AgriLIFE EXTENSION
Texas A&M System
Improving Lives. Improving Texas.

AgriLIFE RESEARCH
Texas A&M System
Improving Life Through Science and Technology.

how to fail miserably at composting large livestock carcasses

brent w. auvermann

burial – the standard option

- an Iowa study showed that:
  - signs of carcass presence persist, and complete decay takes >2 years
  - elevated Cl, TDS, BOD, and NH_4^+ “within or very near” burial zones
- “burial of carcasses is likely to have the greatest impact on water quality of the carcass-disposal techniques discussed”
- in the UK, 24% of incidents of water-quality impair-ment from 2001 carcass-disposal events due to burial in high-water-table areas

why composting instead of burial?

- on-site method for routine, average mortality
- weeks and months instead of years
- above-ground method – remains visible, harder to ignore or pretend “problem solved”
- environmental impact can be seen or smelled rather quickly
- subject to known, controllable risk factors
- land application diffuses environmental risk

why composting instead of burial?

- regulatory tide is turning away from burial (e. g., poultry in Texas)
- persistence of resistant organisms is unknown – ***but the same is true with burial!***

fundamentals

the general idea

- composting involves thermophilic, aerobic microbes

ther•mo•phi•lic

(thûr'mə-fĭl'ĭk) *adj*.

Heat-loving; applied esp. to certain bacteria and fungi

>130F

ae•ro•bic

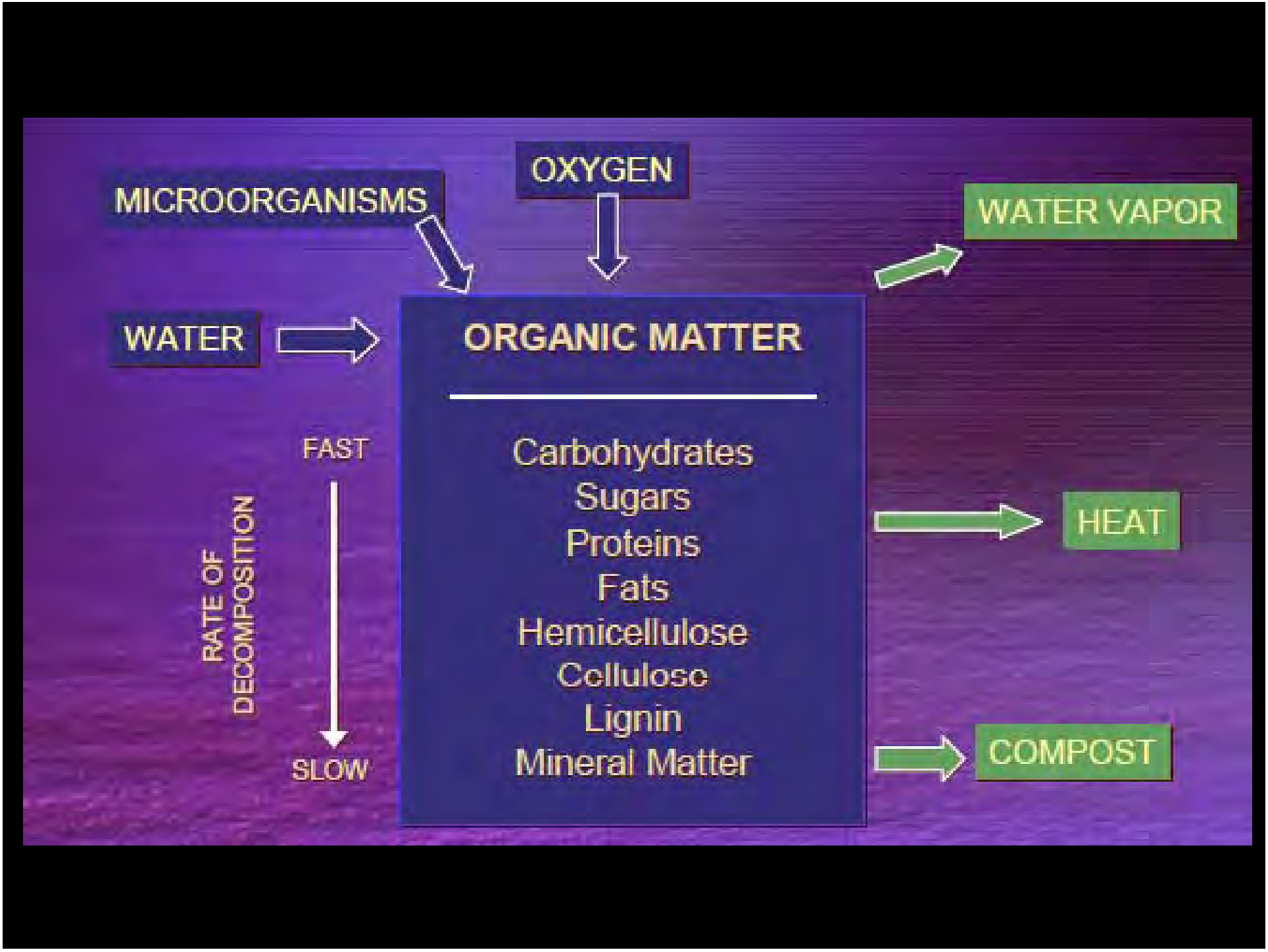
(â-rō'bĭk) *adj*.

Requiring the presence of free oxygen for life

>5% by volume

the general idea

- composting involves thermophilic, aerobic microbes
- failing miserably at composting involves cutting *thermophilic aerobes* off at the knees
- it’s even easier to fail when composting large animals, and the stakes are higher


MICROORGANISMS
OXYGEN
WATER VAPOR
WATER
ORGANIC MATTER
Carbohydrates
Sugars
Proteins
Fats
Hemicellulose
Cellulose
Lignin
Mineral Matter
HEAT
COMPOST
FAST
SLOW
RATE OF DECOMPOSITION

oxygen: a balancing act

- lots of air keeps the aerobes happy
- too much air…
  - dries out the pile
  - drains heat from the pile
- too little air makes the aerobes less competitive, and the anaerobes begin to take over
  - an•ae•ro•bic (ān'ə-rō'bĭk) *adj*. Living or active in the absence of free oxygen

oxygen: a balancing act

- oxygen management is a matter of:
  - materials selection (porosity)
  - forced vs. passive aeration
  - pile construction
  - moisture control

moisture: a balancing act

- water keeps the microbes' food available, mobile
- too little water starves the microbes
- too much water fills the pore space, excludes oxygen, and favors anaerobes
- a wet pile takes longer to warm up
- livestock carcasses contain a lot of water
- our favorite microbes function most efficiently between 35% and 60% moisture, depending on the materials

moisture: a balancing act

- materials selection
  - porosity
  - absorbance
- water addition
- pile construction
  - shape
  - compaction
- drainage and runoff control

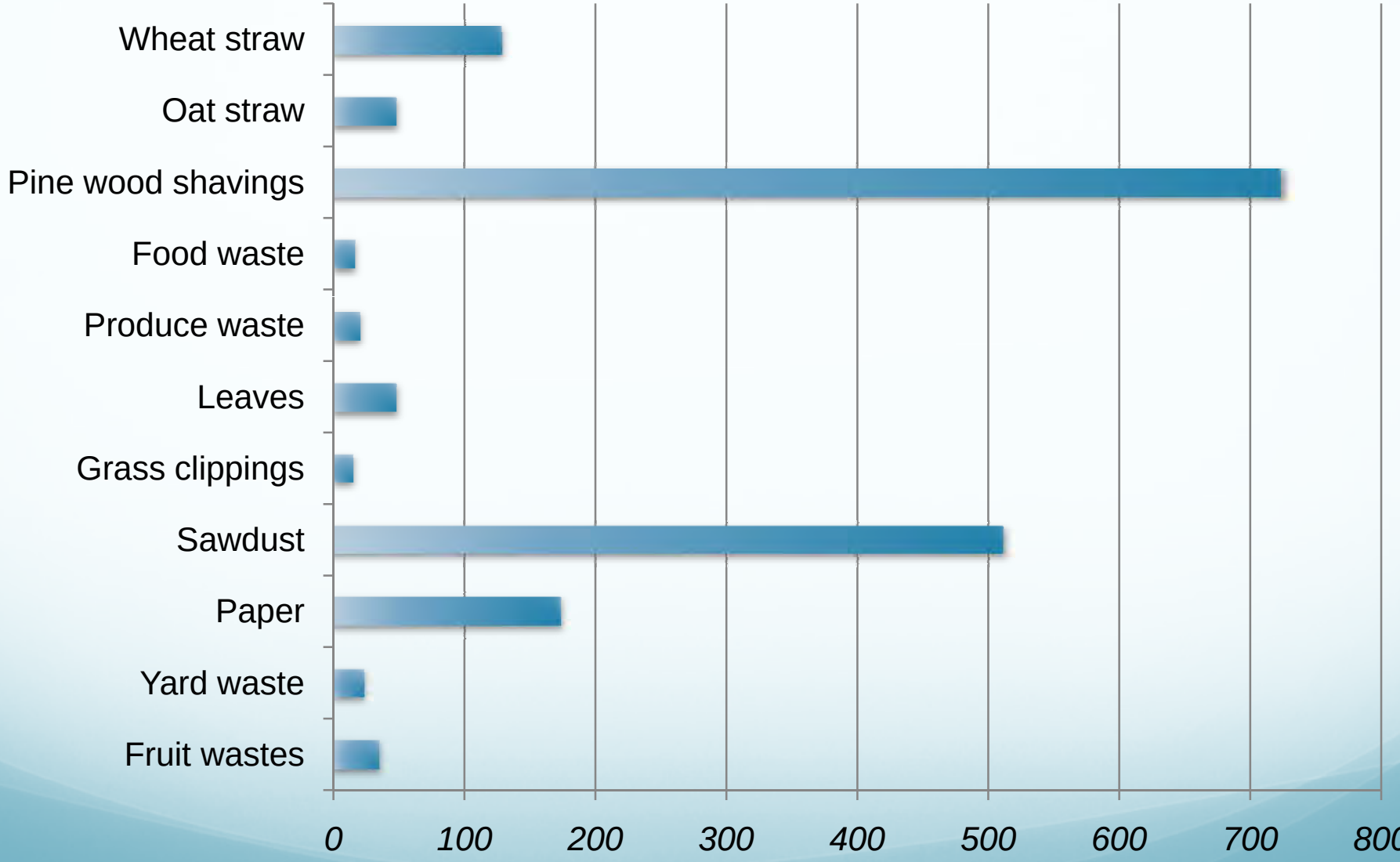
protein and carbs: a balancing act

- roughly speaking:
  - protein=digestible nitrogen (N)
  - carbs=digestible carbon (C)
- an Atkins Diet™ is a great way to mess up a compost pile
  - low C:N ratio (<20:1)
  - manure C:N is typically between 10:1 and 15:1
  - carcass C:N can be less than 10:1
  - bugs run out of C (energy) before they run out of N
  - excess N flashes off primarily as NH_3

protein and carbs: a balancing act

- “carbo loading” is ok, but…
  - high C:N ratio (>40:1)
  - gin trash C:N is typically >40:1
  - sawdust (!) C:N can approach 500:1
  - ground hay, lawn trimmings, waste beets, horse-stall bedding, pasta, rice, etc.
  - carcass C:N can be less than 10:1 but is always low
  - bugs run out of N before they run out of C
  - not all carbon is created equal
- our favorite bugs like it between 20:1 and 40:1
- don’t be a Pharisee about it!

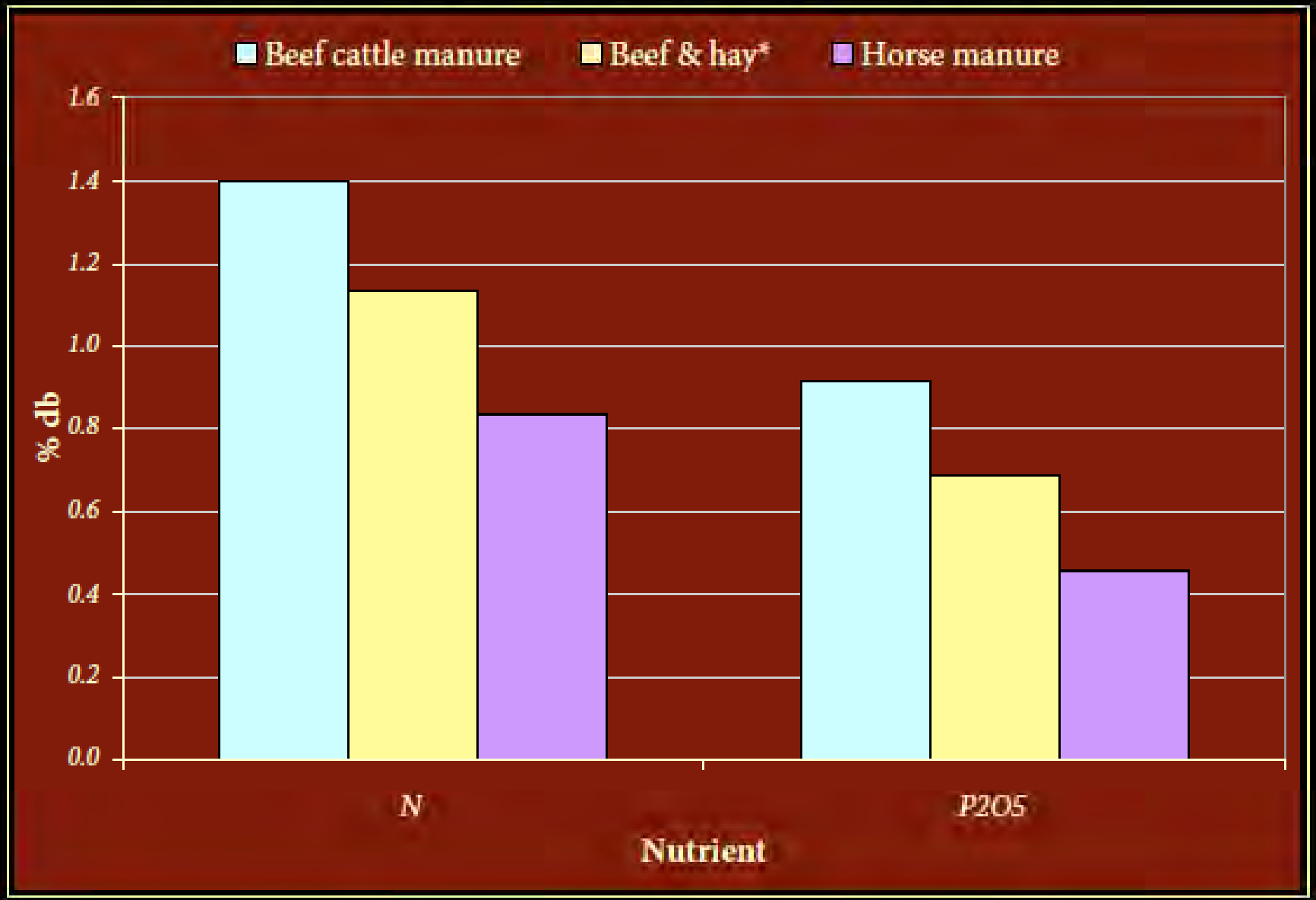
Typical C:N Ratios



C:N Ratios of Some Carbon Sources

Feedstock	N (%db)	C:N Ratio	C (%db)
Fruit wastes	1.5	35	52.5
Yard wastes	1.3	23	29.9
Paper	0.3	173	51.9
Sawdust	0.1	511	51.1
Grass clippings	3.7	15	55.5
Leaves	0.9	48	43.2
Produce waste	2.2	20	44.0
Food wastes	3.2	16	49.9
Pine wood shavings	0.1	723	72.3
Oat straw	1.1	48	52.8
Wheat Straw	0.3	128	38.4

Nutrient Composition of Feedstocks



time for a short snack break

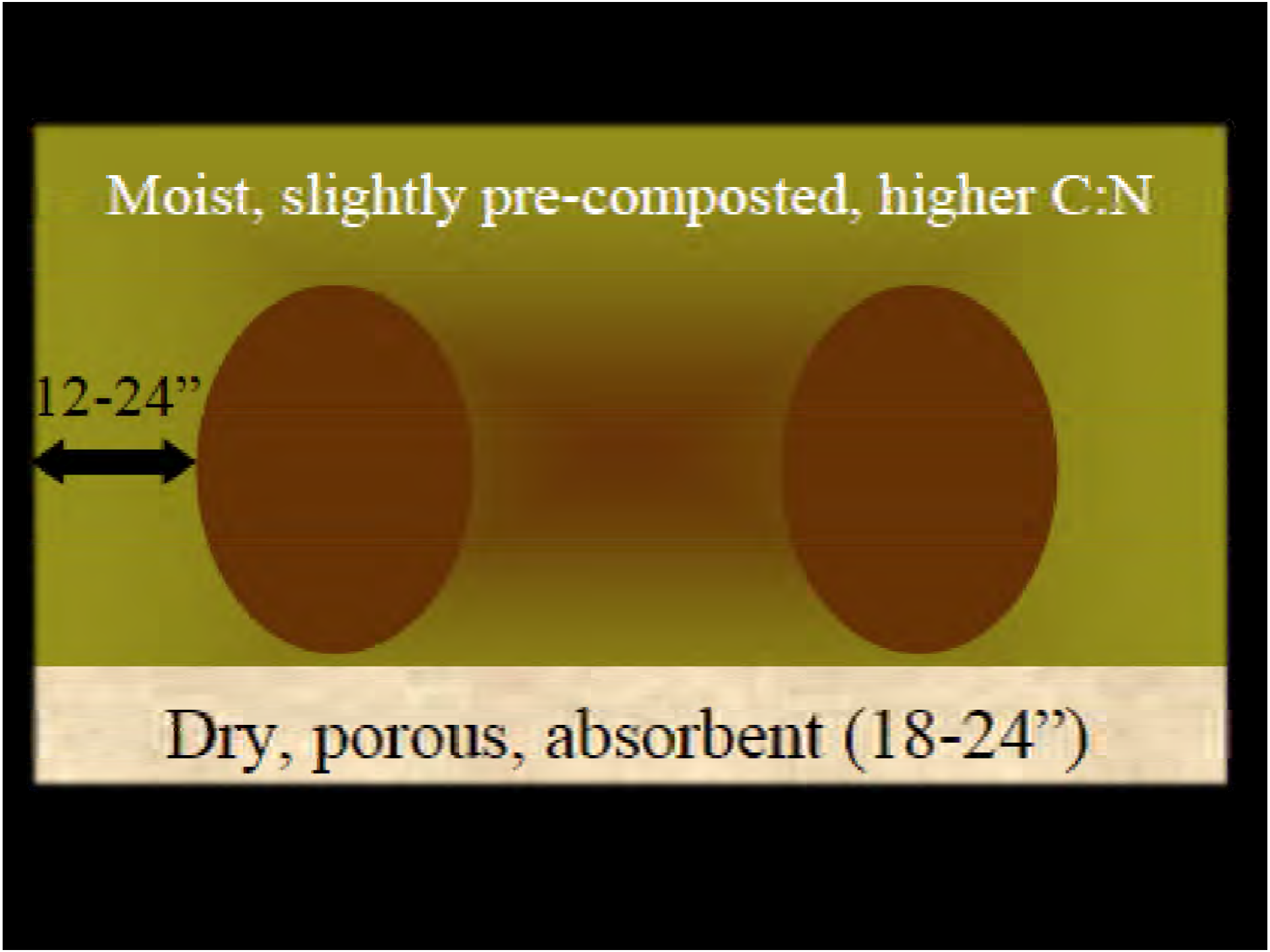
management ideas

building the pile

- location, location, location
  - **IF YOU ARE AN AFO: WITHIN THE RCS DRAINAGE AREA ONLY!**
  - out of sight
  - away from public roads
  - upslope a ways – out of drainage ditches
  - surround it with trees? $60 buys enough saplings from TFS to do it right
  - runoff and leachate control: berm, VFS, grass WW
  - divert rainfall runoff away from pile area
  - windrows up and down slope; don't trap runoff within pile area
  - supplemental water close by and accessible

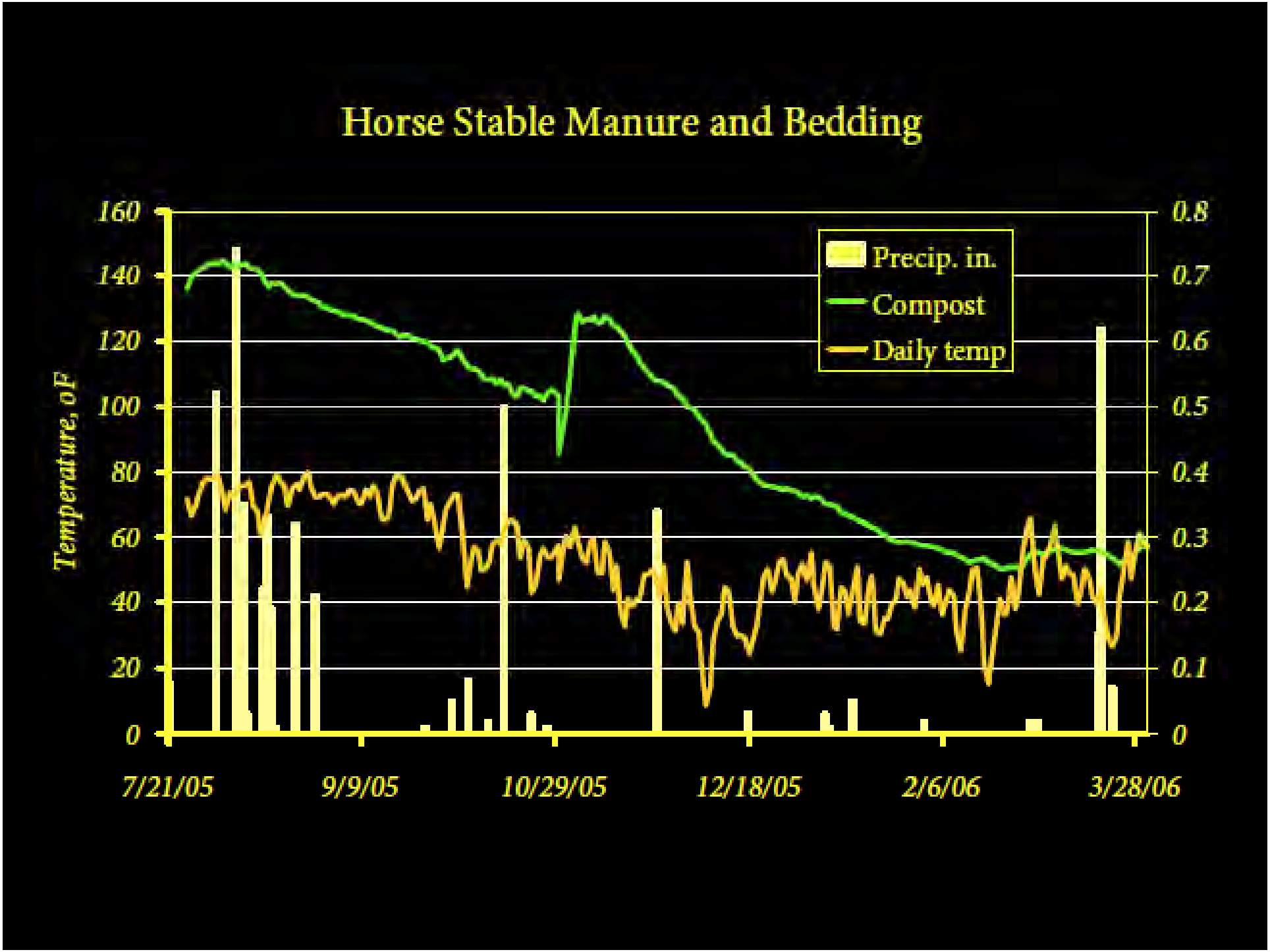
building the pile

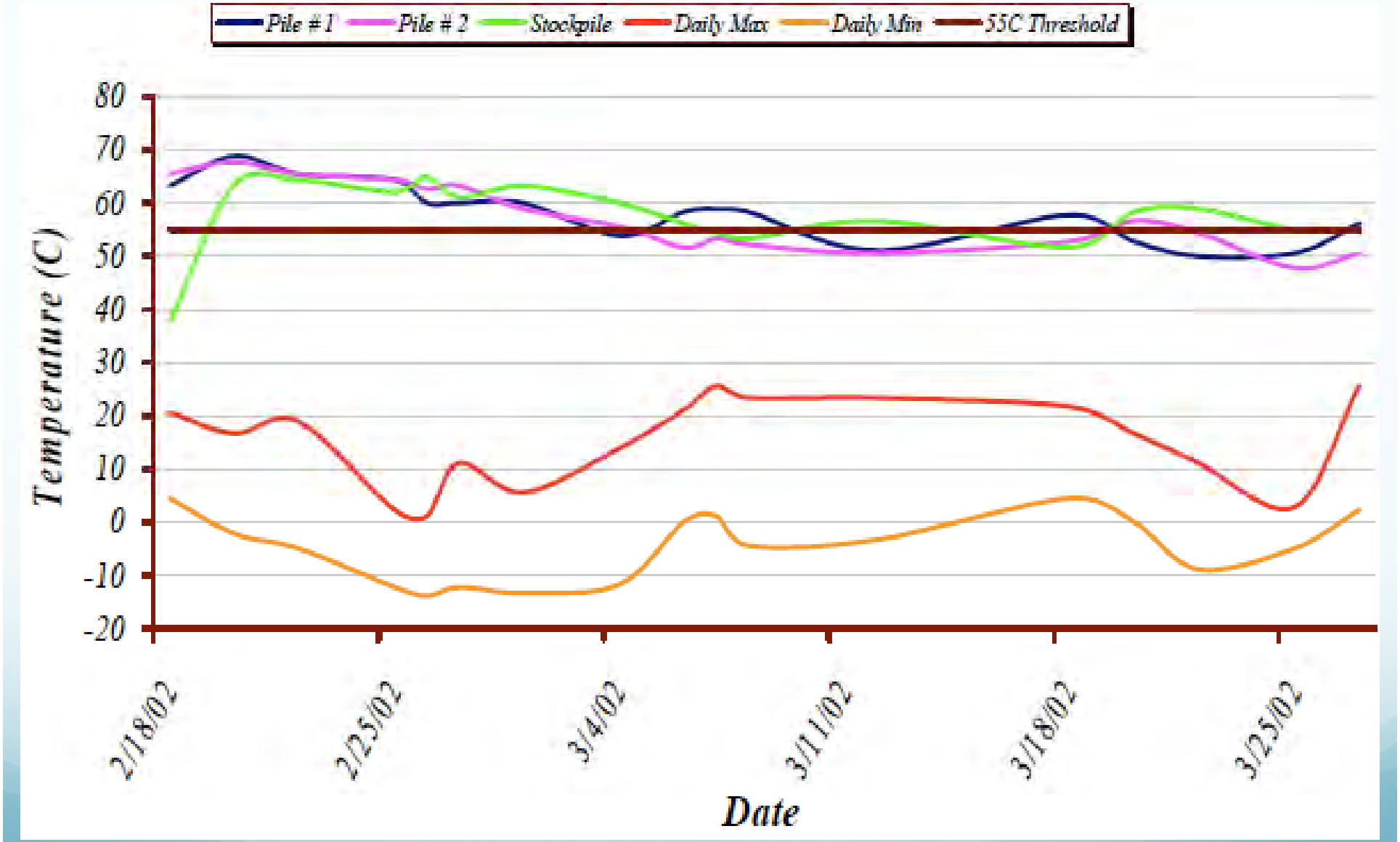
- get the process started before carcasses are available
  - at least two stockpiles close by
    1. dry, carbonaceous, absorbent material
    2. premixed composting material
       - at least one C source
       - mixed with at least one N source (manure is good)
       - mixed with enough water to start composting on its own
    3. optional: compost from previous piles
  - a few pictures are worth a thousand words


Moist, slightly pre-composted, higher C:N
12-24”
Dry, porous, absorbent (18-24”)

pile temperature: a balancing act

- core temperature >130F
  - long-stemmed thermometer is the #1 diagnostic tool
  - should reach 100F within 12-48 hours and continue rising
  - one measurement is never enough – 3 to 5 per carcass
- don’t let it exceed 160F


Horse Stable Manure and Bedding
Temperature, oF
160
140
120
100
80
60
40
20
0
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Precip. in.
Compost
Daily temp
7/21/05
9/9/05
10/29/05
12/18/05
2/6/06
3/28/06


Pile # 1
Pile # 2
Stockpile
Daily Max
Daily Min
55C Threshold
80
70
60
50
40
30
20
10
0
-10
-20
Temperature (C)
2/18/02
2/25/02
3/4/02
3/11/02
3/18/02
3/25/02
Date

what if the animal was a downer?

DON’T compost animals you suspect were killed by strongly zoonotic or prion-based diseases. Call the animal-health authorities.

should i open up the carcass?

in general, yes; it will accelerate decomposition a little bit.

if the animal is “ripe,” use buckshot; if not, use a knife.

can i use 100% manure as my compost material?

yes, of course, but recognize that you will need to manage the piles more attentively.

err on the dry side.

can i re-use compost in a new pile?

yes, up to about 50% of the cover material.

how often should i turn the pile?

it depends on the weight of the carcass.

for anything larger than a beef yearling, wait 4 months before the first turning; for a fat beef, a quarter horse, or a dairy animal, wait 6.

let temperatures be your guide.

do i need to worry about varmints?

keep at least a foot of cover material between the air and all points on the carcass.

preferably more than a foot.