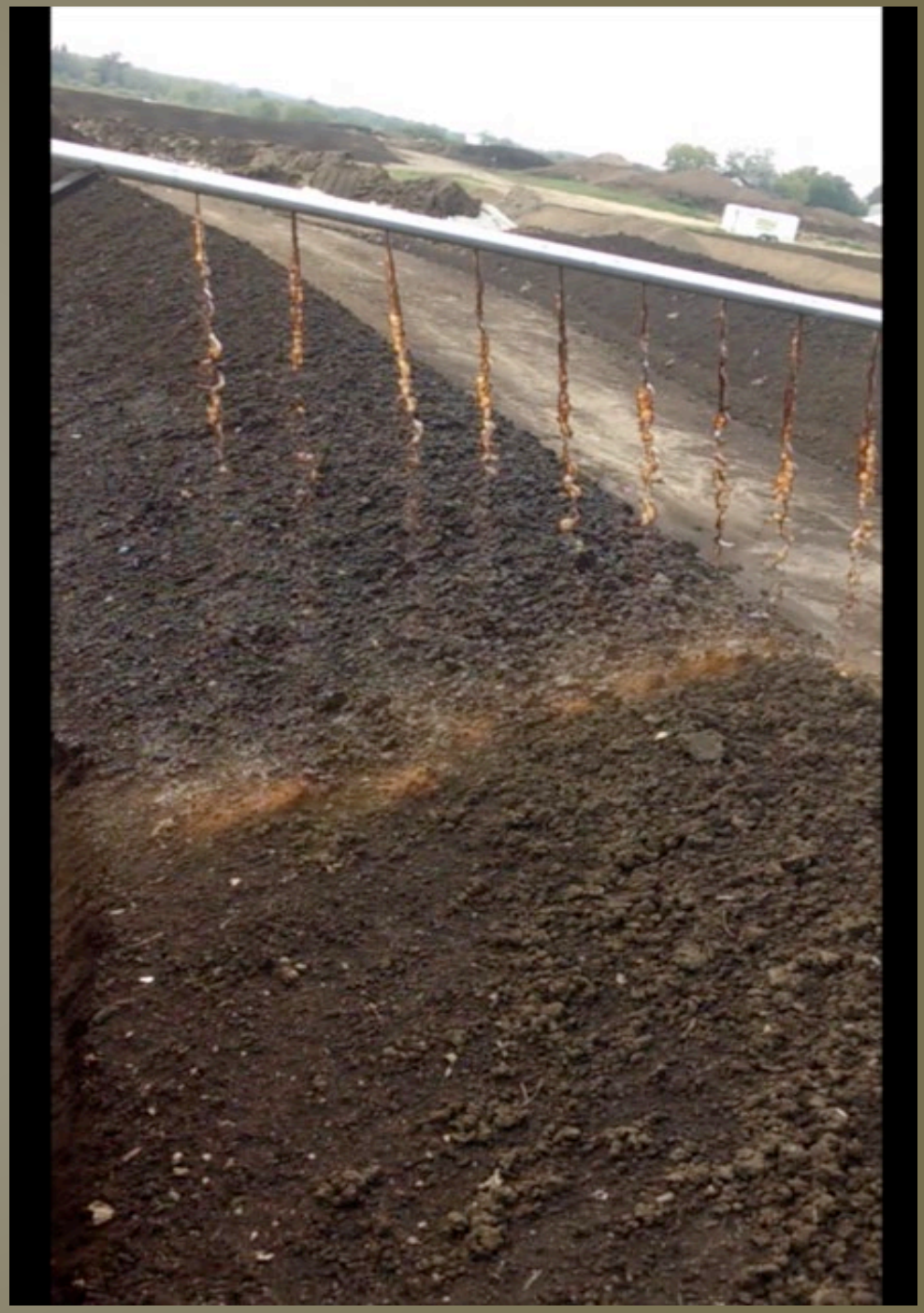


Farm Implements: Compost Turner or Loader



Steam Rising from the Windrows

Applying Odor Control



Odor Control

Curing

- Now that decomposition is complete
  - Time to Pile
  - Set it and forget it

How Do You Know It Is Time To Cure?

When temperatures drop below 140 degrees and steadies

When the compost no longer steams

Should have a rich, earthy smell; like forest soil

Report Number
F16256-6010
Account Number
61518

a&lgreatlakes LABORATORIES
Scientists who don't mind getting dirty.™

3505 Conestoga Dr.
Fort Wayne, IN 46808
260.483.4759
algreatlakes.com

To: MORGAN COMPOSTING
4353 US HWY 10
SEARS, MI 49679

For: MCI FACILITY

Sample ID: DAIRY DOO
Lab Number: 87864

Date Sampled: 9/7/2016
Date Received: 9/12/2016
Date Reported: 9/16/2016

COMPOST ANALYSIS

Analysis	Unit	Analysis Result	Dry Basis Result	Analysis Method
Moisture @ 70 C	%	38.38		TMECC 03.09-A
Solids	%	61.62		TMECC 03.09-A
Total Nitrogen (N)	%	0.81	1.31	TMECC 04.02-D
Phosphorus (P)	%	0.68	1.11	TMECC 04.03-A
Phosphate (P_2O_5)	%	1.57	2.54	TMECC 04.03-A
Potassium (K)	%	0.71	1.16	TMECC 04.04-A
Potash (K_2O)	%	0.86	1.39	TMECC 04.04-A
Sulfur (S)	%	0.70	1.14	TMECC 04.05-S
Magnesium (Mg)	%	0.31	0.51	TMECC 04.05-MG
Calcium (Ca)	%	3.36	5.45	TMECC 04.05-CA
Sodium (Na)	%	0.20	0.33	TMECC 04.05-NA
Iron (Fe)	%	1.44	2.34	TMECC 04.05-FE
Aluminum (Al)	%	0.25	0.40	TMECC 04.07-AL
Boron (B)	mg/kg	12	19	TMECC 04.05-B
Copper (Cu)	mg/kg	63	102	TMECC 04.05-CU

TMECC - Test Methods for the Examination of Composting and Compost (TMECC), The U.S. Composting Council.

Report Approved By: Greg T. Neyman
Greg Neyman - Vice President / COO

Approval Date: 9/16/2016

DAIRY DOO

Approx. N-P-K = 1% - 1% - 1%

33% Moisture

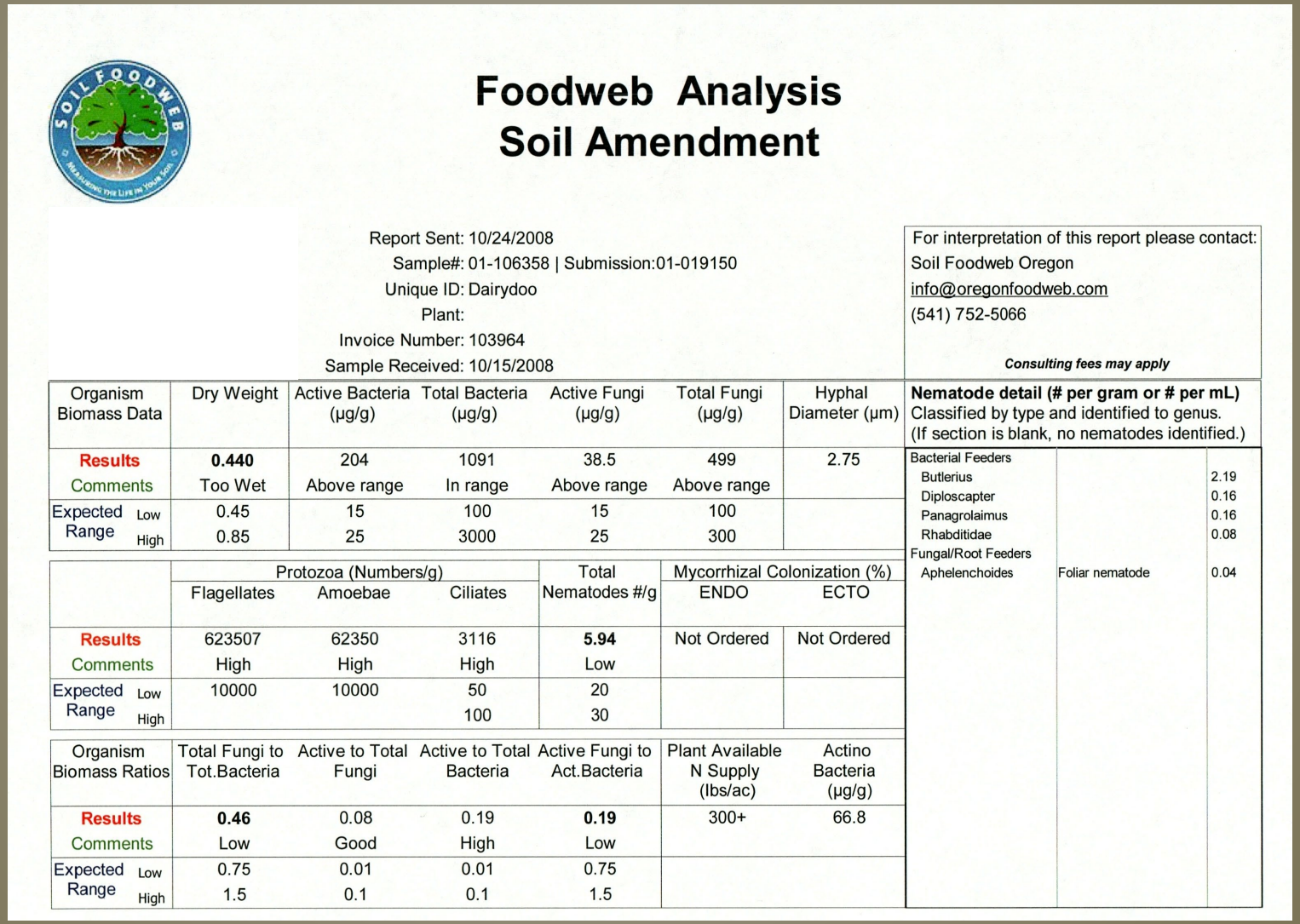
33% Ash (where the nutrients are)

33% Organic Matter (OM)

A cubic yard ≈ 1200 lbs.

Measurable Biology

What is Your End Goal for Compost?



Foodweb Analysis
Soil Amendment

Report Sent: 10/24/2008
Sample#: 01-106358 | Submission:01-019150
Unique ID: Dairydoo
Plant:
Invoice Number: 103964
Sample Received: 10/15/2008

For interpretation of this report please contact:
Soil Foodweb Oregon
info@oregonfoodweb.com
(541) 752-5066

Consulting fees may apply

Organism Biomass Data	Dry Weight	Active Bacteria (µg/g)	Total Bacteria (µg/g)	Active Fungi (µg/g)	Total Fungi (µg/g)	Hyphal Diameter (µm)
Results	**0.440**	204	1091	38.5	499	2.75
Comments	Too Wet	Above range	In range	Above range	Above range	
Expected Range Low	0.45	15	100	15	100	
Expected Range High	0.85	25	3000	25	300	

	Protozoa (Numbers/g)			Total	Mycorrhizal Colonization (%)	
	Flagellates	Amoebae	Ciliates	Nematodes #/g	ENDO	ECTO
Results	623507	62350	3116	**5.94**	Not Ordered	Not Ordered
Comments	High	High	High	Low		
Expected Range Low	10000	10000	50	20		
Expected Range High			100	30		

Organism Biomass Ratios	Total Fungi to Tot.Bacteria	Active to Total Fungi	Active to Total Bacteria	Active Fungi to Act.Bacteria	Plant Available N Supply (lbs/ac)	Actino Bacteria (µg/g)
Results	**0.46**	0.08	0.19	**0.19**	300+	66.8
Comments	Low	Good	High	Low		
Expected Range Low	0.75	0.01	0.01	0.75		
Expected Range High	1.5	0.1	0.1	1.5		

Nematode detail (# per gram or # per mL)
Classified by type and identified to genus.
(If section is blank, no nematodes identified.)

Bacterial Feeders		
Butlerius		2.19
Diploscapter		0.16
Panagrolaimus		0.16
Rhabditidae		0.08
Fungal/Root Feeders		
Aphelenchoides	Foliar nematode	0.04

DAIRY DOO®

Ag Testing - Consulting

Account No. : 2040

Biological Soil Analysis Report

Invoice No. : 1231776
Date Received : 03/27/2017
Date Reported : 03/29/2017
Lab No. : 1880

Results For : MORGAN COMPOSTING
Sample ID 1 :
Sample ID 2 : DAIRY DOO

PLFA Soil Microbial Community Analysis

Functional Group Biomass & Diversity

Total Living Microbial Biomass, Phospholipid Fatty Acid (PLFA) ng/g	12640.41
Functional Group Diversity Index	1.315

Total Biomass	Diversity	Rating
< 500	< 1.0	Very Poor
500+ - 1000	1.0+ - 1.1	Poor
1000+ - 1500	1.1+ - 1.2	Slightly Below Average
1500+ - 2500	1.2+ - 1.3	Average
2500+ - 3000	1.3+ - 1.4	Slightly Above Average
3000+ - 3500	1.4+ - 1.5	Good
3500+ - 4000	1.5+ - 1.6	Very Good
> 4000	> 1.6	Excellent

Functional Group	Biomass, PLFA ng/g	% of Total Biomass
Total Bacteria	**7280.23**	**57.59**
Gram (+)	**5527.53**	**43.73**
Actinomycetes	1300.89	10.29
Gram (-)	**1752.72**	**13.87**
Rhizobia	0.00	0.00
Total Fungi	**947.47**	**7.50**
Arbuscular Mycorrhizal	**552.67**	**4.37**
Saprophytes	**394.81**	**3.12**
Protozoa	**40.53**	**0.32**
Undifferentiated	**4372.18**	**34.59**

DAIRY DOO®
With Spelt Hulls

MI 49417

Invoice No. : 1231776
Date Received : 03/27/2017
Date Reported : 03/29/2017
Lab No. : 1881

Results For : MORGAN COMPOSTING
Sample ID 1 :
Sample ID 2 : DAIRY DOO W/SPELT

PLFA Soil Microbial Community Analysis

Functional Group Biomass & Diversity

Total Living Microbial Biomass, Phospholipid Fatty Acid (PLFA) ng/g	26625.15
Functional Group Diversity Index	1.525

Total Biomass	Diversity	Rating
< 500	< 1.0	Very Poor
500+ - 1000	1.0+ - 1.1	Poor
1000+ - 1500	1.1+ - 1.2	Slightly Below Average
1500+ - 2500	1.2+ - 1.3	Average
2500+ - 3000	1.3+ - 1.4	Slightly Above Average
3000+ - 3500	1.4+ - 1.5	Good
3500+ - 4000	1.5+ - 1.6	Very Good
> 4000	> 1.6	Excellent

Functional Group	Biomass, PLFA ng/g	% of Total Biomass
Total Bacteria	**15186.01**	**57.04**
Gram (+)	**8307.26**	**31.20**
Actinomycetes	2200.44	8.26
Gram (-)	**6878.71**	**25.84**
Rhizobia	215.45	0.81
Total Fungi	**3411.41**	**12.81**
Arbuscular Mycorrhizal	**1817.35**	**6.83**
Saprophytes	**1594.06**	**5.99**
Protozoa	**243.33**	**0.91**
Undifferentiated	**7784.41**	**29.24**

Solvita Testing





Utilization of Compost

- With More & More Farm-to-Table scenarios, Food Safety is a ***MUST***
  - GAP/GHP – Good Agricultural Practices & Good Handling Practices
    - Enforcing Agency - USDA
  - GAAMPs – Generally Accepted Agricultural & Management Practices
    - Enforcing Agency - MDARD
  - FSMA – Food Safety Modernization Act
    - Enforcing Agency - Food & Drug Administration (FDA)
  - National Organic Program (NOP)

GAP & GHP Rules

- **2. Biological Soil Amendments**
- **Raw Manure**: The number of days needed between the applications of raw manure as a soil amendment and harvesting.
- FDA - USDA's NOP standards
  - 120-day interval
- **Stabilized Compost**: Microbial standards that set limits on detectable amounts of bacteria (including *Listeria monocytogenes*, *Salmonella* spp., fecal coliforms, and *E. coli* 0157:H7) have been established for processes used to treat biological soil amendments, including manure.

Worm Castings

- Fungal matter for root growth
- Helps with water and mineral retention
- Great amendment







Hard-working, they never take a day off!



Raising Worms! Worm Castings are essential for soil.





Managed Vermicomposting


Morgan Composting
(616)
734-2790
(616)
734-3468
DAIRY DOO
COMPOSTED COW MANURE



Dairy Farming

- 200 Head Dairy Operation
- No Feed Crops
- Bought Livestock Feed
- This Left a Manure Management Problem


Our Home Facility - TODAY

2018 Employees




N Meridian Rd
Google

Fennville, MI

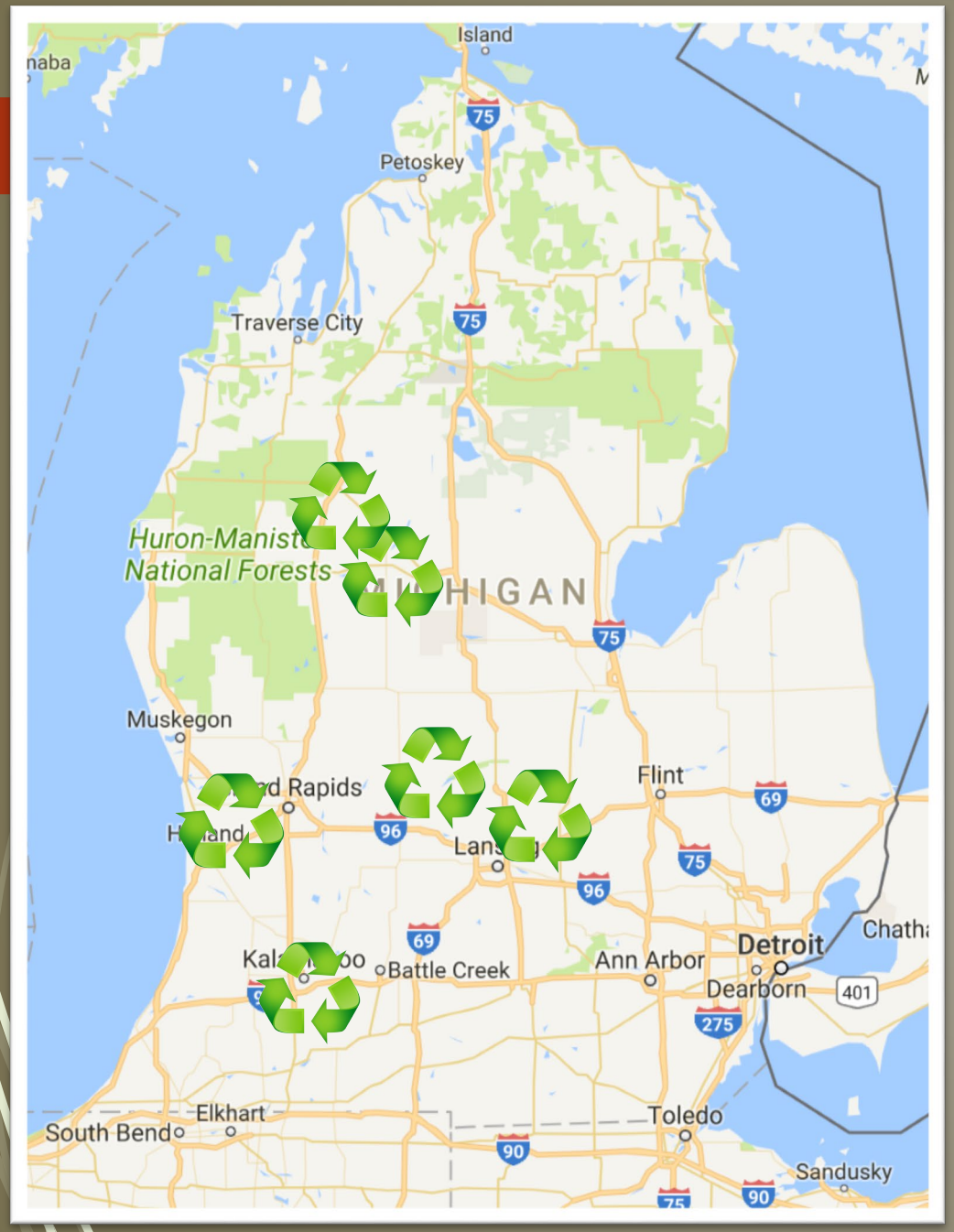








City of Kalamazoo-Municipality



STRATEGIC PLACEMENT

- APPROX. 80,000 TON LAYER MANURE
- APPROX. 3,000 TON WOOD ASH
- APPROX. 1,500 TON FOOD WASTE
- APPROX. 50,000 TON OF DAIRY MANURE
- APPROX. 30,000 TON OF GYPSUM (WALLBOARD)

CUSTOM COMPOST BLENDS

These are based on soil tests.

- We address deficiencies & excesses
- Farm specific plant nutrient needs

Morgan Composting, Inc
DAIRY DOO®
Completing the Cycle

Prescriptive Blend by
Morgan Composting Inc
4353 U.S. 10
Sears, MI 49679
Off: (231) 734-2451
fax: (231) 734-6259

Date: 5-11-2018
Farm Name:
Blend Name: Custom Compost Blend
Phone:
Address:
City, State, Zip:
Email:
Please Sign For Quote Approved:

Acres:
1

Certified for Organic: Yes

Product	#s/Acre	Total Lbs	lbs/ac OM	lbs/ac N	lbs/ac P_2O_5	lbs/ac K_2O	lbs/ac Ca	lbs/ac Mg	lbs/ac S	ppm B	ppm Cu	ppm Fe	ppm Mn	ppm Zn
Agrothrive LFN 3-3-2	10	10		0.30	0.30	0.20								
Azomite Slow Release	44	44	0	0	0	2	2	0	0	0.0	0.0		0.0	0.0
DAIRY DOO®	1415	1415	425	14	14	14	47	4	6	0.0	0.1	9.9	0.4	0.3
Feather Meal 14-0-0	100	100		14										
Gypsum 20%Ca, 17%S	200	200					40		34					
Humates (Source Coarse)	50	50	15	0			1	0	1			0.4	0.0	0.0
Intrepid Trio 0-0-22 11Mg 22S - Organic	50	50				11		6	11					
Kelp Meal	20	20												
Molasses Organic (11lbs/gallon)	11	11		0.1		0.3								
Wollastonite	100	100		0	0	2	19	4	1		0.0	0.8	0.0	0.0
TOTAL POUNDS / ACRE:	**2000.0**	**2000.0**	**440**	**29**	**15**	**30**	**108**	**14**	**52**	**0.0**	**0.1**	**11.1**	**0.5**	**0.3**
			OM	**N**	**P_2O_5**	**K_2O**	**Ca**	**Mg**	**S**	**B**	**Cu**	**Fe**	**Mn**	**Zn**

TOTAL TONS: 1.00
TOTAL CUBIC YARDS: 1.66

Morgan Composting sells soil amendments, not fertilizer. Therefore all given analysis should be considered approximate, not guaranteed.

Mineral Amendments



- Azomite = 77 trace minerals in Azomite. (65% silica)
- Colloidal Phosphate = 22% Phosphate (3% available); also called "soft rock phosphate"
- DAIRY DOO® = high-quality, thermophilic, humified, biologically-active compost
- Dolomite = Calcium and magnesium; raises pH
- Tiger 90 ® Elemental Sulfur 90% S = lower pH by converting S to SO_4
- Feather Meal = 14% Organic Nitrogen.
- Greensand = 10% total Potassium; 0.2% water available K_20

Mineral Amendments



- Gypsum = Calcium and Sulfur.
- HiCal Lime = pH adjustment and add Calcium source.
- Humates (leonardite) = Long-term stable carbon source. Builds a stronger root system. Great source of energy for beneficial soil organisms, which influence both soil fertility and plant health.
- Intrepid Trio = 0-0-22 11%Mg 22%S. Organic K-Mag; also called Sol-Po-Mag because it contains potassium, magnesium and sulfate sulfur
- K*ash = derived from sunflower hulls; contains up to 34% potassium
- Meat and Bone Meal = 8-13-2. This is a slow release Nitrogen and a high Phosphorous source. It also includes a fair amount of Calcium.

Mineral Amendments



- Mycorrhizae Fungi = Tiny, harmless critters that attach themselves to plant roots and actually help plants to make use of water and organic nutrients in the soil.
- Paramagnetic Rock = Paramagnetic soils increased water retention, increased microbial stimulation, improved nutrient utilization and increased light energy.
- Poultry Compost = Make from chicken manure; Packed full of beneficial microbes (2-4-2)
- Sphagnum Peat = Canadian peat; low pH, great for adding organic matter to garden to creating potting soil
- Sulfate of Potash (SOP) = 50% potassium and 17% sulfur

Mineral Amendments



- Super Sulfur = 0-0-8-24%S. Adds Sulfur in sulfate and elemental forms which helps to balance soil pH; also has potassium
- Tennessee Brown Rock Phosphate = A great natural source of full of slow release phosphorus; 23% P (6% available)
- Trace Minerals = Boron 10%, Copper Sulfate, Manganese Sulfate, Iron Sulfate, Zinc Sulfate
- Wollastonite = Calcium silicate, plus many other trace minerals
- Worm Castings = Gives a fungal activity that is superior over other products.
- Zeolite = natural volcanic minerals that are mined in certain parts of the world

CMU Cooperative Effort

https://vimeo.com/148651604

Questions??

We Greatly Appreciate Your Time!!