

# 2009 Georgia Grazing School:

Soil fertility and nutrient cycling in grazing systems

## Soil Fertility and Nutrient Cycling in Grazing Systems




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## What we'll cover

- Soil tests and fertility
- Lime - more bang for your buck
- Nitrogen, phosphorus and potassium cycles
- Fertilizer tips and poultry litter

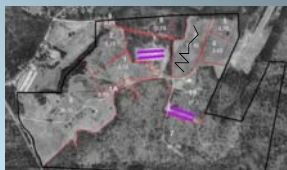
## Soil Testing and Fertility



If you don't test, you don't know what you need

Take 6 to 12 samples per area, zig zag pattern, 0-4 inches, same time each year

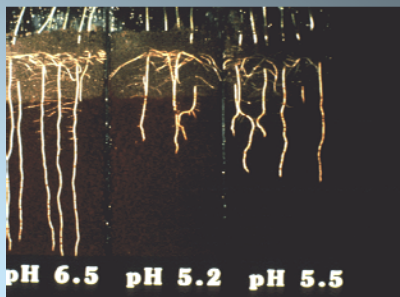
Keep your records, look for patterns over time



## Liming - More Bang for Your Buck

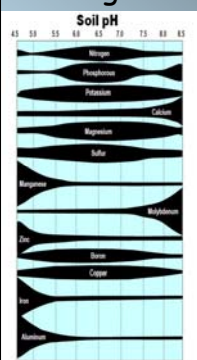
Our soils natural pH 4.5 to 5.5

pH is master variable



pH 6.5   pH 5.2   pH 5.5

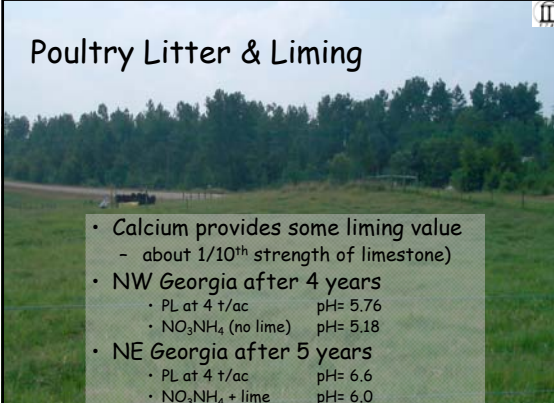
## Liming - More Bang for Your Buck



The difference of a soil pH of 5.6 vs. 6.2:

Nutrient	Amt. Used Annually (Lbs/acre)	Unit Price (\$/lb)	Dec. in Efficiency	Value of Decrease (\$/acre)
N	200	\$0.55	35%	<b>-\$39</b>
P <sub>2</sub> O <sub>5</sub>	50	\$0.62	50%	<b>-\$16</b>
K <sub>2</sub> O	150	\$0.63	10%	<b>-\$9</b>
			<b>Total</b>	<b>-\$64</b>

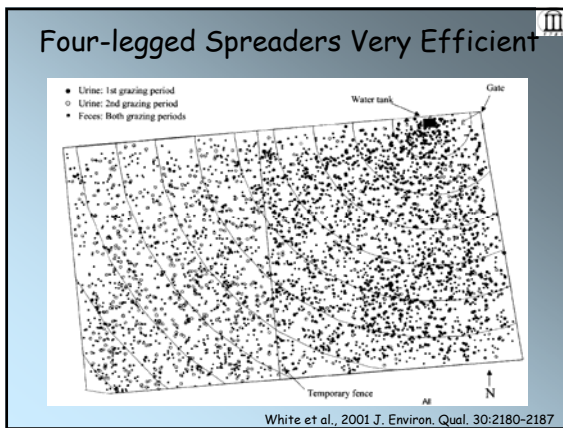
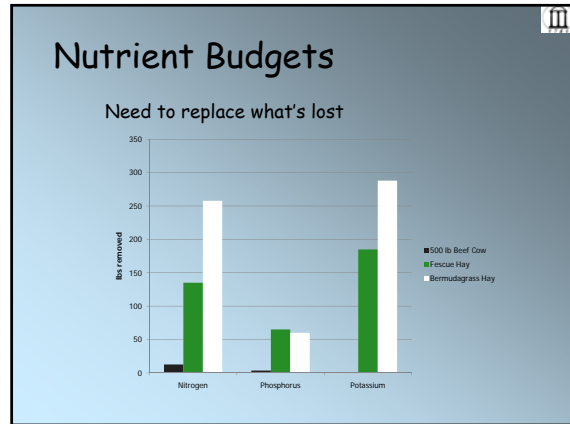
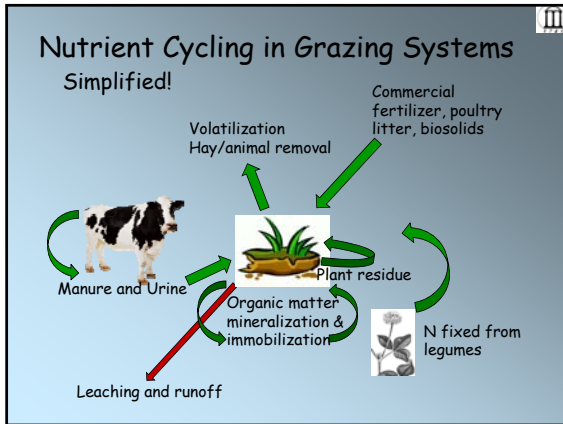
## Poultry Litter & Liming



- Calcium provides some liming value - about 1/10<sup>th</sup> strength of limestone)
- NW Georgia after 4 years
  - PL at 4 t/ac      pH= 5.76
  - NO<sub>3</sub>NH<sub>4</sub> (no lime)      pH= 5.18
- NE Georgia after 5 years
  - PL at 4 t/ac      pH= 6.6
  - NO<sub>3</sub>NH<sub>4</sub> + lime      pH= 6.0

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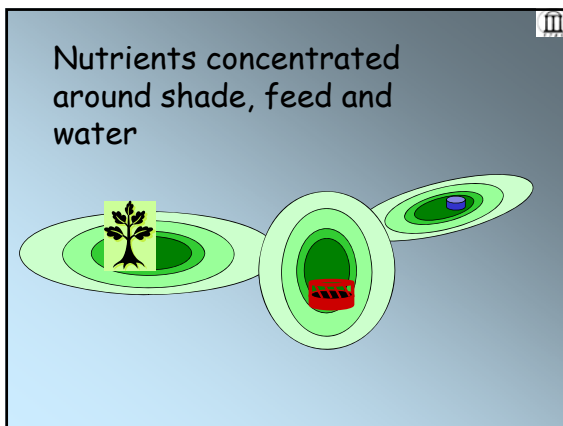
## Soil fertility and nutrient cycling in grazing systems



### You Can Get Better Distribution with More Frequent Rotation

Rotation Frequency	Years to Get 1 Pile/sq. yard
Continuous	27
14 day	8
4 day	4 - 5
2 day	2

University of Missouri Study



### Nitrogen Cycle

**Volatilization** - up to 60% of applied N


- Type of fertilizer
  - urea,  $\text{NH}_4\text{NO}_3$ , poultry litter
- Soil pH
  - higher soil pH, higher losses
- Environmental conditions
  - high temperatures, moist soils
- Amount of plant material
  - surface interception and enzymes

**Denitrification** - in areas with high soil organic matter and fluctuating water tables

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## Soil fertility and nutrient cycling in grazing systems

### Nitrogen Cycle



**Leaching/runoff -**

- Timing of application
  - Try not to apply before big rainstorms
- Soil type
  - Heavy and/or compacted soil increase runoff losses
- Pasture condition
  - overgrazed, bare spots, low soil organic matter increase leaching/runoff losses

### Poultry Litter

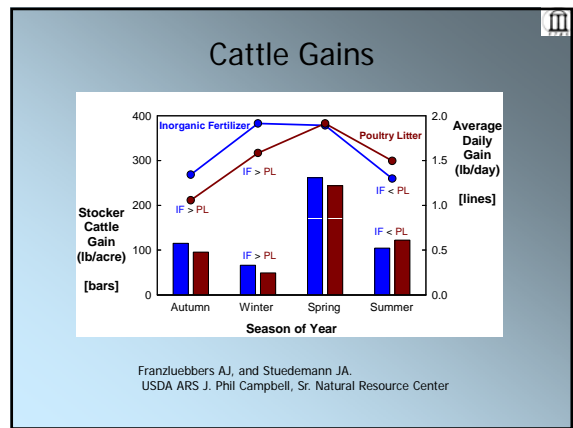


- "3-2-2"
- *Varies* with type of bird, ration, # of growouts, feed efficiency, storage & handling
- Most N is organic form (about 50 lbs/ton)
- Has to be mineralized before plant available
- Only 50 to 60% of **total N** available

### Poultry Litter

- Comparable yields using poultry litter at same N rates
- Bermudagrass study in NE GA
  - 138 lbs/ac poultry litter
  - 200 lbs/ac inorganic
- Pasture situation same productivity
- Hayfield 22% lower productivity

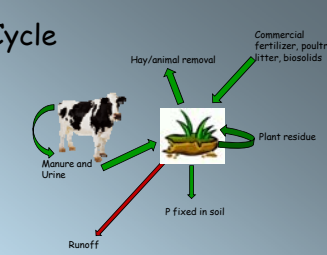
Franzluebbers and Stuedemann, USDA ARS, Watkinsville GA



### Split Applications to Maximize Efficiency of Nitrogen Fertilizers

- Long-term, this can increase yields by **5-10%** and increase NUE by **25-30%**
  - Helps prevent
    - Leaching/runoff
    - Volatilization (in the case of urea-based products)
  - Especially important under extremes
    - Late freeze
    - Drought
- Helps to prevent **NITRATE TOXICITY!**

### Phosphorus Cycle



Plants need 3 to 4 times more nitrogen than phosphorus

Issue with poultry litter  
3-2-2 fertilizer equivalent

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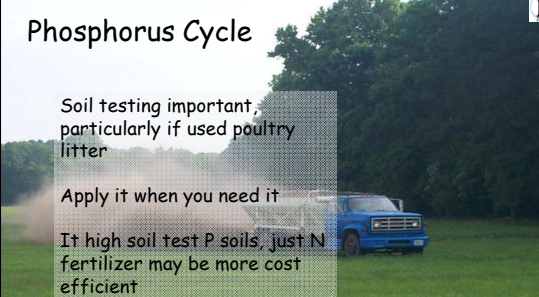
## Soil fertility and nutrient cycling in grazing systems

### Phosphorus Cycle

Soil testing important, particularly if used poultry litter

Apply it when you need it

It high soil test P soils, just N fertilizer may be more cost efficient



Miles 1 Results				2008 Low Buffer Cattle Station			
High	Medium	Low	High	Medium	Low	High	Low
Phosphorus	Phosphorus	Calcium	Magnesium	Phosphorus	Phosphorus	Calcium	Magnesium
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
100	100	100	100	100	100	100	100

### The Value of Poultry Litter


2009 Prices

60#N x 0.50 x 0.6 = 18.00


40#P<sub>2</sub>O<sub>5</sub> x 0.80 x 0.8 = 25.60

40#K<sub>2</sub>O x 0.70 x 0.8 = 22.40

» Total = \$66.00




### Phosphorus Fertilizer



- P can essentially be applied any time during the year on established forage crops.
- Purchase P fertilizer in "off-peak" times of the year (i.e., summer and fall)
  - Demand for the product is low
  - Demand for spreading services is low
  - Less risk of P runoff

### Potassium Cycle

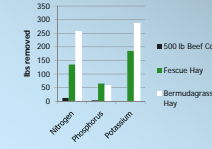
Can't get no respect



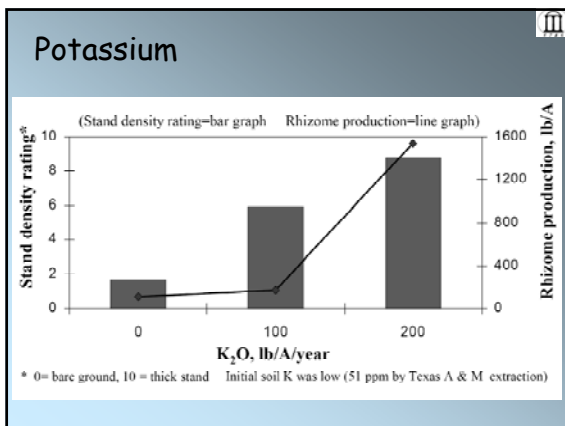
Potassium important for persistence

Helps enhance root growth & development

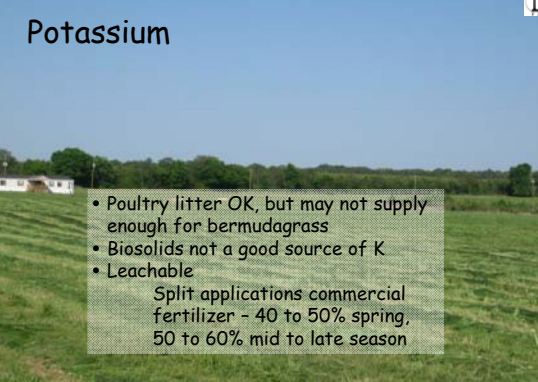
Increases resistance to cold stress, leafspot diseases (bermudagrass)



Nutrient	500 lb Beef Cow	Fescue Hay	Bermudagrass Hay
Nitrogen	~250	~150	~100
Phosphorus	~100	~50	~30
Potassium	~250	~150	~100



### Potassium



- Poultry litter OK, but may not supply enough for bermudagrass
- Biosolids not a good source of K
- Leachable

Split applications commercial fertilizer - 40 to 50% spring, 50 to 60% mid to late season

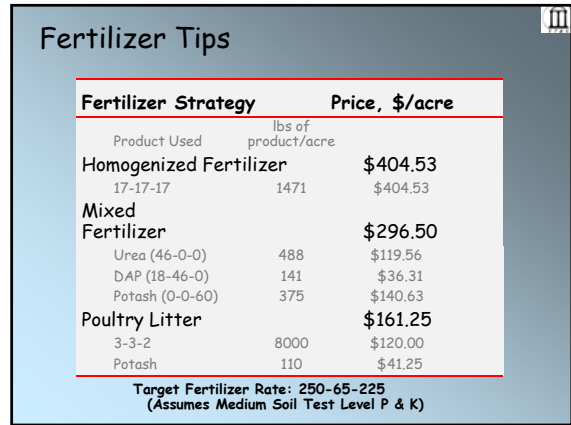
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### Fertilizer Tips

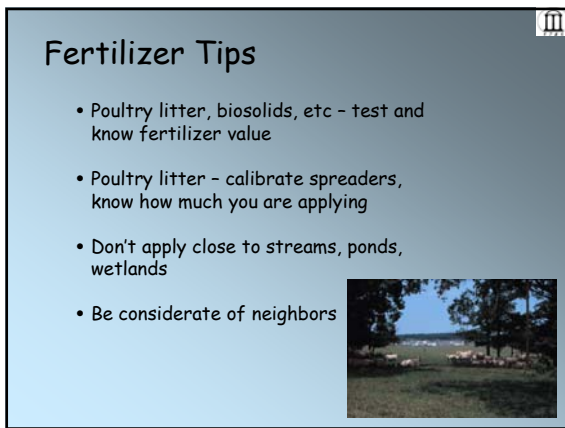
- Soil test - apply what you need
- Split applications and apply when forage needs it
- Purchase and apply P during off-peak times (summer and fall)



### Fertilizer Tips


Fertilizer Strategy	Price, \$/acre
Product Used	lbs of product/acre
<b>Homogenized Fertilizer</b>	<b>\$404.53</b>
17-17-17	1471 \$404.53
<b>Mixed Fertilizer</b>	<b>\$296.50</b>
Urea (46-0-0)	488 \$119.56
DAP (18-46-0)	141 \$36.31
Potash (0-0-60)	375 \$140.63
<b>Poultry Litter</b>	<b>\$161.25</b>
3-3-2	8000 \$120.00
Potash	110 \$41.25

Target Fertilizer Rate: 250-65-225  
(Assumes Medium Soil Test Level P & K)



### Fertilizer Tips

- Poultry litter, biosolids, etc - test and know fertilizer value
- Poultry litter - calibrate spreaders, know how much you are applying
- Don't apply close to streams, ponds, wetlands
- Be considerate of neighbors




In pastures  
use your 4-legged spreaders



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