

Feedstocks and Recipes

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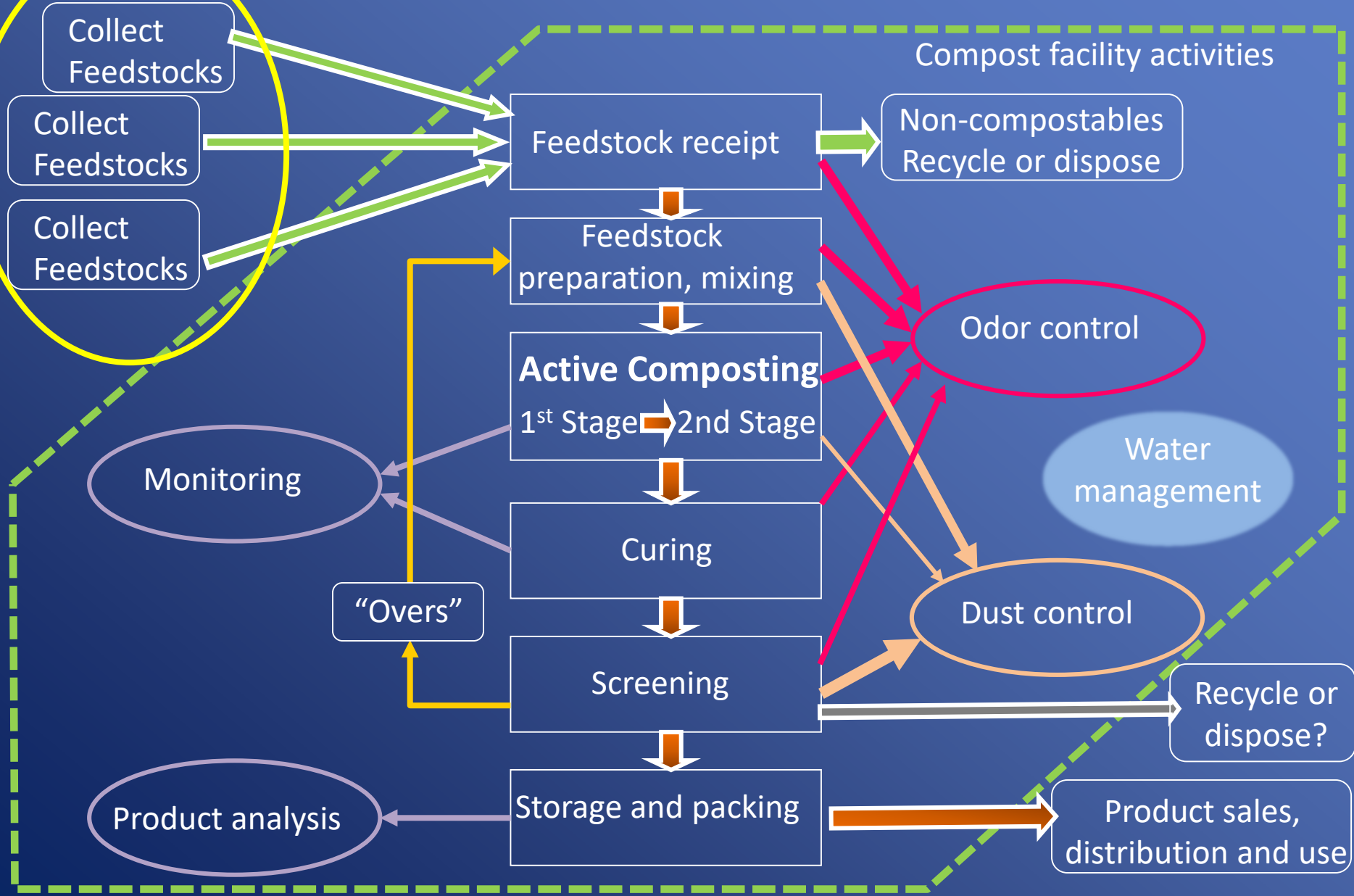
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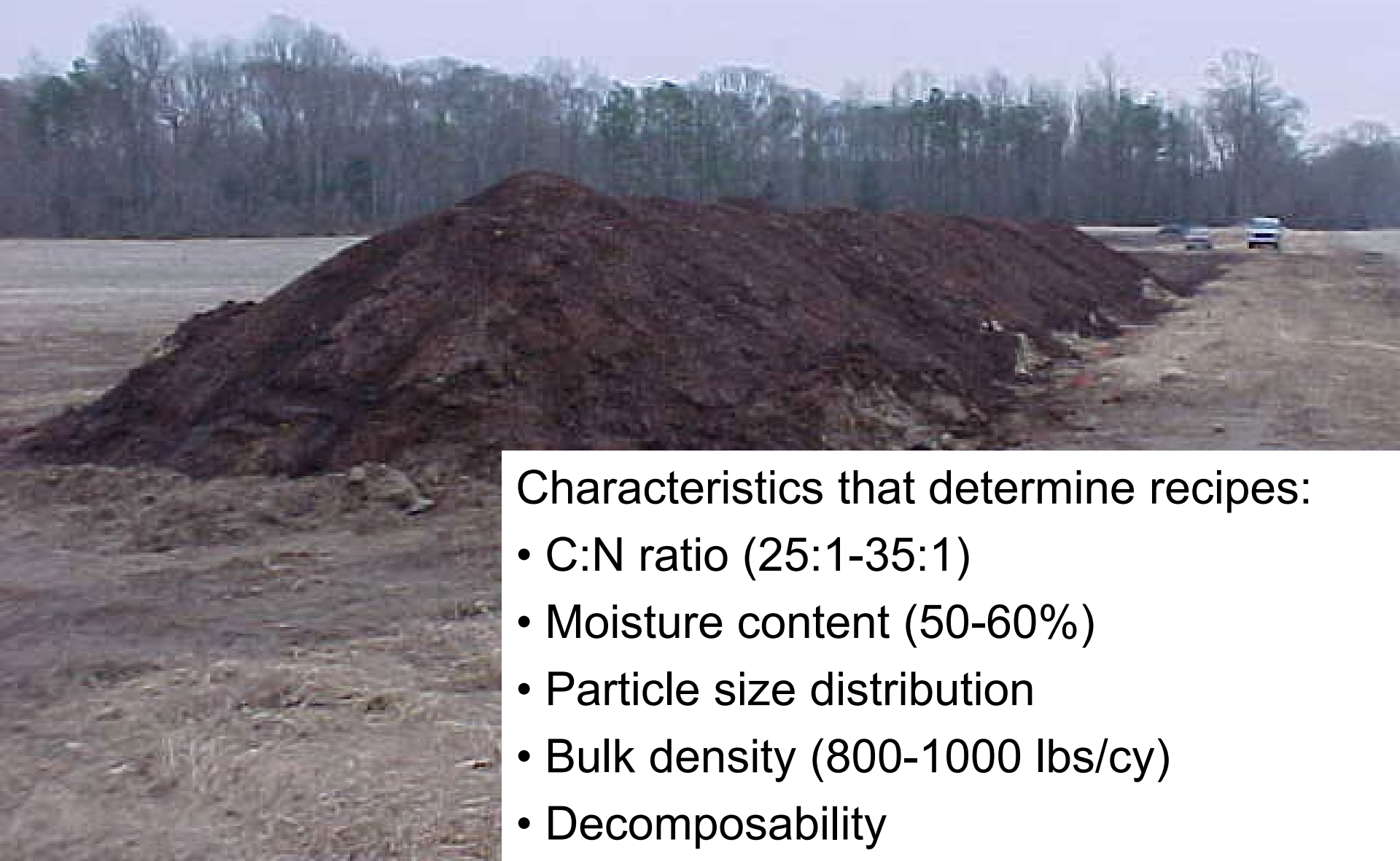
Confined Animal Manure Managers Workshop

January 16, 2020

Flow of materials and activities at the compost facility



Feedstocks



Characteristics that determine recipes:

- C:N ratio (25:1-35:1)
- Moisture content (50-60%)
- Particle size distribution
- Bulk density (800-1000 lbs/cy)
- Decomposability



Solids



Semi-solids



Liquids



Bulking agents



Amendments

Feedstock Types

Feedstocks Parade



US Composting
Council®



Grass





Woody waste



Food residuals

A large pile of food waste and packaging, including vegetables, fruits, and plastic containers, illustrating food residuals. The waste is piled high, showing a variety of items such as leafy greens, tomatoes, oranges, and plastic bags, all mixed together in a dark container.



Meat and Fish Residuals



04/22/2010

Liquids (beverages)







Dairy



Horse

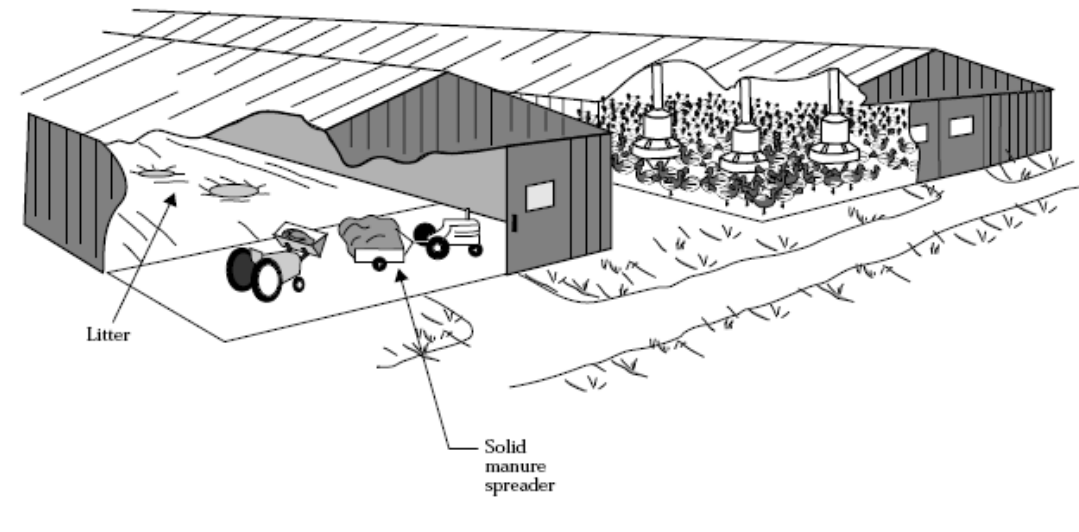
Livestock Manure



US Composting
Council®



Figure 9-20 Litter system for broilers and turkeys



Poultry Manure



Straw



Cranberry Processing





Biosolids
aka: sewage sludge

Wet or putrescible feedstocks require special handling

- HANDLE PROMPTLY
- COVER IT
- Contain it
- Add porosity
- Manage moisture



Mix ingredients together to create a better balance

Dry Leaves

High C

Dry

Bulky

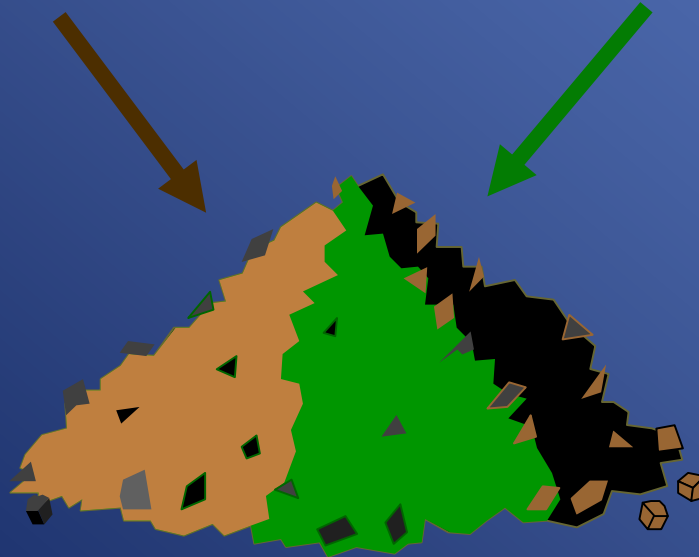
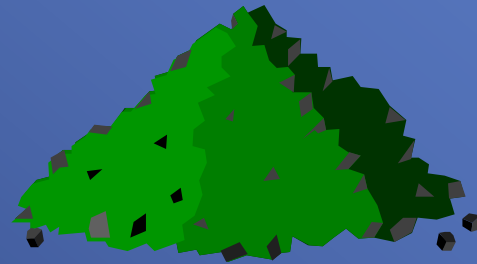


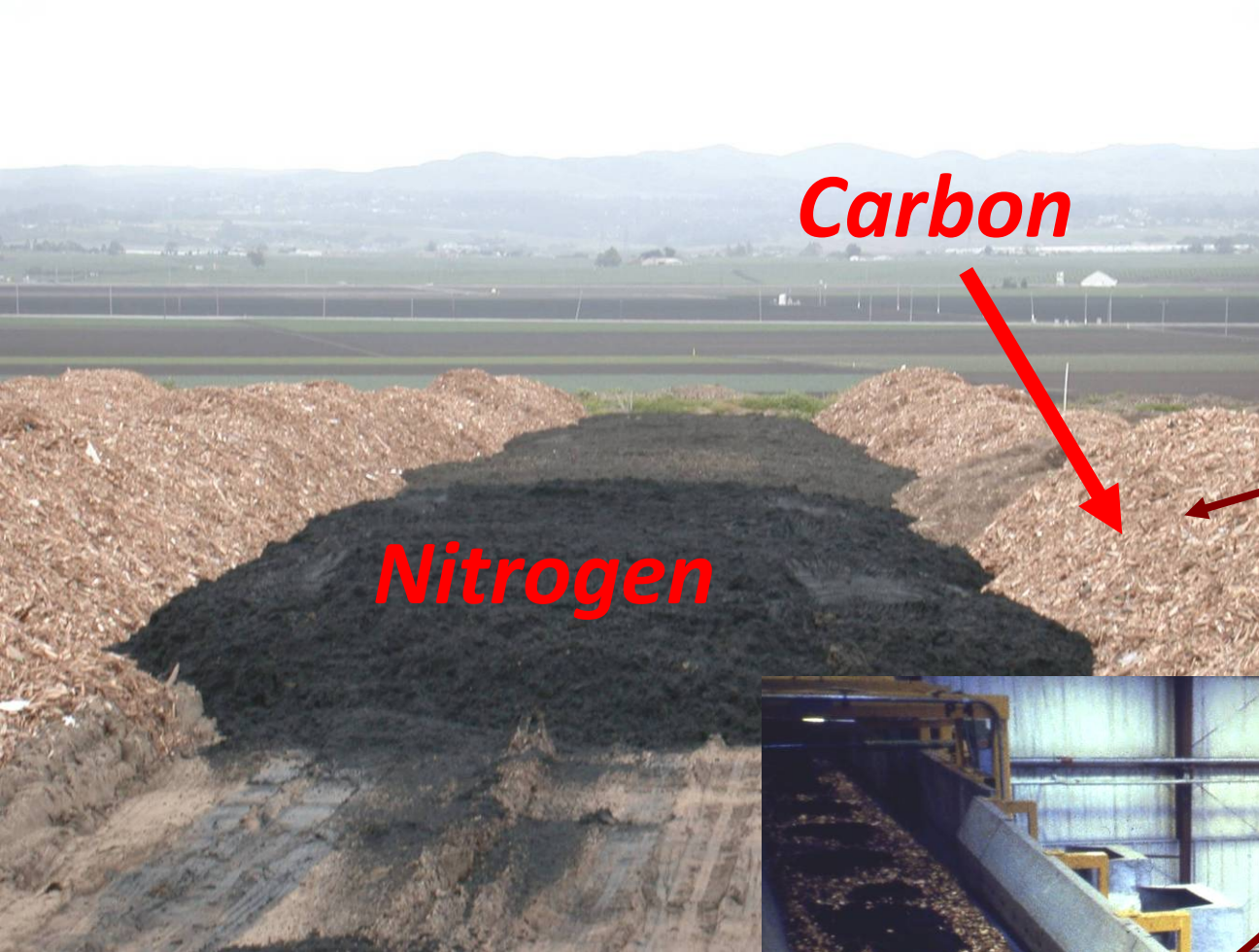
Grass

High N

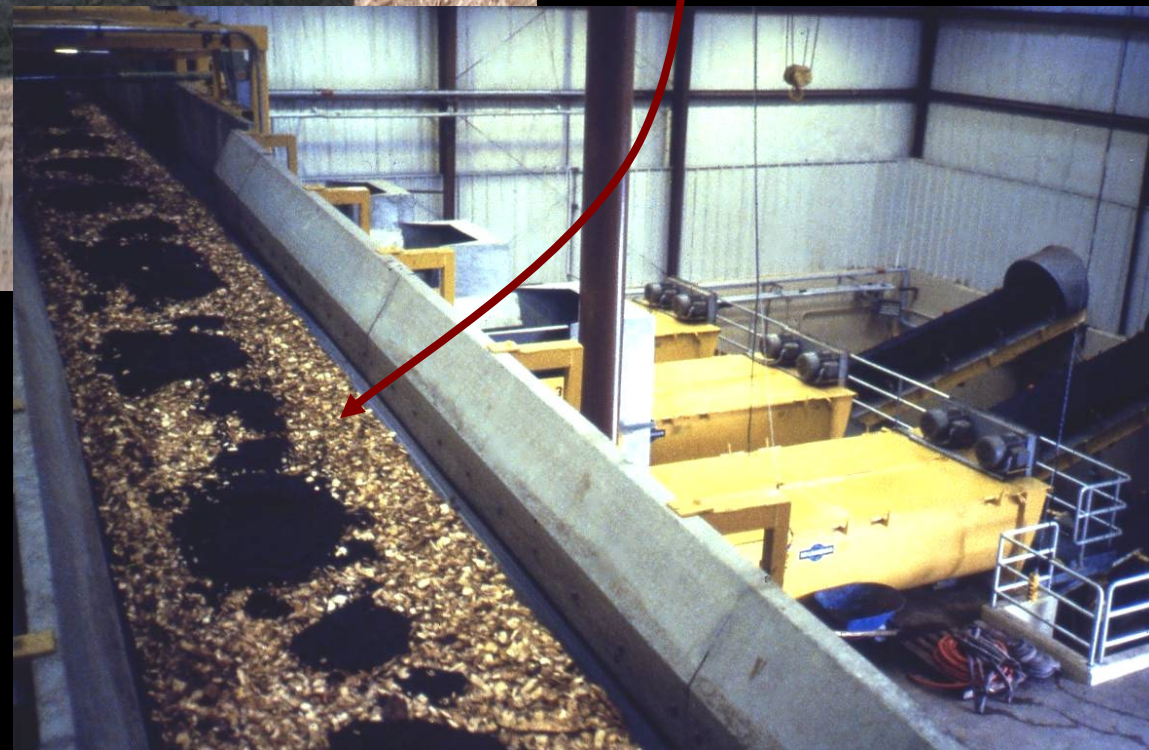
Wet

Dense





Bulking agent



Measuring Bulk Density



Feedstock Analysis Example, fresh cow manure

Variable	Unit	Dry basis	"As is" basis	/ton, "as is"
Density	lbs/cy	245	1440	
Solids	%	100	17.1	342 lbs
Moisture	%	0	82.9	199 gals
pH			8.23	
EC	dS/m		3.8	

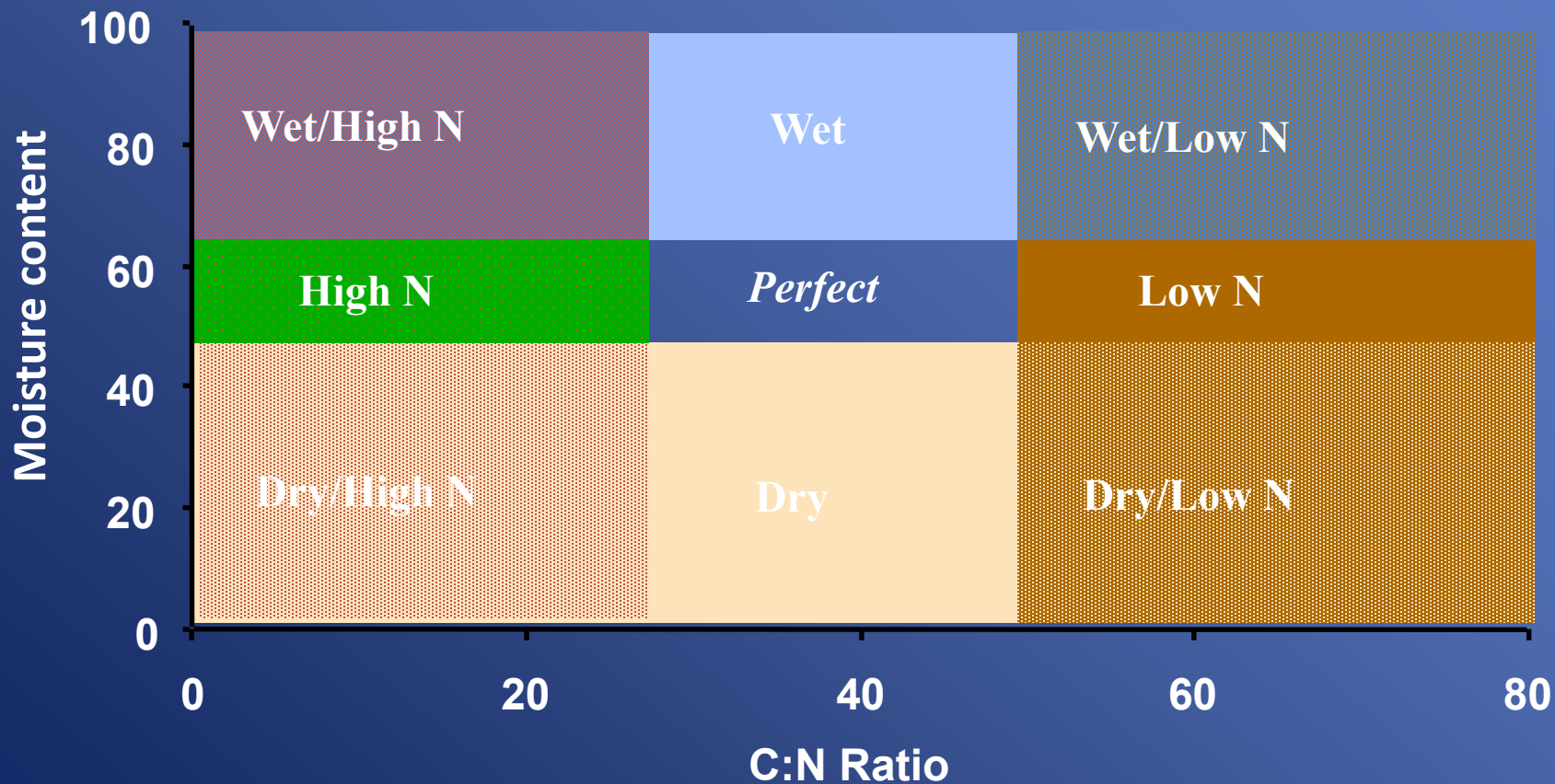


Feedstock Analysis Example, fresh cow manure

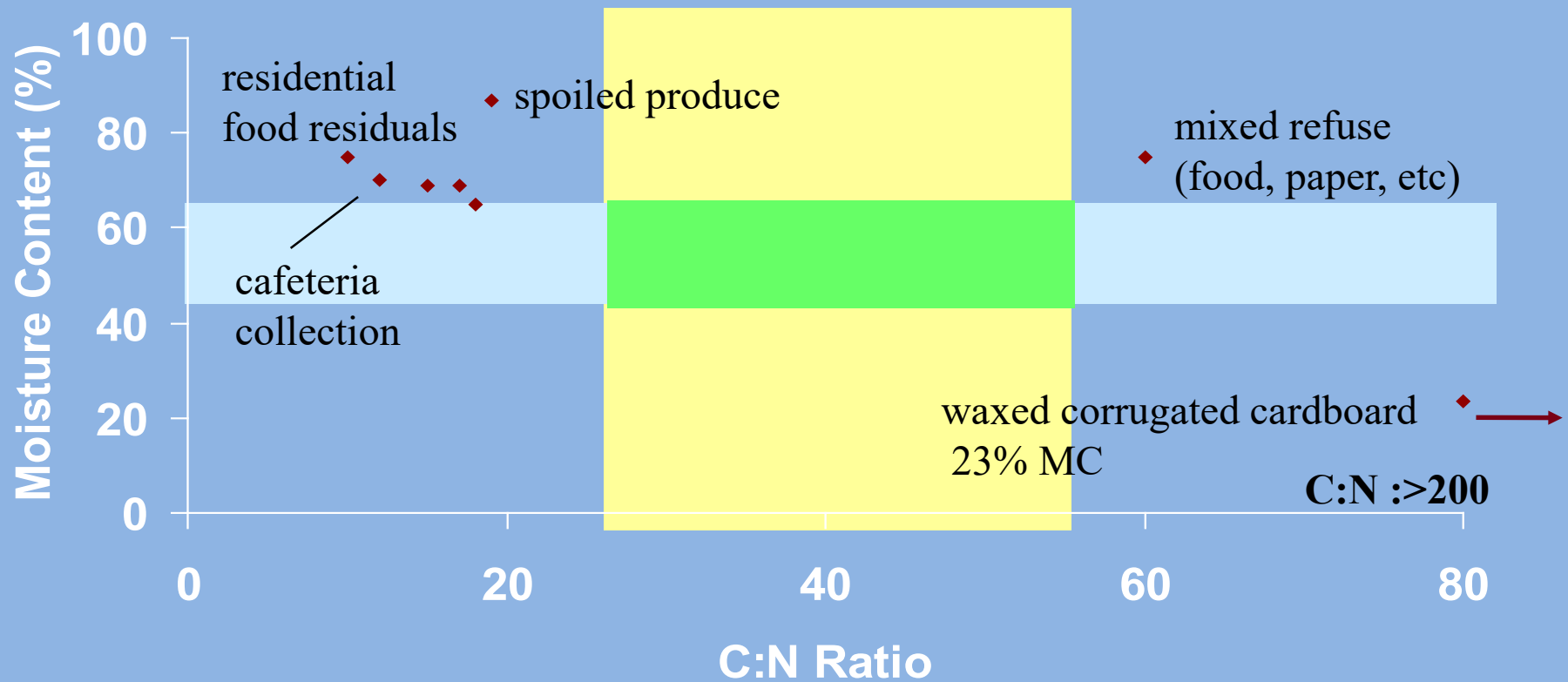
Variable	Unit	Dry basis	"As is" basis	/ton, "as is"
OM	%	84.6	14.5	289 lbs
C	%	49.1	8.40	168 lbs
Tot N	%	1.67	0.286	5.7 lbs
C:N	w:w	29.3	29.3	



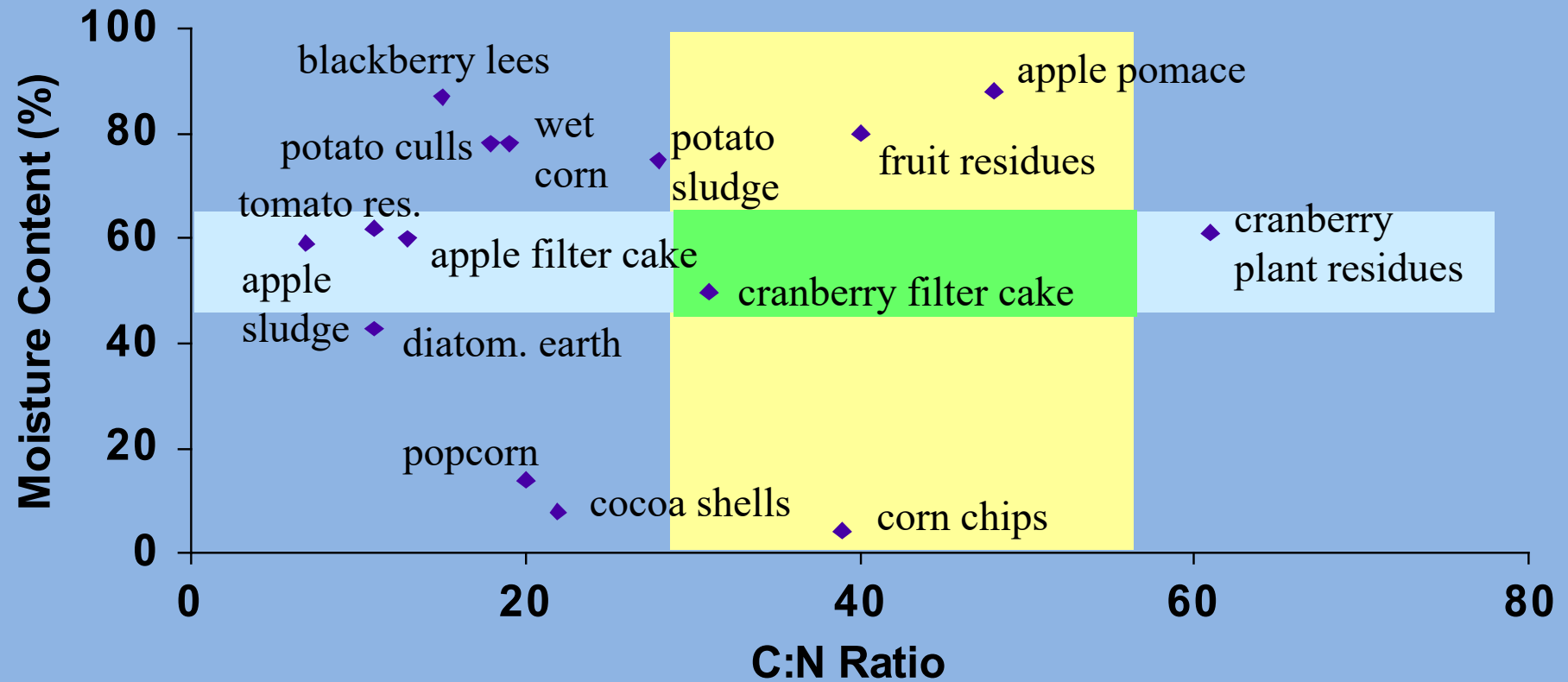
Balancing Moisture & C:N Ratio



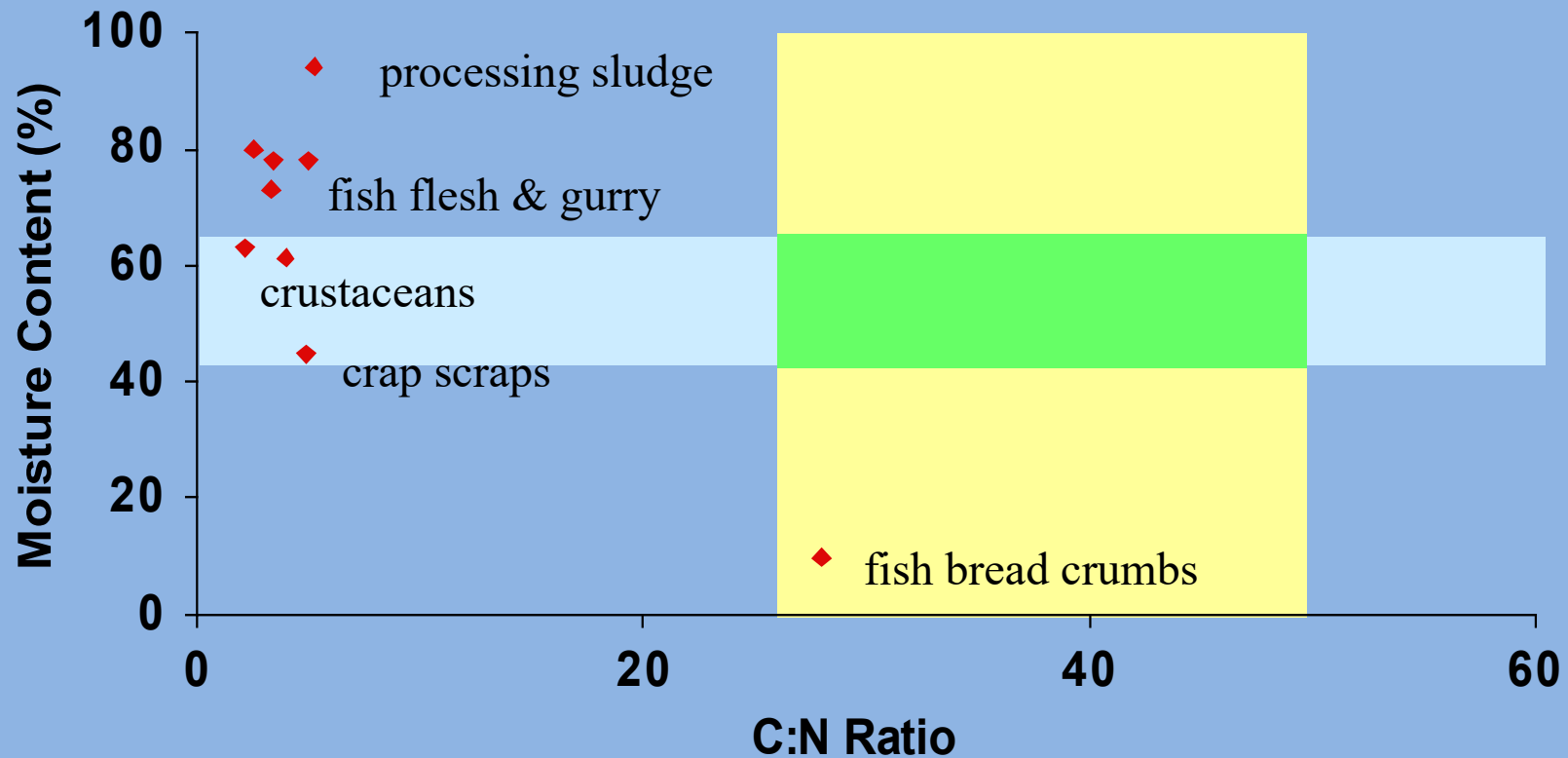
Commercial & Residential Food Residuals



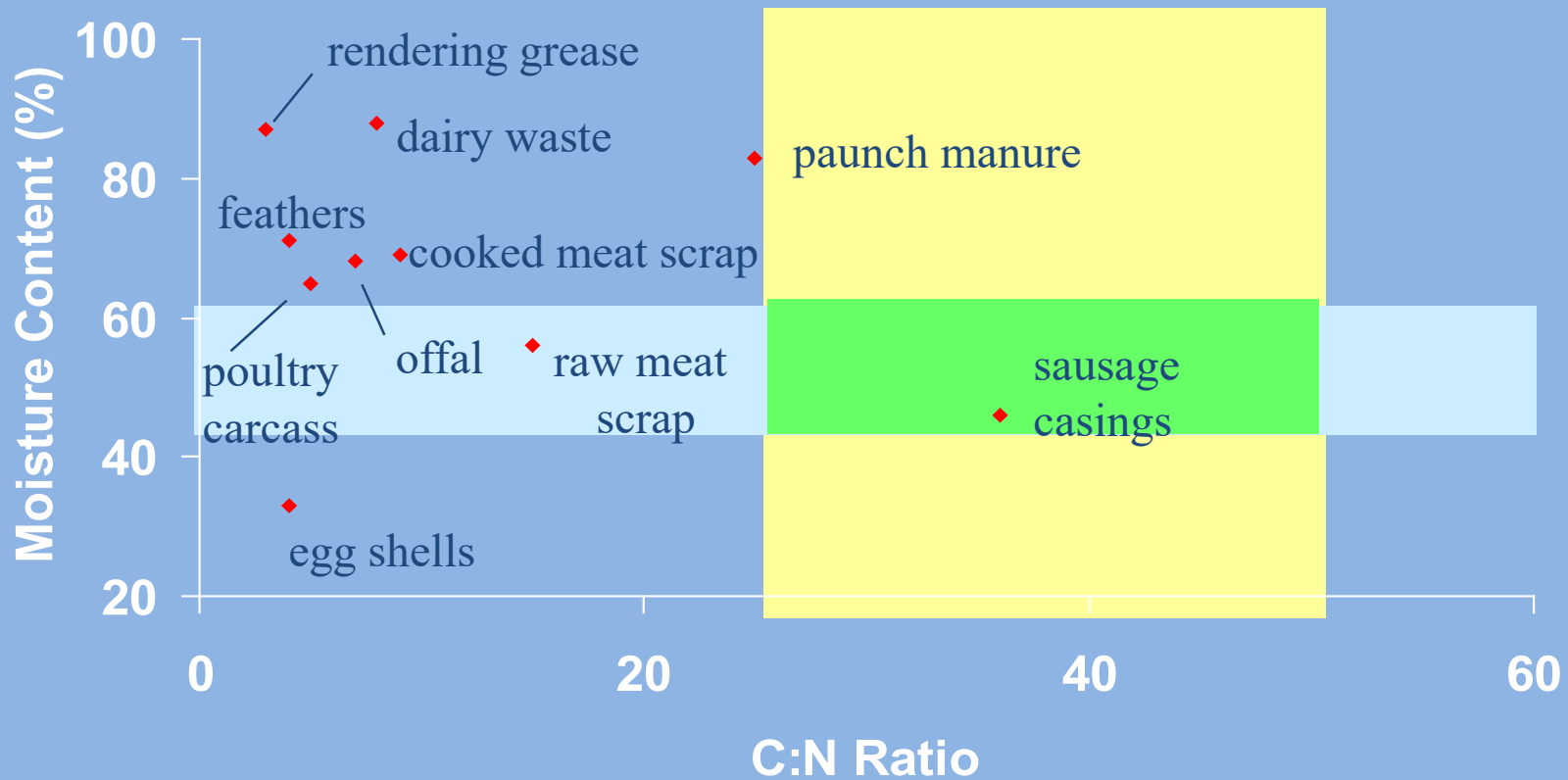
Fruit & Vegetable Processing Residuals



Fish & Seafood Processing Residuals



Meat, Poultry & Dairy Processing Residuals





Mathematically Balancing

Moisture & C:N Ratio



Balancing Moisture & C:N with only 2 Ingredients

- Formulas for direct calculation
- Moisture:

$$A = (m_B - M) \div (M - m_A)$$

A = amount of A needed per unit weight of B

M = target moisture content

m_A and m_B = moisture contents of A and B
respectively

EXAMPLE: Balancing Moisture with 2 Ingredients

- Target moisture (M) = 55%
- Mixed YT (A): $m_A = 42\%$
- Produce (B): $m_B = 85\%$

$$A = (m_B - M) \div (M - m_A)$$

$$A = (85 - 55) \div (55 - 42) = 20/13 = 1.54$$

Need about 1.5 lbs of YT per 1 lb. of produce to get a moisture content of 55%.

Now go figure the C:N ratio.

Balancing C:N with only 2 Ingredients

- Formula:

$$A = \frac{\%N_B}{\%N_A} \times \frac{(R-R_B)}{(R_A-R)} \times \frac{(1-m_B)}{(1-m_A)}$$

A = amount of A needed per unit weight of B

$\% N_A, N_B$ = nitrogen percent of A and B on a dry wt basis

R, R_A, R_B = C:N Ratio of Target, A and B

m_A, m_B = moisture contents of A and B

What about more than 2 ingredients?

- Sorry ... you're out of luck
- More than 2 → its trial and error
- → repeated calculations until you get it right



Determining Moisture Content of a Mix

$$MC_w = \frac{\text{Water in A} + \text{Water in B} + \text{Water in C} + \dots}{\text{Weight of A} + \text{Wgt of B} + \text{Wgt of C} + \dots}$$



Determining C:N Ratio of a Mix

$$\text{C:N} = \text{Total C in all} \div \text{Total N in all}$$

Carbon* in A + Carbon in B + Carbon in C +

Nitrogen* in A + Nitrogen in B + Nitrogen in C +

** Weight of C and N*



That's what computer programs are for!

- Excel spreadsheet with look-up tables

Composting Feedstocks Recipe By WEIGHT Proportions							
Ingredients	Weight Proportion	Moisture Content	Dry Weight	C:N ratio	% N	% C	Bulk Density (lbs/CY)
Ground Newsprint	1.00	10.00	0.90	450.00	0.13	58.50	150
Leaves	3.00	40.00	1.80	48.00	1.00	48.00	250
Grass clippings	2.00	75.00	0.50	18.00	2.50	45.00	500
Seaweed	0.50	55.00	0.23	20.00	1.50	30.00	900
Brush	0.00	30.00	0.00	90.00	0.50	45.00	400
Mix	6.50	47.31	3.43	48.02	1.02	49.14	



Edit Recipe

Recipe Name:

Sample Farm Recipe

Manure, Dairy Cow

4 tons

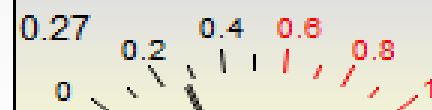
Straw

2 tons

Wood Chips, Softwood

2 tons

Recipe Totals



Bulk Density



Moisture



Available C:N Ratio

00000008

Total (tons)



Save

Cancel