Principles of Composting

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What is Composting ?

- Simple definition: Managed Decomposition
- Composting is a natural form of recycling, which continually occurs in nature. Decomposition is how nutrients are recycled in an ecosystem.
- This natural decomposition can be refined by **managing** ideal conditions.

More on the definition…

- Composting is the *biological* ***transformation*** of organic material through decomposition into a soil-like material called compost.
  - When a plant dies, its remains are attacked by microorganisms and invertebrates in the soil, and it is decomposed into humus*.
- The end products of the process are soil-enriching compost (humus), carbon dioxide, water, and heat.
- We will be focused on **aerobic** composting

* The theory that a 'humification' process created 'humus' predates a sophisticated understanding of soils. Products of a humification process have not been observed in soil. Although 'humification' theory is unsupported by evidence, "the underlying theory persists in the contemporary literature, including current textbooks."Lehmann, J.; Kleber, M. (2015-12-03)

Why Compost ?

- Reduces MSW/Ag Bi-product Management
  - Yard and food waste makes up approximately 30-40% of waste stream in US
- Nutrient Rich Soil Amendment
- Soil Improvement/Soil Health
- Disease Prevention/Suppression
- Carbon Sequestration/Impact on Global Warming

Biological Process

- Carbon
- Nitrogen
- Water
- Air
- Time

Guidelines for making compost:

- Use a variety of raw materials (such as leaves, prunings, food scraps, manure, sawdust, etc..)
  - Greens = nitrogen materials
  - Browns = carbon materials
  - What NOT to compost and why ?
- It's important to keep compost aerobic (turn it!)
- It must stay heated to 131° F for at least 15 days and be turned 5 times during that process.

Browns ... and ... Greens

CARBON **&** **NITROGEN**

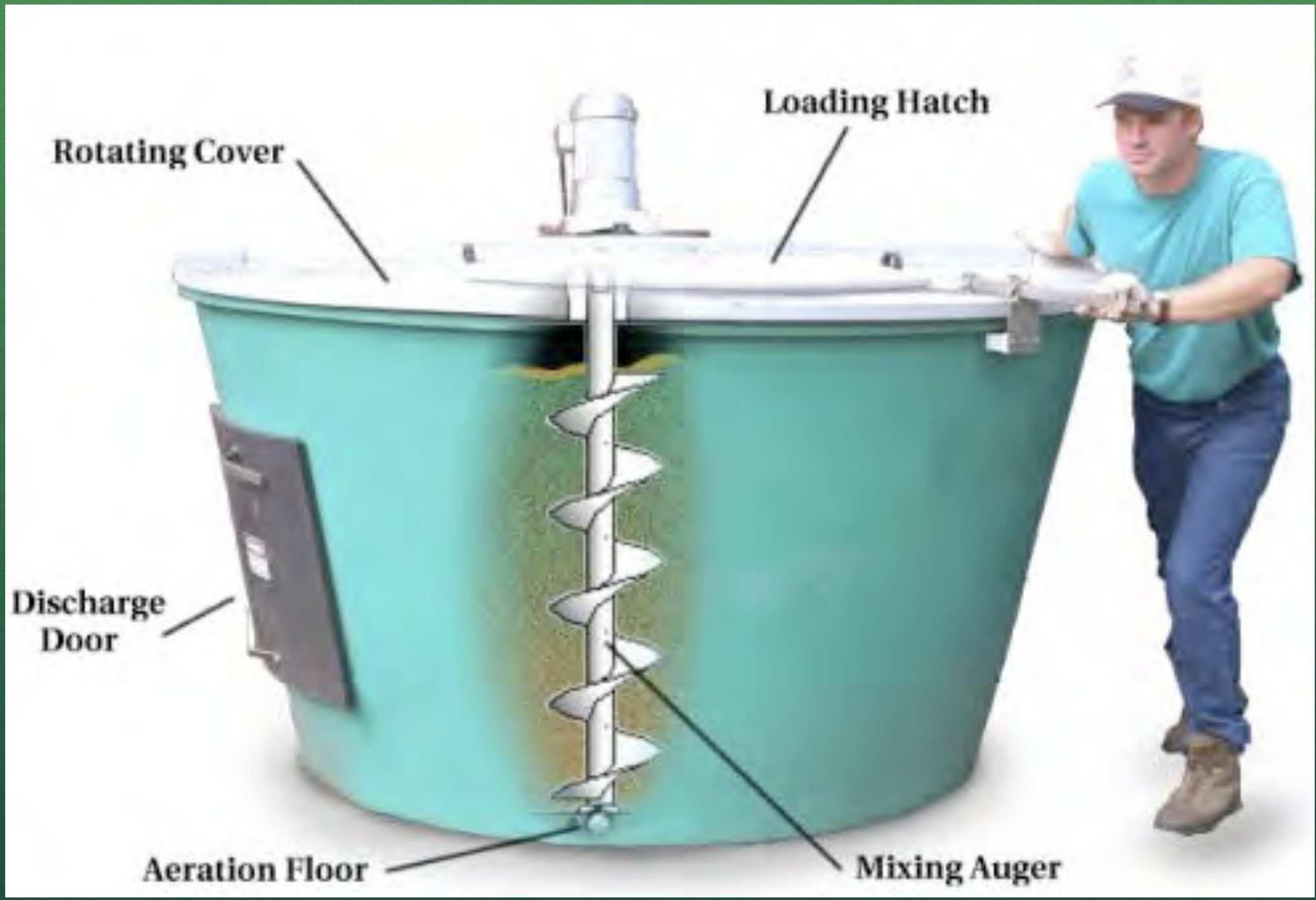
Food

- Use a variety of ingredients: leaves, grass, weeds, prunings, vegetative food scraps, manure…
- Right particle size <2" preferred
- .5 to 1.5 inches most rapid
- **Do not use**:
- Meat, bones, dairy, fats
- Soil
- Stubborn weeds: Bermuda grass
- Poison Oak
- Cat and dog (carnivorous) feces
- Diseased plant material

Food Cont’ d

- Compostable Plastics
- Allelopathic plant material - Ok
- Ash - Dusting
- Plants with pesticides – Mostly Ok
- Fertilizer - Ok
- Egg shells - Ok
- Coffee Grounds - Ok
- Others??? – Ask away

Bins or Open, Freestanding



Green Mountain Technologies

1-2-3 Rollover

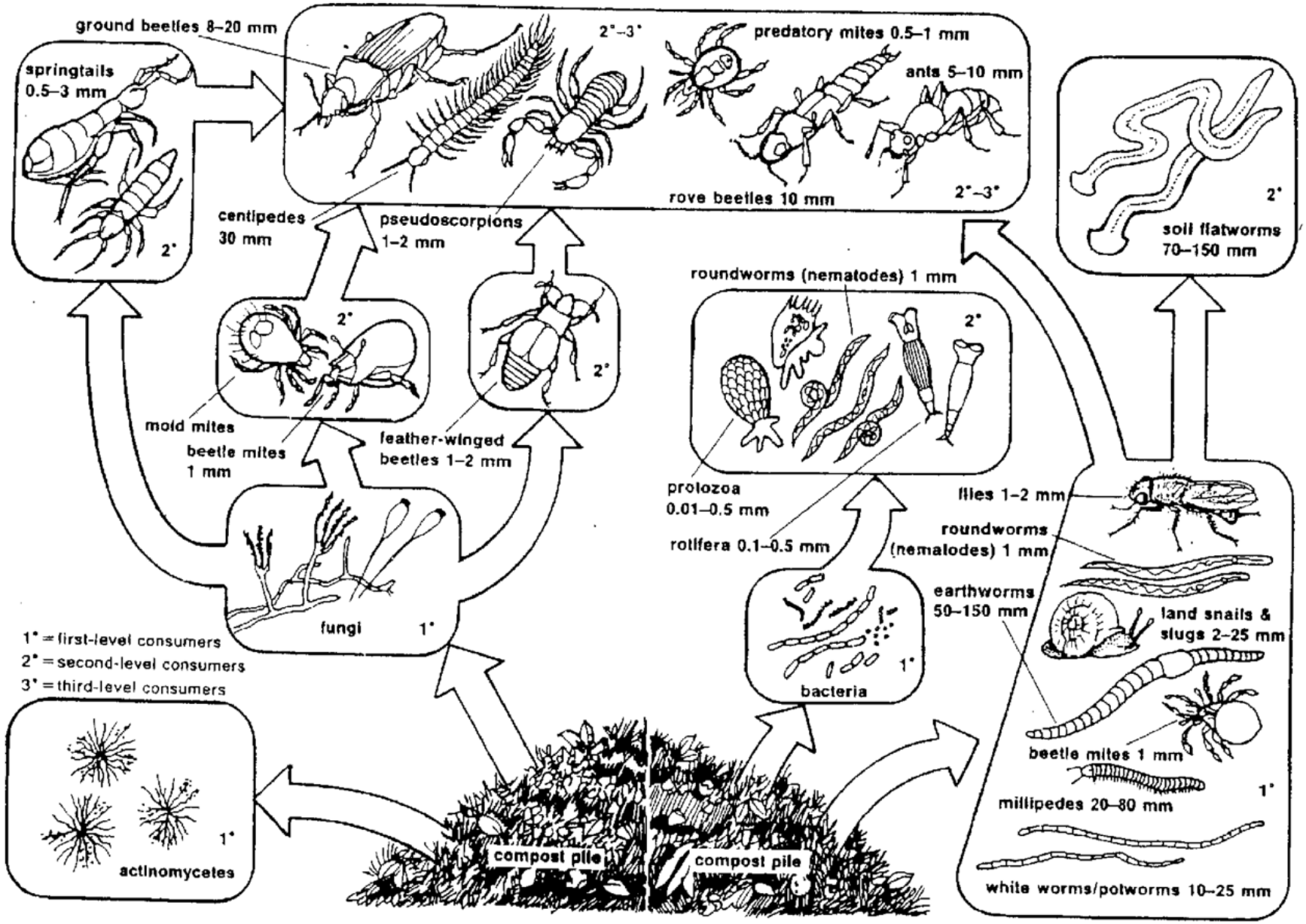

SCARAB

Water as Needed !

Moisture by Feel

- Handful of material
- Squeeze firmly
- Water escapes: > 60 %
- Shiny ball: 55% - 60 %
- Ball remains when tapped: 50 - 55 %
- Ball falls apart when tapped: 45 – 50 %
- No ball forms: 40 – 45 %
- Unless hand feels talky dry: < 40 %

Appendix 1: Compost Food Web



TROUBLE-SHOOTING

- Pile not heating up / low pile temperature
  - Below 90 F
- High pile temperature
  - Above 163 F
- Pile smells like rotten eggs
- Pile smells strongly of ammonia
- Pile is attracting pests and flies

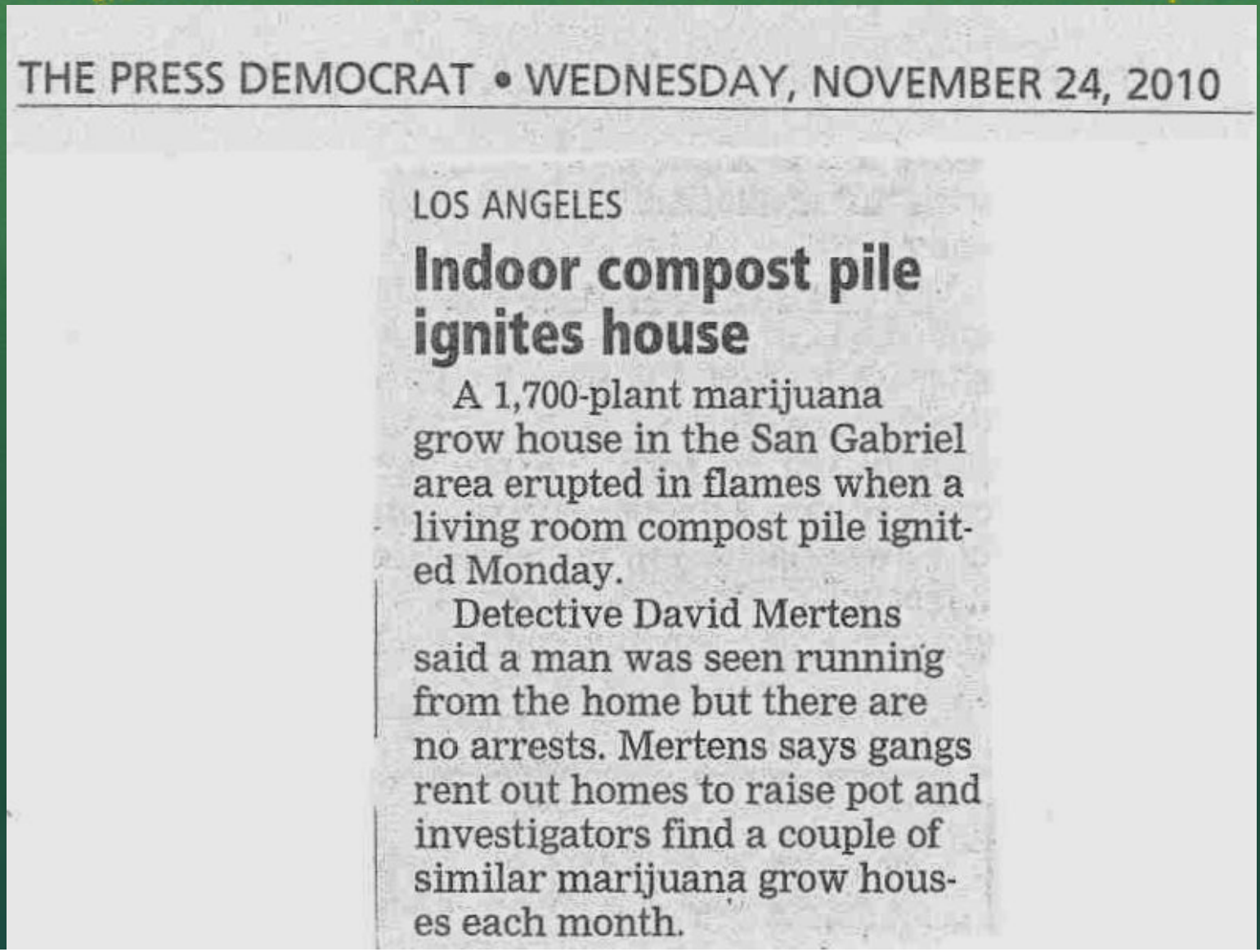
Monitor the Temperature

Monitoring the Compost Pile Temperature

April 22 = 165 F
April 25 = 150 F
April 29 = 135 F

April 22 = 138 F
April 25 = 135 F
April 29 = 115 F

This is not Indore (sir Albert Howard)



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LOS ANGELES

Indoor compost pile ignites house

A 1,700-plant marijuana grow house in the San Gabriel area erupted in flames when a living room compost pile ignited Monday.

Detective David Mertens said a man was seen running from the home but there are no arrests. Mertens says gangs rent out homes to raise pot and investigators find a couple of similar marijuana grow houses each month.

Temperature/Turning Chart

Start Date: 2-25-11 **Windrow: Spring Harvest**

°F/Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	75	76	77
>170					1,2																	
170				2																		
168				1																		
166																						
164																						
162																1						
160										2												
158								1					1	1,2			1					
156				2	1			2		1	1.2		2			2						
154				1	2		1.2										2		2			
152												2			1				1			
150						1			2			1										
148			1.2						1						2			1,2				
146						2														1,2		
144																						
142																						
140																					2	
138		1																				
136																					1	
134		2																				
132																						
130																						1
128																						2
126																						
124																						
122	2	1	2																			
120		2																				
118	1		1																			
116																						
114																						
112																			P			
110																			R			
108																			M			
106																						
104																						
102																						
<102																						
Turn						X			X			X			X			X			X	

How to choose your compost

- Earthy smell
- Lost identity of original material
- Stains fingers black when rubbed
- pH < 8.0
- C:N ratio < 20, <17 preferred
- Stability
- Maturity

Stability

- Stability an expression of microbial activity; How complete is the composting process.
  - Measured by respirometry
    - Carbon Dioxide Evolution (CO_2)
    - Oxygen Uptake (O_2)
    - Dewar (Self-heating test)
    - Solvita (CO_2 and NH_3)
- A compost must be stable before maturity can be assessed

Maturity

- Maturity an expression of how well the compost is cured.
  - Use bioassays (best indicator)
    - Cucumber seedling emergence and vigor
  - Other
    - NH_{4+} to NO_3 ratio Lower number is better
    - pH < 8.0
    - C/N ratio < 20:1

Ask For a Lab Test

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188
www.compostlab.com

Account #: 5060398-1/1-6811
Group: Jun.15 B #31
Reporting Date: July 2, 2015

Sonoma Compost Co.
550 Meacham Road
Petaluma, CA 94952
Attn: Will Bakx

Date Received: 11 Jun. 15
Sample Identification: OHTBD,SF:Jun15
Sample ID #: 5060398 - 1/1

Nutrients-Primary + Secondary	Units	Wet wt. Basis	Dry wt. Basis	TMECC Method
Total Nitrogen:	%	1.4	2.3	4.02-D
Ammonia (NH_4-N):	mg/kg	20	31	4.02-C
Nitrate (NO_3-N):	mg/kg	1300	2100	4.02-B
Organic Nitrogen (Org.-N):	%	1.3	2.1	Calc.
Phosphorus (as P_2O_5):	%	0.45	0.70	Calc.
Phosphorus (P):	mg/kg	2000	3100	4.03-A
Potassium (as K_2O):	%	0.69	1.1	Calc.
Potassium (K):	mg/kg	5700	9100	4.04-A
Calcium (Ca):	%	1.3	2.1	4.05
Magnesium (Mg):	%	0.38	0.60	4.05
Sulfate (SO_4):	mg/kg	1000	1600	4.12-D/IC
Nutrients - Trace elements				
Copper (Cu):	mg/kg	33	52	4.05-Cu
Zinc (Zn):	mg/kg	91	140	4.05-Zn
Iron (Fe):	mg/kg	8300	13000	4.05-Fe
Manganese (Mn):	mg/kg	230	360	4.05-Mn
Boron (B):	mg/kg	22	34	4.05-B
Salts, pH, Bulk Density, Carbonates				
Sodium (Na):	%	0.056	0.088	4.05-Na
Chloride (Cl):	%	0.09	0.14	04.05/IC
pH Value:	units	6.25	NA	04.11-A
Electrical Conductivity (EC5 dw):	mmhos/cm	NA	6.4	04.10-A
Bulk Density :	lb/cu ft	41	26	SCL
Carbonates (as $CaCO_3$) :	lb/ton	4.2	6.6	04.08-A
Organic Matter:	%	27.1	42.8	05.07-A
Organic Carbon:	%	15	24	4.01
Ash:	%	36.2	57.2	3.02
C/N Ratio	ratio	10.4	10.4	calc.
Moisture:	%	36.8	0	3.09
AgIndex	ratio	> 10	> 10	SCL

To Calculate lbs/ton: (%Nutrient) x (20)
To Calculate lbs/ton: (mg/kg Nutrient/10,000) x (20)
To Calculate lbs/cu yd: (%Nutrient/100) x B.D. x 27
To Calculate lbs/cu yd: (mg/kgNutrient/1,000,000) x B.D. x 27

Analyst: Assaf Sadeh

Compost

- In the Soil/**On Top**
- Supplies Nutrients
- Directly Improves Soil Structure
- Conserves Water
- Improves CEC
- Some Erosion Control

Mulch

- On Top of the Soil
- Zero Nutrient Input
- Slow Soil Structure Improvement
- Conserves Water
- No CEC Change
- Reduced Erosion

Mulches

- Aesthetics
- pH
- Coarse to last, resist blowing away
- High C for weed suppression, aggregation
- Water conservation
- Temperature moderation
- Slowly build soil
- Lazy soil preparation (fall)

Thank you
Questions?

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Handouts: https://www.dropbox.com/sh/u5qabw7qtjvmfgo/AACwYlPTQPDvsAbkghScQhbpa?dl=0