Composting Turkey Brooder Litter in South Carolina: A Case Study

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What is the difference between a turkey grow-out barn and a brooder barn?

How is brooder litter different from grow-out litter?

Brooder litter vs Grow-out Litter

	Brooder Litter	Grow-Out Litter
Moisture	14.5%	26.5%
F_{DM}	0.855	0.735
Bulk Density	22 lb / ft^3	30 lb / ft^3

Brooder Litter vs Grow-Out Litter

	Brooder Litter		Grow-Out Litter	
	lb/ton	lb/TDM	lb/ton	lb/TDM
TAN	2.60	3.04	12	16.3
Org.-N	37.22	43.55	42	57.1
NO_3-N	0.51	0.60	0.3	0.4
TN	40.34	47.19	54.3	73.8
P_2O_5	29.33	34.31	64	87.1
K_2O	20.37	23.83	39	53.1

Plant Available N (PAN)

$$\text{PAN} = A_f\,\text{TAN} + m_f\,\text{Organic-N} + \text{Nitrate-N}$$

- Brooder Litter

  PAN (incorp) = 24.9 lb /ton

- Grow-out Litter

  PAN (incorp) = 35.1 lb /ton

Turkey brooder litter contains 29% less plant available nitrogen than grow-out litter.

Application & Transportation Costs (ATC)

$$ATC = (C_P + C_A) \times MAR$$

- C_P = purchase & transportation cost, $/ton
- C_A = application cost, $/ton
- MAR = Material application rate, tons per acre

Combined transportation and application costs for brooder litter are about 70% greater than grow-out litter.

If the nutrient management plan requires moving litter significant distances from the farm, then poult producers are at an economic disadvantage.

Objectives

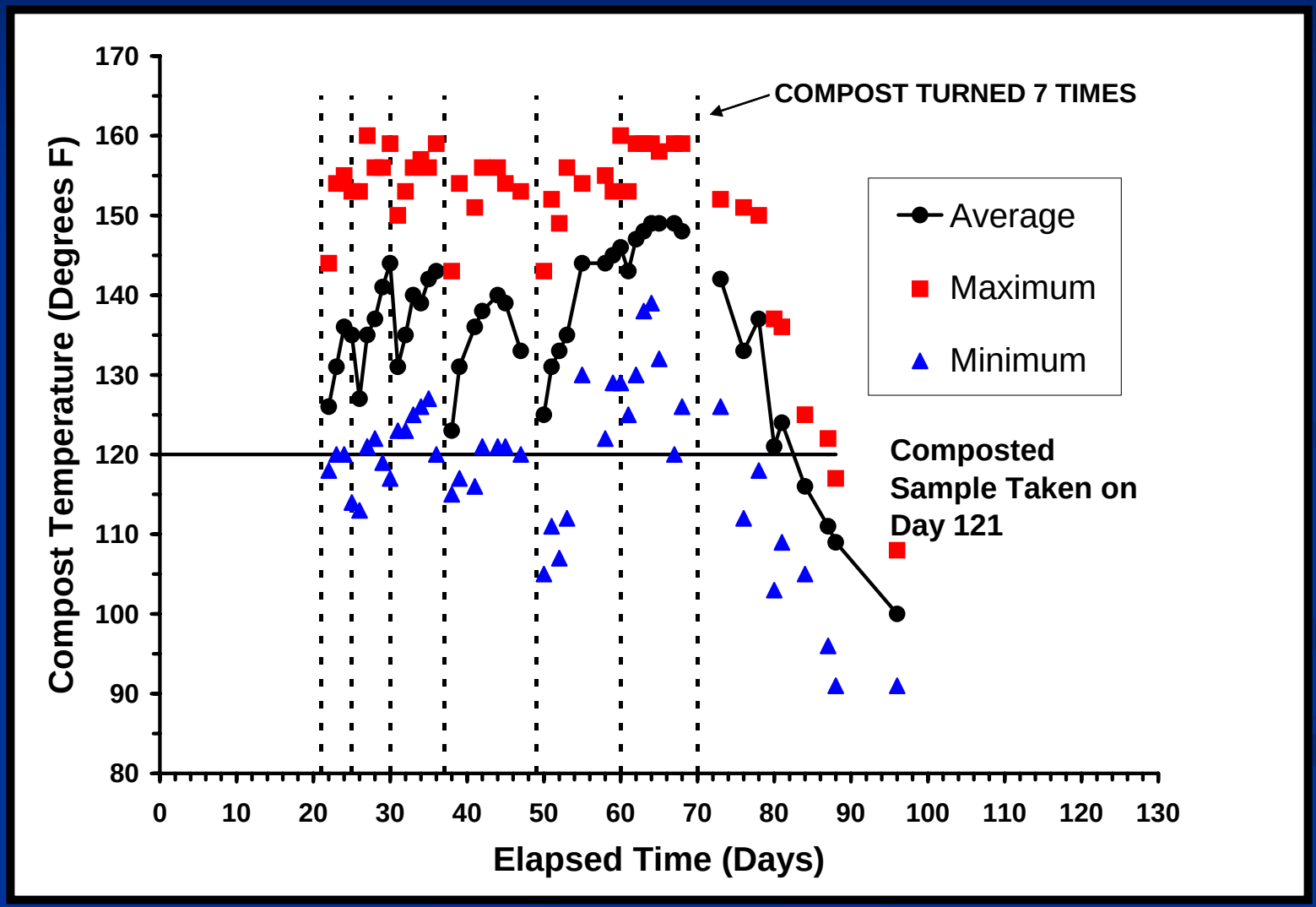
- Determine the nutrient, solids, carbon, and ash content of brooder litter.
- Determine C:N and moisture content of brooder litter.
- Observe maximum, minimum, and average composting temperatures.
- Evaluate quality of finished compost.

Composting Shed & Water System

Final Curing in an Open Windrow

Temperature measurements began 21 days after composting began.

Composting Temperature History



Temperatures Met Lethality Requirements

- Average compost temperature was 138 degrees °F for 59 days.

- EPA (SCDHEC) standards for pathogen reduction require:
  - 128 °F for 5 days,
  - 131 °F for 2.6 days, or
  - 158 °F for 30 min.

Brooder Litter vs Compost

	Brooder Litter	Compost
Moisture	14.5%	51.0%
F_{DM}	0.855	0.490
C:N	**22**	**23**
Change in C:N is NOT a good indicator of compost quality!		

Carbon Dioxide Evolution Rate

- A measure of the microbial activity in compost.
- Used as an index for compost quality.
- Test performed on a sample sent to Penn State University.

Carbon Dioxide Evolution Rate

- **Result: 0.2 g CO_2-C/g organic matter / day**

- U.S. Composting Council Test states that…

  Carbon Dioxide Evolution Rate < 2

  - **No odor**
  - **Very stable, well cured compost**
  - **No VFA phytotoxicity**

Finished compost had a nice dark color.

Brooder Litter vs Compost

	Brooder Litter		Compost	
	lb/ton	lb/TDM	lb/ton	lb/TDM
TAN	2.60	3.04	2.20	4.48
Org.-N	37.22	43.55	7.99	16.29
NO_3-N	0.51	0.60	0.59	1.19
TN	40.34	47.19	10.77	21.97
P_2O_5	29.33	34.31	10.66	21.74
K_2O	20.37	23.83	6.73	13.73

Effect of Composting on Major Nutrient Concentrations

	Change in Dry Matter Concentration
TAN	+ 47%
Org.-N	- 63%
NO_3-N	+ 98%
TN	- 53%
P_2O_5	- 37%
K_2O	- 42%

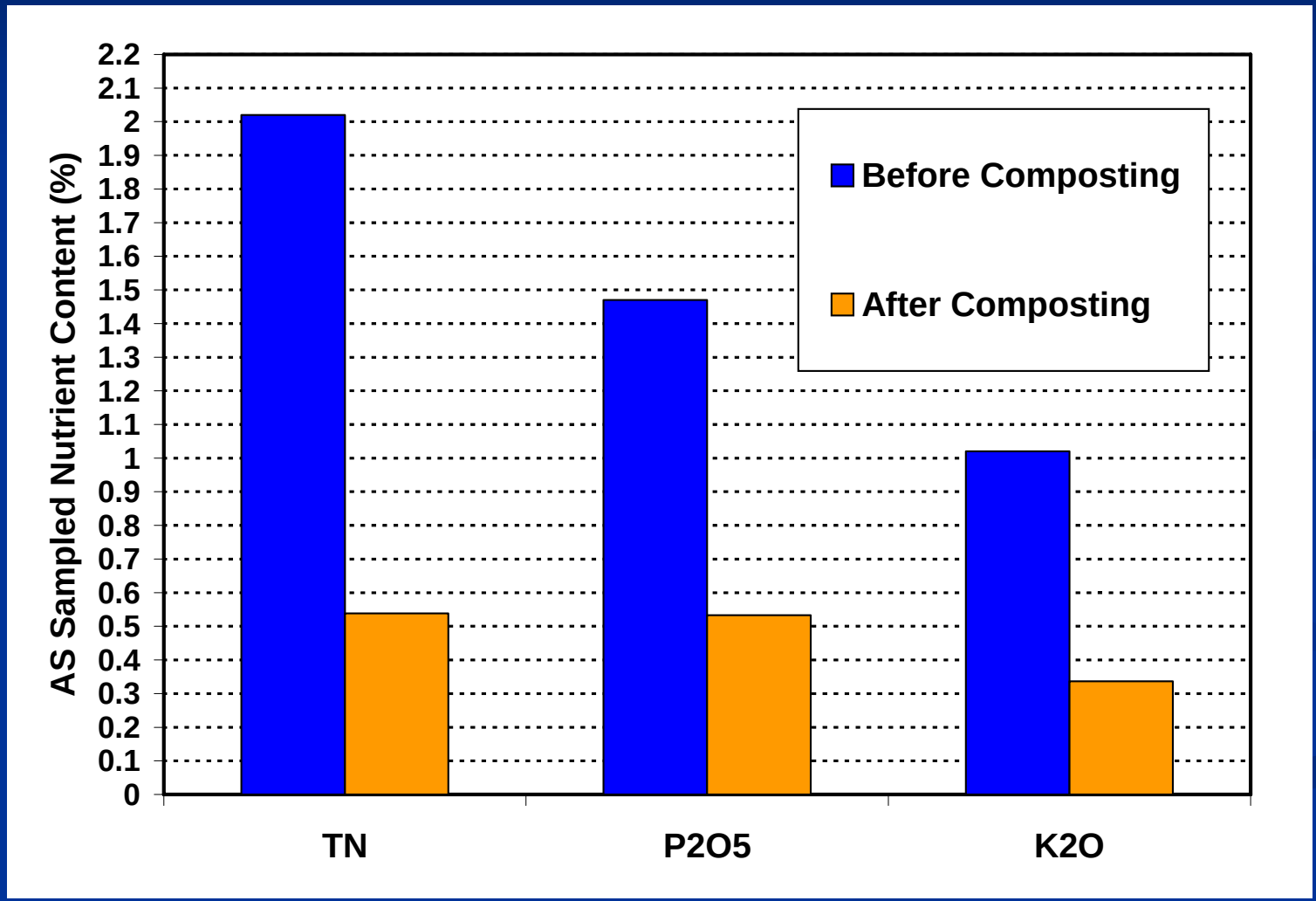
Effect of Composting on Carbon, VS, Ash Content, and Key Minor Nutrients

	Change in Dry Matter Concentration
Carbon	- 51%
VS	- 30%
Ash (FS)	+ 364 %
Magnesium	- 29%
Sulfur	- 48%

We had leaching losses during the outside curing phase.

Porous geotextile covers could help – see current issue of *BioCycle* Magazine.

Compost has lower nutrient content than litter.

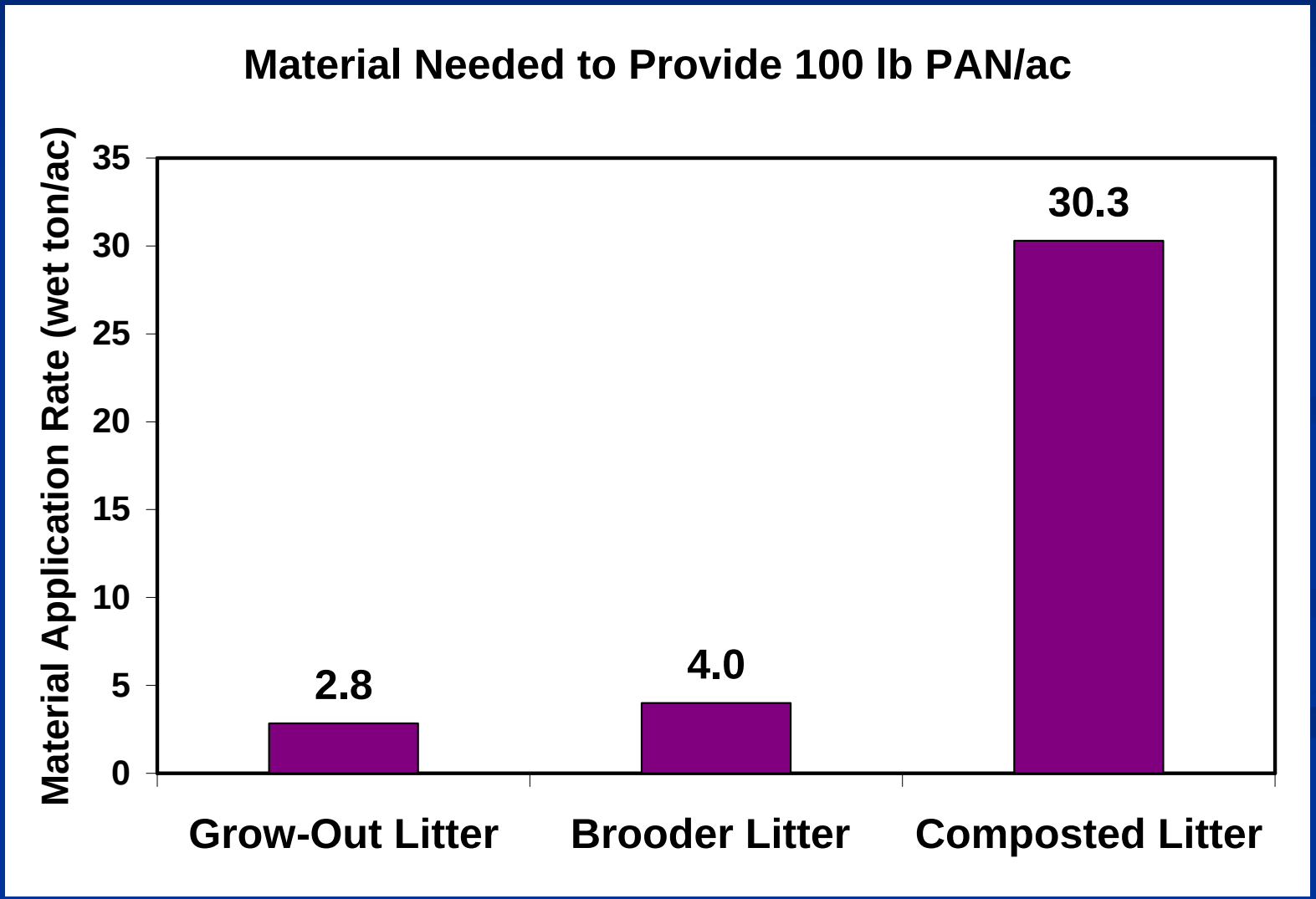


Availability of N and P_2O_5 in Compost is Different than Litter

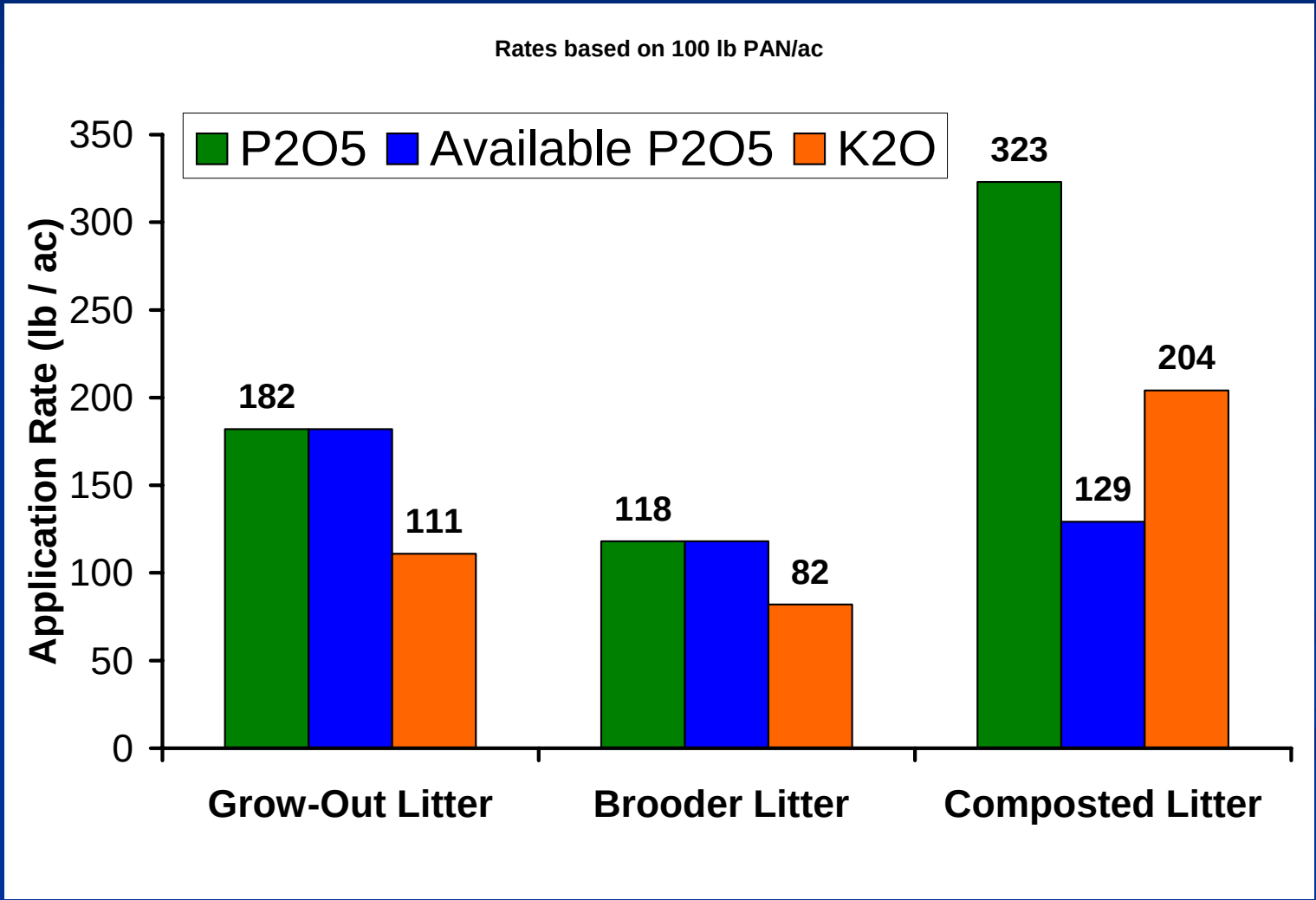
- For litter – average organic-N mineralization rate is about 0.6.
- For compost – mineralization rate is about 0.12.
- P_2O_5 in litter acts like fertilizer – 80% to 100% available.
- P_2O_5 in compost – 25% to 40% available.
- One source is: ***On-Farm Composting Handbook***, NRAES-54.

Should brooder litter compost be used as an N source?

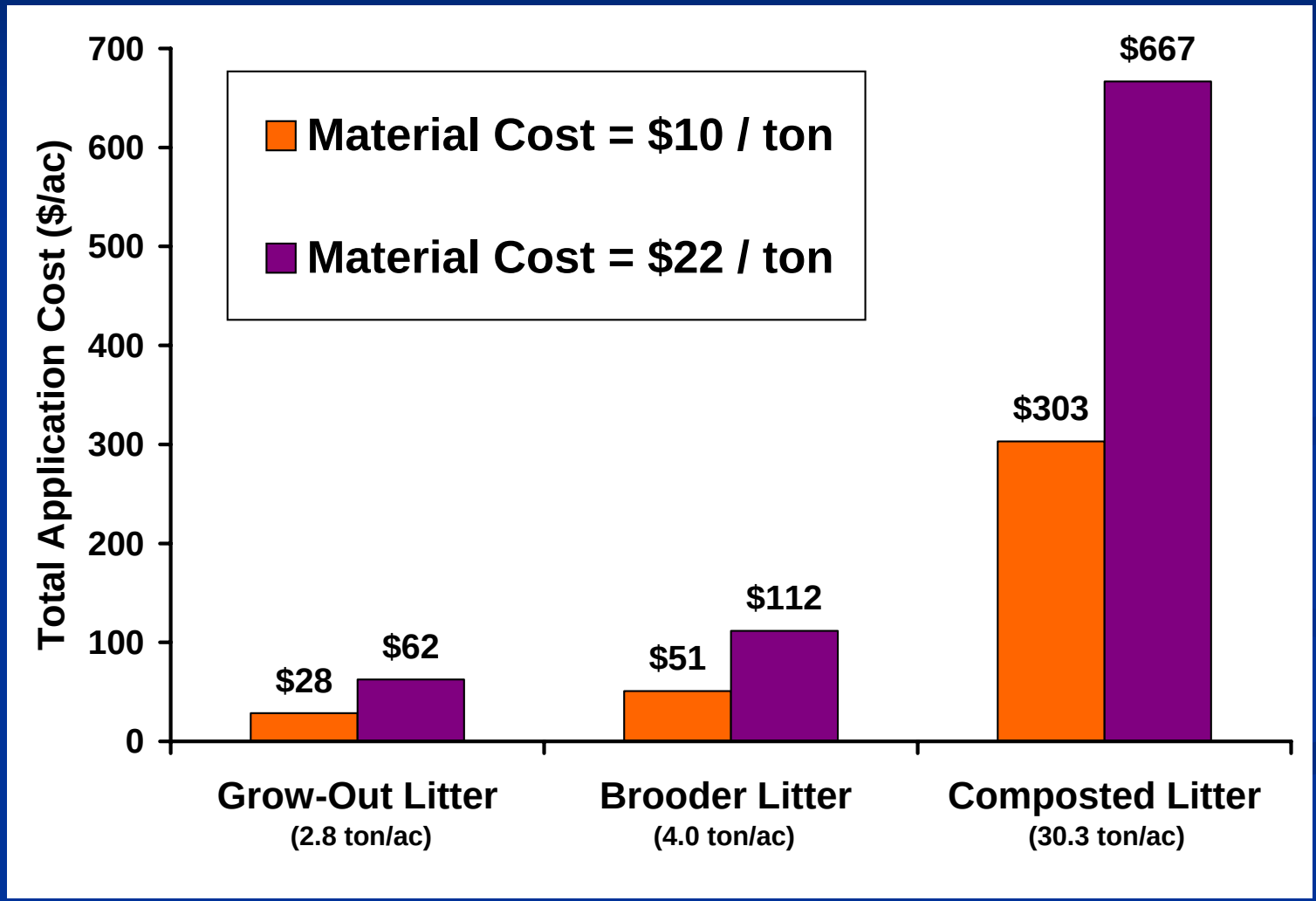
Need 7 to 10 times as much compost as litter for equivalent PAN.



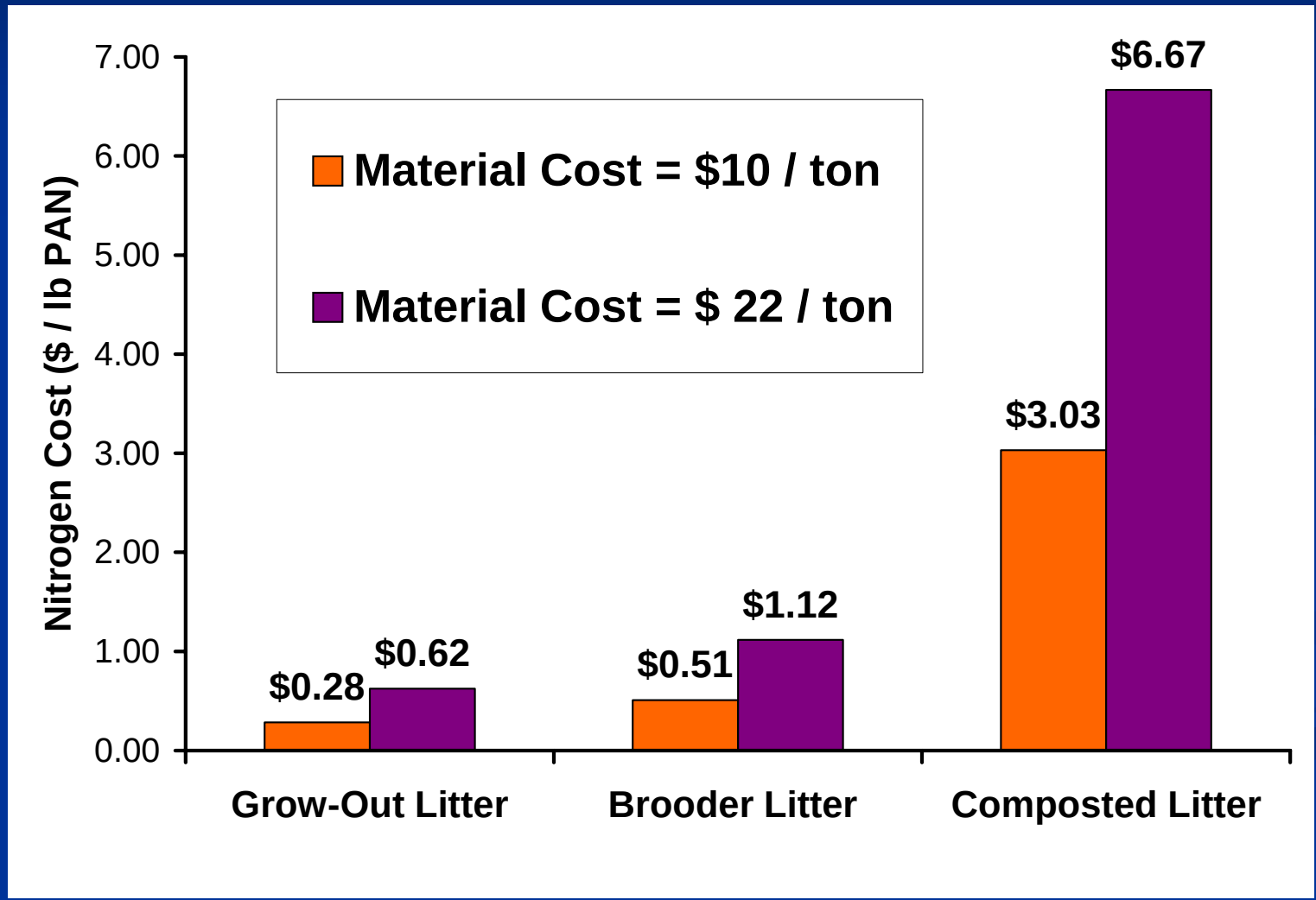
Still over apply P. What about K?



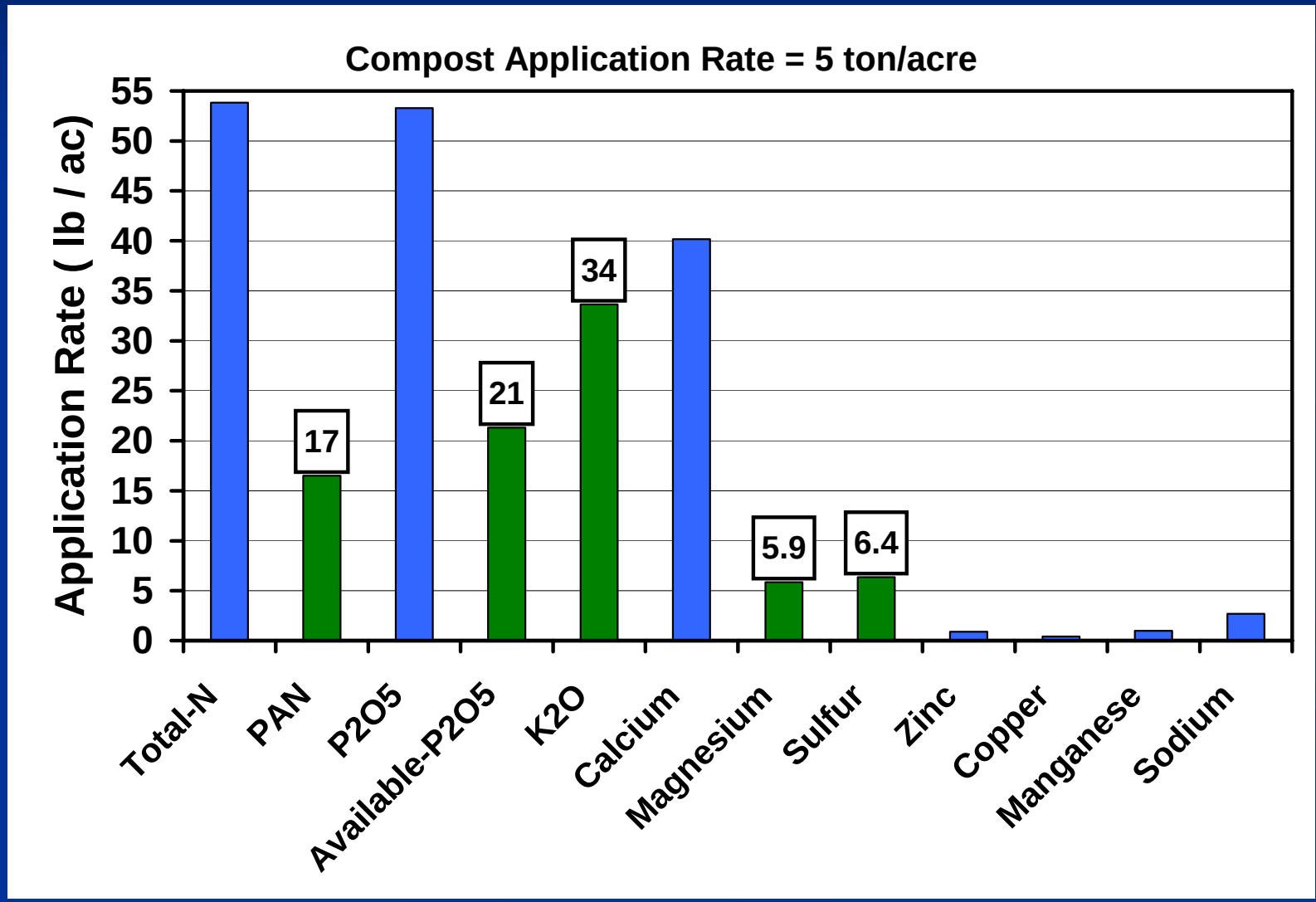
Even if I spread compost on my own field compost costs more to apply.



Compost is an expensive form of N.



A 5 ton/ac application costs $50 to $110/ac. Is it worth it?



Conclusions

Turkey brooder litter composted well as indicted by:

- ✓ Temperature history (138 °F for 59 days),
- ✓ Reduction in carbon (51%),
- ✓ Reduction in organic-N (63%), and
- ✓ Dark brown color and low CO_2 evolution rate (0.2 mg CO_2 – C/g organic matter – day).

Change in C:N was determined to be a poor indicator of compost quality under field conditions.

- The final compost product would make a good soil or potting media amendment to add organic matter, P_2O_5, K_2O, minor plant nutrients and some nitrogen.

- Need more information on cost and benefits of using compost.

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