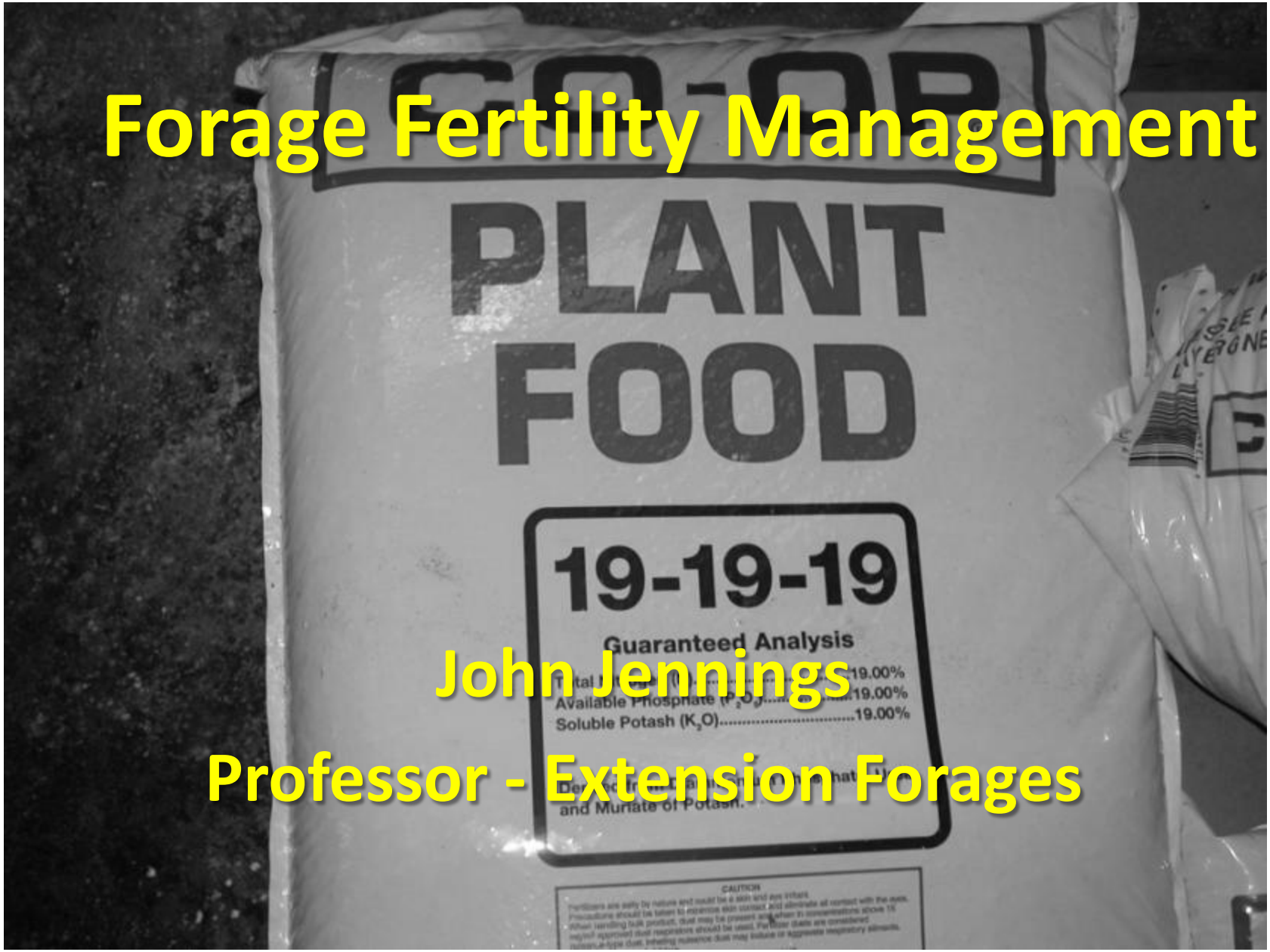

Forage Fertility Management

John Jennings

Professor - Extension Forages

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Fertility Management
vs.
Fertilizer Application

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Forage fertility management

- Where do nutrients for plant growth come from?
- Is there a need for improving fertility?
- How can fertility be improved?

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Effect of 4 years of fertilizer treatments on broomsedge (Peters et al., Univ of MO)

	Kentucky Bluegrass	Broomsedge	Legumes	Other
Check	14	17	12	27
N,P,K	46	0	7	40
P,K	38	1	22	24

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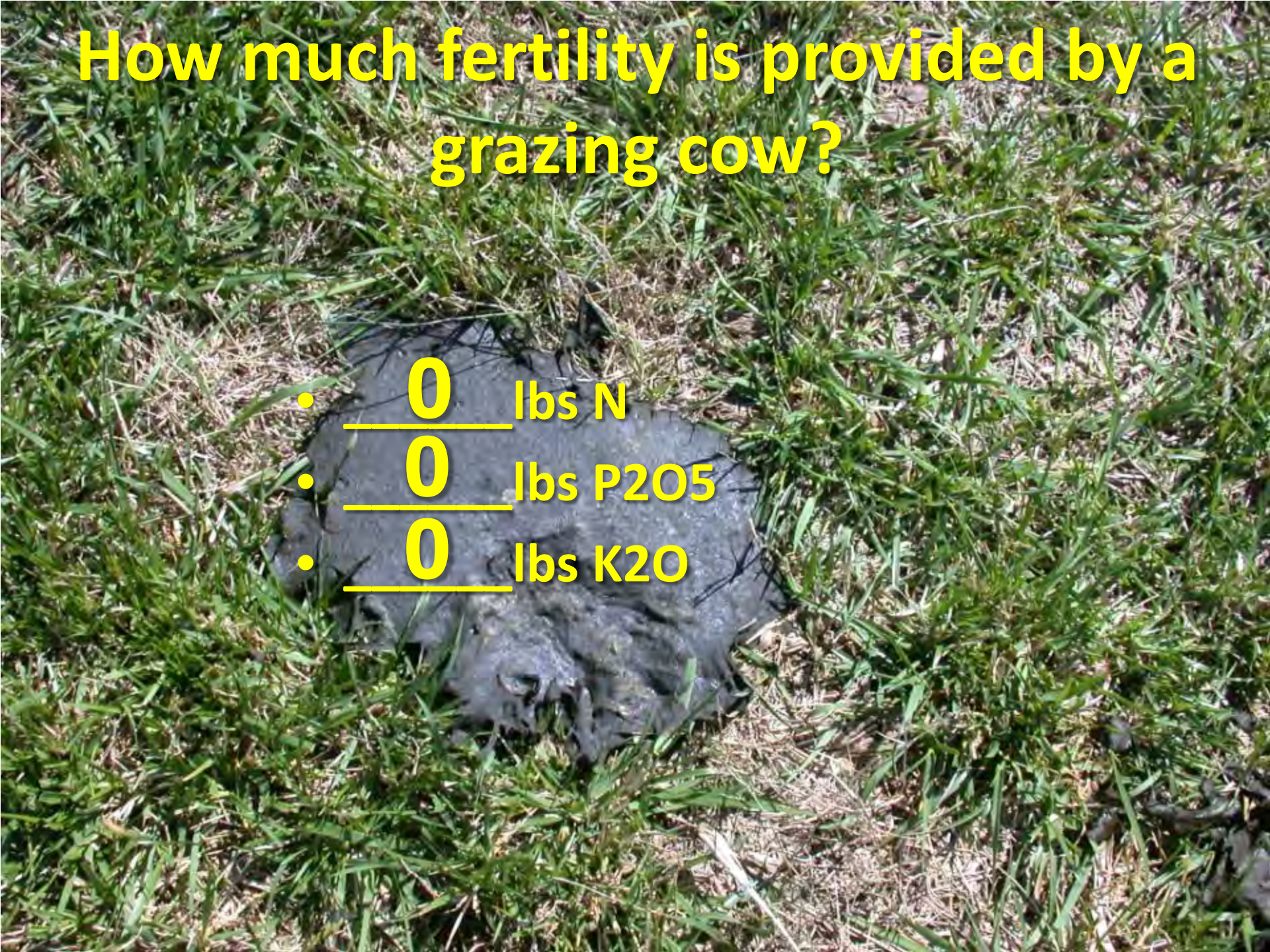
How much fertility is provided by a grazing cow?



- 0 lbs N
- 0 lbs P_2O_5
- 0 lbs K_2O

What two pieces of information are needed to reach a destination?

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Why do you measure anything?

You cannot improve or manage what you do not measure

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soil survey of

Logan County, Arkansas

United States Department of Agriculture
Soil Conservation Service
and Forest Service
in cooperation with
Arkansas Agricultural Experiment Station

Soil Productivity Potential

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Soil tests are valuable tools to manage forage growth

- The forage must be fed before it will feed the livestock
- **Feed it if you need it**

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Prescription without diagnosis is malpractice!!!

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Fertility Reality

- Nature is not oriented for profit or land ownership
- Nutrient demands of natural ecosystems and fenced pasture are not the same
- Measurements are important in low input systems to avoid high output expectations

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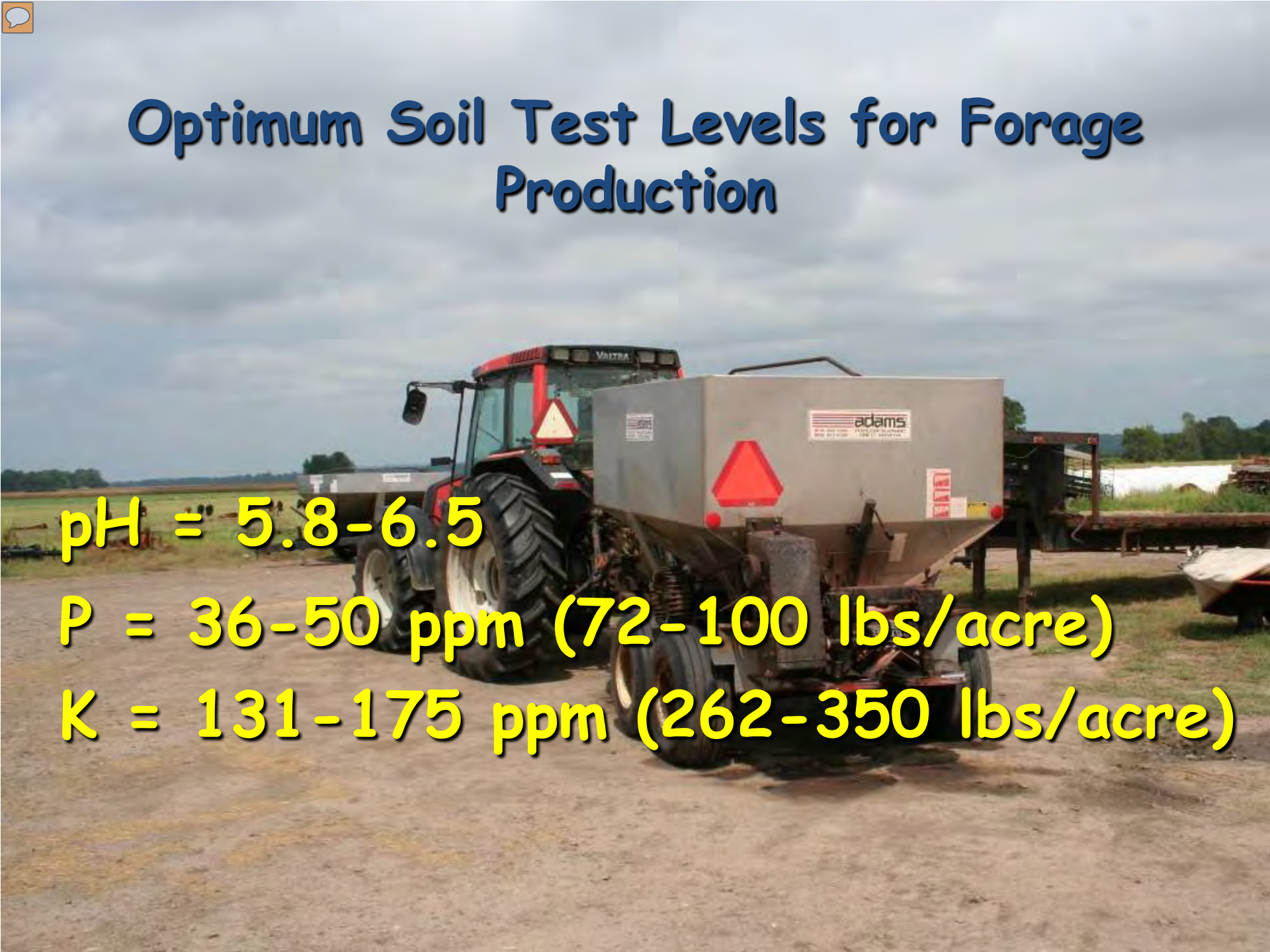
Optimum Soil Test Levels for Forage Production



pH = 5.8-6.5

P = 36-50 ppm (72-100 lbs/acre)

K = 131-175 ppm (262-350 lbs/acre)

Functions of the major fertilizer nutrients in plants

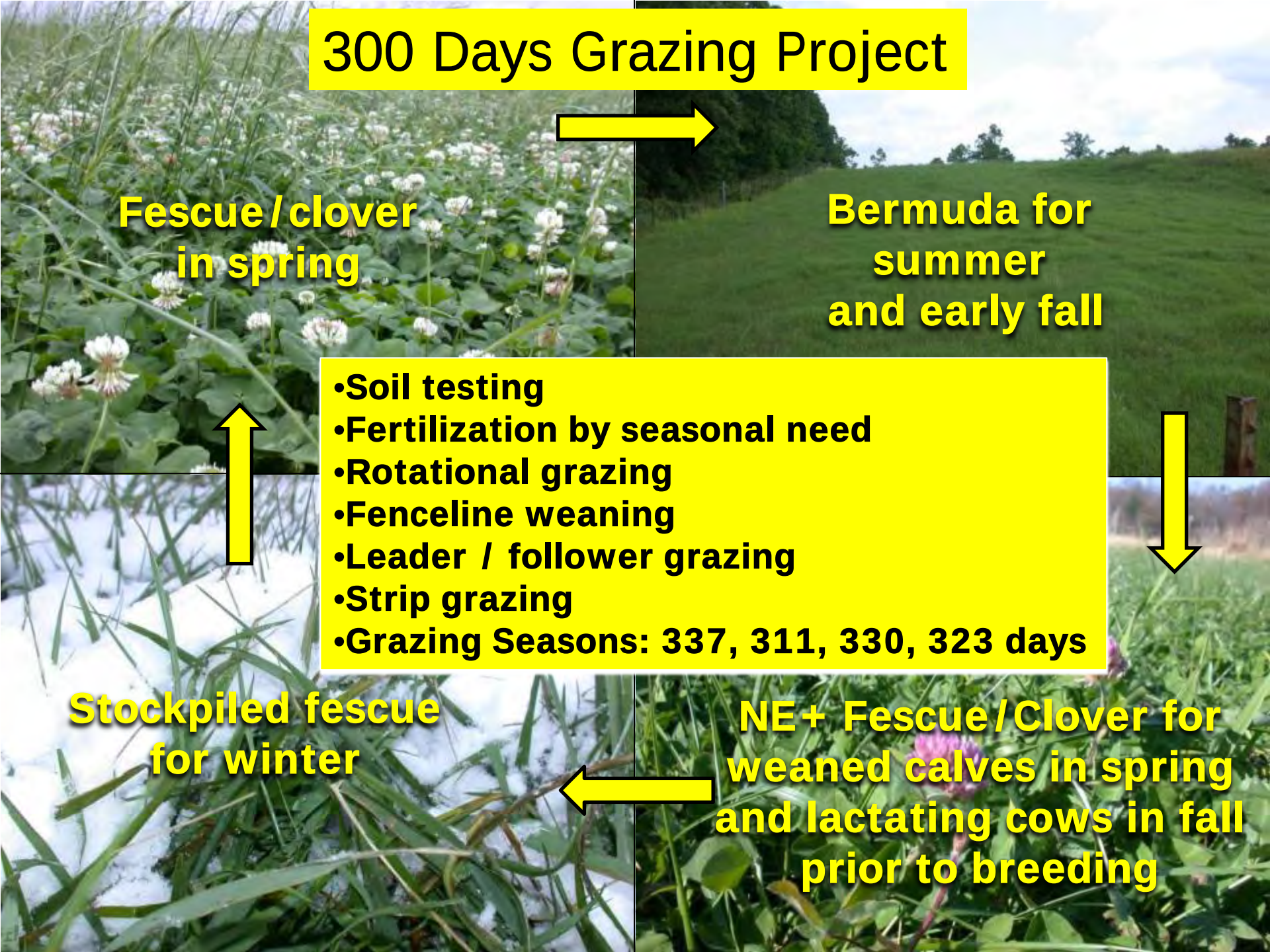
Nitrogen – functions as fuel for growth
Found in protein and amino acids

Phosphorus – functions as electrical system
Critical for energy functions, root growth, and cell membranes

Potassium – functions as lubrication system
Critical for nutrient transport, enzyme function, and disease resistance

Lime – functions as climate control
Improves fertilizer efficiency & availability and N fixation

300 Days Grazing Project



Fescue / clover in spring

Bermuda for summer and early fall

- Soil testing
- Fertilization by seasonal need
- Rotational grazing
- Fenceline weaning
- Leader / follower grazing
- Strip grazing
- Grazing Seasons: 337, 311, 330, 323 days

Stockpiled fescue for winter

NE+ Fescue / Clover for weaned calves in spring and lactating cows in fall prior to breeding

Soil Test Results

Field ID	Year	pH	P	K	OM
NA10	2008	6.7	106	176	2.9
	2009	7	156	190	3.7
NA12	2008	6.4	102	172	3
	2009	6.9	160	190	3.3

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Fertility for Hay vs. Pasture

Fertilizing for Hay

Nutrients removed in hay by various forages in Arkansas			
	N	P_2O_5	K_2O
	lbs removed/ton DM		
Bermuda	42	14	48
Fescue	36	14	48
Clover / Grass	40	13	45
Ryegrass	37	14	47
Univ. of Ark. Forage Database http://feedanalysis.uaex.edu/			

6 tons of bermuda hay = 1220 lbs fertilizer/a


Grazing management to spread nutrients

Fertilizer recommendation based on crop option

pH=5.4

P=40 ppm

K=150 ppm

Hay

- #133 WSG 4 T/A
  200-40-150
- #114 WSG/legume 4 T/A
  0-45-180

Pasture

- #207 WSG MNT
  60-0-0
- #209 WSG/legume MNT
  0-0-0

Fertilizer Fact!!!!

- It takes 40-50 lbs of N to produce 1 ton of forage
- As well as 10-15 lbs P_2O_5 and 40-50 lbs K_2O

Other than what is in soil and Organic Matter:

- N comes from fertilizer, litter, legume N fixation
- P & K come from fertilizer, litter, other feed

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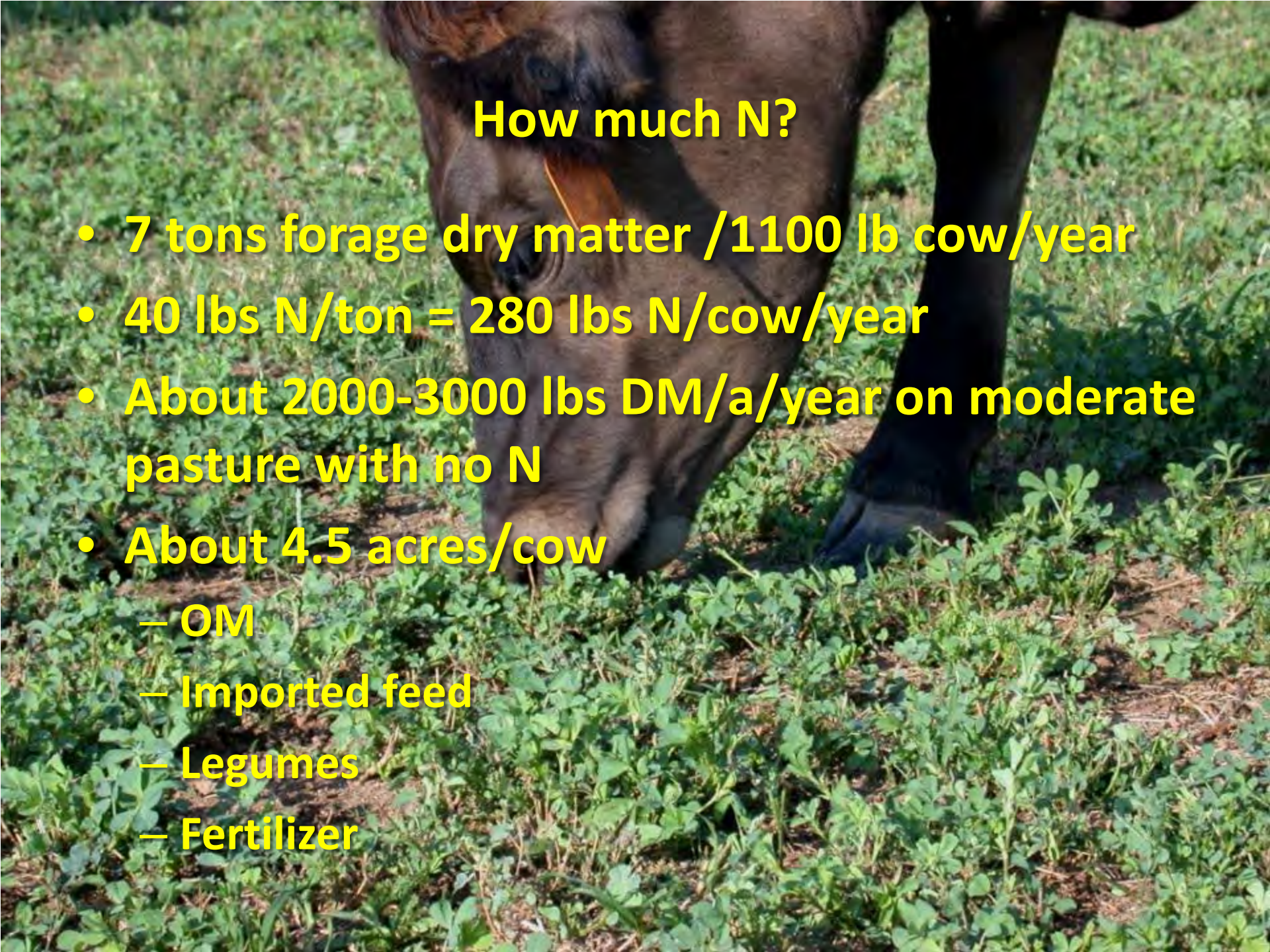


How much N?

- 7 tons forage dry matter /1100 lb cow/year
- 40 lbs N/ton = 280 lbs N/cow/year
- About 2000-3000 lbs DM/a/year on moderate pasture with no N
- About 4.5 acres/cow
  - OM
  - Imported feed
  - Legumes
  - Fertilizer

N Value of Soil Organic Matter

	lbs. N released from OM during growing season		
% OM	Silt Loam	Clay / Clay Loam	Sand / Sandy Loam
1.0	23	18	50
2.0	45	36	100
3.0	68	54	------
4.0	90	72	------

Legumes


Annual lespedeza


White Clover


Crimson Clover


Hairy Vetch


Red Clover


Arrowleaf Clover


Winter peas


Alfalfa

Legumes

- Rhizobia bacteria fix 50-200 lbs N/a/year
- N fixation is reduced or stopped if N is applied or if soil pH is low
- Most N is in topgrowth and becomes available to other forages later by tissue decay and recycling of manure & urine


Legumes
• 2010 - $4,600 savings for 2 producers vs N fertilization cost on grass

N content of legumes

Table 2. Total annual yield (hay plus forage stockpiled for winter grazing) and botanical composition of tall fescue fertilized with nitrogen or grown with red clover or alfalfa during 1988.

Item	Tall fescue stockpiling treatment			SE
	Nitrogen	Red clover	Alfalfa	
Total annual yield (ton/acre)[a]	4.7	4.7	5.8	0.3
Botanical composition[b]				
Grass, (%)	89	41	32	4
Legume (%)	0	53	59	4
Weed (%)	11	6	9	3

[a] Tall fescue-red clover differed from fescue-alfalfa ($P < 0.05$).

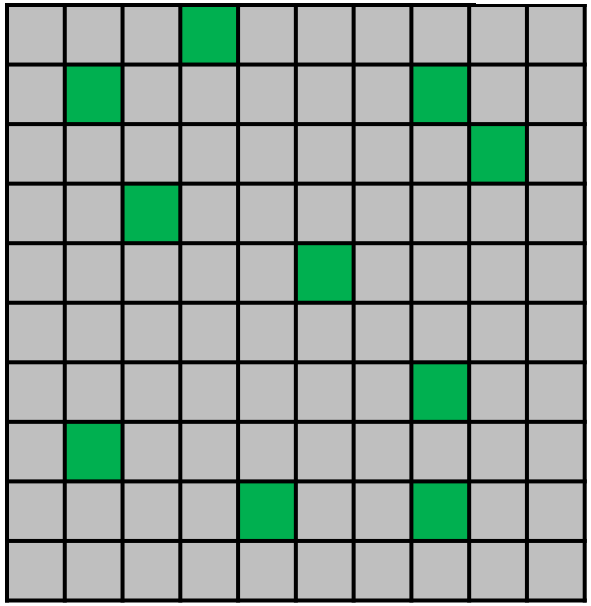
[b] Tall fescue fertilized with N differed from the mean of fescue grown with legumes ($P < 0.01$).

Fescue was fertilized 2x/yr at 80 lbs /application

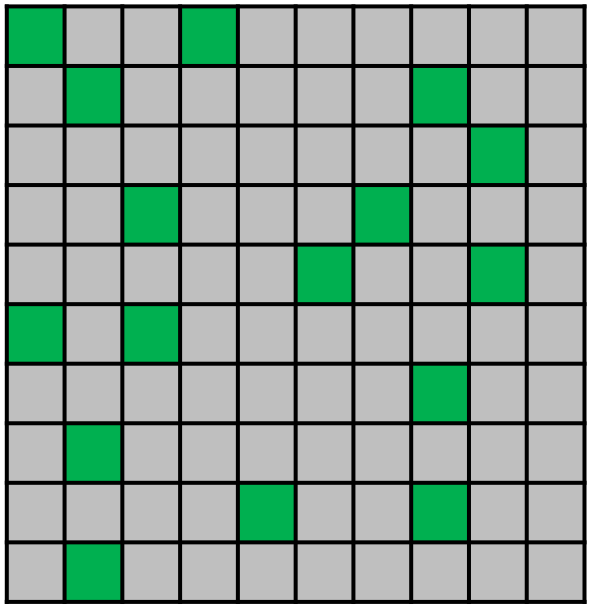
Vines et al. VA Tech

% Stand

10%



15%



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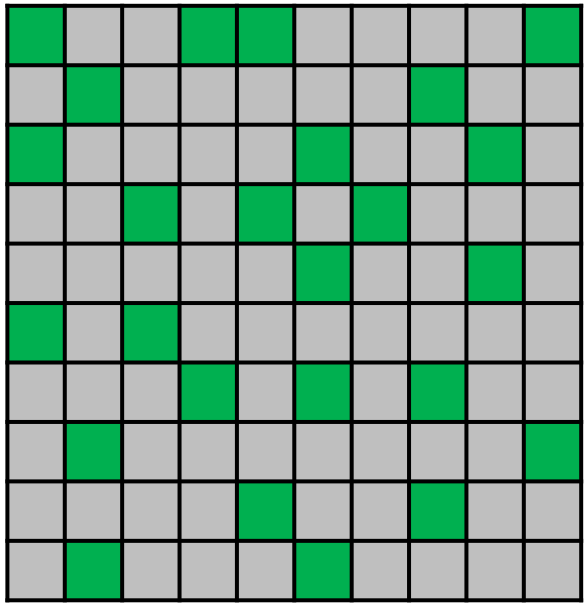

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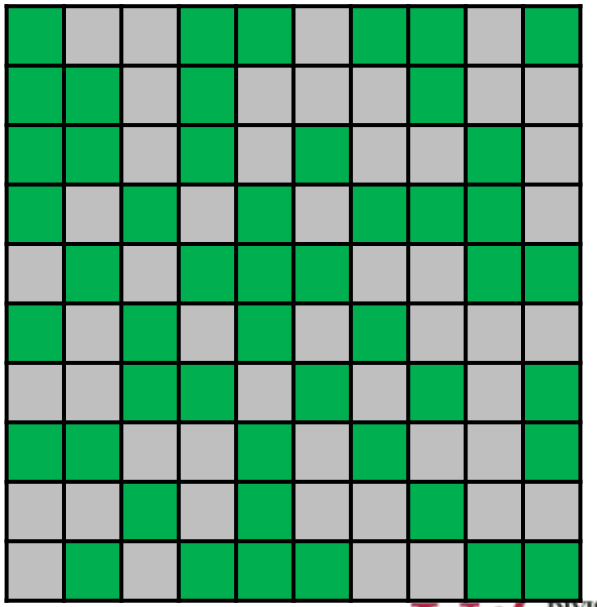

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STRATEGIC HAY FEEDING TO IMPROVE SOIL FERTILITY

K. J. Simon, J. A. Jennings, and M. S. Gadberry

Funded by
AR Grazing Lands Coalition

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Nutrients in average 4x5 round bale of bermuda hay
16 lbs N
5 lbs P_2O_5
18 lbs K_2O

Build up of nutrients in unfertilized pastures vs traditional hay feeding area

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Build up of nutrients in unfertilized pastures vs traditional hay feeding area

County	Unfertilized Pasture (Soil test lbs/ac)			Concentrated Hay Feeding Area (Soil test lbs/ac)			Change (Soil test lbs/ac)		
	P	K	O.M.	P	K	O.M.	P	K	O.M.
Bradley	110	225	2.7	326	1,508	15.9	+216	+1,283	+13.2
Little River	40	130	2.6	246	984	9.9	+206	+854	+7.3
Union	408	341	2.6	1,336	3,134	4.5	+928	+2,793	+1.9
Average	**186**	**232**	**2.6**	**636**	**1,875**	**10.1**	**+450**	**+1,643**	**+7.5**

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Strategically feeding hay in rings within a designated field

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Strategically feeding hay in rings within a designated field

County	Pasture Soil Fertility Before Hay Feeding (Soil test lbs/ac)			Pasture Soil Fertility After Hay Feeding (Soil test lbs/ac)			Hay Ring Zone Soil Fertility (Soil test lbs/ac)			Tons of Hay fed/ac (DM basis)
	P	K	O.M.	P	K	O.M.	P	K	O.M	
Baxter	470	868	4.8	463	678	4.2	556	1,334	6.5	1.49
Bradley	66	176	3.1	38	128	2.4	44	256	2.2	4.49
Drew	38	94	N/A	32	118	1.9	52	304	2.6	41.99
Faulkner	49	178	4.4	88	232	6	106	502	8.1	4.07
Yell	200	164	N/A	N/A	N/A	N/A	343	506	5.9	0.30
Average	**165**	**296**	**4.1**	**155**	**289**	**3.6**	**220**	**580**	**5.1**	**10.5**

Strategically unrolling hay within a designated field

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Strategically unrolling hay within a designated field

County	Pasture Soil Fertility Before Hay Feeding (Soil test lbs/ac)			Pasture Soil Fertility After Hay Feeding (Soil test lbs/ac)			Tons of Hay fed/ac (DM basis)
	P	K	O.M.	P	K	O.M.	
Baxter	114	276	6.6	133	597	6.5	5.96
Cleburne	546	484	6.7	568	654	9.1	2.91
Lonoke	104	218	4.3	102	216	N/A	3.23
White	34	192	3.4	56	340	2.9	6.02
Average	**200**	**293**	**5.3**	**215**	**452**	**6.2**	**3.7**

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Hay Feeding Management to Reduce Waste

Fed on a TDN basis

85 % utilization (84-87% range)

91 % utilization (86-95% range)

<u>6% less waste @$65/bale</u>

$3.90/bale

$117/30 bales

$234/60 bales

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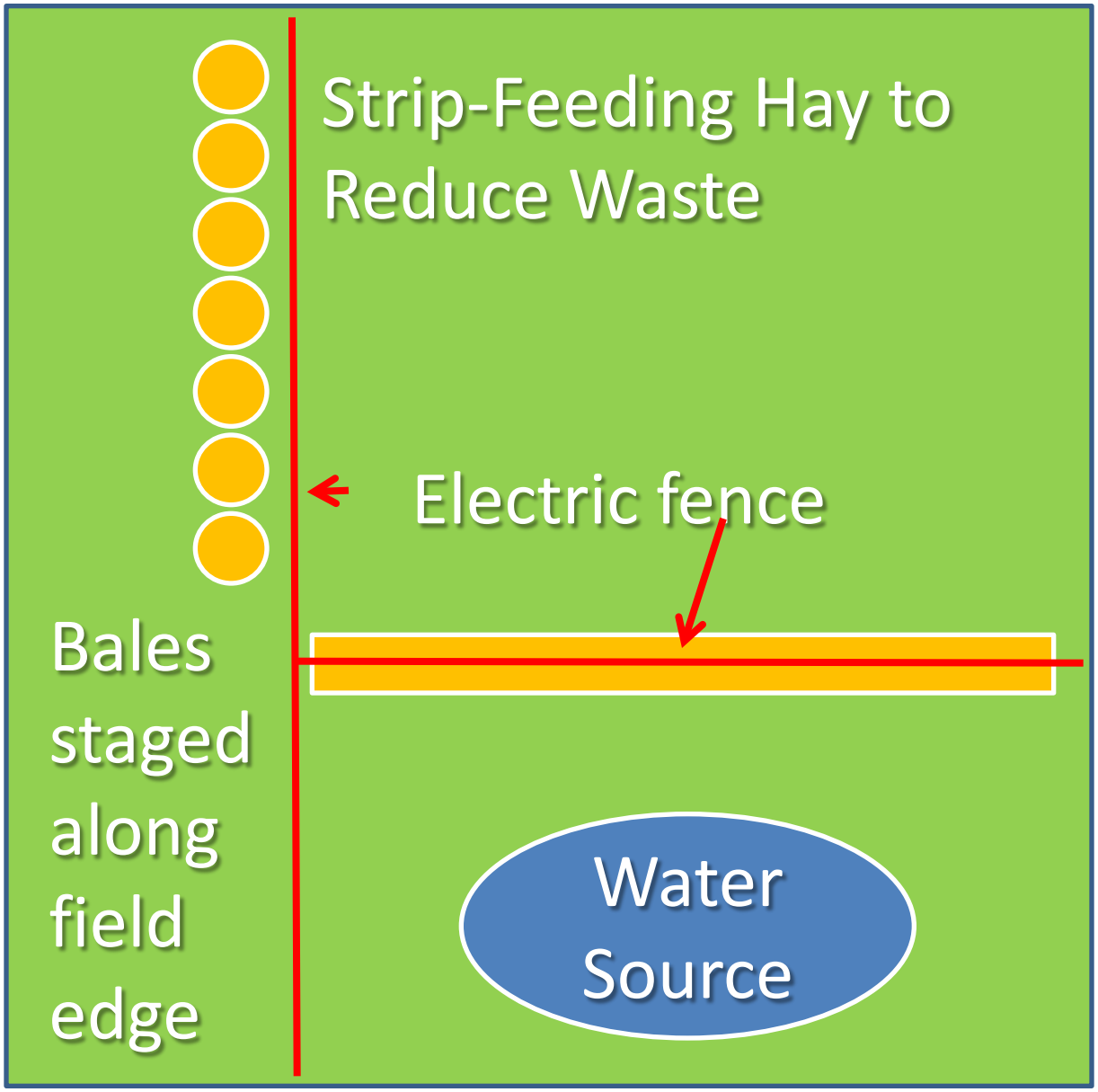

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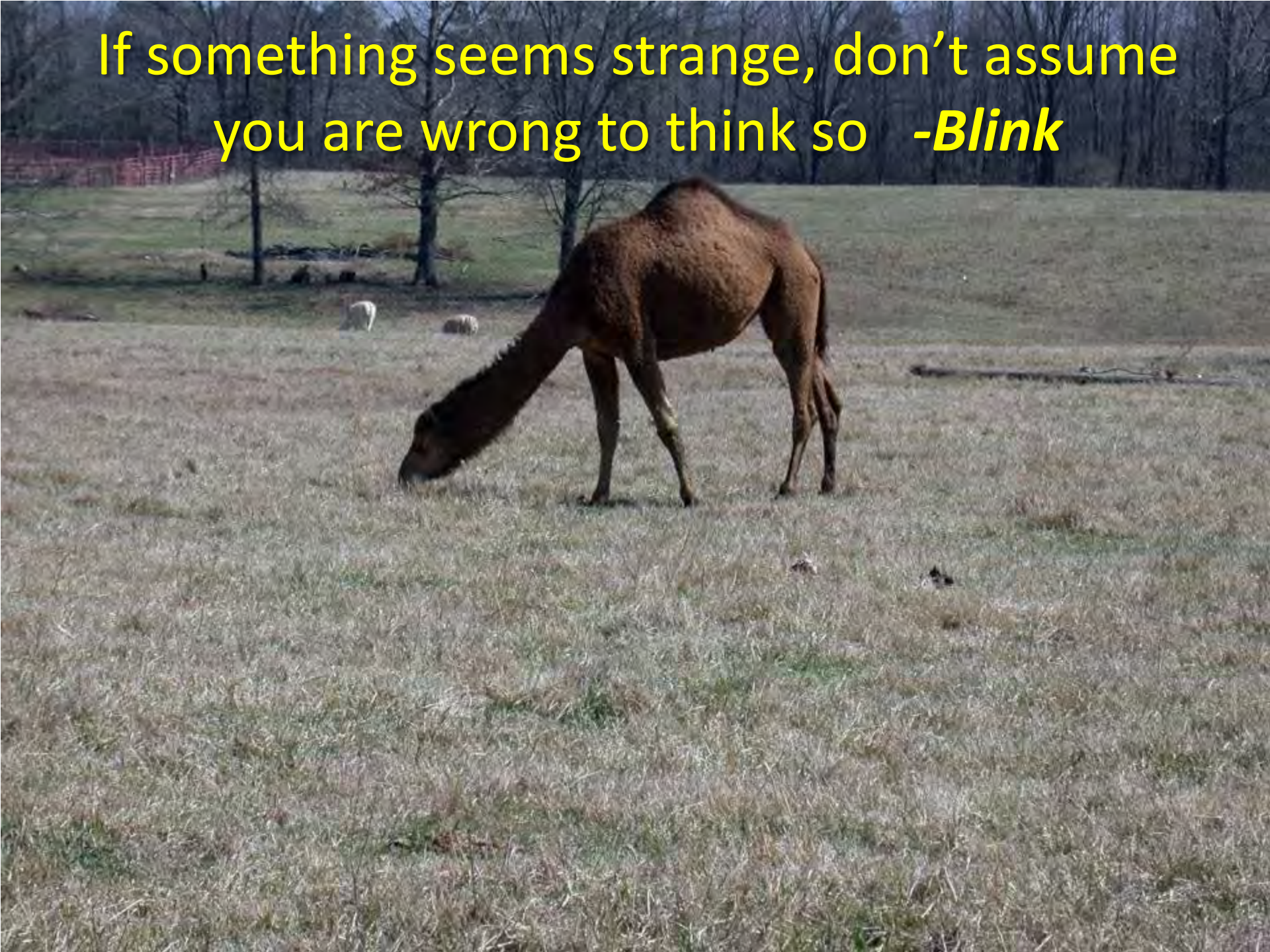
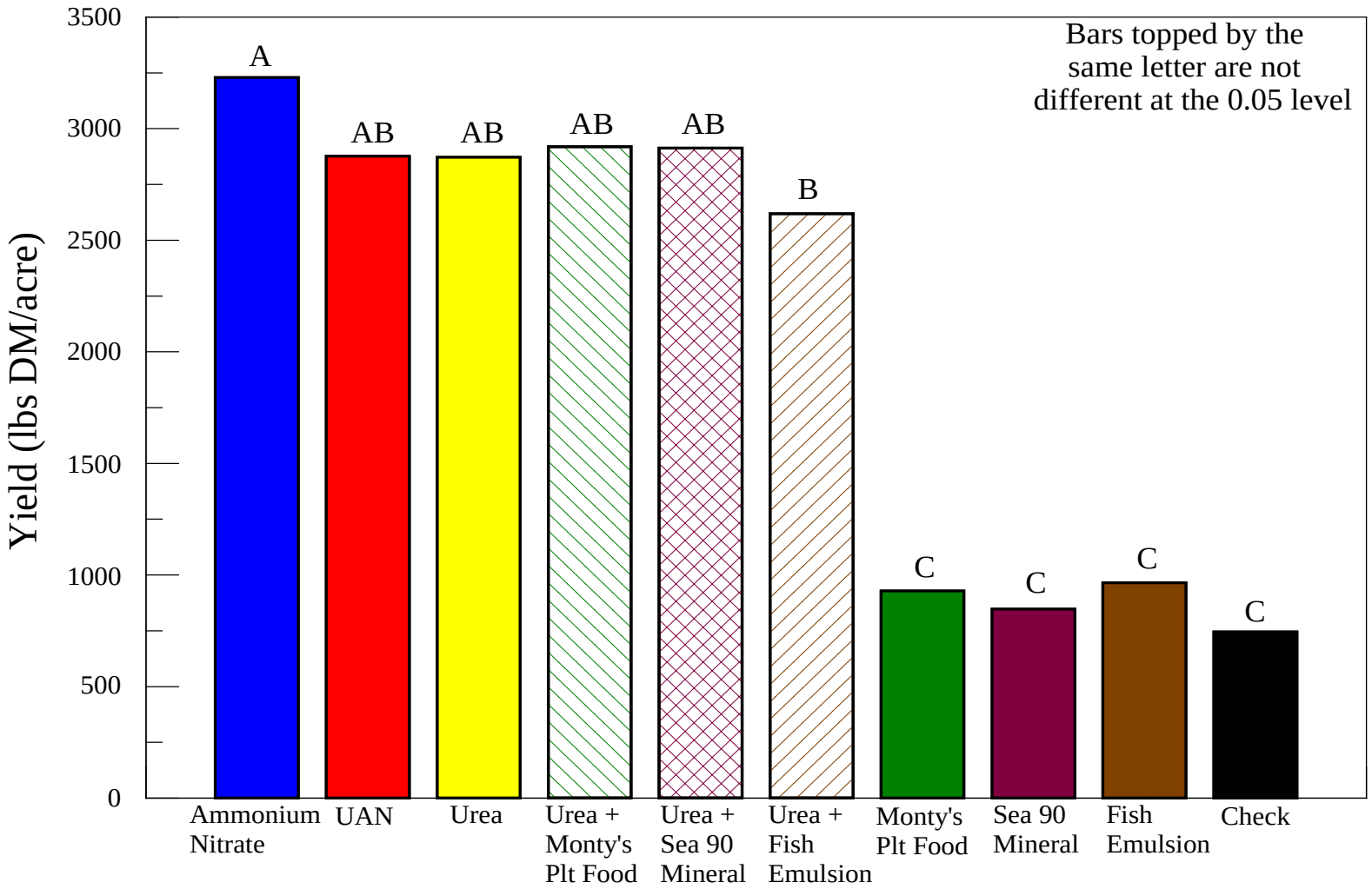

If something seems strange, don't assume you are wrong to think so -Blink

Figure 1. Comparison of traditional and nontraditional fertilizers for bermudagrass yield

Treatments applied 6/27/08 - Harvested 7/28/08



AN, UAN, Urea applied at 75 lb/a N
Monty's Plt Food - 1.5 pints/a
Sea 90 Mineral - 2 lbs/a
Fish Emulsion - 4 gal/a

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Summary

Take Home Message

- Soil test to determine nutrient status.
- Determine yield potential of field and production needs for best fertility management.
- Use legumes.
- Improve grazing and hay feeding management to distribute nutrients.
- Target nutrient applications by season.
- Be realistic about forage need, nutrient availability, and nutrient sources.