Forage Research at VT's Southern Piedmont AREC

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Water Use in Agriculture

- Agriculture accounts for 80-90% of freshwater use (Morison et al., 2008)
- 18% of cropland irrigated, accounts for 40% production (FAOSTAT, 2006; Doll and Siebert, 2002)
- Increased competition for water use
  - Population growth, urban expansion, economic development (Morison et al., 2008)
- More efficiently use water resources
  - Rainfed and irrigated cropping systems
  - Agronomic management, species selection, irrigation technology, crop breeding

Water Use in Forage Crops

Crop	Water Used			Reference
	kg H2O/ kg DM	kg H20/ Mg DM	% of Alfalfa	
Alfalfa (C3)	844	844,000	100	Bennett and Doss, 1963
Bromegrass (C3)	828	828,000	98	Martin, 1973
Crested wheatgrass (C3)	678	678,000	80	Martin et al., 1973
Soybean (C4)	584	584,000	69	Nielsen, 2011
Tall Fescue (C3)	583	583,000	69	Bennett and Doss, 1963
Wheat (C3)	505	505,000	60	Martin et al., 1976
Orchardgrass (C3)	418	418,000	50	Bennett and Doss, 1963
Sudangrass (C4)	380	380,000	45	Martin et al., 1973
Corn (C4)	372	372,000	44	Martin et al., 1976
Sorghum (C4)	271	271,000	32	Martin et al., 1976
Coastal Bermuda (C4)	265	265,000	31	Doss et al., 1962

Annual Forages

- Supply forage during summer and winter deficit periods
- Advantages
  - fast germination and emergence
  - rapid growth
  - high productivity and quality
  - flexibility of utilization
- Disadvantages
  - Establishment cost: $150 to $175
  - increased risk of stand failures
  - hard to cure

Annual Forages

- Supply forage during summer and winter deficit periods

Profitable forage systems will be based on well adapted perennial sods that are supplemented with annuals.

  - Establishment cost: $120 to $140
  - increased risk of stand failures
  - hard to cure

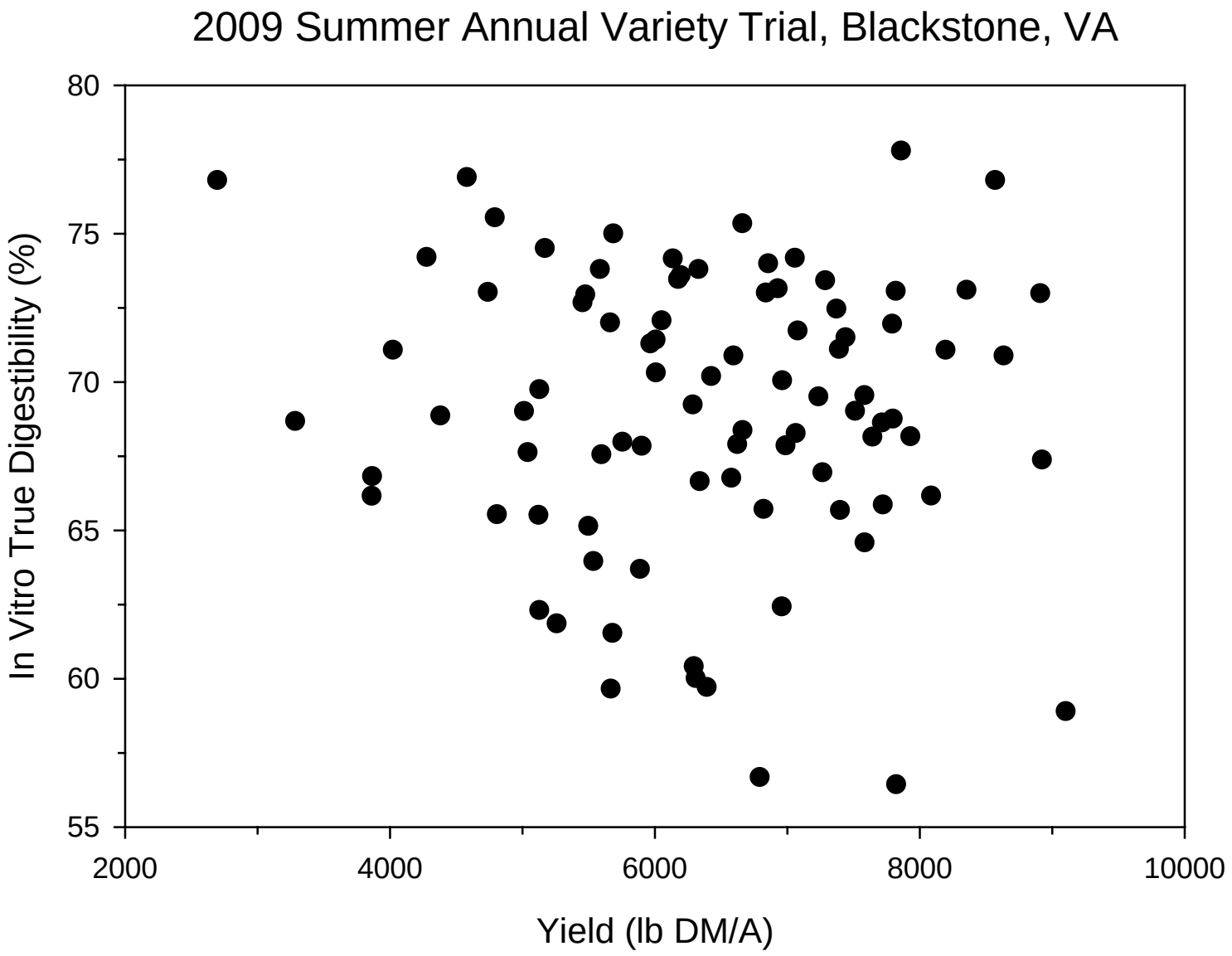
Summer Annual Variety Trial

- Conducting trials since early 2000s
- Recently evaluating digestibility
- Sorghum-Sudangrass, sudangrass, forage sorghum, and pearl millet
- 75 lb N/A at seeding and 60 lb N/A after each harvest

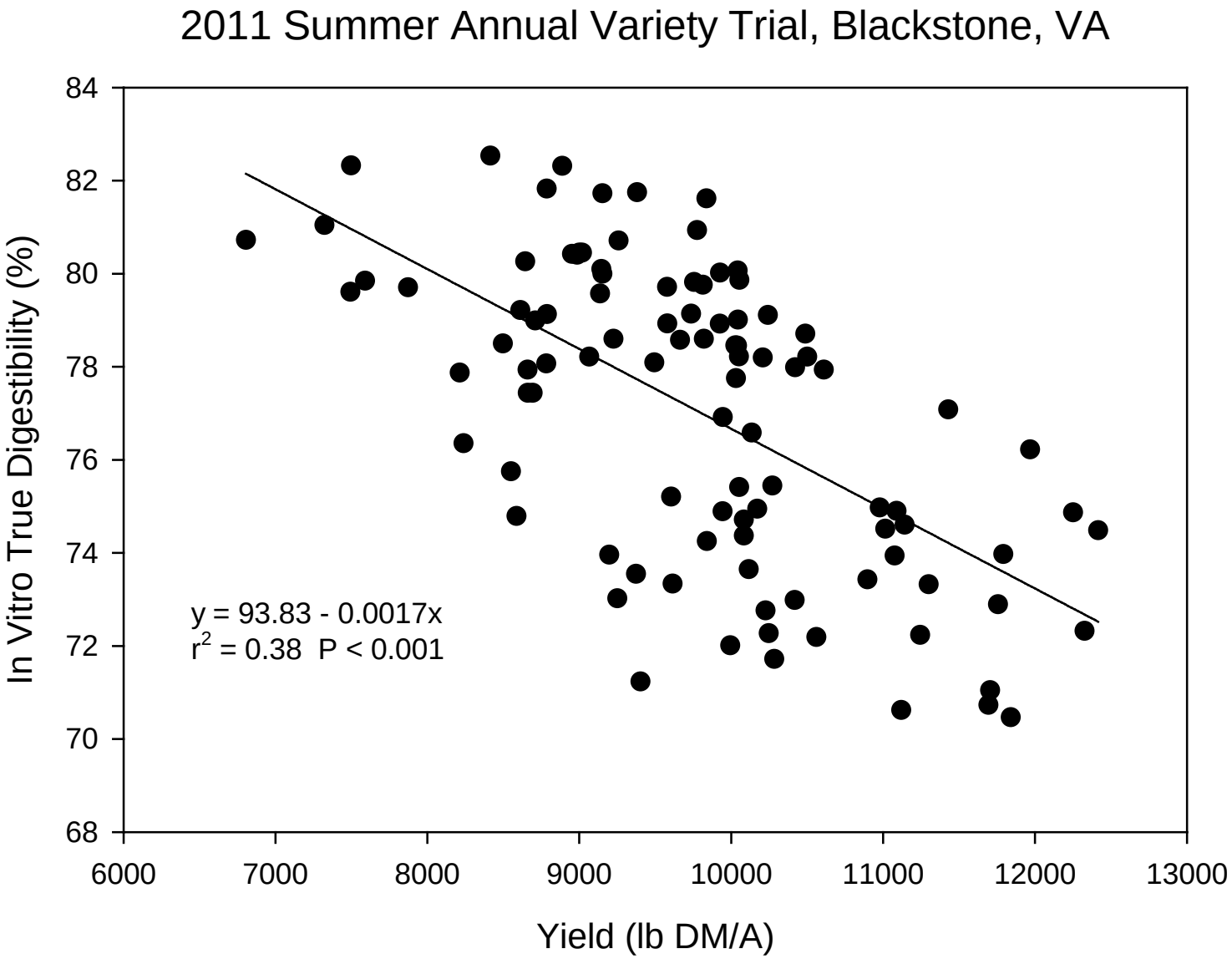
First Harvest-SAVT 2009

Variety	Species	BMR	Yield	IVTD
			lb DM/A	%
Canex 402 BMR	FS	Yes	6848	74
XtraGraze BMR	SS	Yes	5277	68
Haymaster2	SG	Yes	4390	64
SS501	PM	No	4820	54
Hayking	SG	Yes	4524	58
Promax BMR	SG	Yes	3765	64
LSD (0.10)			1061	3.4

Yield and Digestibility-2009



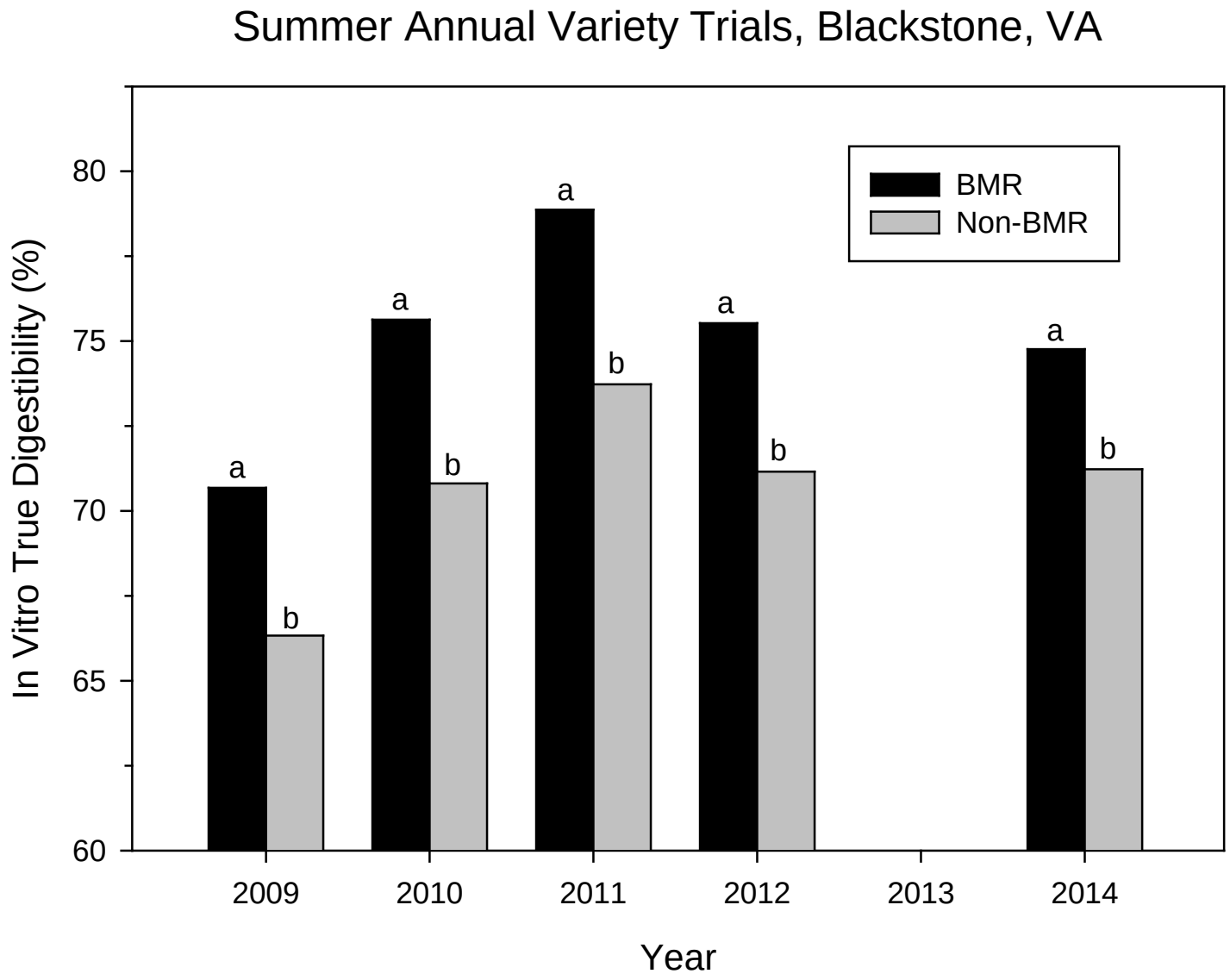
Yield and Digestibility-2011



Yield and Digestibility Summary

- Relationships varied form year to year
  - 2009 and 2010 no relationship
  - 2011, 2012, and 2014 negative relationship
- Factors impacting this relationship not fully understood
- Need to look at outliers
  - High yield and digestibility

BMR Trait and In Vitro True Digestibility



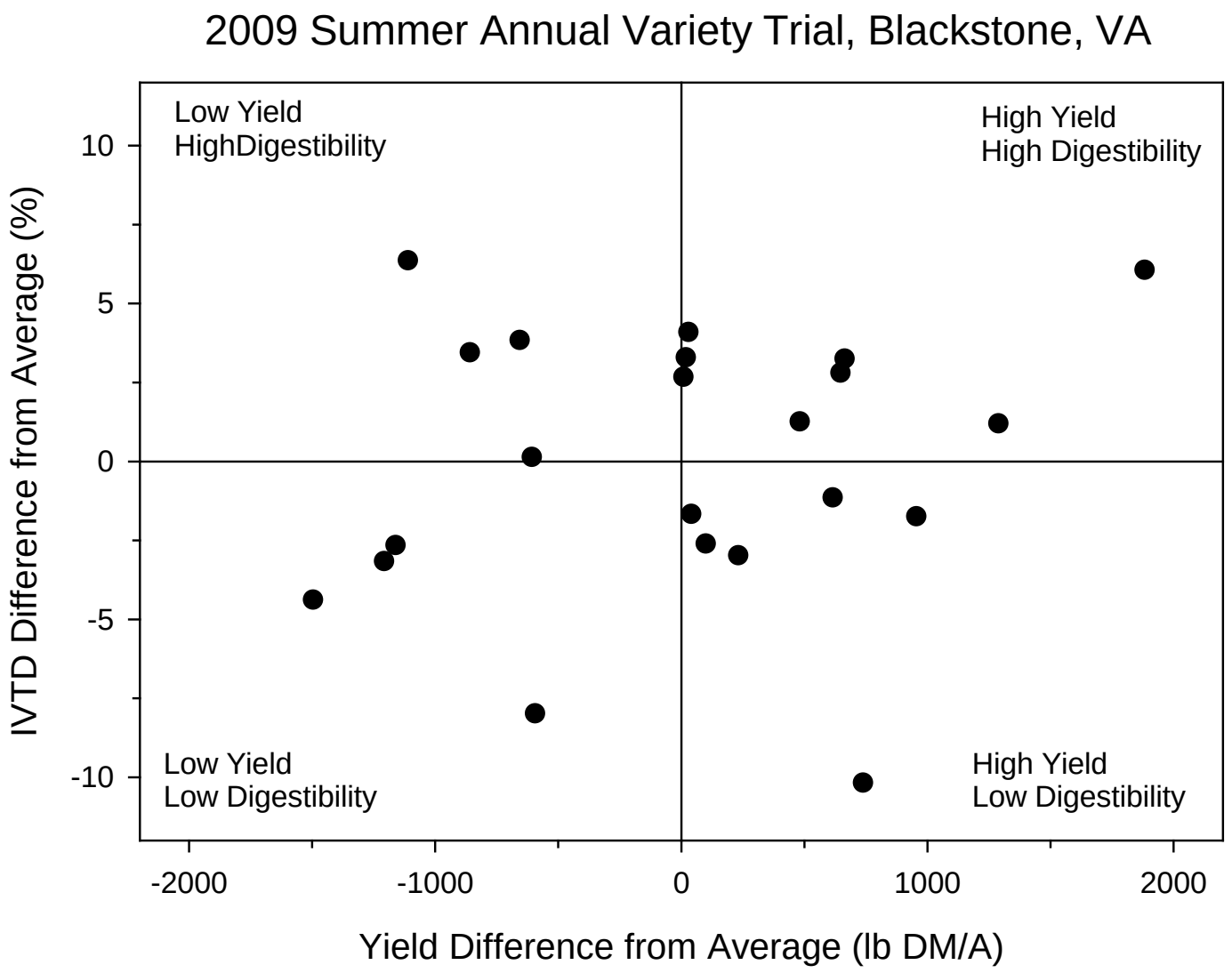
Summer Annual Variety Trial Summaries

Summer Annual Variety Trial-2009

Variety	BMR	Gene	Yield	IVTD-YLD	ADF	NDF	CP	TDN	IVTD	NDFD-30	YLD-DIF	IVTD-DIF	Above Average
			lb DM/A	lb DM/A	%	%	%	%	%	%	lb DM/A	%	
CanexBMR402	BMR	18	8289	6228	34.1	59.6	9.2	62.2	75.2	58.4	1882	6.1	X
XtraGraze	BMR	6	7695	5410	34.8	60.4	10.4	61.4	70.3	51.1	1288	1.2	X
HayMaster	NBMR	0	7361	4963	35.3	60.1	10.4	60.9	67.4	45.8	954	-1.7	
SS501	NBMR	0	7145	4208	36.9	64.3	11.6	59.0	58.9	36.6	738	-10.2	
SS1	BMR	6	7071	5114	33.0	58.3	11.2	63.4	72.4	52.6	664	3.3	X
Mix-PM+SS	BMR	12	7054	5075	33.3	59.8	12.4	63.1	71.9	53.0	647	2.8	X
GrazexBMR802	BMR	18	7022	4775	35.7	61.4	10.0	60.4	68.0	48.0	615	-1.1	
SS1515A	NBMR	0	6888	4816	34.6	60.9	11.2	61.7	70.4	51.7	481	1.3	X
Leafy2000	NBMR	0	6638	4403	35.1	62.1	13.2	61.1	66.1	45.6	231	-3.0	
SS635	NBMR	0	6506	4306	34.2	61.2	14.3	62.0	66.5	45.5	99	-2.6	
HayMaster2	NBMR	0	6447	4335	35.3	60.7	11.0	60.9	67.4	46.8	40	-1.7	
Surpass	BMR	6	6435	4706	32.8	60.1	11.8	63.7	73.2	55.6	28	4.1	X
22050	BMR	6	6425	4651	34.7	59.9	10.9	61.6	72.4	54.0	18	3.3	X
22053	BMR	6	6415	4592	34.8	60.0	10.7	61.5	71.8	53.0	8	2.7	X
Hayking	BMR	12	5813	3502	36.8	62.2	10.7	59.2	61.1	37.9	-595	-8.0	

Varieties ranked by YIELD!!!

Yield and Digestibility Difference-2009



Summary of Varieties with Above Average Yield and Digestibility

Variety	Seed Company	2009	2010	2011	2012	2014
22050	Advanta US	X				
26837	Advanta US		X			
6810 BMR	Coffey Forage Seeds		X			
AS6401	Alta Seeds		X			
AS6402	Alta Seeds		X			
AS6501	Alta Seeds	X	X	X		
AS9301	Alta Seeds	X	X	X		
Canex 402 BMR	Sharp Brothers Seed	X				
Grazex 802 BMR	Sharp Brothers Seed	X				
GW8528FB	Gayland Ward Seed Company		X			
SS1515A	Southern States Cooperative	X				
SS211	Southern States Cooperative		X			
SS220	Southern States Cooperative		X			X
SSG886	Advanta US					X
Super Sugar	Gayland Ward Seed Company				X	
Surpass BMR	Coffey Forage Seeds	X				
Xtragraze BMR	Coffey Forage Seeds	X	X		X	

Summary of Varieties with Above Average Yield and Digestibility

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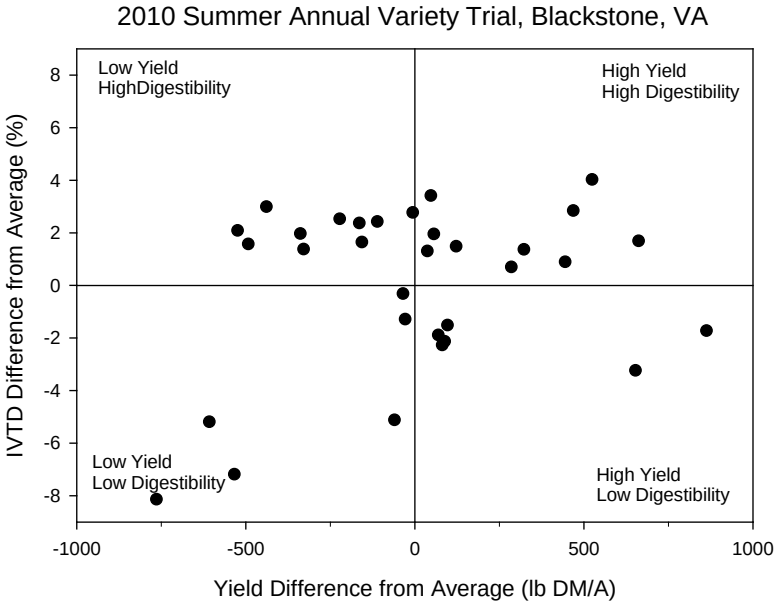
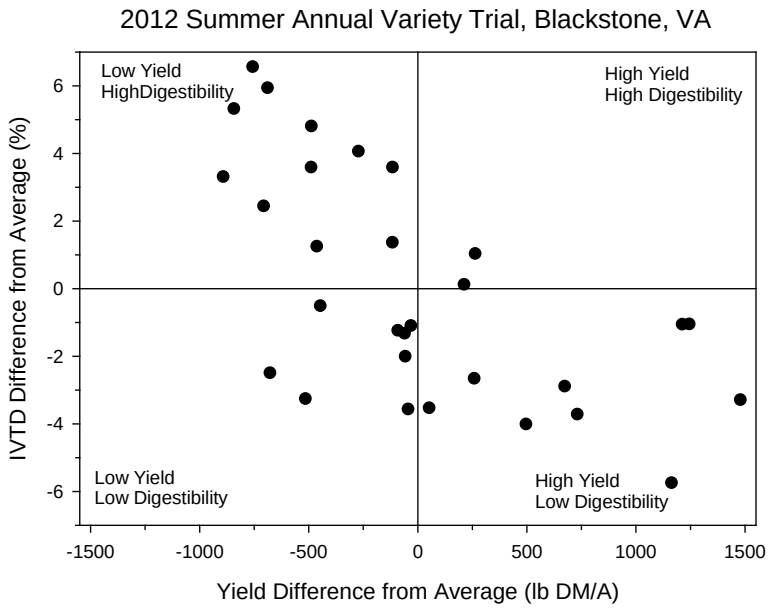
26837	Advanta US		X			
6810 BMR	Coffey Forage Seeds		X			
AS6401	Alta Seeds		X			
AS6402	Alta Seeds		X			
AS6501	Alta Seeds	X	X	X		
AS9301	Alta Seeds	X	X	X		
Canex 402 BMR	Sharp Brothers Seed	X				
Grazex 802 BMR	Sharp Brothers Seed	X				
GW8528FB	Gayland Ward Seed Company		X			
SS1515A	Southern States Cooperative	X				
SS211	Southern States Cooperative		X			
SS220	Southern States Cooperative		X			X
SSG886	Advanta US					X
Super Sugar	Gayland Ward Seed Company				X	
Surpass BMR	Coffey Forage Seeds	X				
Xtragraze BMR	Coffey Forage Seeds	X	X		X	

Final Take Home

Both yield and digestibility should be considered when selecting summer annual varieties!!!







Using Brachytic Dwarf BMR Forage Sorghums to Bridge the Extremes

Chris Teutsch

Southern Piedmont AREC

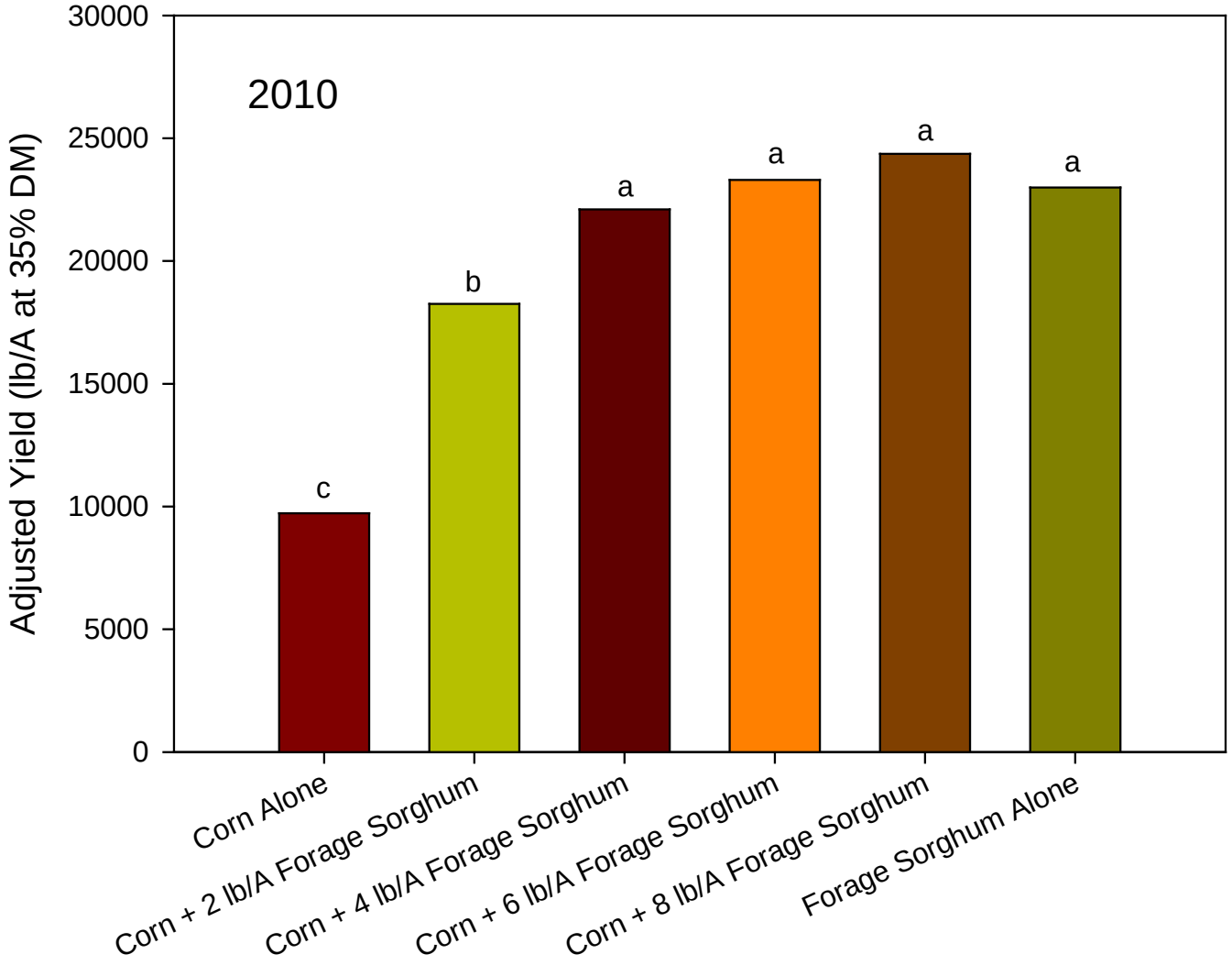
Blackstone, VA

Drought in Mid-Atlantic Region

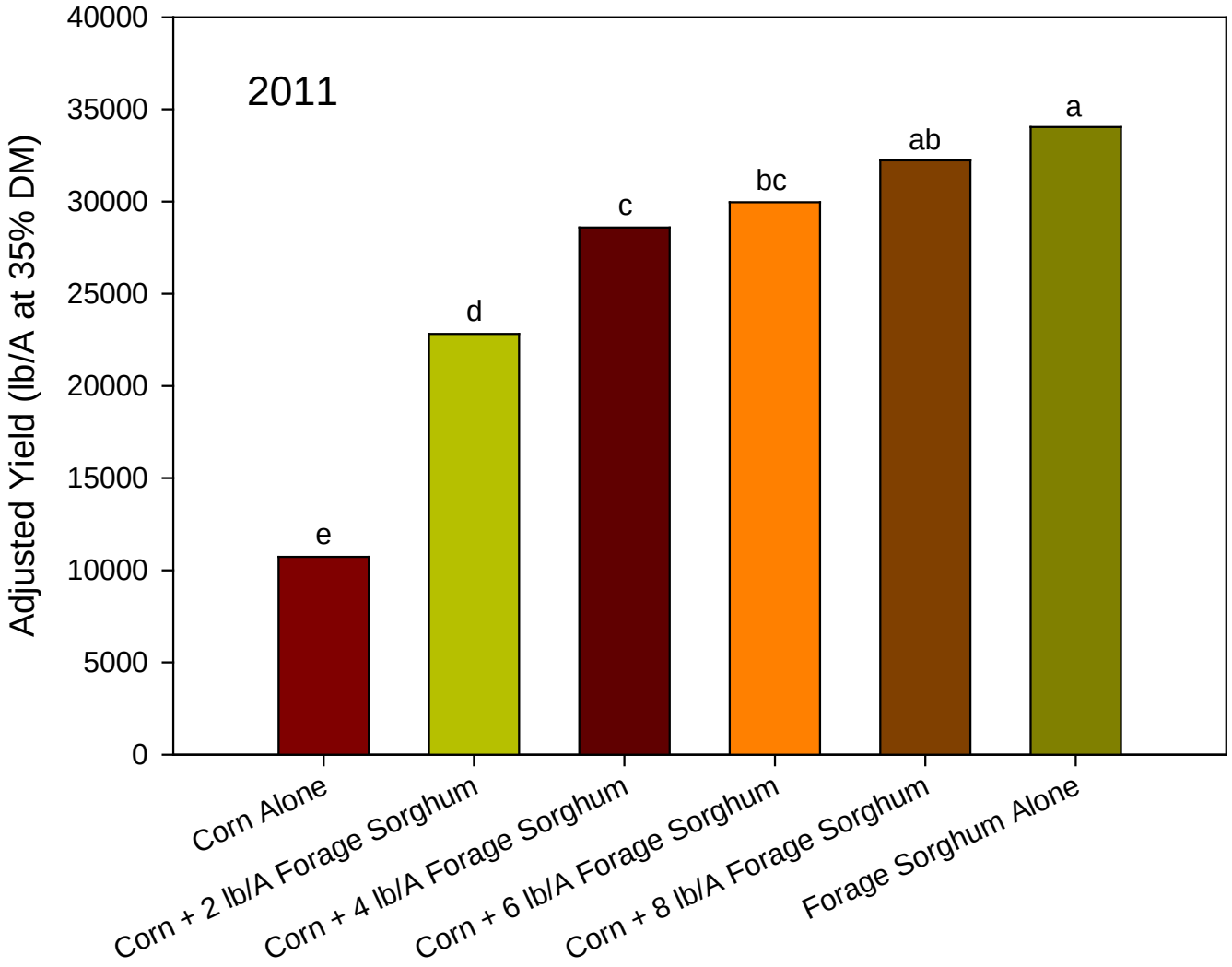
- Records indicate (Dickerson and Dethier, 1970)
  - Moderate drought one out five years
  - Severe drought one out of ten years
- Always seems to be a surprise
- Need to manage forage production systems for drought conditions
- Every farm needs a drought plan

Drought-Corn and Sorghum

Corn and Forage Sorghum-2010

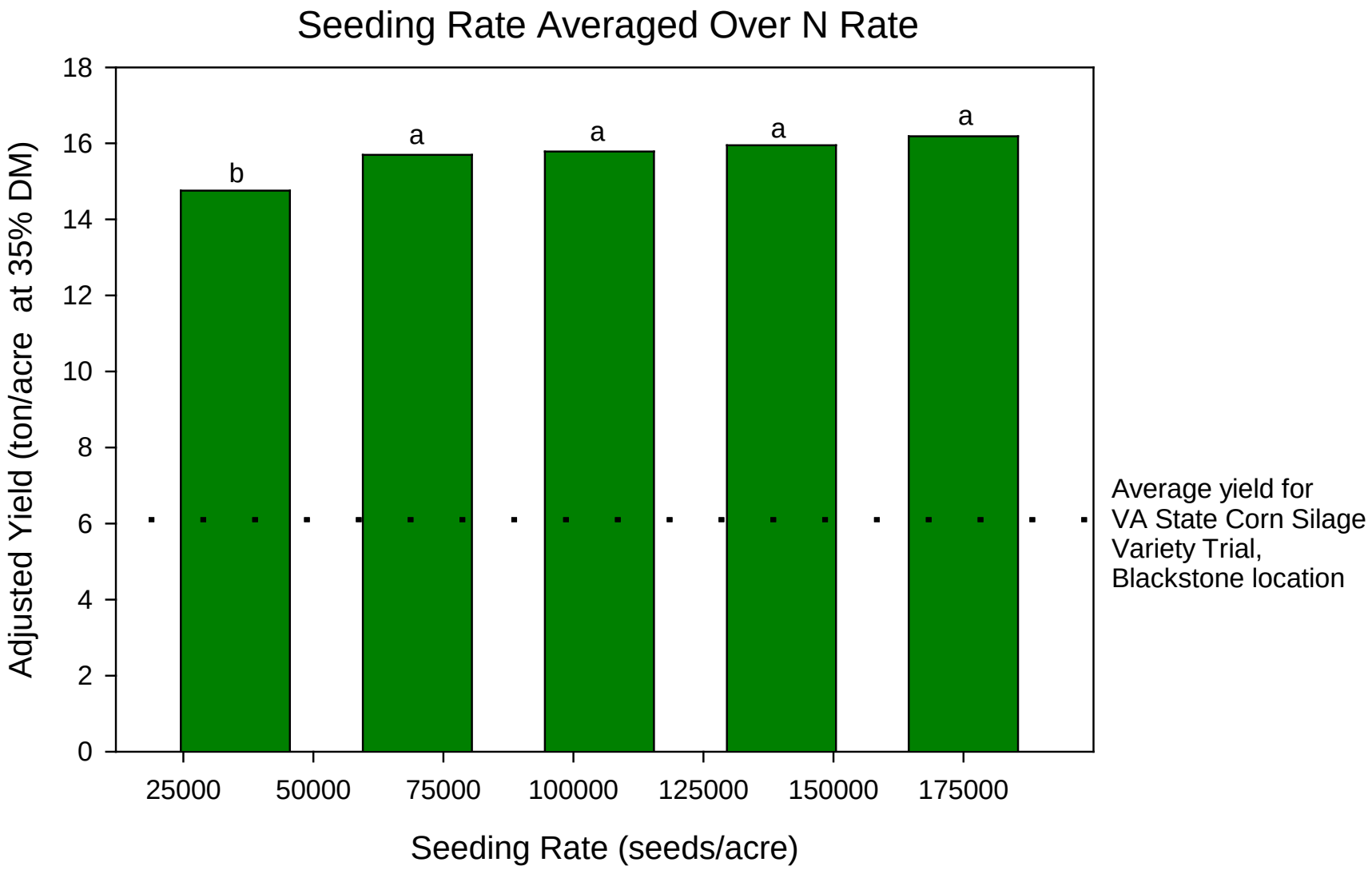


Corn and Forage Sorghum-2011

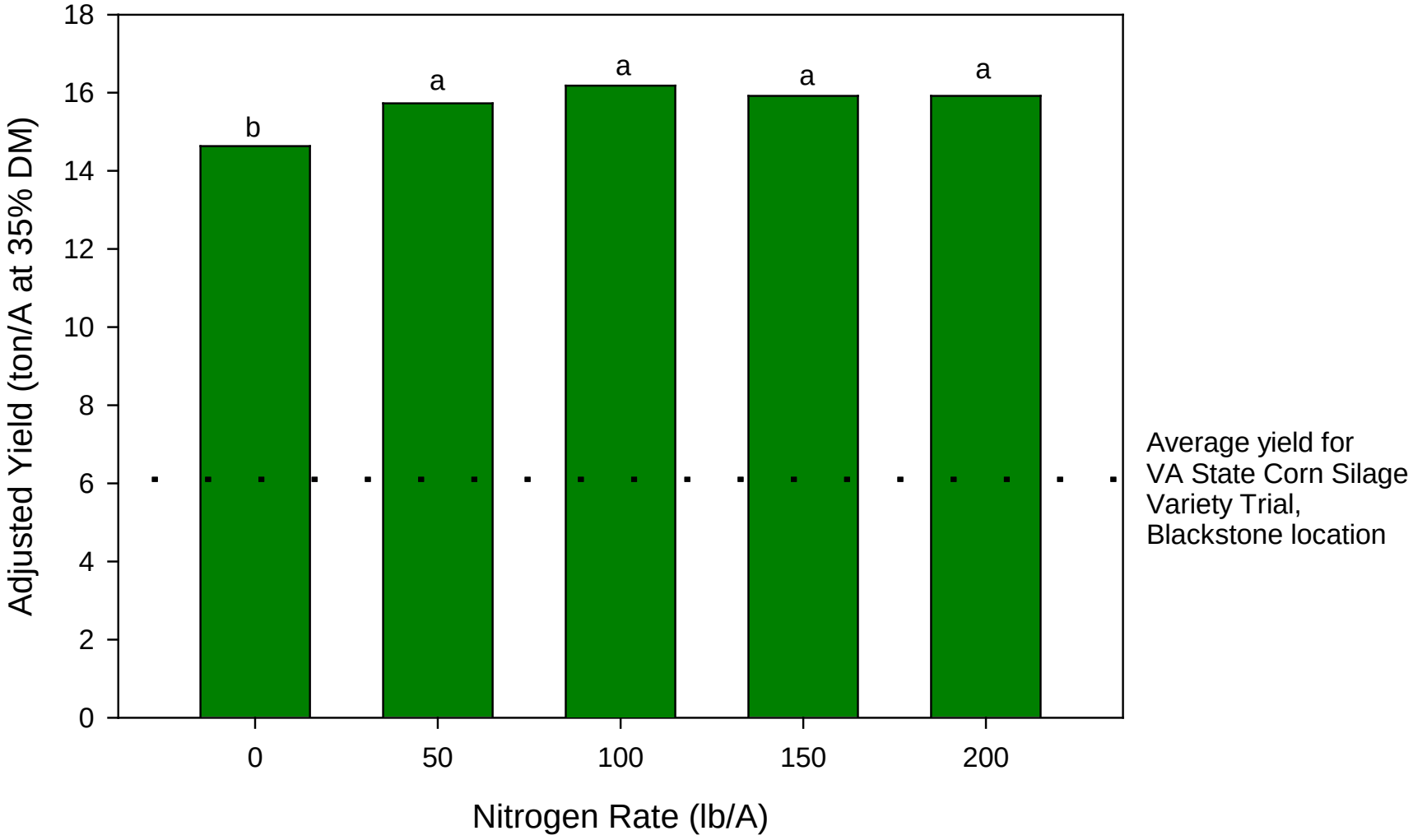


Seeding and N Rate Study

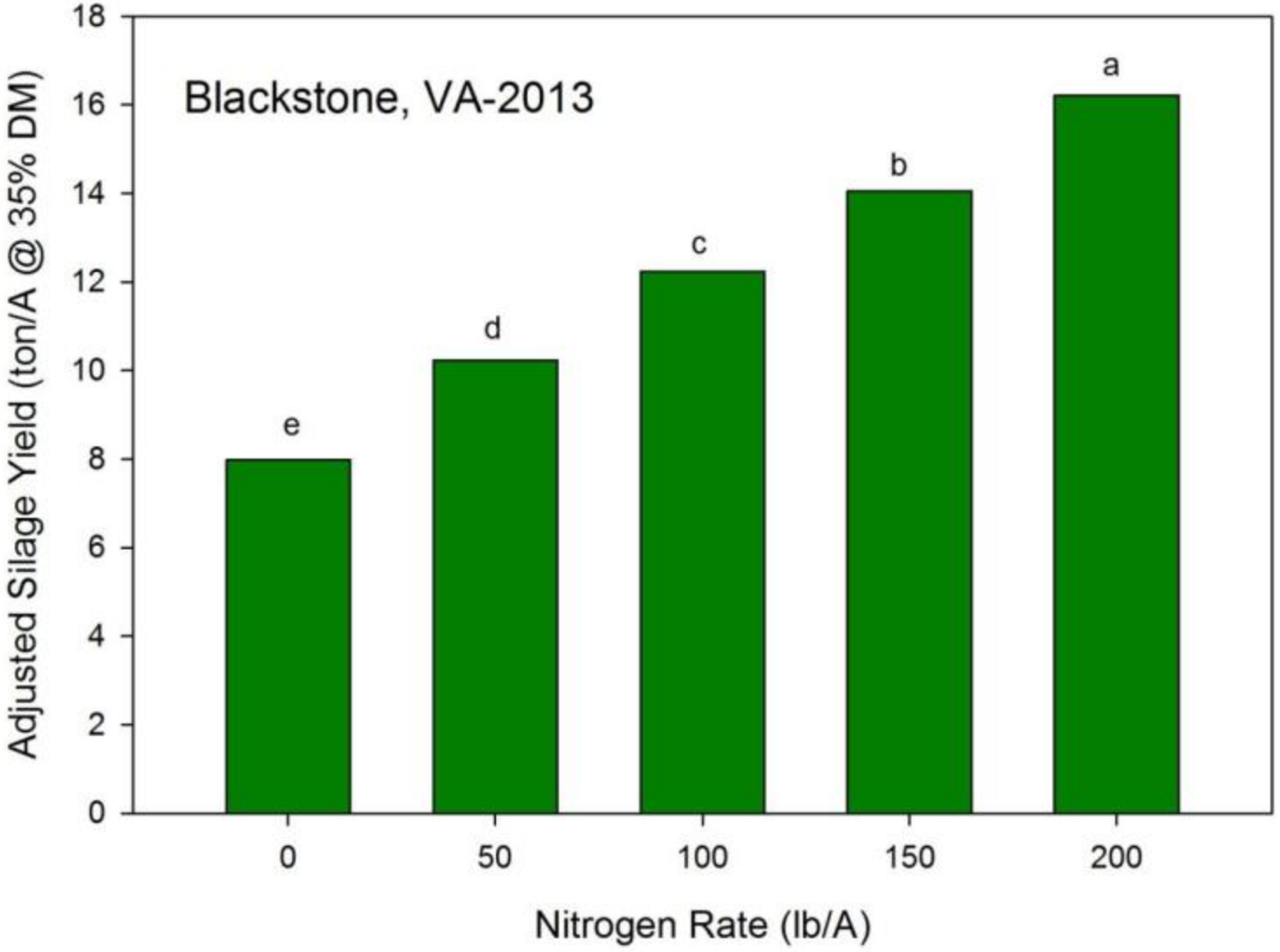
Impact of Seeding in 2012



Impact of N Rate in 2012



Impact of N Rate in 2013



Dairy Cow Performance

Study	Normal	BMR-6	BMR-12	BMR-18	Corn
	kg fat corrected milk/day				
Browning and Lusk, 1966	16.2a				16.1a
Lusk et al., 1984 Experiment I Experiment II			 22.3a 24.7a		 21.7b 23.7a
Grant et al., 1995	17.9b	26.2a			26.6a
Oliver et al., 2004	29.1b	33.7a		31.2ab	33.3a
Aydin et al., 1999 Experiment I Experiment II	 20.7c 31.4b	 23.7b 33.8a			 29.0a 32.4ab

Contreras-Govea, F.E., M.A. Marsalis, M.A., L.M. Lauriault, and B.W. Bean. 2010. Forage sorghum nutritive value: A review. Online. Forage and Grazinglands doi: 10.1094/FG-2010-0125-01-RV.

Where does forage sorghum fit into silage production systems?

- NOT going to replace corn!!!
- In mixtures with corn as “insurance”?
- Best fit on droughty soils that are marginal for corn silage production
- Arid regions or regions that are prone to short-term drought
- Delayed or late silage plantings



Developing Protocols for Containerizing Hay for Export from the Humid Eastern U.S.

Kyle Quick, Graduate Research Assistant
and Chris Teutsch



Introduction

- Global demand for hay has doubled in last decade
  - China and Middle East
  - Demand and price projected to remain high
- 95% of hay for export produced in arid west
  - Irrigated production systems
- Little hay is exported from humid eastern U.S.
  - Problems harvesting and curing hay
  - Problems successfully containerizing hay
- Competitive advantage
  - Hay production systems are rain fed in the eastern U.S.

Project Objectives

- Overarching objective is to develop hay export market in the humid eastern United States
- Specific objectives
  - To develop protocols for containerizing hay for export from the humid eastern United States.
  - To develop an alfalfa production school targeting producers and agriculture professionals who work with them that is specifically designed for the humid eastern United States.

Materials and Methods

- Alfalfa hay will be obtained form local producer
  - Harvested at 1/10 bloom
  - Baled at 18% moisture
  - Hay stored for 4-6 weeks
  - Double compressed
- Treatments
  - Control (no preservative)
  - Propionic-acetic acid hay preservative at baling
  - Surface application of hay preservative just prior to containerizing of hay
  - Ammonization of hay once containers are loaded

Application of Hay Preservative

Application of Hay Preservative

Stored and Samples Hay

Double Compressing Hay

Double Compressing Hay

Double Compressing Hay

Surface Application of Hay Preservative

Containerized Bales

Ammoniating Containers

Resample Hay in 40 Days

Graduate students not performing?

Into the HOT Box!

Made in the Shade: Silvopasture Research at Virginia Tech's Southern Piedmont AREC

What is Silvopasture?

Silvopasture isn't new


Silvopasture is NOT turning cows loose in the forest

…nor a solo tree in a pasture

Silvopasture

- Sustainable practice
- Intensive, integrated management
  - Trees / Forages / Livestock
- Two economic time frames

Establishing and Managing Pine and Hardwood Silvopastures in the Mid-Atlantic Region of the US

Conservation Innovation Grant from the Virginia NRCS

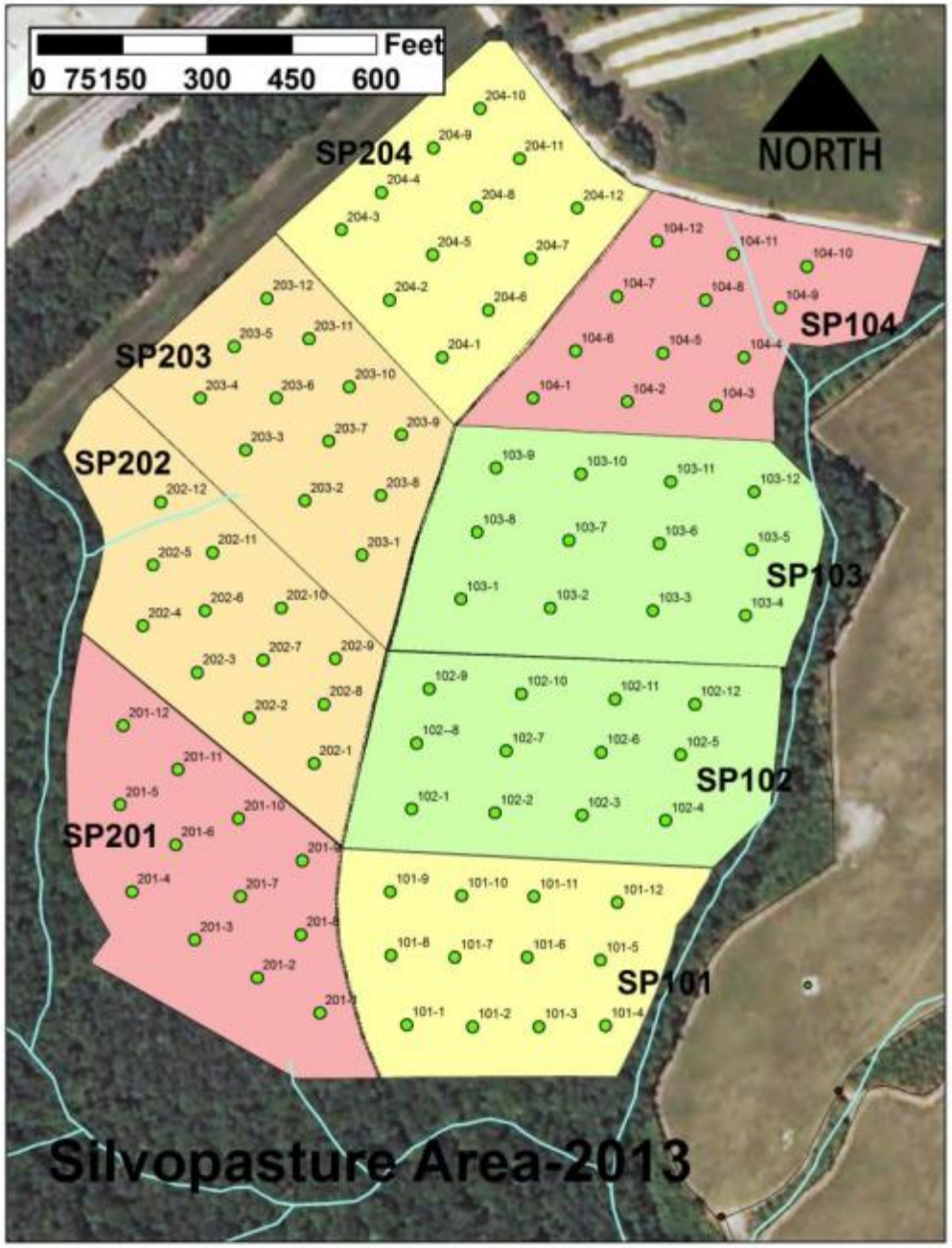
USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

Objectives

- To demonstrate the establishment of pine and hardwood silvopastures
- To demonstrate the use of managed grazing in silvopastures
- To provide educational opportunities for livestock producers and agricultural, forestry, and conservation professionals working with livestock producers

Plot Layout

- 40 acres
  - 8-5 acre blocks
- Sampling grid
  - 12 points/block
  - 1 point/0.42 A



“Snapshot” of Ecosystem

- Insects
- Macro-invertebrates
- Soil chemistry
- Soil microbes
- Soil C and N
- Leaf litter
- Tree community
- Soil nematodes

Sampling Insect Communities

Sampling Macro-Invertebrates

Initial Results

- Predominant tree species
  - Oak species with basal area of 119 sq ft/A
  - Loblolly pine with a basal area of 382 ft/A
- Soil chemistry at 10 cm sampling depth
  - pH: 4.88 with a range of 4.38 to 5.60
  - P: 2 ppm with a range of 1 to 24 ppm
  - K: 28 ppm with a range of 15 to 54 ppm
  - N: 0.04% with a range of 0.01 to 0.41%
  - C: 2.46% with a range of 1.05 to 5.69%

Initial Results

- Total microbial biomass at 10 cm
  - 28302 lb/A with a range of 14895 to 77160 lb/A
- 15 species of parasitic nematodes and other free living
- Most abundant insects
  - Camel crickets, pillbugs, harvestmen, flatback millipedes, field crickets

Thinning Existing Stand

Thinned Stand

Mulching Stumps


Questions?