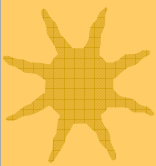




## *The Classification system:*



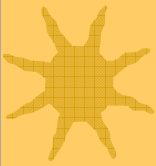
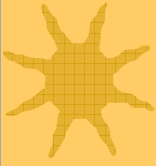
### ★ Components of Maturity

#### –**Respirometry**

–NH<sub>4</sub>-N/NO<sub>3</sub>-N

–Carbon/Nitrogen

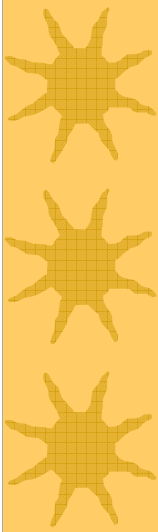
–Germination and Vigor



1. Begin @ 1:35 - 1:55 (end), slide 1 of 10
2. Different presenters...hopefully each one of us can add a part to provide a large picture that is useful...
3. Different points of view and expertise represented here.
4. An understanding of the parameters that are measured which provide the basis for the classification is important to use the compost classification system effectively!
5. This discussion primarily relates to active windrow composting...
  1. Gore Covered system, other commercial and management systems may be designed to accelerate entire process, including curing phase



## *What is Respirometry?*



Begin @ 1:35 - 1:55 (end) Slide 2 of 10

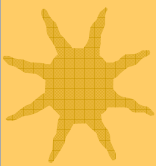
Respirometry means the measuring (metry) of respiration, which is what we humans do when we breathe. Composting microorganisms are also organisms that respire, or breathe, in order to live. Most compost piles with a good supply of oxygen support communities of aerobic microorganisms, which also breathe, breathing in oxygen, and exhaling carbon dioxide, but we usually don't use the words breathe and exhale, but the concept is the same. We say "take in" and "give off."

Tell first in plain words, then show slides with definition, which comes next

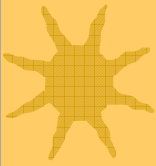


## *Wind?*

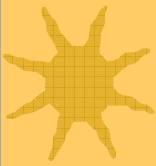
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★ **Respirometry**: the measurement of microbial respiration, which is the breathing of a microorganism (MO)



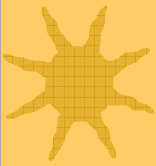
★ **Respiration** is a measure of compost **Stability**



Begin @ 1:35 - 1:55 (end) slide 3 of 10



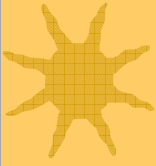
## *Respiration...*



★ Many composting MO's

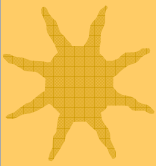
– take in oxygen ( $O_2$ )

– Give off carbon dioxide ( $CO_2$ )



★  $O_2$  and  $CO_2$  can be measured

★ Measurements are related to MO activity

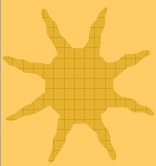


**Begin @ 1:35 - 1:55 (end)** slide 4 of 10

**When numbers of MO's are low, use of  $O_2$  or production of  $CO_2$  is low, when numbers of MO's are high, amount of  $O_2$  used or  $CO_2$  given off changes proportionally with population #'s.**

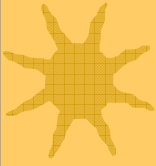


## *How is respiration measured?*



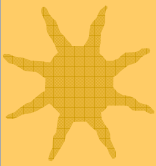
★ **O<sub>2</sub> Consumption:** Good measure, but tedious and hard to replicate

- SOUR: Specific Oxygen Uptake Rate
- In situ with a probe
- Dewar Self-Heating Test



★ **CO<sub>2</sub> Evolution:** Commonly used

- Trap CO<sub>2</sub> in NaOH, measure pH change
- Commercial: Solvita<sup>®</sup> Test\*: CO<sub>2</sub> & NH<sub>3</sub>
- Biologically Available Carbon (BAC)



\*[www.woodsend.org](http://www.woodsend.org)

### **Begin @ 1:35 - 1:55 (end)** slide 5 of 10

Show mason jar with some compost in the bottom, tight lid, small clear vial in it with liquid, and explain that this jar is incubated, left to sit for a measured period of time. Concentration of basic NaOH is known at time 1, it is measured with pH meter at time 0 and amount of CO<sub>2</sub> that has evolved from compost is dissolved in the NaOH, its concentration, and thus pH changes, and amount of CO<sub>2</sub> evolved over a measured time per known amount of compost can be calculated. Find out from TMECC what levels constitute high, medium, and low!!!

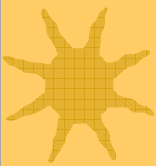
OM is organic matter and TS are total solids, which might include contaminants such as soil

Put handwritten notes here of reaction that occurs and offer to send description from TMECC of method....

Bring in a solvita test to show what it is

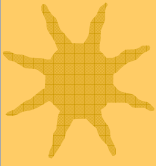


## *Composting Process and CO<sub>2</sub>*



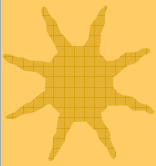
★ Early in process, many nutrients available, MO's grow quickly, give off high levels of CO<sub>2</sub>

– “UNSTABLE” on lab report



★ Late in process, few nutrients available, less MO activity, lower levels of CO<sub>2</sub>

– “STABLE” on lab report



**Begin @ 1:35 - 1:55 (end)** slide 6 of 10

Add that if the carbon dioxide of decomposing saw dust was measured, it would give a stable value, because the level of microbial activity is not high, due to lack of available nutrients which would allow composting microorganisms to grow and decompose the carbon in it! So

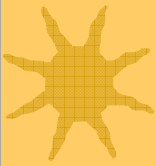
**respirometry alone is not enough to judge whether a compost is STABLE!**

Show overhead here of the graph from Cooperband, 2003 and discuss how long it took CO<sub>2</sub> in all composts to come down to stable level....about one year

“Research studies suggest that biological stability may not occur until 100 – 200 days of composting, many commercially produced composts are considered stable after 60 – 90 days of composting.” from Cooperband, 2003, same place as graph.

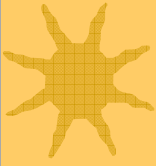


## *Effects of Compost Stability on Plants (-)*

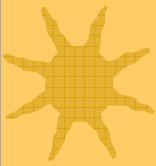


★ Applying unstable compost to soil:

- “available” nutrients high in compost
- Soil MO’s compete more successfully for nutrients than plants
- Plants can show nutrient deficiency



★ **Soil Microorganisms eat first!**



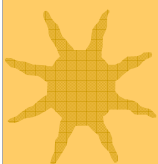
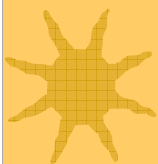
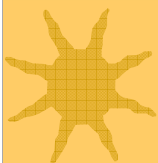
- ★ Unstable compost best if applied well before planting and incorporated

**1. Begin @ 1:35 - 1:55 (end)** slide 7 of 10

2. This will come up again in C:N ratios! This is where compost science has to meet soil science to understand what happens to compost once it is applied to a soil
3. Unstable compost can break down further in the soil if the timing is right for plant growth.
4. Respirometry can be an important parameter in deciding how compost can best be sold and used.



## *Effects of Compost Stability on Plants (+)*



### ★ Applying **stable** compost to soil:

- Nutrients in compost mostly organic, slow release
- No increased activity of soil microorganisms to use nutrients in compost
- Soil health enhanced
- Plant response good



to slow release, stable organic forms of nutrients in compost

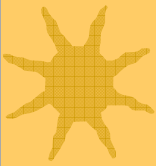
- Stable composts have many uses, few limitations

**Begin @ 1:35 - 1:55 (end)** slide 8 of 10

Little risk when using compost with low respirometry reading (stable) if other indicators also show that compost is mature...



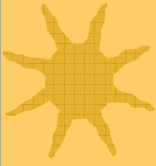
## *How can Management Affect CO<sub>2</sub>?*



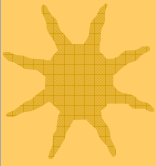
### ★ Shorten time to “low activity” by:

#### – Optimizing:

- Initial Carbon and Nitrogen mixture (40:1?)
- Size of feedstocks – some well ground and mixed
- Moisture (50%)
- Oxygen (20%...turning, bulking agents)
- Pile Size (not too big, not too small.....)
- Careful **monitoring** temps, moisture



### ★ Curing compost!



1. **Begin @ 1:35 - 1:55 (end)** slide 9 of 10
2. Curing is important. On-Farm Composting Handbook recommends at least a month
3. Commercial systems available (Gore Composting System, Ag Bags, etc, that can accelerate entire process)



The slide features a vertical yellow bar on the left with a metallic sun icon at the top and three yellow sun icons below it. The main title "Respirometry!" is in a brown serif font at the top right. Below the title is a stylized black and white illustration of a person's head in profile, with a large, cloud-like shape representing the lungs and a smaller cloud-like shape representing the mouth, with lines indicating air flow. At the bottom right, the contact information is listed.

*Respirometry!*

Kathy.Doesken@colostate.edu  
970-491-6984

**Begin @ 1:35 - 1:55 (end)** slide 10 of 10

Ask if there are any questions here if time. Keep on time.

End at 1:50, then 5 minutes for questions. Next presentation start at 1:55!!!!