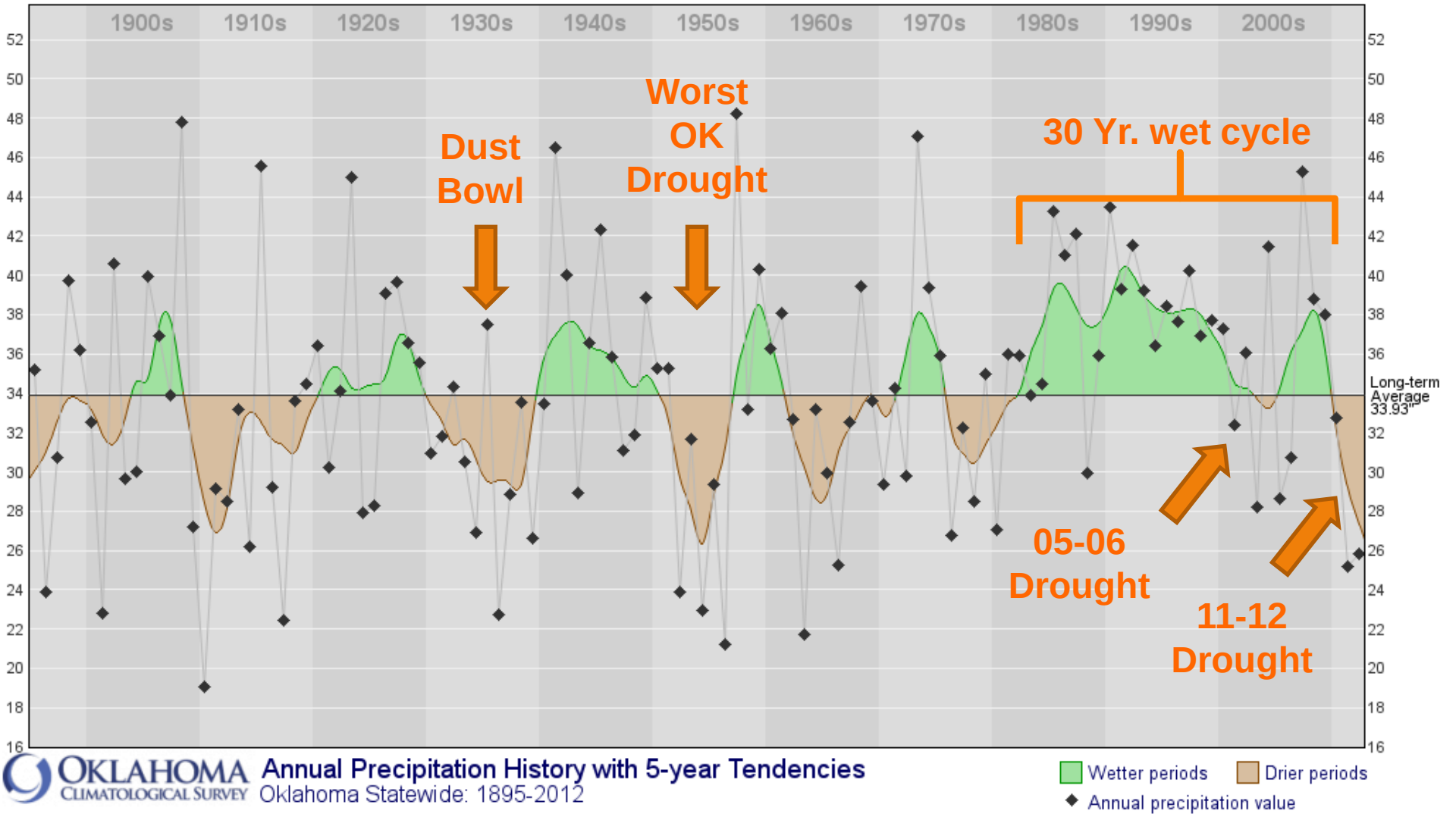
Drought?

Making Efficient Use of Limited Moisture; The Planning Starts Now

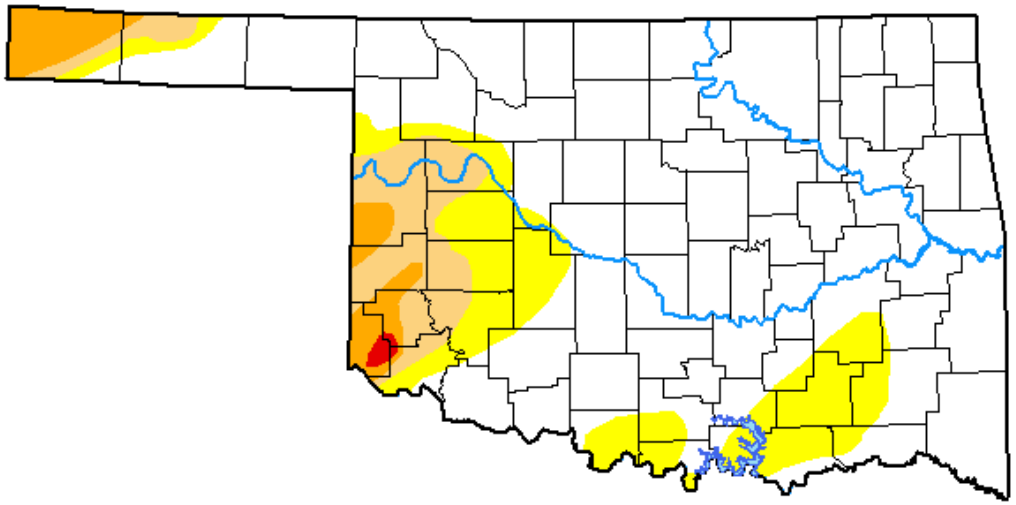
Leland McDaniel
OSU Extension

Oklahoma's Annual Precipitation History 1895 to 2012.



U.S. Drought Monitor

Oklahoma



January 26, 2021

(Released Thursday, Jan. 28, 2021)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	75.15	24.85	10.93	4.05	0.23	0.00
Last Week *01-19-2021*	67.61	32.39	11.96	5.52	0.83	0.00
3 Months Ago *10-27-2020*	47.94	52.06	32.42	15.58	3.61	0.00
Start of Calendar Year *12-29-2020*	56.83	43.17	25.21	7.75	1.45	0.00
Start of Water Year *09-29-2020*	66.79	33.21	17.71	11.97	1.55	0.00
One Year Ago *01-28-2020*	81.34	18.66	8.03	0.85	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:

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CPC/NOAA/NWS/NCEP

droughtmonitor.unl.edu

Fertility

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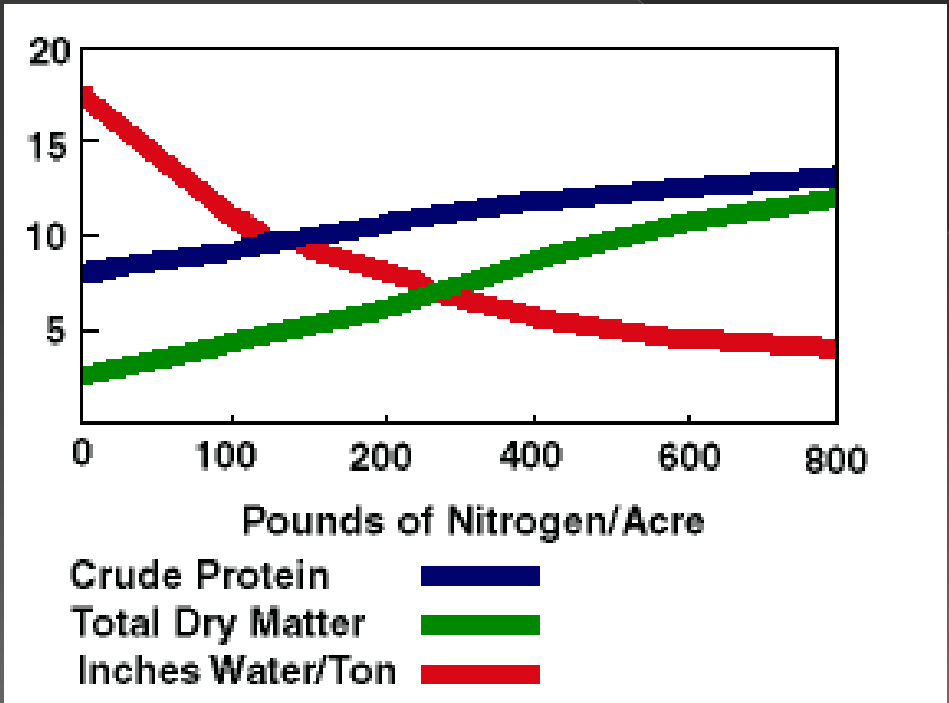
- A Texas study in 1958 found that it takes about 20 inches of water to produce one ton of un-fertilized Bermuda.
- Under high fertility it only took 4 inches per ton.



Research conducted by Fisher and Caldwell, Texas A&M University

Effect of Nitrogen Fertilizer on Hay Production and Water Utilization by Midland 99 Bermudagrass @ ERS- 2012

Nitrogen Lb./A	Tons/A	Inches of Rain/ton
0	1.2	3.4
33	1.85	2.2
130	2.79	1.5
217	3.17	1.3
435	4.17	1.0

It's More Than Just Nitrogen

Of main concern are the Primary Macronutrients:

- N = Nitrogen
- P = Phosphorus
- K = Potassium

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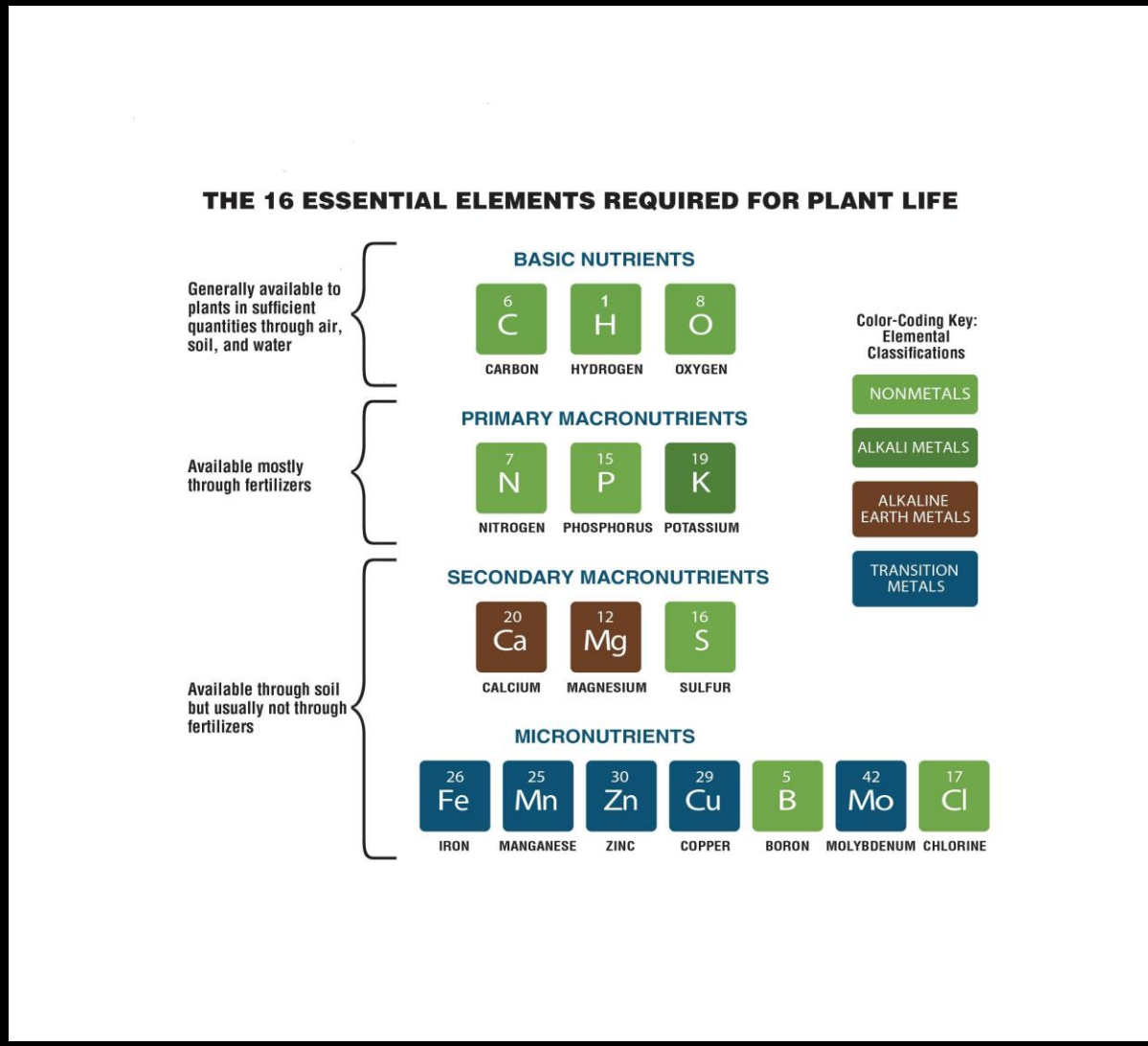

It’s More Than Just Nitrogen

Automobile analogy:

- (N) Nitrogen = Fuel
- (P) Phosphorus = Oil
- (K) Potassium = Engine Coolant

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It’s More Than Just Nitrogen

Nitrogen Use Efficiency:

- Without adequate levels of phosphorus and potassium, we cannot burn the full tank of nitrogen.
  - Some of the nitrogen remains unavailable to the plants
  - Reduced plant growth/yield
  - Wasted money

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It's More Than Just Nitrogen

Nitrogen Use Efficiency:

- Simply adding more nitrogen, if phosphorus and/or potassium are deficient, will not maximize yield or growth.

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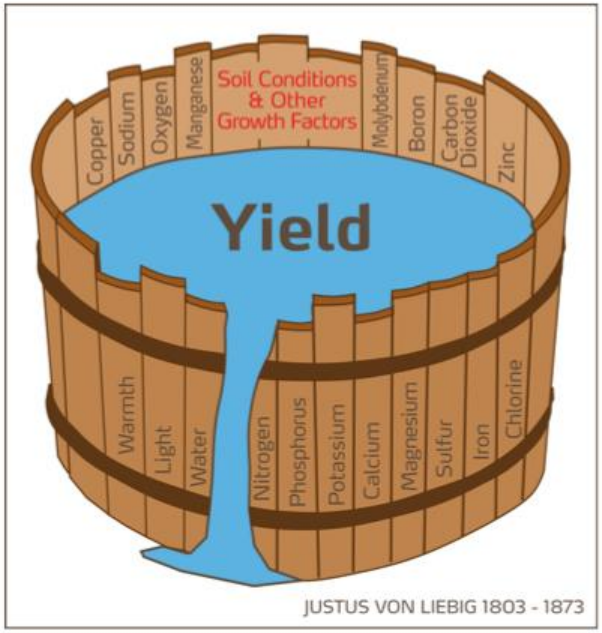
Justus von Liebig's "Law of the Minimum" published in 1873

"If one growth factor/nutrient is deficient, plant growth is limited, even if all other vital factors/nutrients are adequate…plant growth is improved by increasing the supply of the deficient factor/nutrient"



It's More Than Just Nitrogen

Soil pH Also Affects Nutrient Availability:

- If pH is too high or too low, nutrients become bound up in complex compounds and availability to the plants is limited

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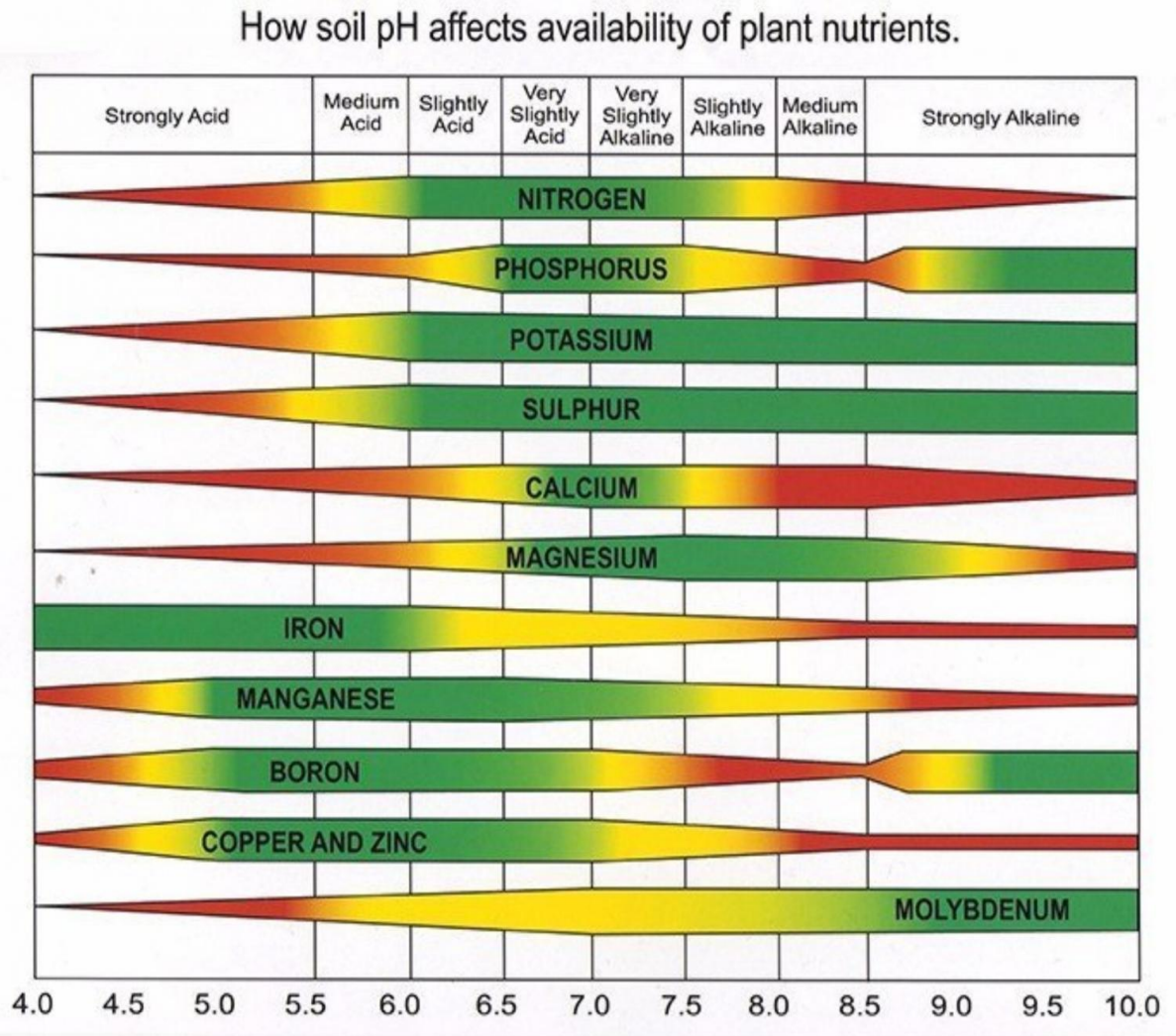

It's More Than Just Nitrogen

Automobile analogy:

- (N) Nitrogen = Fuel
- (P) Phosphorus = Oil
- (K) Potassium = Engine Coolant
- pH = Tire Air Pressure

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It’s More Than Just Nitrogen

Soil Testing Tells Us Which and How Much Fertilizer To Apply:

- Soil testing = checking the gauges

+

=

Nitrogen

Phosphorus

Potassium

Soil pH

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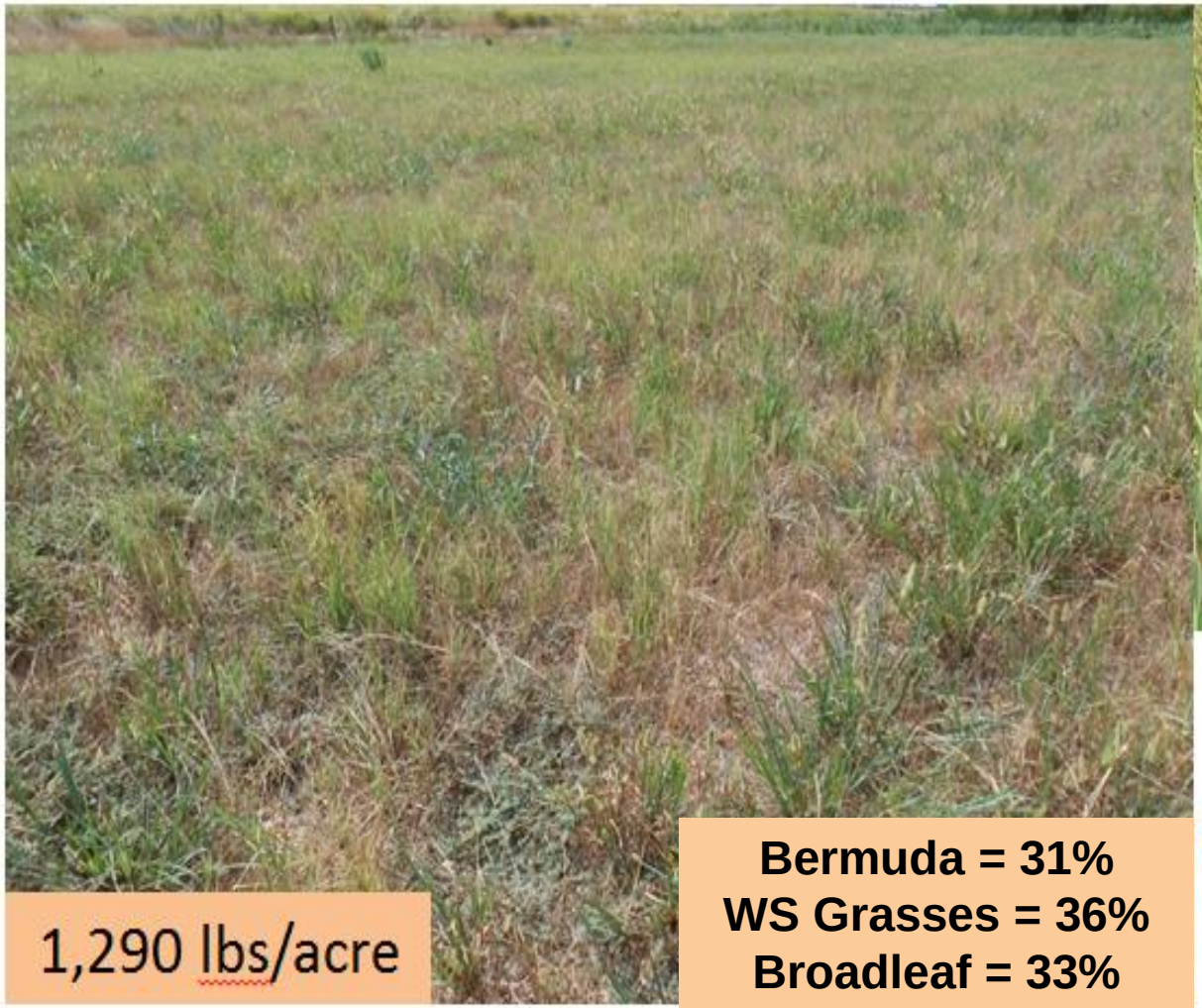
Long Term P Study (8/12)

7/24/12 – 57 days growth



1,290 lbs/acre

Bermuda = 31%
WS Grasses = 36%
Broadleaf = 33%

No fertility
9.25” avg. height

Long Term P Study (8/12)

This was with 2.97” of rainfall!!!

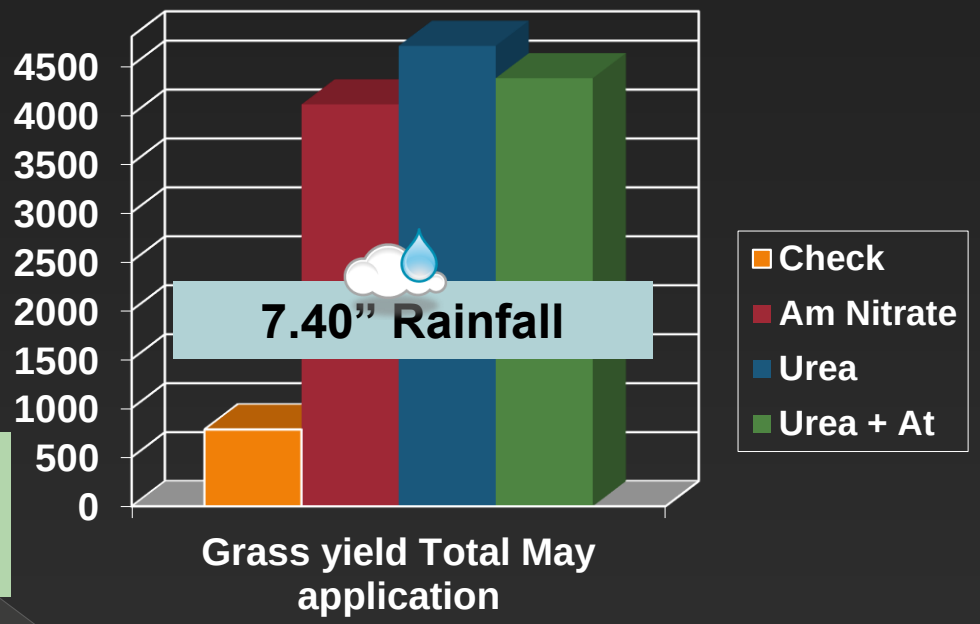
N Source Effects On Yield

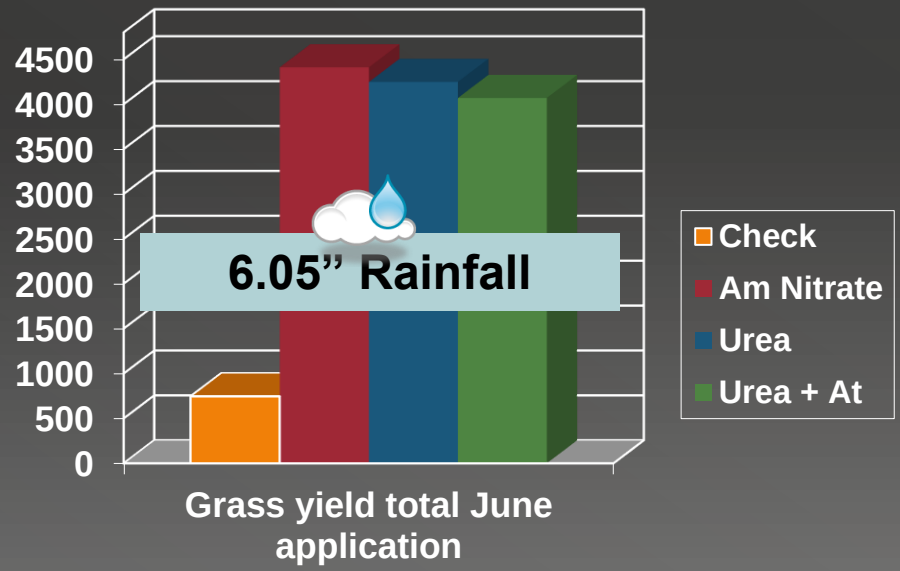
Kinta, OK 2005

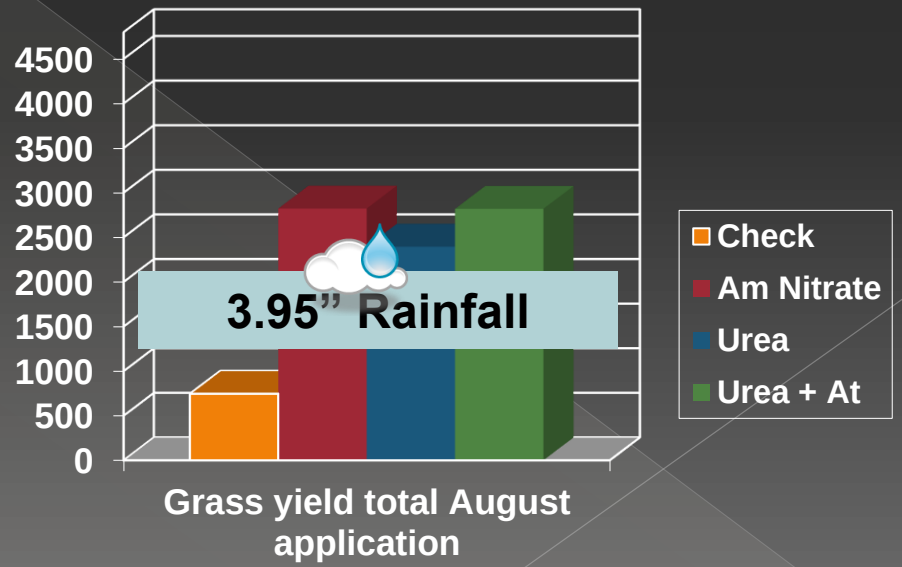
Brian Pugh & Chris Rice

Statistically no significant differences!

Plots harvested on Oct 17th







Application of 100 units N – 294 lb/ac amm. nitrate, 217 #/ac urea, or 217 lb/ac of urea+Agrotain.

Old-world Bluestems

Introduced –
Eurasia, India, et al.

Requires fertility!!

Stephens Co. – B. Dahl
Aug. 5 - fertilizer applied following baled

- 50, 75 and 100# actual N/ac
- 40# P_2O_5/ac per soil test
- Potassium & pH adequate
- **48-day forage accumulation**:
  - Control = 3,121 lbs./ac
  - 50# N = 5,135 lbs./ac (**2,014# fertilizer response**)
  - 75# N = 5,714 lbs./ac (**2,593# fertilizer response**)
  - 100# N = 5,906 lbs./ac.(**2,785# fertilizer response**)

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Fertility Management during Drought

- Introduced forages
  - P for root growth.
  - N at greenup/prior to rainfall.
  - Additional N based on soil moisture.
  - K for drought tolerance

Moisture Efficient WS Annuals

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Forage Water Use

Cool-season species				Warm-season species		
	gallons/pound	inches/ton			gallons/pound	inches/ton
Wheat	63	4.6		Sudangrass	33	2.4
Oat	66	4.9		Sorghum	33	2.4
Cereal rye	72	5.3		Blue grama	38	2.8
Smooth bromegrass	111	8.2				
Alfalfa	96	7.1				
Mean	83	6.0		Mean	35	2.5

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How can we make more efficient use of rainfall?

- Some grasses are naturally more drought tolerant than others
- This can result from a more efficient root system or from a reduced transpiration rate
- Crabgrass is a great example of a high moisture forage that even when Bermuda browns out will still be green
- Teff is another that can withstand dry weather while making high quality hay and/or forage

Native Grass Adaptability

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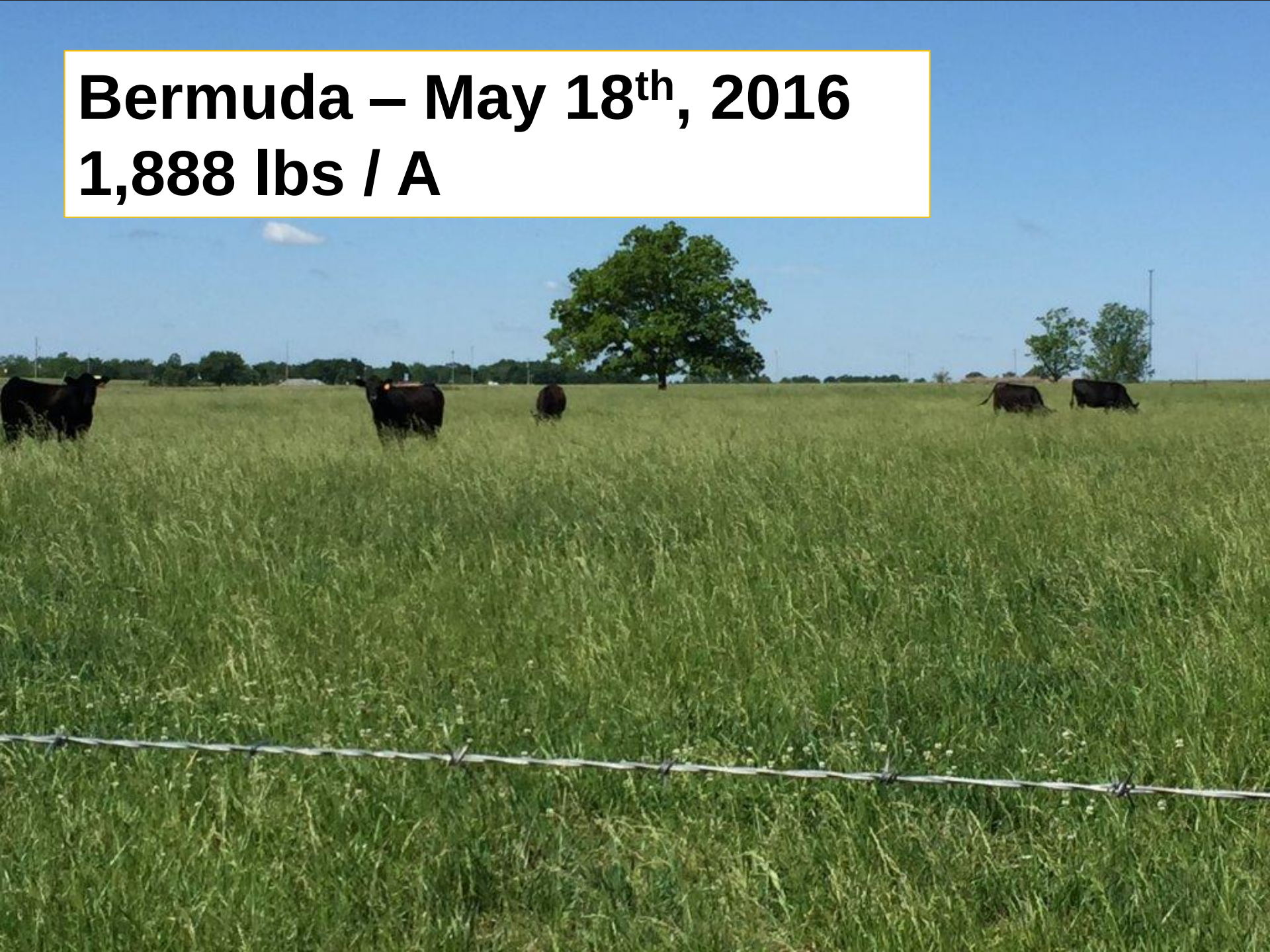
How can we make more efficient use of rainfall?

- Native grasses
- Adapted under wetting and drying cycles for thousands of years
- Will take some management to maintain a healthy stand
- Stocking rate!
- Standing winter forage

- Very deep rooted and therefore able to extract deep soil moisture
- Could go a long way to forage needs during a drought
  - 2012 – 5.6 tons
  - 2013 – 7.4 tons
  - 2014 – 6.9 tons
  - 2015 – 8.2 tons (no fire)


Bermuda – May 18th, 2016
1,888 lbs / A


Switchgrass – May 18th, 2016
6,244 lbs / A


Switchgrass – June 10th, 2016
Day 29


Switchgrass – July 12th, 2016
Day 61

Native Range

Fertility??

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Table 1. Effect of fertilizer rate on yield and profitability ranking of native grass at two Oklahoma locations (two-year average 2008-09)

	Location		Profitability Ranking
	St. Louis, Okla.	Ardmore, Okla.	1= most profitable
Treatment	Yield (lbs dry matter forage per acre)		5 = least profitable
0-0-0	2,536 D	1,504 B	1 A
50-0-0	3,674 C	2,213 B	3 A
50-50-0	4,648 AB	3,720 A	4 A
100-0-0	4,014 BC	2,161 B	5 B
100-50-0	5,212 A	4,024 A	2 A

Yields followed by the same letter are not statistically different at the 5 percent level of probability.

NRI; 2008-2009

Key Points:

- No fertilizer was more profitable than 100-0-0
- Adding phosphorus per soil test improved economics
- Profitability will vary with cattle and fertilizer markets
- Adding P to enhance long-term productivity?
- Weed response to fertility
  - Need good range condition and/or weed control

Grazing/ Mowing Height

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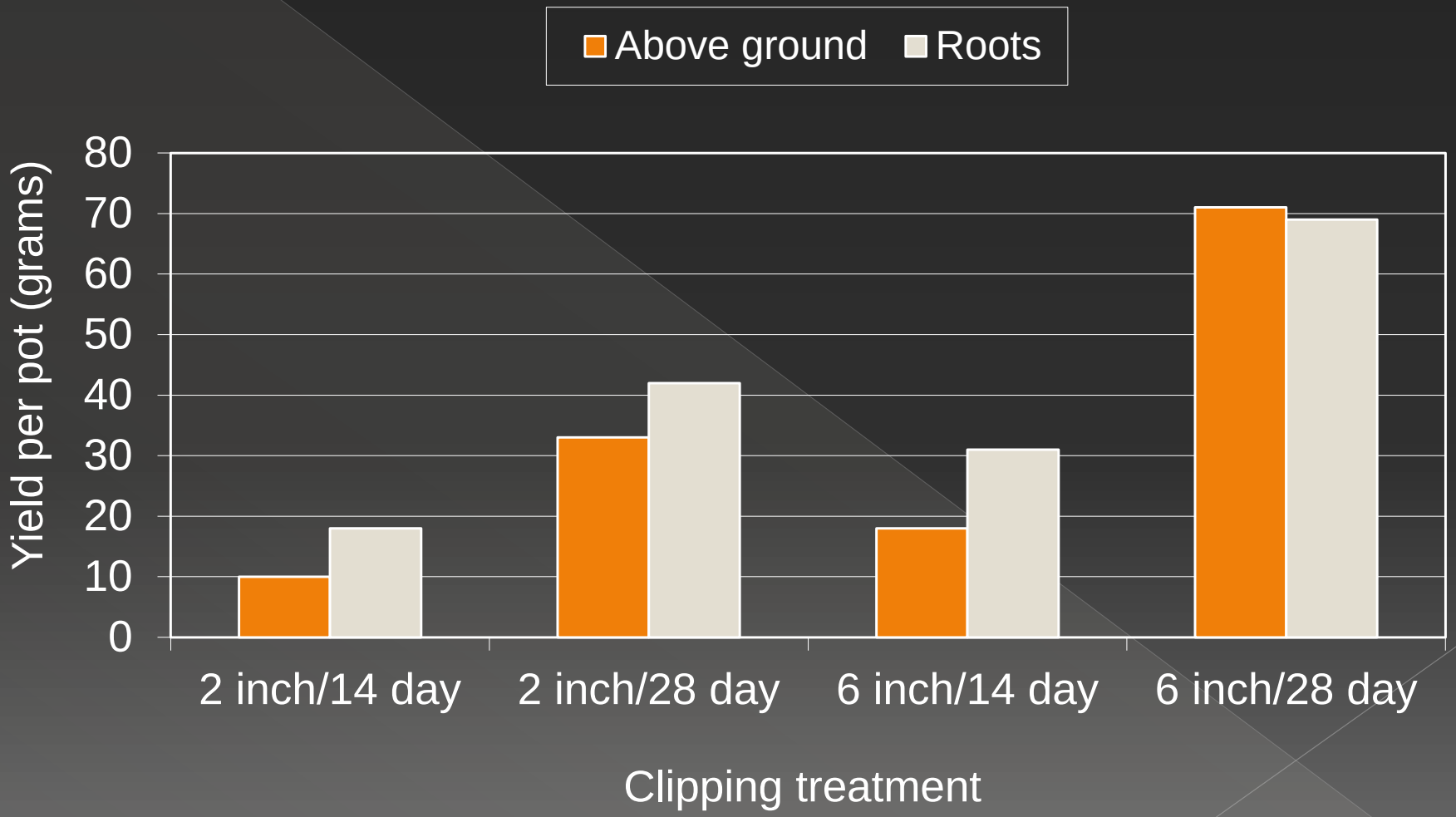
How can we make more efficient use of rainfall?

- Many producers over graze and mow hay fields too short and this halts growth…reducing yield over the season
- Open canopies tend to see higher soil temps and therefore increased evapotranspiration rates
- This management technique also tends to reduce the root system mass, reducing the ability of plants to harvest moisture from the soil profile

Clipping height and frequency effects on plant yield



Harvest Deferment during Drought

- Don't graze too early!
- Allow at least 4 to 5 weeks of uninterrupted growth.
- Maintain a critical stubble height
  - Bermudagrass – no less than 3 inches
  - Fescue – 4-6"
  - Native – 6" minimum!

- Just as "it takes money to make money."
  - **It takes grass to grow grass; leaves are the plants' solar panels.**
    - How do we manipulate forage DM yields and mitigate impacts of drought?
      1. **Fertility**
      2. **Grazing/harvest management**