



Forage Species for Kentucky's Small Ruminants

Chris Teutsch, chris.teutsch@uky.edu


UK Research and Education Center, Princeton, KY



Introduction

- Ruminants co-evolved with grasslands
 - natural grazing animal
 - able to digest plant fiber
 - extract energy from low quality feed source
- Modern Pastures
 - high quality feed source
 - inexpensive feed source
 - Reduce soil erosion
 - Increase water infiltration





Forage Options for Kentucky and the Upper South

Forage Species Adapted to Kentucky

- Alfalfa
- Austrian winter pea
- Barley
- Bermudagrass
- Birdsfoot trefoil
- Kentucky bluegrass
- Smooth brome grass
- Caucasian bluestem
- Corn
- Crimson clove
- Crabgrass
- Crownvetch
- Dallisgrass
- Eastern gamagrass
- Meadow fescue
- Tall fescue
- Creeping red fescue
- Johnson grass
- Kudzu
- Annual lespedeza



- Sericea lespedeza
- Matua prairie grass
- Pearl millet
- Foxtail millet
- Oats
- Orchardgrass
- Rape or brassica
- Red clover
- Reed canarygrass
- Rye
- Annual ryegrass
- Perennial ryegrass
- Sorghum
- Soybean
- Sudangrass
- Sweet clover
- Switchgrass
- Timothy
- Wheat
- White clover

Common Forage Species

- Alfalfa
- Annual ryegrass
- Barley
- Bermudagrass
- Corn
- Crimson clover
- Eastern gamagrass
- Tall fescue
- Annual lespedeza
- Sericea lespedeza
- Matua prairie grass
- Pearl millet
- Crabgrass?
- Perennial ryegrass
- Foxtail millet
- Kentucky bluegrass
- Oats
- Orchardgrass
- Red clover
- Rye
- Sorghum species
- Soybean
- Sudangrass
- Switchgrass
- Teff grass
- Wheat
- White clover

Weed or Forage?

- Defining weeds
 - Plant that is not valued where it is growing
 - Plant that cattle will not readily consume
- Weeds are low in nutritional value

Plant Species	IVDMD	ADF	CP
	-----%-----		
Alfalfa	72	24	27
Redroot pigweed	73	21	25
Common ragweed	73	25	25
Giant foxtail	62	33	18
Barnyardgrass	70	33	18



Adapted from The nutritive value of common pasture weeds and their relation to livestock nutrient requirements, VCE Pub. 418-150.

Selecting Forage Species

- Characteristics of forages
 - regionally adapted
 - adapted to your soils
 - high yielding
 - high nutritive value
 - drought and heat tolerant
 - tolerant of close and frequent grazing
 - persistent
- What are the options?



Cool- and Warm-Season Grasses

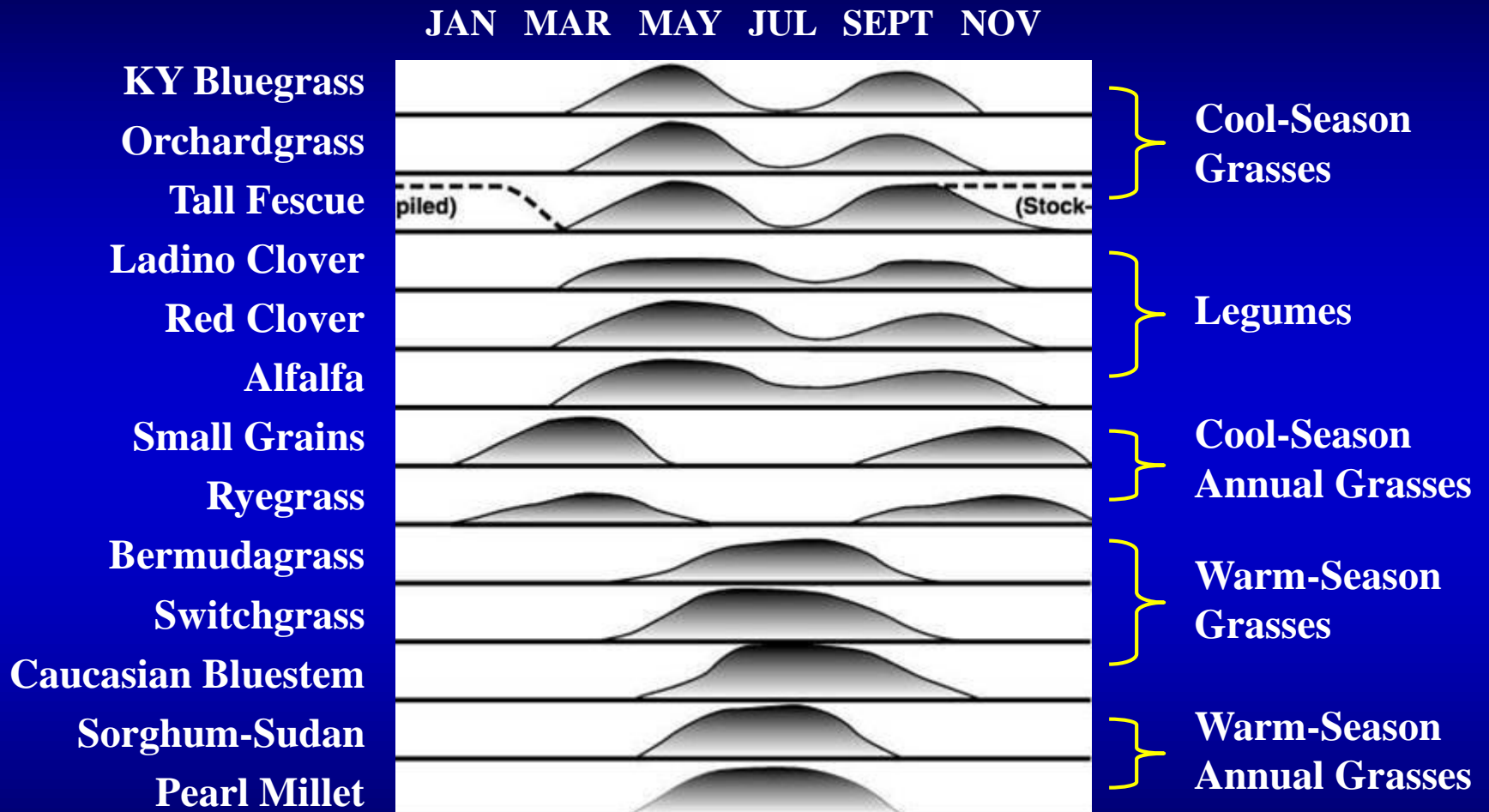
- **Cool-Season Grasses**
 - optimal growth at cooler temps (70 F)
 - more digestible and higher in CP
 - longer growing season
- **Warm-Season Grasses**
 - optimal growth at higher temps (90 F)
 - less digestible and lower in CP
 - more drought tolerant
 - more efficient at using water



Tall Fescue

Bermudagrass

Growth Curves for Common Forages



Adapted from Controlled Grazing of Virginia's Pastures, Publication 418-012

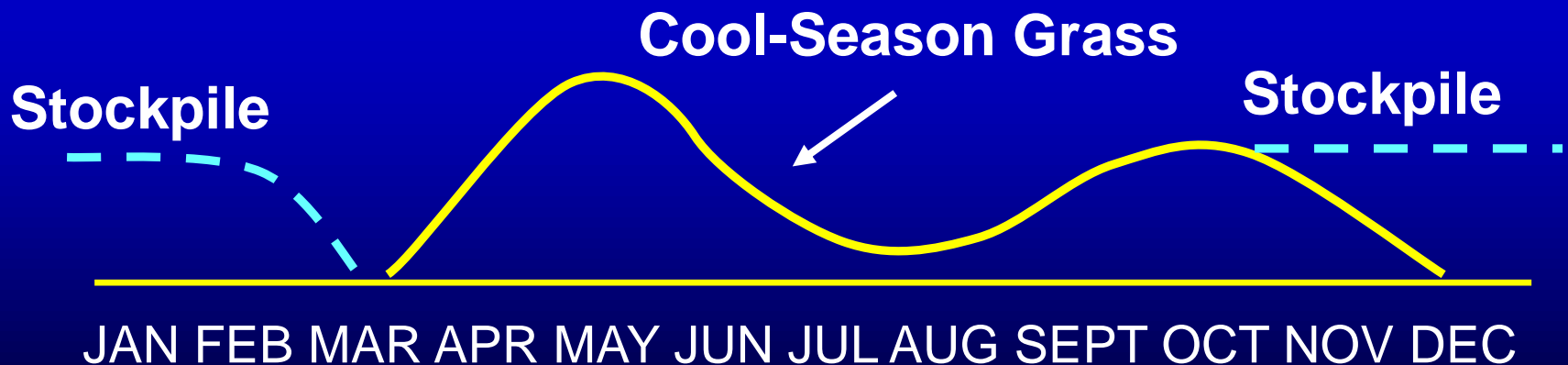
A close-up photograph of tall fescue grass blades, showing their characteristic serrated edges and green color. The blades are arranged in a dense, overlapping pattern, filling the entire frame. The lighting is bright, highlighting the texture of the grass.

Tall Fescue

- Best adapted cool-season grass
- Blessing rather than a curse
- Focus on management
 - Optimizing soil fertility
 - Managing for legumes
 - Incorporating novel endophyte
 - Stockpiling for winter grazing

Stockpiling Cool-Season Grasses

- **Stockpiling**
 - allowing forage growth to accumulate
 - best option for extending grazing
- **Protect pastures to be stockpiled!!!**
- **Seasonal Distribution**



10-Feb-2010

- **16% CP**
- **34% ADF**
- **60% NDF**
- **60% TDN**



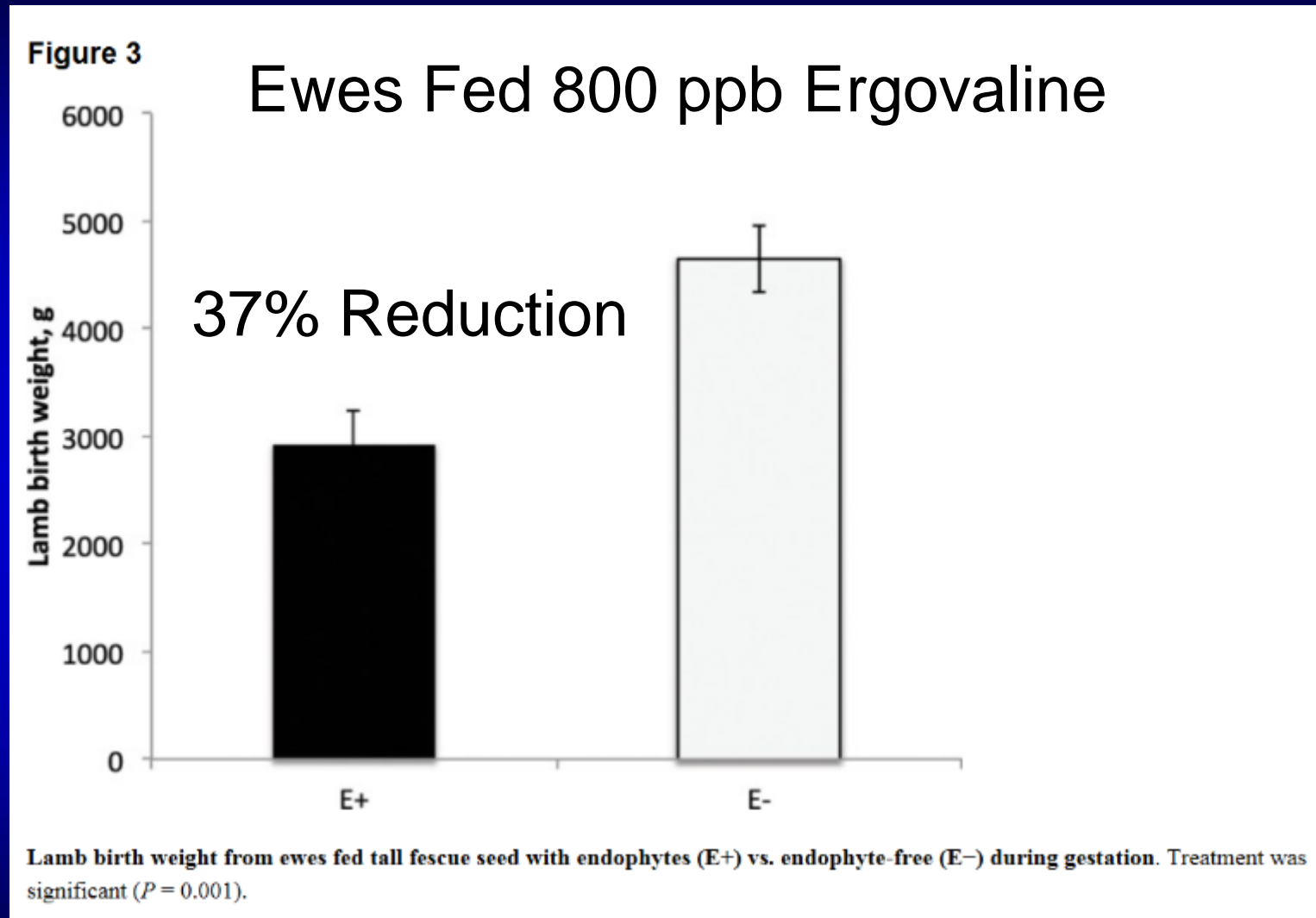
Novel Endophyte Tall Fescue

- Latest chapter in tall fescue story
- Remove toxic replace with novel
- Requires higher level of management

Cultivar	Location	Pasture Endophyte Status		
		Toxic	Free	Novel
		Average Daily Gain (lbs)		
ArkPlus	Fayetteville, AR	0.90	1.50	1.40
	Mt. Vernon, MO	0.55	1.25	1.25
MaxQ	Calhoun, GA	1.03	1.84	1.81
	Eatonton, GA	1.14	2.24	1.91

Roberts, C. and J. Andrae. 2010. Fescue Toxicosis and Management. ASA-CSSA-SSSA, Madison, WI.

Impact of Ergot Alkaloids on Lamb Birth Weight



Duckett, S.K, J.G. Andrae, and S.L. Pratt. 2014. Exposure to ergot alkaloids during gestation reduces fetal growth in sheep. *Front Chem.* 2014; 2: 68. doi: 10.3389/fchem.2014.00068.

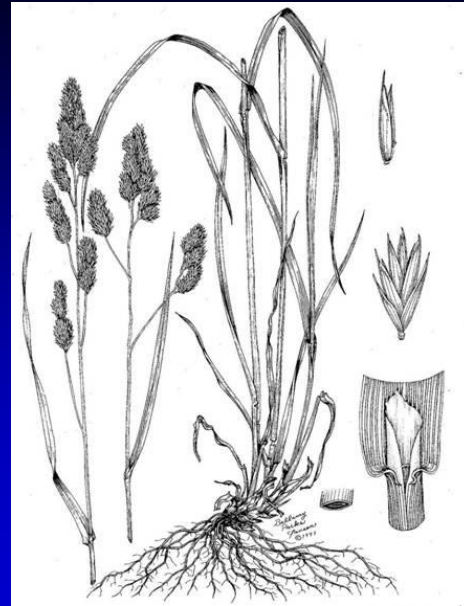
Variety	Species	2007	2008	2009	2010	2007-10	Commerically Available Novel Endophyte
		lb DM/A					
RAD-ERF47	TF	6644	8476	9500	7011	31631	
AGRFA144	TF	6353	8954	9374	6399	31080	Texoma MaxQ II
KY31/EI	TF	6119	8586	9708	6572	30986	
ISI-FTF31	TF	6255	8358	8821	6547	29981	
Bronson	TF	6475	7945	8544	6999	29964	
RAD-ERF48	TF	6691	7910	8654	6627	29882	
Jesup MaxQ	TF	6523	8576	8538	6235	29872	Jesup MaxQ
AGRFA140	TF	5822	8090	9201	6156	29269	
KYFA9301/EF	TF	5653	7217	8884	6647	28401	
KYFA9821/EF	TF	6113	7573	8538	6121	28345	
AGRFA155	TF	5630	7784	8927	5931	28271	
Kora	TF	5972	7525	8682	5915	28094	
RAD-ERF38	TF	5438	7816	8590	6160	28004	
KYFA9304/EF	TF	5306	7752	8860	5824	27741	
Advance MaxQ	TF	5864	7591	8418	5829	27702	
KYFA9301/AR584	TF	5259	7654	8739	5858	27510	Lacefield
K6560QII542	TF	5252	7924	8157	6083	27416	
KFA402V542	TF	5567	6762	8492	6031	26853	
KYFA9821/AR584	TF	5492	7226	8240	5872	26831	
KY31/EF	TF	4991	7586	8603	5372	26551	
BAR-FA-MT9301A	TF	5450	6582	8091	5915	26038	BarOptima Plus E34
BAR-FA-BE9301A	TF	5006	6854	8147	5225	25232	
KYFA9819	TF	7102	5356	7662	0	20120	
Lofa	FL	6396	5374	7774	0	19545	
Felopa	FL	7707	4938	6629	0	19273	
Sulino	FL	7370	4750	6694	0	18814	
Spring Green	FL	7343	4614	6485	0	18442	
Duo	FL	5790	3442	5906	0	15138	
CV (%)		12	7	6	12	7	
LSD (0.10)		852	623	603	681	2101	

Tall Fescue

- NE varieties
 - Jesup MaxQ
 - Texoma MaxQII
 - BarOptima Plus E34
 - Duramax
 - Estancia
 - Lacefield
- Persistence?

Orchardgrass

- Bunchgrass-forms open sod
- Does not tolerate close and frequent defoliation
- Limited summer growth
- Short-lived perennial
- Insect & disease problems
- More persistent varieties???



Seeded Bermudagrass

- Bermudagrass is adapted to Kentucky
- Relatively little planted
 - Vegetative establishment
- Seeded bermudagrass
 - Facilitate adoption
- Cultivar
 - Single pure variety
- Blend
 - Mixture of several varieties, AZ common
 - Same trade name, but different mixture



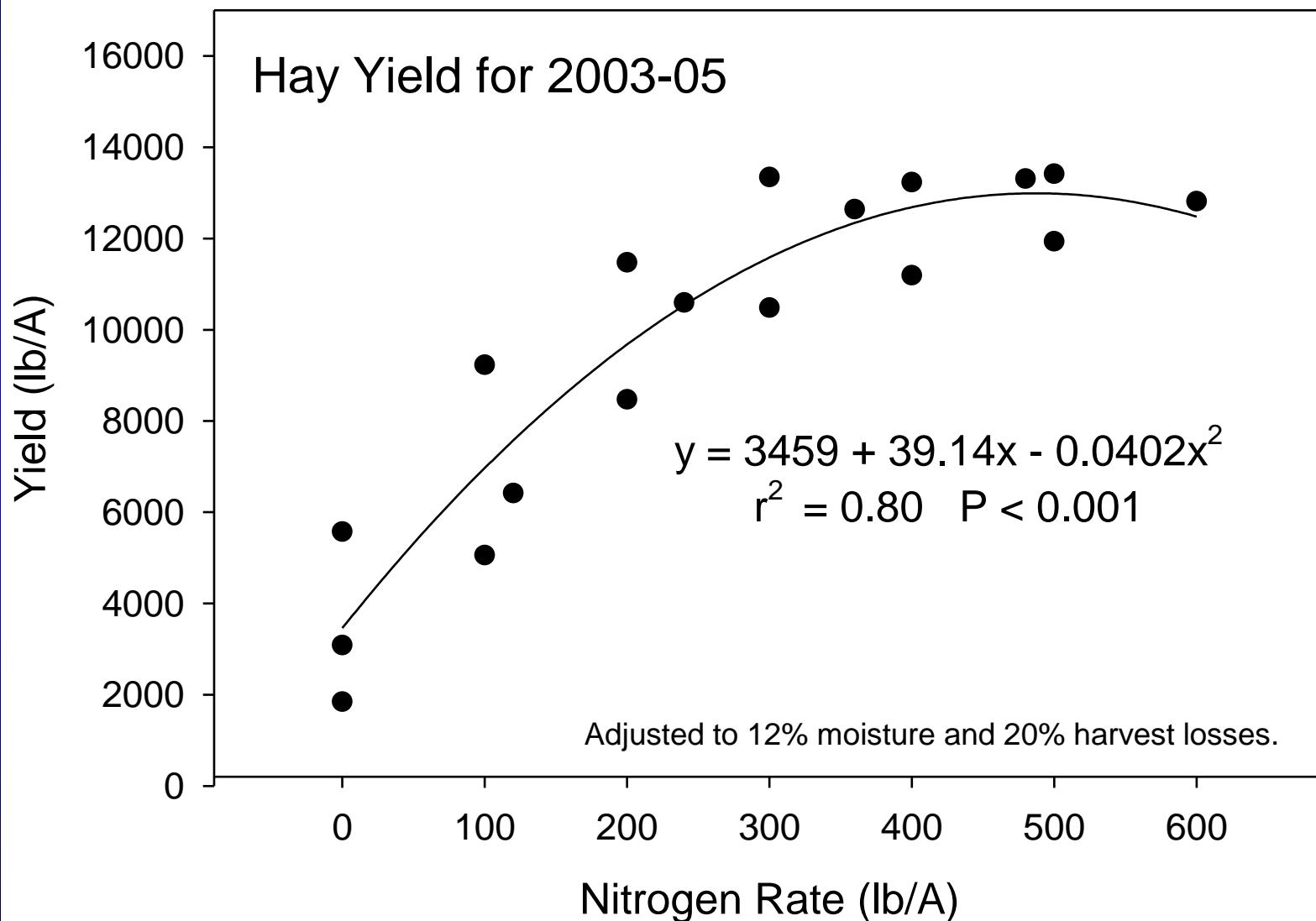
Average Yield for 2001-08

Variety	2001	2002	2003	2004	2005	2006	2007	2008	Average 2002-08
-----lb DM/A-----									
Pasto Rico	7027	19572	13375	16974	17205	18398	11219	13815	15794
Ranchero Frio	6774	18781	15288	17547	15718	17185	10006	12463	15284
Cheyenne	6547	19144	14695	16240	16285	17366	9850	12306	15127
Mirage	5788	14655	17097	16078	15655	15197	8861	10889	14395
Tifton 44		9274	15650	17818	16545	18697	11893	13857	14250
CD90160	4723	15318	16294	15728	14738	14895	8921	11036	13847
KF194	5492	15461	17250	16962	13952	14740	7525	9148	13813
Pyramid	4782	14796	16310	15900	14282	15216	8133	10176	13545
Mohawk	4902	14752	17739	16822	13581	13473	7711	9320	13342
SunGrazer	5149	14991	17716	17111	12560	13398	6469	8103	12907
Guymon	3757	12849	16859	16284	12018	12482	7793	10000	12612
Wrangler	3695	13643	18801	16017	11069	12049	7711	8786	12582
CV (%)	14	10	8	7	8	9	10	9	5
LSD (0.05)	970	2098	1812	ns	1730	1906	1308	1451	986

Bermudagrass Variety Trial 2003

Variety	6/15/06	7/18/06	8/23/06	11/30/06	Total06	Description
	lb/acre					
Tifton 44	3343	6356	4749	2860	17307	Sprigged
Vaughn's #1	2691	6281	4774	2929	16676	Sprigged
World Feeder	4552	4949	3807	2184	15491	Sprigged
Midland 99	2280	5240	4628	2551	14698	Sprigged
SPAREC1	2059	5539	4380	2708	14684	My local selection
Jail Break	2233	5368	4374	2477	14451	My local selection
Copeland	2022	5893	3874	2527	14315	My local selection
Cheyenne	1834	5273	4302	2779	14187	Seeded
Riata	2345	4527	3622	1669	12162	Seeded
SPAREC3	1777	4977	3212	1928	11893	My local selection
Wrangler	1949	4336	3495	1491	11272	Seeded
LSD (0.05)	844	637	622	516	1831	

Bermudagrass Response to N Fertilization



Average Forage Quality-2002 to 2008

Variety	Acid Detergent Fiber	Crude Protein	Total Digestible Nutrients
	%	%	%
Cheyenne	31	14	64
Gaucha	30	15	66
KF194	29	15	66
Mirage	29	15	66
Mohawk	29	15	67
Pasto Rico	31	14	64
Pyramid	29	15	67
Ranchero Frio	31	14	65
SunGrazer	29	15	67
Tifton 44	32	14	63
Wrangler	30	15	65
CV (%)	5	9	3
LSD (0.05)	1.2	1.5	1.4

Crabgrass

- Well adapted to mid-South region
- Annual that acts like a perennial
 - Self-reseeding
- Double cropped
 - Winter annual
- Good yield potential
- Excellent forage quality
 - Higher than bermudagrass
- No prussic acid
- Nitrate accumulator

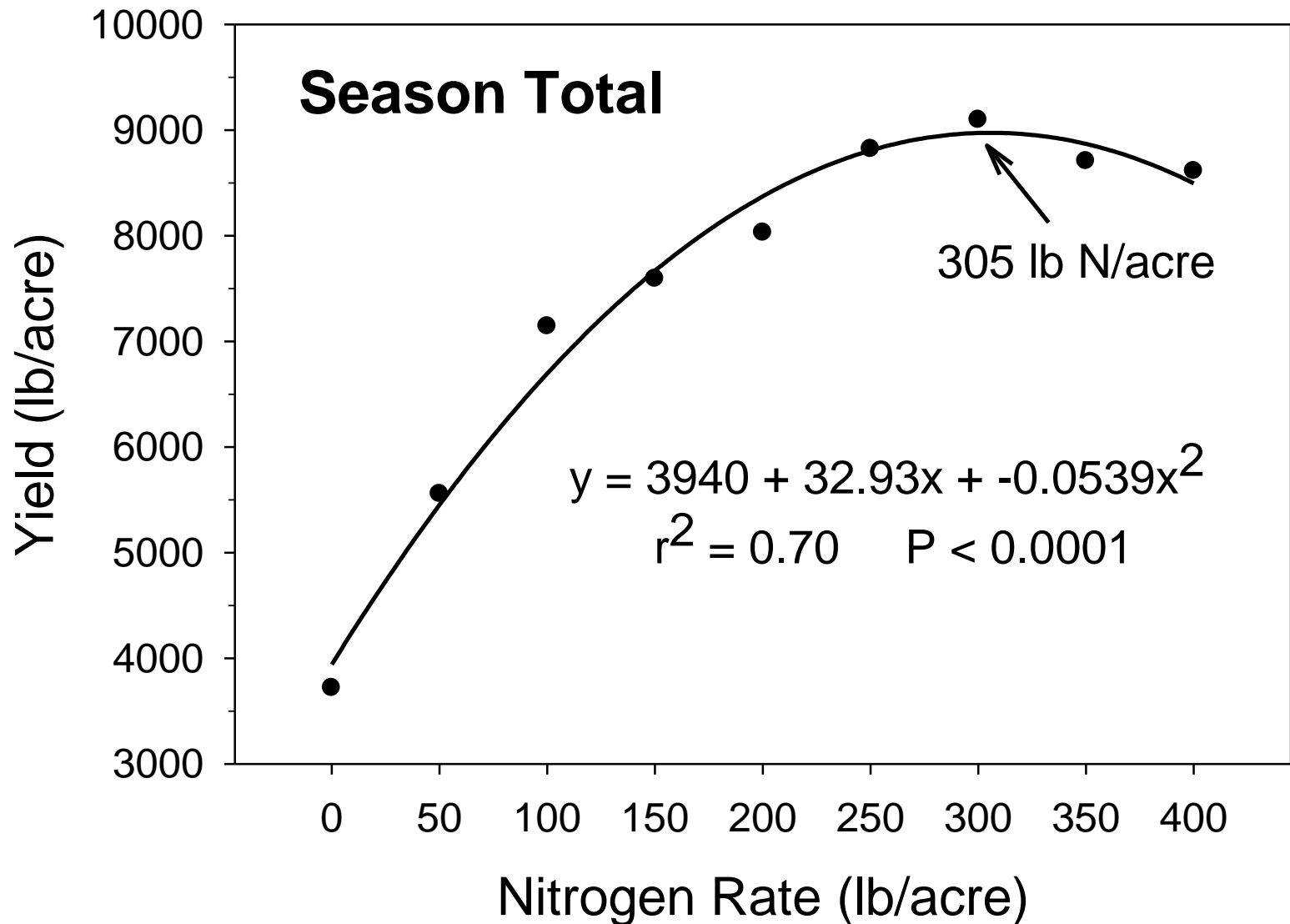


Red River Crabgrass



**First Harvest in 2001 (60
days after seeding)**

Nitrogen Rate: Total Seasonal Yield



Forage Quality

- **In Vitro Digestibility**
 - 75 to 90% (Teutsch et al., 2005)
- **Crude Protein**
 - 6 to 14% (Teutsch et al., 2005)
 - Increased with nitrogen fertilization
- **Average Daily Gain (Dalrymple, 1994)**
 - Poor to fair quality crabgrass: 0.6 to 1.5 lb/day
 - Medium quality crabgrass: 1.85
 - Excellent quality crabgrass: 2.35
 - Bermudagrass: 1lb/day, Crabgrass: 1.75 lb/day



Perennial Sudax (Johnsongrass)

- *Sorghum* species (*Sorghum halepense*)
- Spreads via seeds and rhizomes
- Commonly found old dairies and bottom land
- Thrives under hay management
- Not found in continuously grazed pastures
- Responds to N fertilization
- Good quality if managed
- Harvest at boot stage
- Prussic acid and nitrates



Nutritive Value of Johnsongrass

Fig. 1 **Top 10 Grasses in Nutritive Quality Study (1999-2001)**

	Avg. % CP	Range	Rank*	Avg. % TDN	Range	Rank*	Cumulative Rank
Johnsongrass	11.6	2.4 - 24.5	1	58	39.6 - 72.1	2	3
Bermudagrass	11.4	4.3 - 20.5	2	59.8	51.9 - 65.6	1	3
Buffalograss	8.3	6.0 - 12.1	4	56.5	46.1 - 62.0	4	8
Eastern gamagrass	8.2	3.0 - 15.9	5	57.6	46.0 - 68.2	3	8
Purpletop	9.4	2.8 - 17.9	3	53.9	41.5 - 64.5	6	9
Plains bluestem	6.8	3.5 - 10.9	6	52.1	41.7 - 65.3	8	14
Broomsedge bluestem	6.2	4.2 - 9.8	9	54.2	48.9 - 57.7	5	14
Switchgrass	5.9	2.4 - 13.6	11	53.8	41.0 - 63.0	7	18
Silver bluestem	6.5	2.9 - 15.1	7T	50.1	38.4 - 65.2	13	20
Sideoats Grama	6.0	3.3 - 10.0	10	50.2	42.5 - 56.4	11T	21

*Rank out of 16 grasses

Data collected by Frank Motal, Noble Foundation

Glidewell, C. 2008. Don't overlook Johnsongrass in your pasture. In Ag News and Views, August Issue, Samuel Roberts Noble Foundation, Ardmore, OK.

Winter Annuals



Annual Ryegrass and Small Grains

Small Grains for Forage

- Adapted statewide
- Grazed, silage or hay
- Double cropped with summer annuals
- *Wheat* most versatile
- *Rye* least exacting soil requirements, earliest
- *Barley* best on well-drained fertile soils
- *Winter oats* palatable, lower yielding



Annual Ryegrass

- High yielding with excellent quality
- Can be grazed, hayed, or ensiled
- Regrows after cutting until June
- Adapted to wide range of soils
- Consistent production
- Requires nitrogen fertilization
- Overseed bermudagrass or double crop with summer annual
- Serious weed in small grains

Long-Term Performance

Year	Jackson	Marshall	Passerel Plus
	lb DM/A		
2002-03	8322	9369	9348
2003-04	10996	10964	9487
2004-05	7886	8173	8236
2005-06	6445	6512	6479
2006-07	9085	9423	8234
2007-08	6159	5823	6018
2008-09	6363	7753	6717
Average	7894	8288	7788
Std Dev	1764	1786	1397

Legumes and Grazing Systems

- Fixes nitrogen from air
- Increases yields
- Higher forage quality
 - animal performance
- Improved summer growth
 - Alfalfa and sericea lespedeza
- Dilutes endophyte in tall fescue



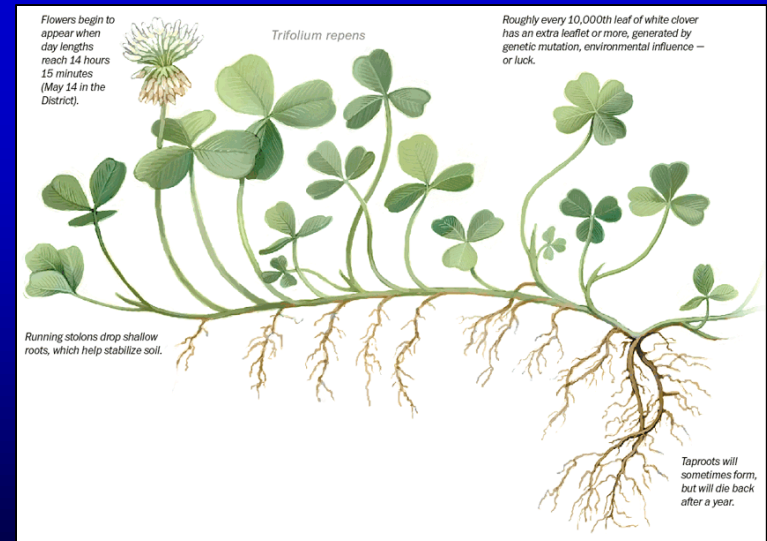
Alfalfa

- “Queen of Forages” or “Pouty Princess”?
- Long-lived perennial
- Deep tap-root
 - Drought tolerance
- Fixes 150-250 lb N/yr
- Well-drained soils
- Needs high fertility
- Rotational grazing
- Can cause bloat



White Clover

- Important in pastures
- Three types
 - small, medium, large
- Ladino or large type produces 3-5X
- Stolons
 - well adapted to grazing
- Poor drought tolerance
 - persists via reseeding
- Very high in quality



Red Clover

- Important pasture legume in Kentucky
- Short-lived perennial
 - Common: 1-2 years
 - Improved: 2-3 years
- Good drought tolerance
- Excellent seedling vigor
- Easily established
 - frost seeding



Rethinking Legumes

- Normally focus on changing soil
 - Not always economically feasible
- Why not change legume to match soil?
- Legumes that tolerate poor fertility

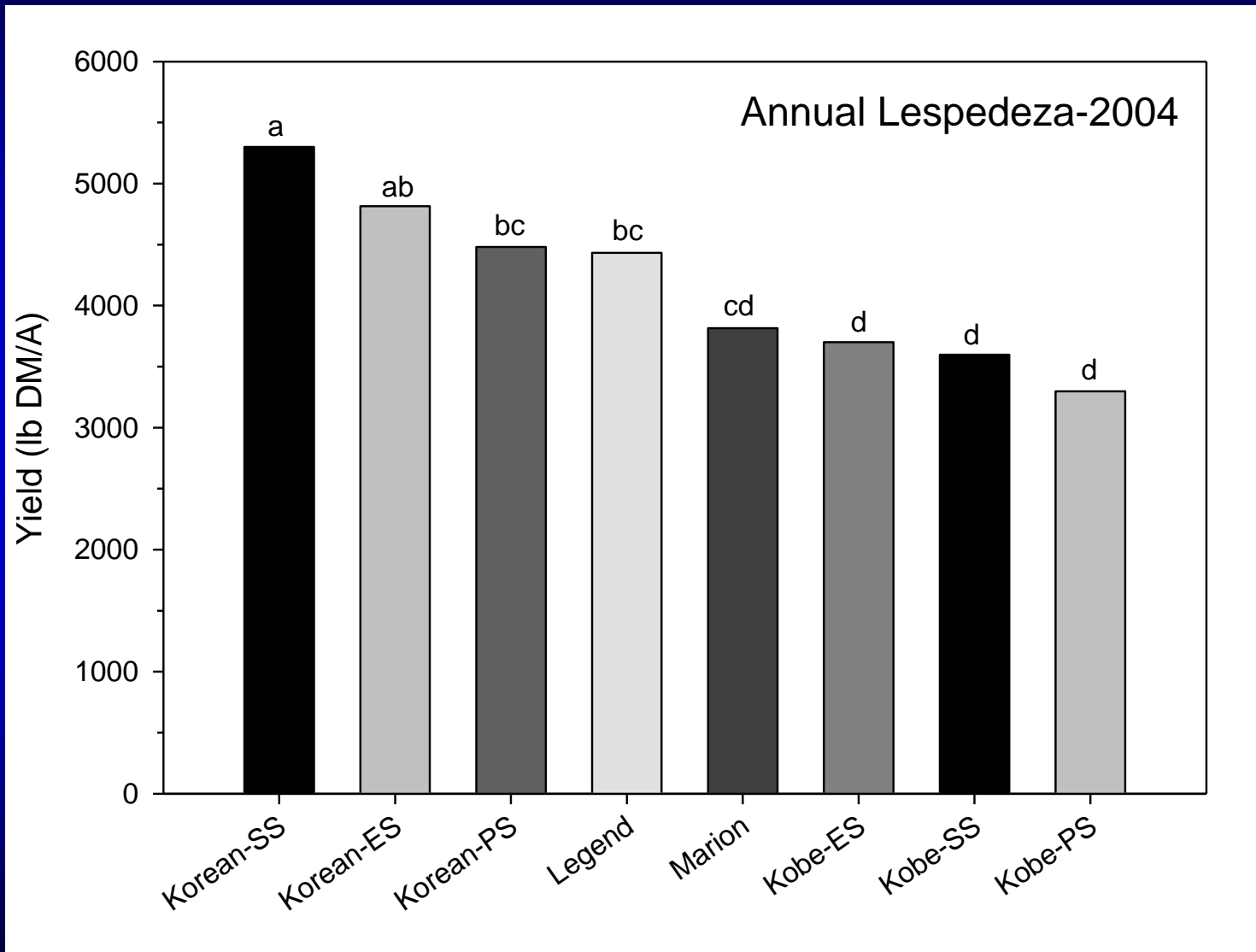


- Tolerant to low fertility
- Yields 1 to 2 ton/A
- Kobe
 - Prostrate growth
 - Does not reseed as well
- Korean
 - Higher yields
 - Dependable reseeding
- Frost seed
 - late winter
 - 10 to 15 lb/A

Annual Lespedeza



Annual Lespedeza Type and Variety

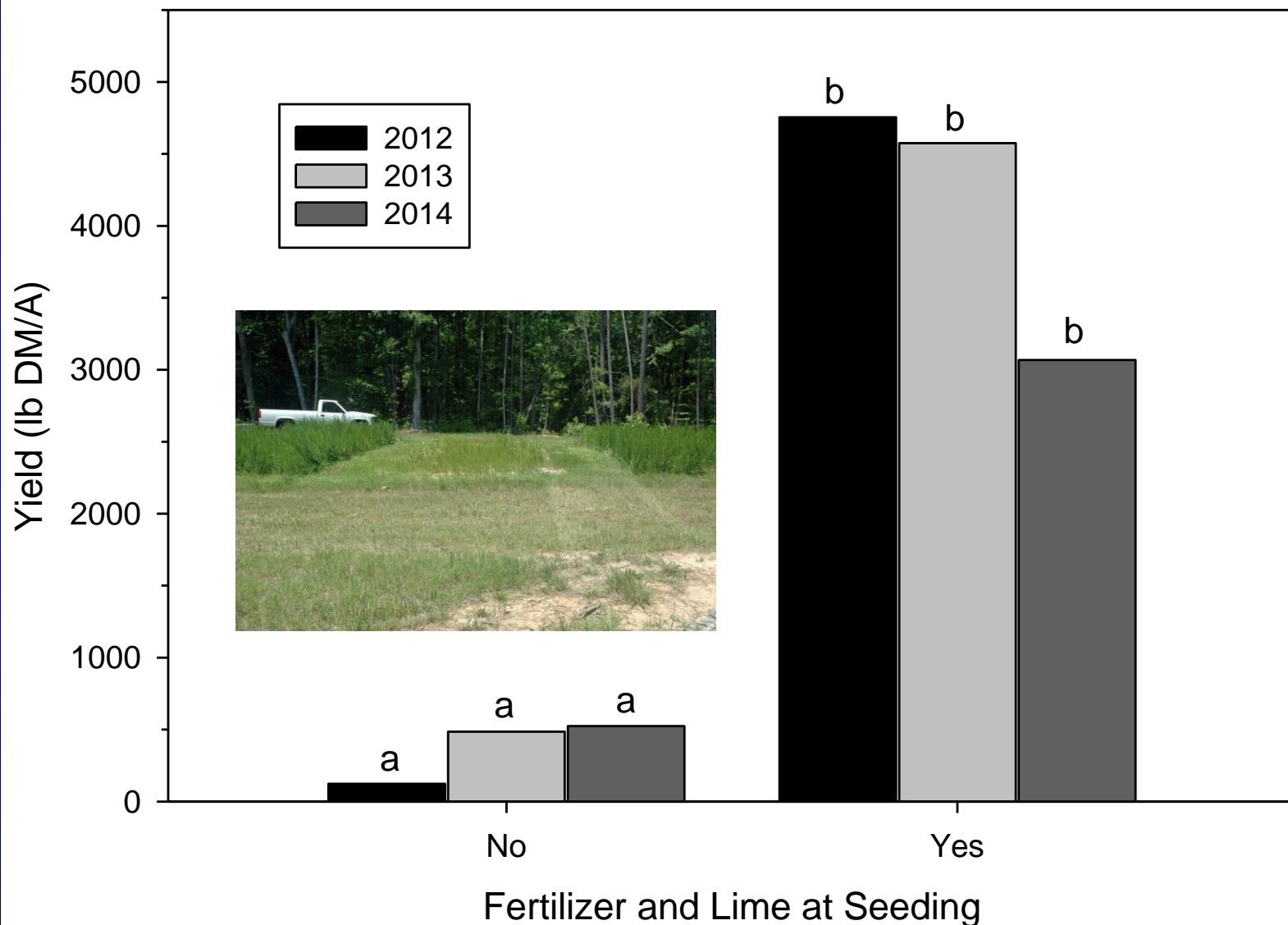


Sericea Lespedeza

- Long-lived perennial, warm-season, nonbloating
- Well adapted to Mid-South
- Extremely drought tolerant
- Tolerant of acid soils (?)
- Tolerant of low fertility (?)
- Newer cultivars
 - Lower tannins, finer stems, grazing tolerant
- Grazed rotationally
- Poor seedling vigor

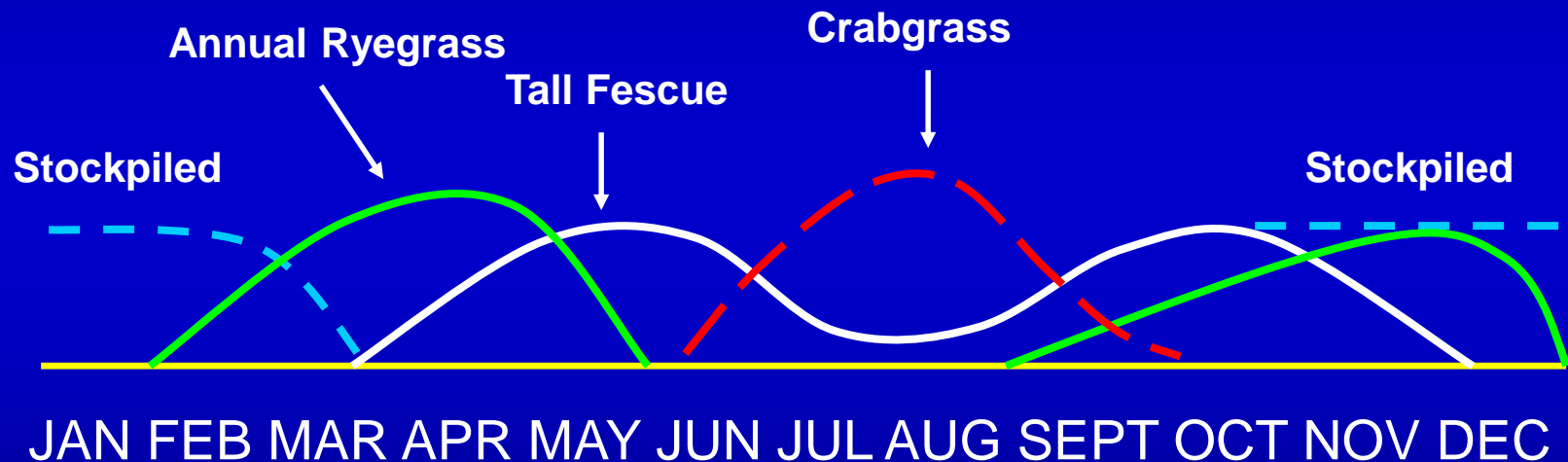


Impact of Lime and Fertilizer on Sericea



Putting it all together!

- Goal: YEAR-ROUND GRAZING
- Potential system for Western Kentucky



- Year-round grazing requires management