

A photograph of a herd of brown cows grazing in a lush green field. The cows are scattered across the field, with one cow in the center looking towards the camera. The background shows a line of trees under a clear sky.

**Forage Fertility to Improve Herd
Nutrition...**

...and not break the bank

Cheryl Mackowiak, Soil Fertility and Water Quality

UF-IFAS, North Florida Research and Education Center, Quincy, FL

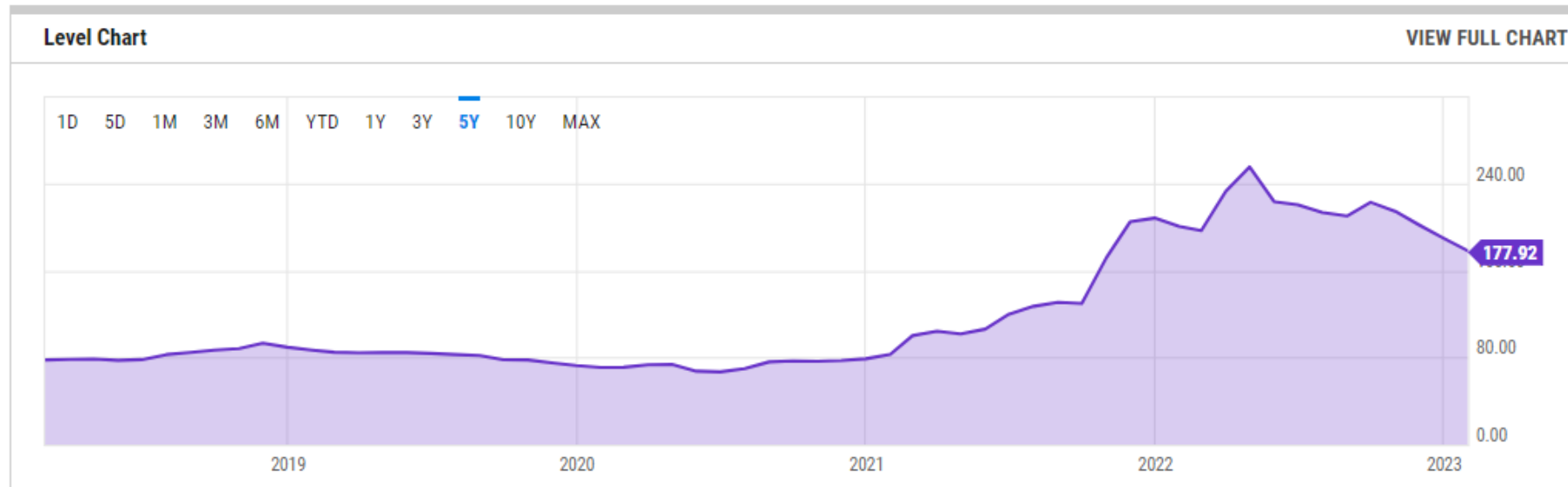
Fertilizer prices trending lower but remain historically high in 2023

Fertilizers Price Index

177.92 for Jan 2023

Overview

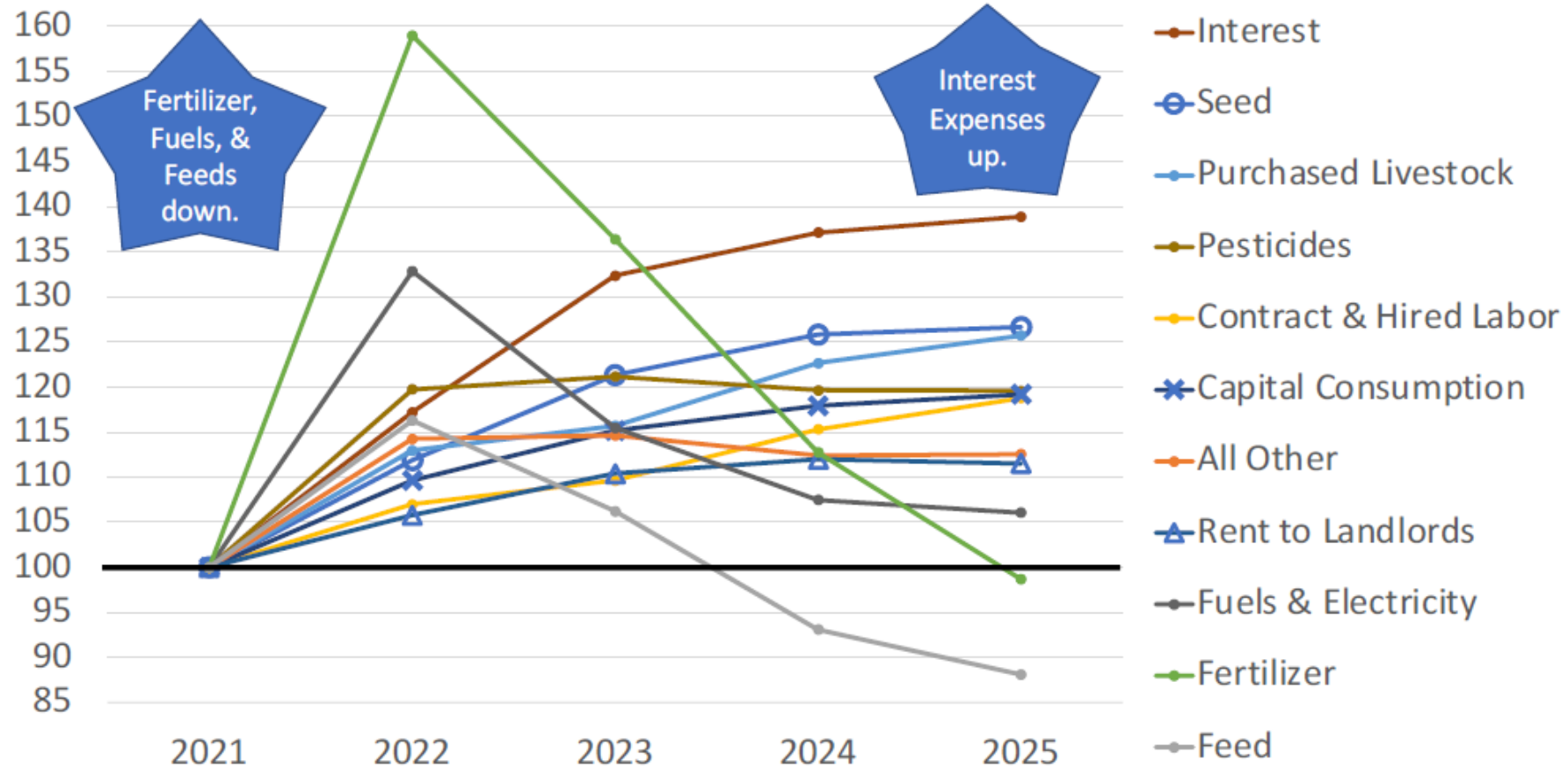
Interactive Chart



- Potash out of Canada: Supply chain improved
- Phosphate: ample supplies in US.
- Nitrogen trend is the big unknown!

https://ycharts.com/indicators/fertilizers_index_world_bank

Baseline Projections Index: U.S. Farm Production Expenses, 2021-2025 (2021 = 100)



Source: Food & Agricultural Policy Research Institute Baseline Update Projections, Sep. 2022

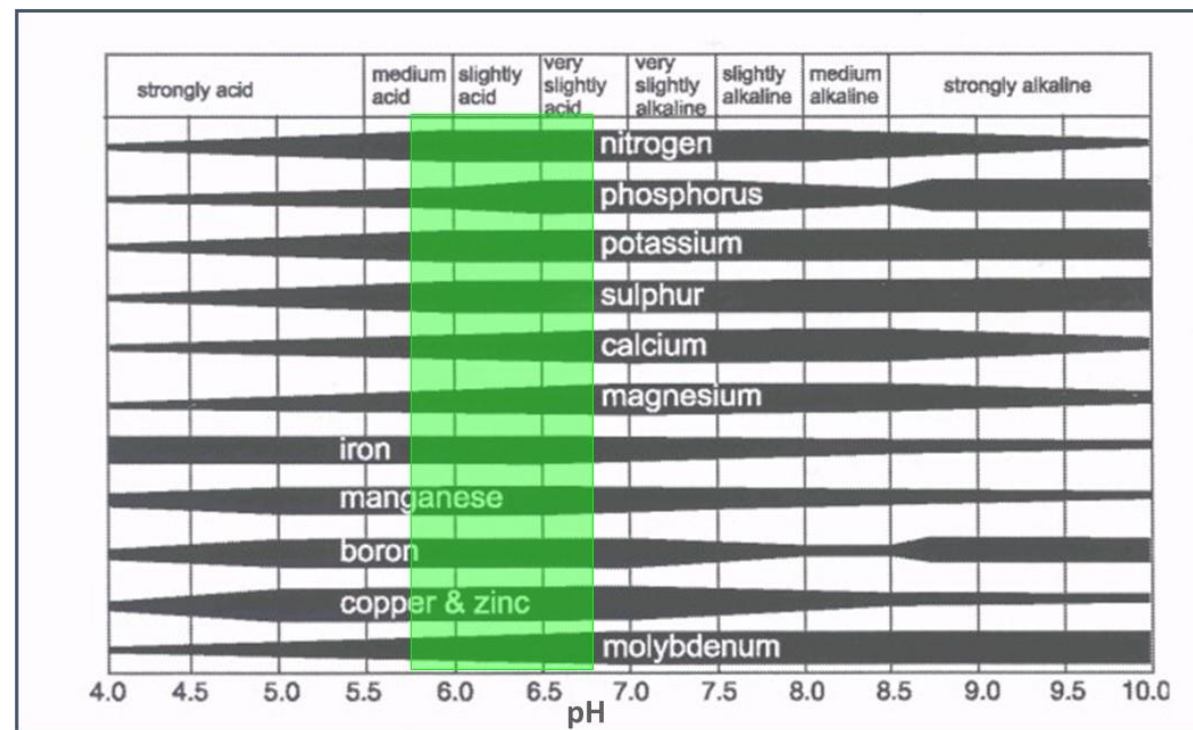
Amanda Smith, Economist, UGA, 2023



2nd least expensive cost is to lime your soil IF your soil pH is below target pH (~ 5.5)



Bahiagrass under high (> 6.5) pH

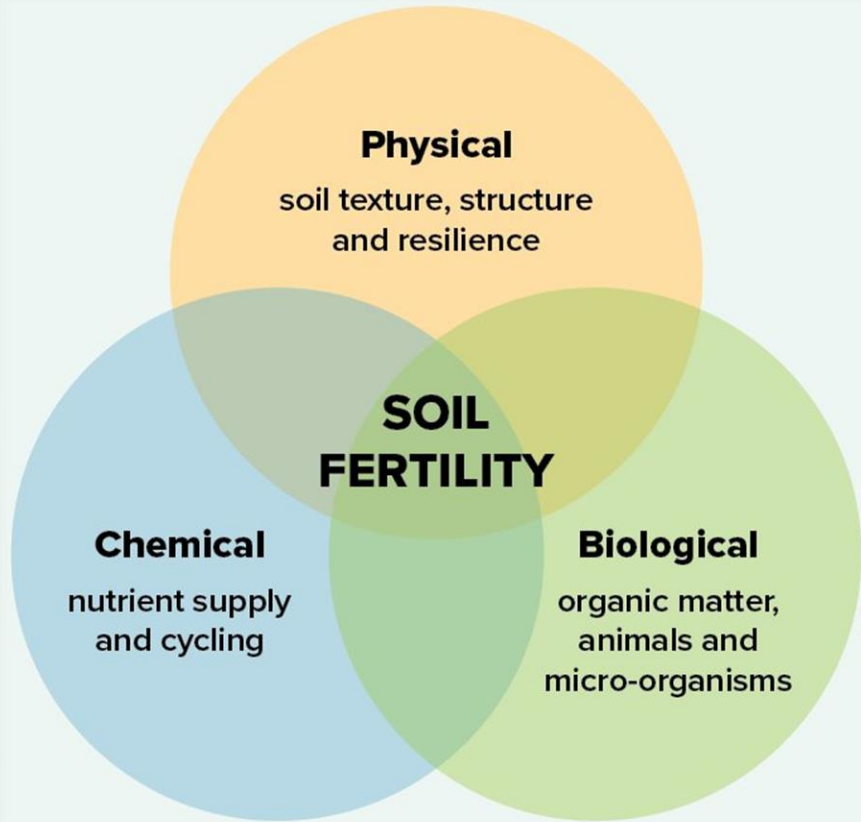


Hay production removes a lot of fertility!

Crop	Yield Per Acre	N	P ₂ O ₅	K ₂ O	Ca	lb/acre	
						Mg	S
Bahia or Bermudagrass Pasture	200 lb. beef	6	5	1
Bermudagrass Hay	8 tons	400	92	345	48	32	32

Charles Mitchell, Auburn

Soil Fertility



If you don't know where you are going, you might end up someplace else...

Yogi Berra

Organic Matter “Grows” More Forage

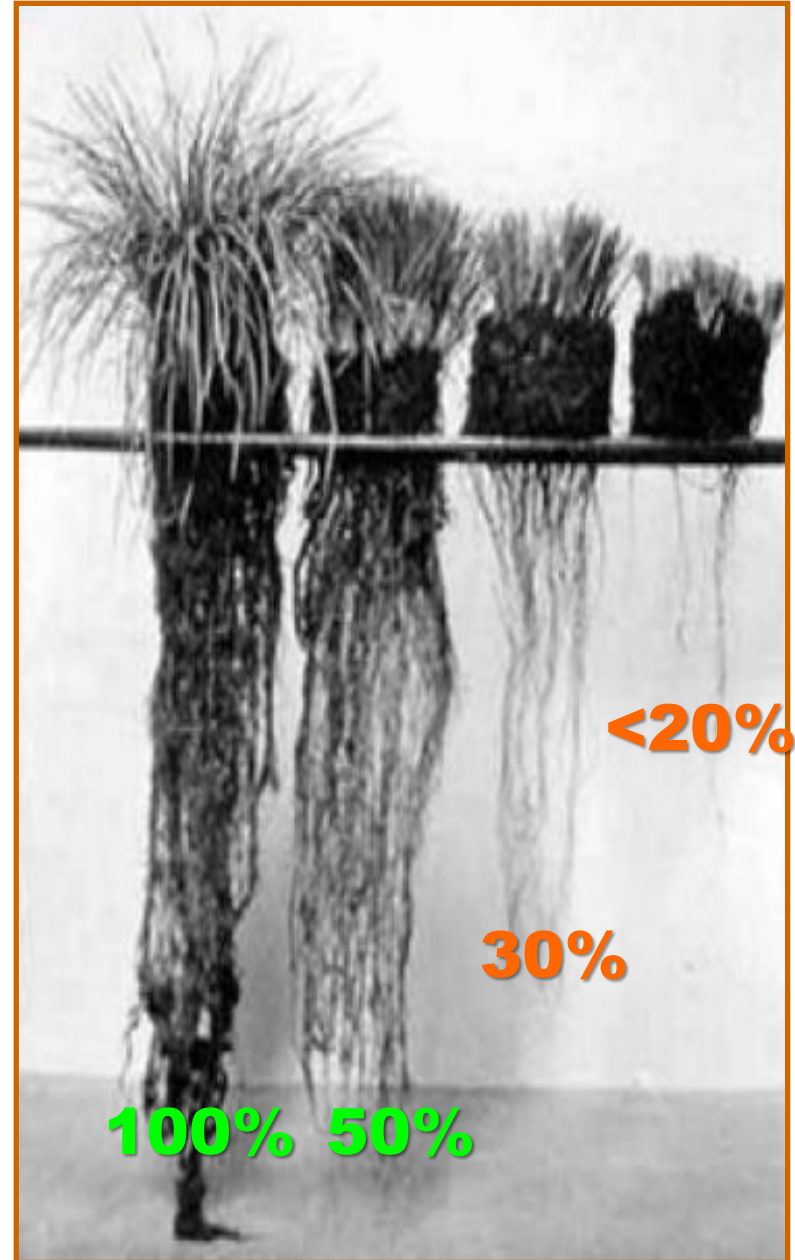
- Conserves soil moisture
- Holds plant nutrients
- Increases soil aggregation





The plant as a factory...

- Roots provide raw materials (water, nutrients, energy reserve).
- Leaves are the assembly line.





Good grazing management
24/7, & year-round!



Is there fat to trim from my fertilization costs?



- Grid sampling for variable rate application
- Ag, municipal, industry by-products
- Apply only what you require

“Be careful at work, dear. They’ll be looking everywhere for ways to trim the fat.”

Grid Size – Application Accuracy vs Cost (lime)

Field 1

- Average variable land
- More adequate pH zones
- Larger grids=overapply lime

Grid Size	Accuracy (%)	Cost (\$/ac)
1.0	90	20
2.5	85	14
5.0	75	15
7.5	66	20
10.0	34	17

Field 2

- Highly variable land
- Overall, more acid zones
- Larger grids=overapply lime

Grid Size	Accuracy (%)	Cost (\$/ac)
1.0	87	43
2.5	66	35
5.0	51	31
7.5	46	33
10.0	45	41

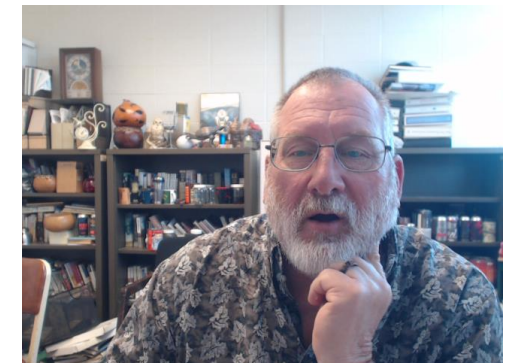
Field 3

- Least variable land
- Generally high lime requirement
- Larger grids=overapply lime

Grid Size	Accuracy (%)	Cost (\$/ac)
1.0	95	34
2.5	93	30
5.0	87	32
7.5	62	30
10.0	30	39

If unsure, 2.5-acre grid size perhaps the best compromise...

Tables from Glen Harris



Application Cost = Soil sampling + soil analysis + cost of lime



UNIVERSITY OF GEORGIA
EXTENSION

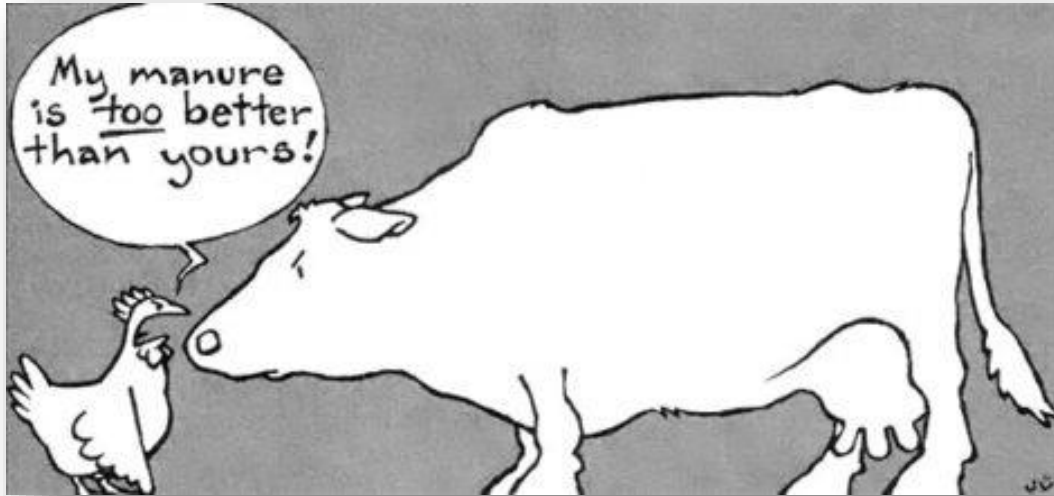
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Agricultural, Municipal and Industrial By-Products



Chicken Litter
"Poultash"
Gin Trash



Biosolids
Symtrex
Sus-Terra



FGD Gypsum
Wood Ash
Wallboard
RecycLime



Conventional fertilizer alternatives?

- Biosolids (Class AA or Class B): contains everything but potassium (great source of micronutrients)
- Wood ash: Primarily as liming agent (~ 50% of Ag lime CCE); contains ample potassium and manganese (micronutrients)
- Soil biologicals and other supplements: Targeting corn and other row crops to help produce more with less fertilizer inputs. Often products are expensive (\$10 to \$30/acre). Must put pen to paper and you need more than testimonials. Would aim for at least 20% yield gain.



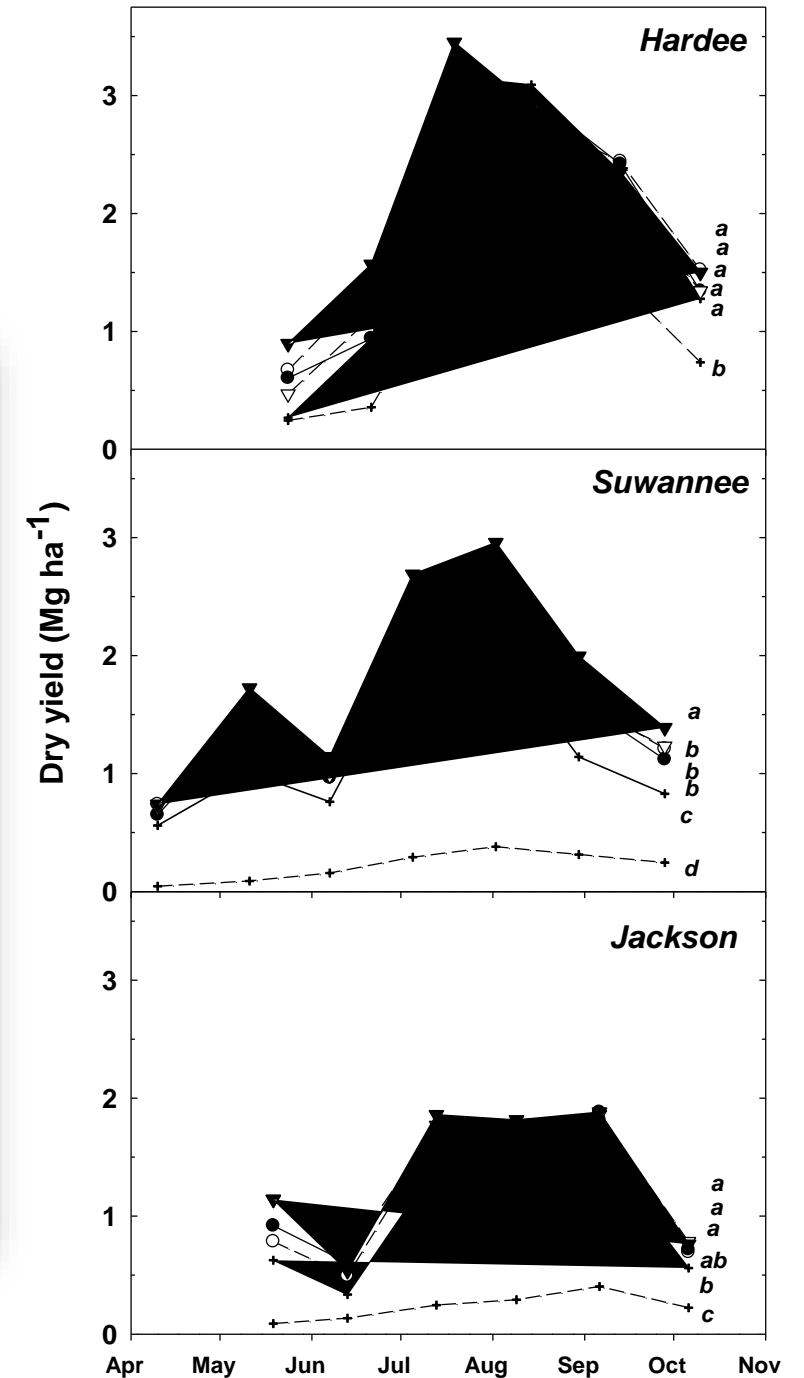
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Timing: Daylength has a strong influence on warm-season forage yield!



Bermudagrass response to N sources (season total)

Treatment	Bermudagrass total yield	
	BC field	JP field
	----- (kg ha ⁻¹) -----	
CTL	6,615 c	8,170 b
UCU	11,903 b	17,386 a
ARB	12,454 ab	15,420 a
ESN	15,795 a	16,447 a
BIO	11,275 bc	13,273 a
SE	812	811
<i>p</i> value	0.0003	<0.0007

CTL = control; UCU = uncoated urea; ARB = Arborite; ESN = polymer-coated; BIO = Class AA biosolids

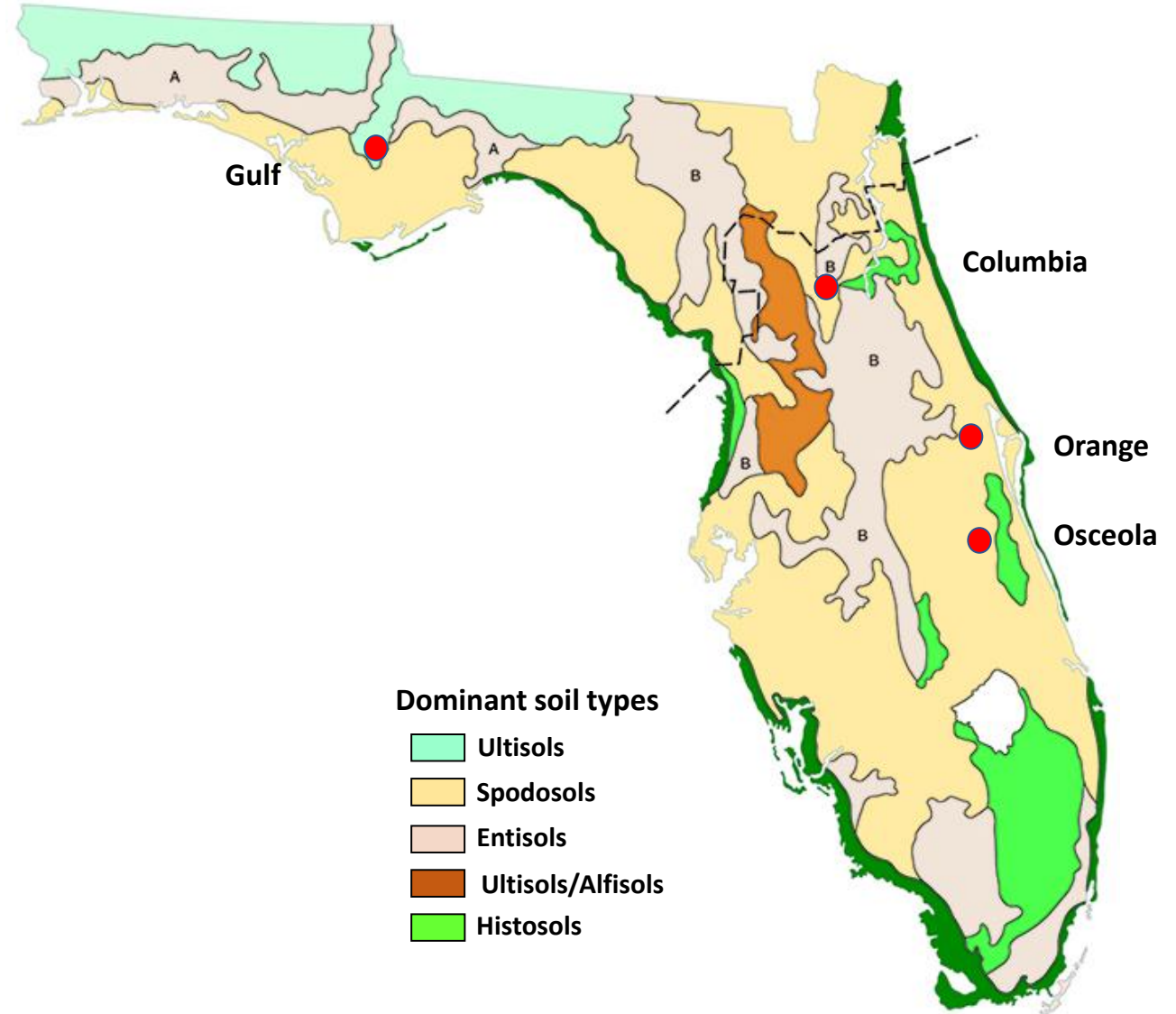
Bahiagrass response to N sources (season total)

Treatment	Bahiagrass total yield	
	House field	Low field
	----- (kg ha ⁻¹) -----	
CTL	4,567 b	4,324 b
UCU	8,578 a	10,097 a
ARB	7,342 ab	10,721 a
ESN	9,043 a	10,055 a
BIO	9,205 a	8,536 a
SE	763	535
<i>p</i> value	0.0109	<0.0001

Bahiagrass often yields less than productive bermudagrass varieties, (i.e., Tifton-85)

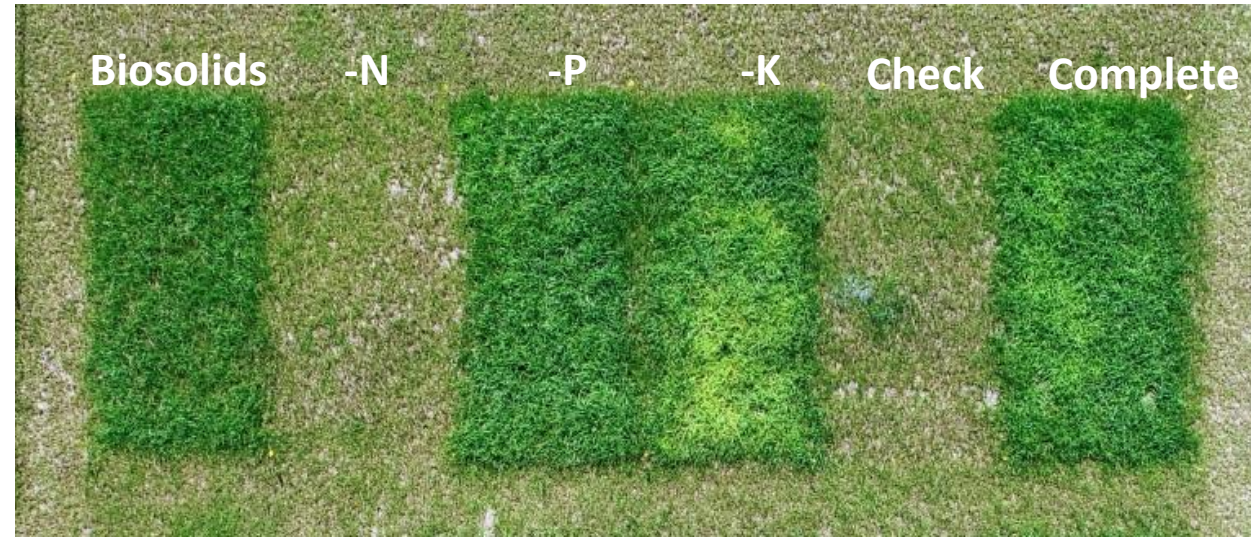
Results from a multi-year, on-farm, bahiagrass fertilizer depletion study

- Four Florida counties.
- Osceola county for 6 years and others for 3 years.
- Compared full fertilization (N, P, K) against same but used biosolids (class AA), versus minus N, minus K, and minus P treatments. A check (no fertilizer application was also included).

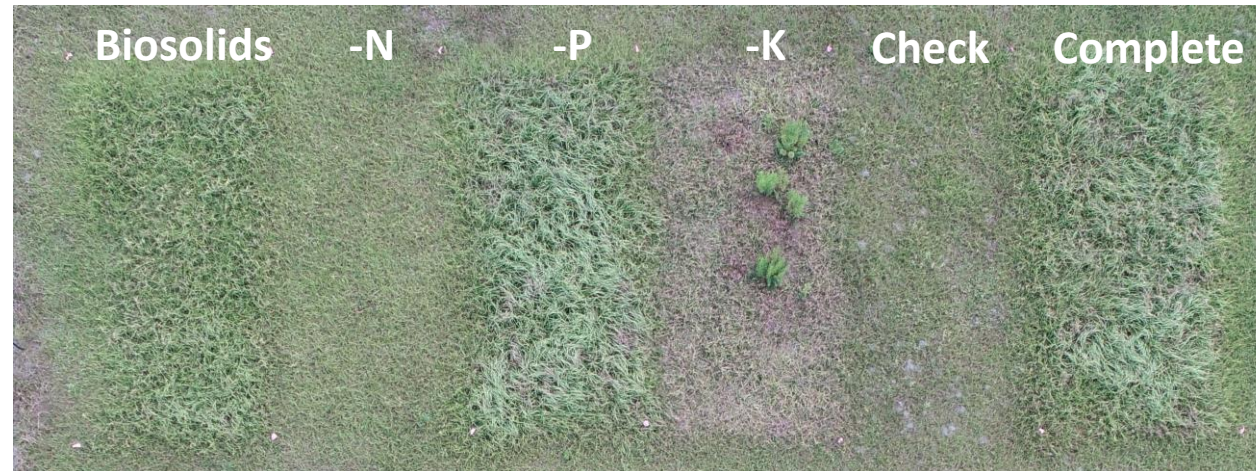


Bahiagrass long-term fertility trial

**Osceola county
plots after 3 years**



**Osceola county
plots after 6 years**



Bahiagrass fertility trial (roots)



Complete

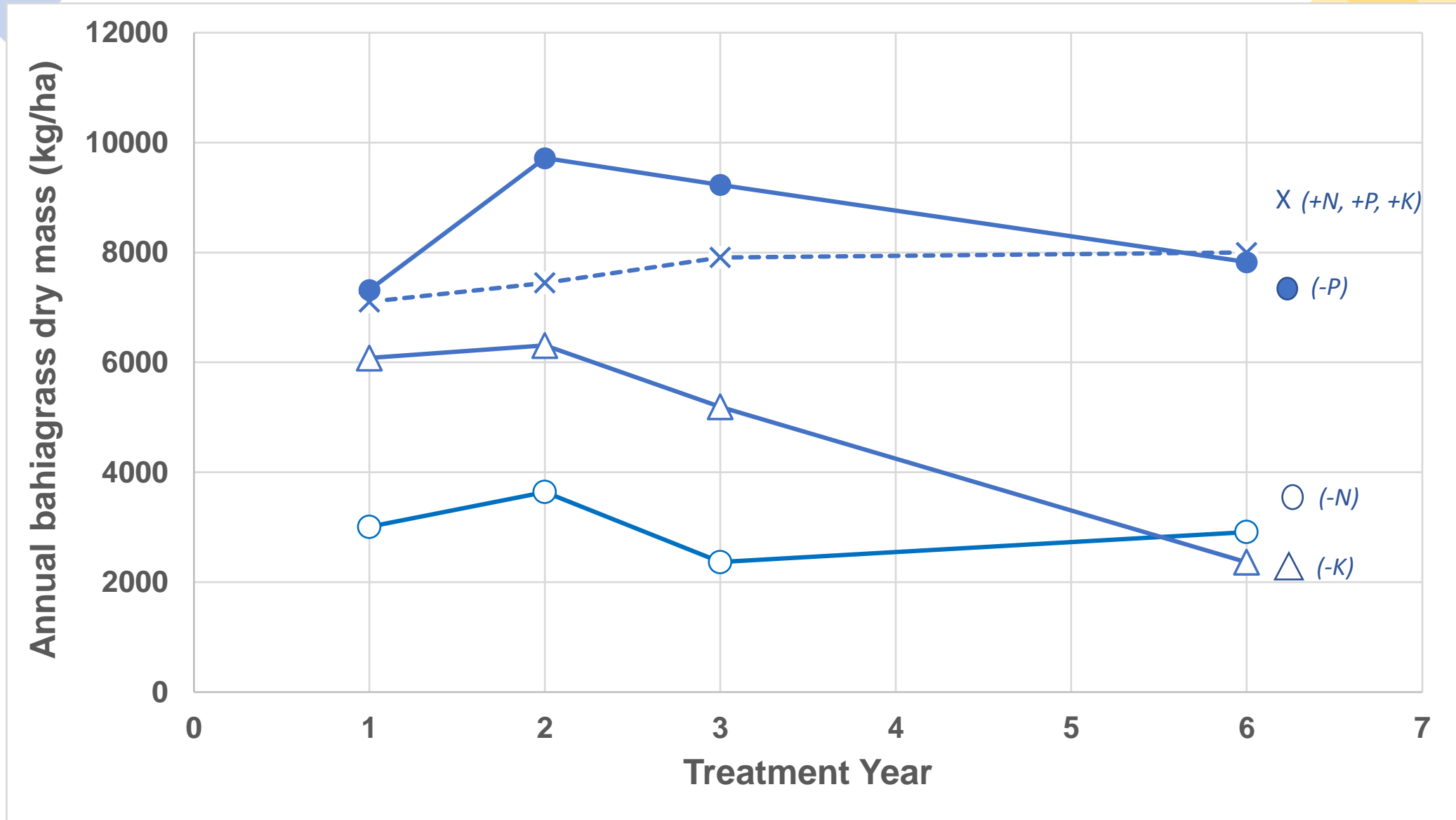


Minus K



Minus P

Osceola County

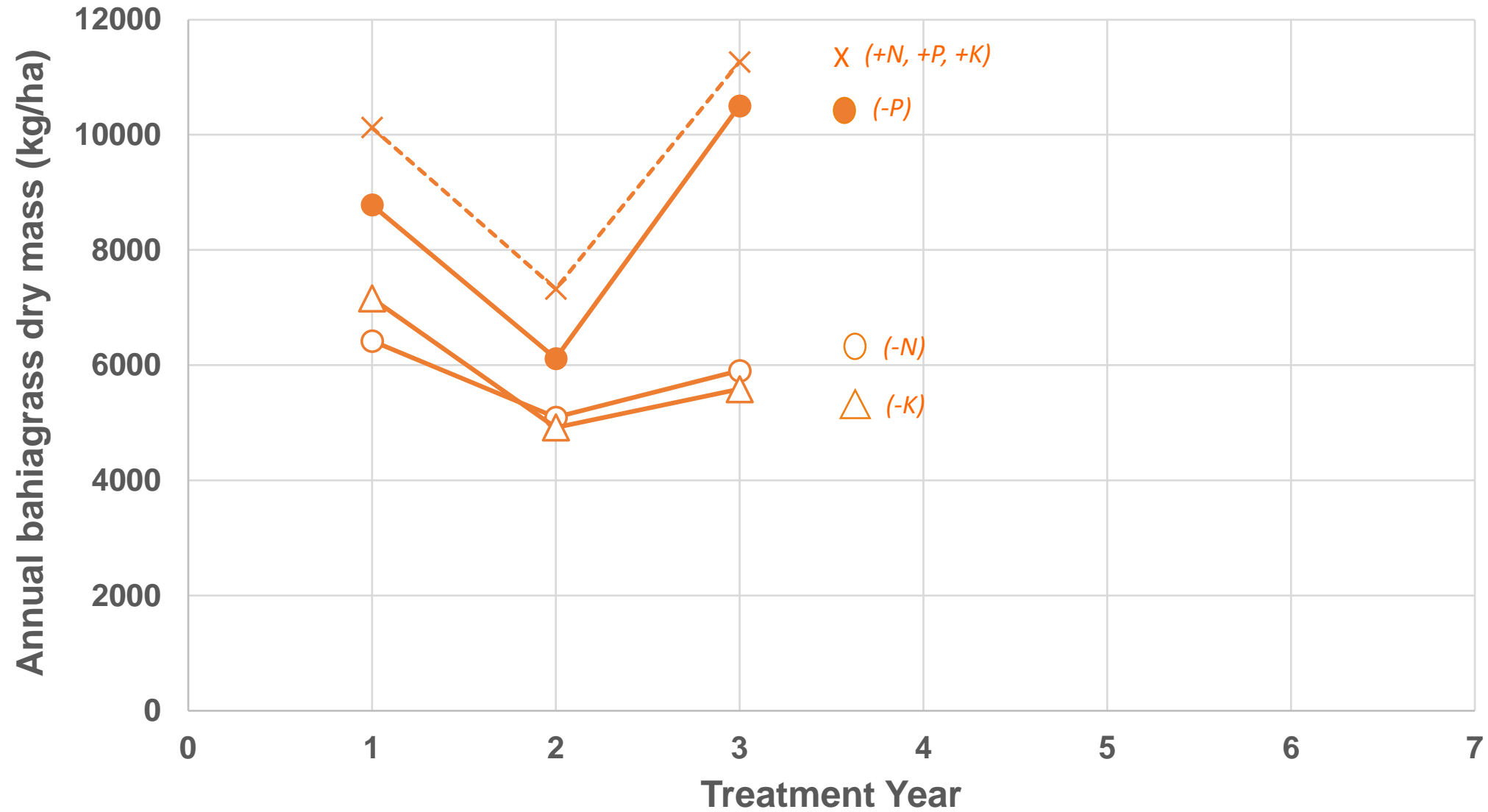




Potassium deficiency in bahiagrass

- Leaf tip scorching is visually somewhat similar to cold damage (pale, frayed tips).
- Greater susceptibility to fungal diseases, such as Bipolaris leaf spot.

Gulf County



Nutrient uptake (removed by forage) in year 3 (Osceola County)

Nitrogen		kg N ha ⁻¹	<u>N (lbs/a)</u>	Phosphorus		kg P ha ⁻¹	<u>P₂O₅ (lbs/a)</u>
Complete fertilizer	<i>a</i>	96	86	Complete fertilizer	<i>ab</i>	16.9	36
Class AA biosolids ^y	<i>ab</i>	83	74	Class AA biosolids	<i>a</i>	19.7	42
Minus P fertilizer	<i>a</i>	108	96	Minus P fertilizer	<i>c</i>	11.8	24
Minus K fertilizer	<i>b</i>	86	77	Minus K fertilizer	<i>bc</i>	16.6	34
Minus N fertilizer	<i>c</i>	32	29	Minus N fertilizer	<i>d</i>	7.0	14
No fertilizer (check)	<i>d</i>	38	34	No fertilizer (check)	<i>e</i>	6.7	14

Potassium		kg K ha ⁻¹	<u>K₂O (lbs/a)</u>
Complete fertilizer	<i>a</i>	95	102
Class AA biosolids	<i>a</i>	96	103
Minus P fertilizer	<i>a</i>	125	134
Minus K fertilizer	<i>c</i>	36	39
Minus N fertilizer	<i>b</i>	35	38
No fertilizer (check)	<i>d</i>	26	28

Nitrogen and management demo for late-season bahiagrass pastures

Treatment	Mature Grass	Mow Only	Mow + 30# N/A	Mow + 50# N/A	Mow + 80# N/A
Dry lbs/acre	1,460	840	1,560	2,180	2,250
Crude Protein (%)	4.8	6.6	8.0	10.1	10.4
Potential Use	Grazing with Significant CP Supplementation	Grazing with Limited CP Supplementation	Grazing for Dry Pregnant Cows	Grazing for Cows or Hay for Mature Cows	Grazing for Cows or Hay for Mature Cows Potential N Leaching

Yield and quality measured 6 weeks after treatment in August 2018

Cost: \$38/ton

Cost: \$46/ton

Cost: \$71/ton

What is quality worth? Compare against supplementation



NFREC Beef & Forage Field Day (April 13th) (Marianna)

- Bahiagrass pasture
- Spring pasture N timing
- Overlay a legume mix on half the plots (Austrian winter pea, hairy vetch, crimson clover)
- Forage sampling continues into May
- Will discuss late, cool-season plantings and early fertilizer applications with associated costs

Legume	No legume	Legume	No legume	No legume	Legume	Legume	No legume
No N	No N	25 lbs/A Feb 4th	No N	50 lbs/A Apr 4th	25 lbs/A Feb 4th	50 lbs/A Apr 4th	50 lbs/A Mar 4th
25 lbs/A Feb 4th	25 lbs/A Feb 4th	50 lbs/A Feb 4th	50 lbs/A Mar 4th	25 lbs/A Feb 4th	50 lbs/A Mar 4th	50 lbs/A Mar 4th	50 lbs/A Feb 4th
50 lbs/A Feb 4th	50 lbs/A Feb 4th	50 lbs/A Apr 4th	50 lbs/A Feb 4th	No N	25 lbs/A Feb 4th	No N	50 lbs/A Apr 4th
50 lbs/A Mar 4th	50 lbs/A Mar 4th	50 lbs/A Mar 4th	50 lbs/A Apr 4th	50 lbs/A Mar 4th	No N	25 lbs/A Feb 4th	No N
50 lbs/A Apr 4th	50 lbs/A Apr 4th	No N	25 lbs/A Feb 4th	50 lbs/A Feb 4th	50 lbs/A Apr 4th	50 lbs/A Feb 4th	25 lbs/A Feb 4th
Block 1		Block 2		Block 3		Block 4	

Take home messages

- Start with soil report and other basics. Have a management plan and realistic expectations.
- Grid sampling (variable rate lime and fertilizer applications) might save you money, particularly if land is highly variable.
- Bahiagrass producers might be able to delay P inputs, lower K inputs (short-term!) and tweak N application timing.