

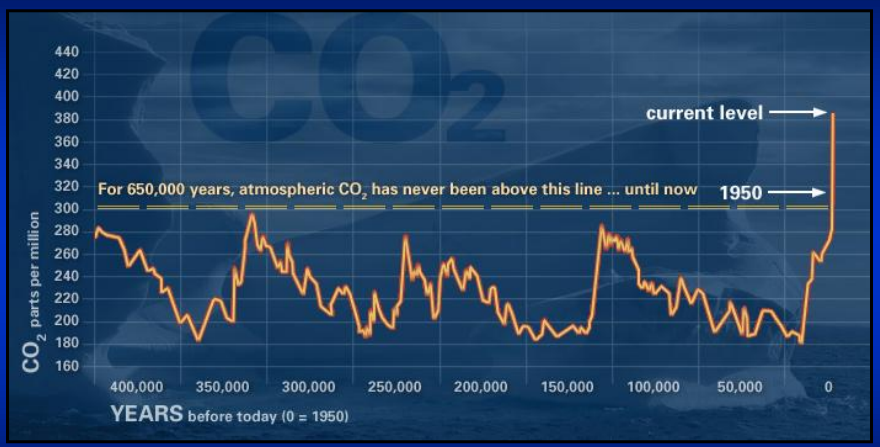
Adapting to a Changing Climate: Forages for Drought Prone Conditions

Chris Teutsch

Southern Piedmont AREC

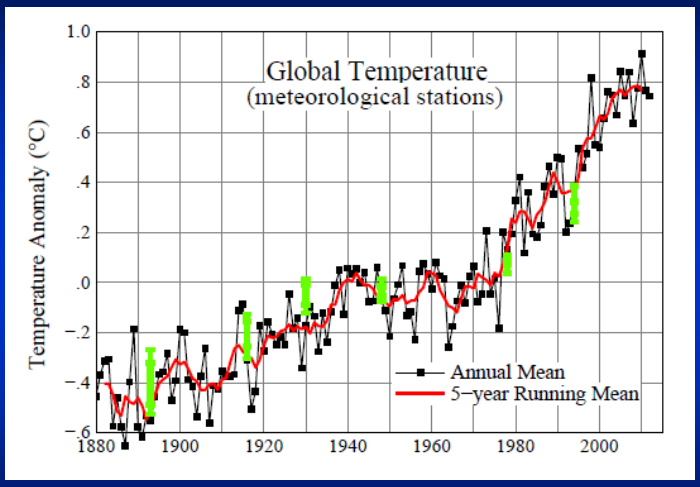
Blackstone, VA

Atmospheric CO2 Levels

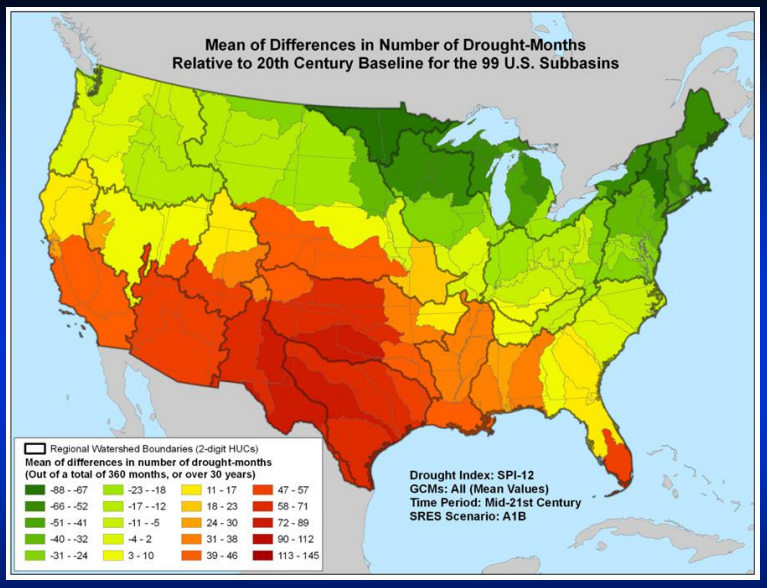


NOAA NATIONAL CLIMATIC DATA CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Temperature Change



Hansen, J.E., R. Ruedy, Mki. Sato, M. Imhoff, W. Lawrence, D. Easterling, T. Peterson, and T. Karl, 2001: A closer look at United States and global surface temperature change. *J. Geophys. Res.*, **106**, 23947-23963, doi:10.1029/2001JD000354.



Kenneth Strzepek, K., Yohe,*G., Neumann,* J., and Boehlert, B. 2010. Characterizing changes in drought risk for the United States from climate change. Environ. Res. Lett. (5):1-9. Avalable on-line at http://dx.doi.org/10.1088/1748-9326/5/4/044012.

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 everyday
- Every farm needs a drought plan

Topic Outline

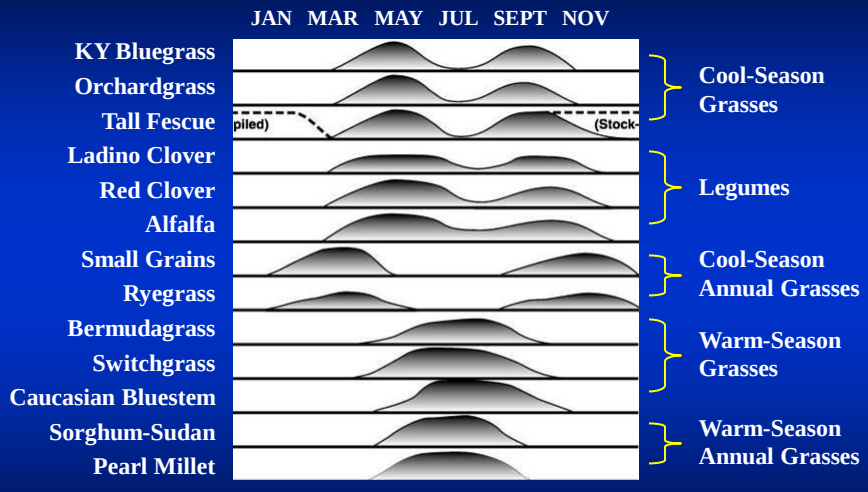
I. Photosynthetic pathways
II. Summer annual variety testing in VA
III. Crabgrass for summer grazing
IV. Forage sorghum as silage
V. Discussion



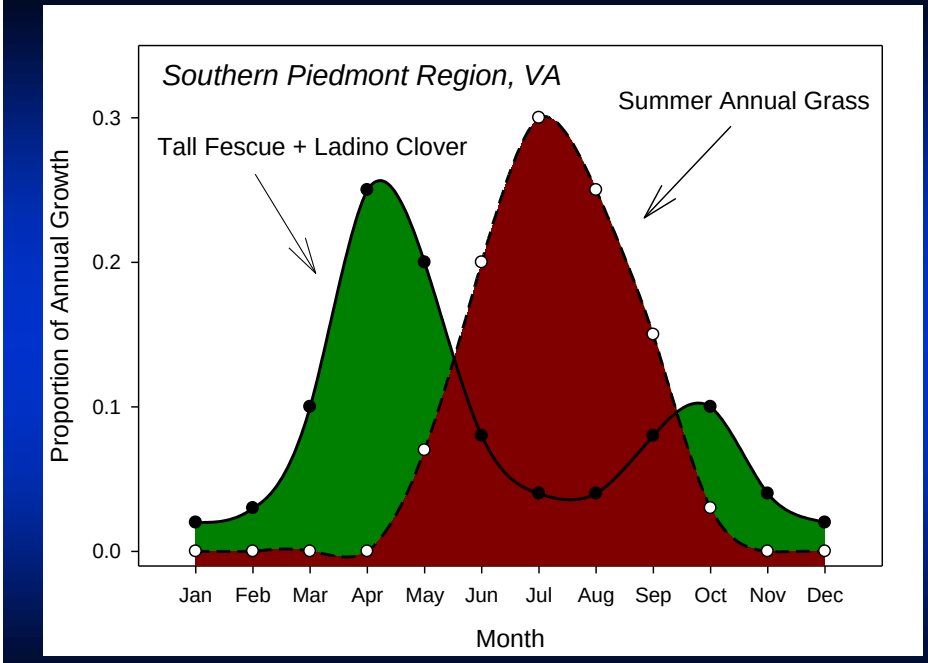
Cool- and Warm-Season Grasses

- Cool-Season Grasses: C3
  - optimal growth at cooler temps (70 F)
  - more digestible and higher in CP
  - longer growing season
- Warm-Season Grasses: C4
  - optimal growth at higher temps (90 F)
  - less digestible and lower in CP
  - more drought tolerant
  - more efficient at using water

Growth Curves for Common Forages



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



Summer Annual Variety Trial

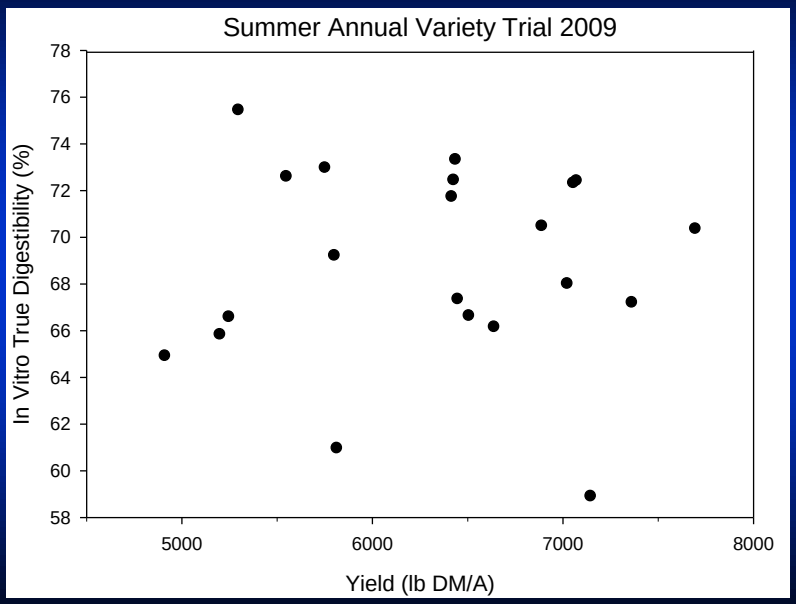
- Conducting trials since early 2000s
- Recently evaluating digestibility
- Sorghum-Sudangrass, sudangrass, forage sorghum, and pearl millet
- 75 lb N/A at seeding and 60 lb N/A after each harvest



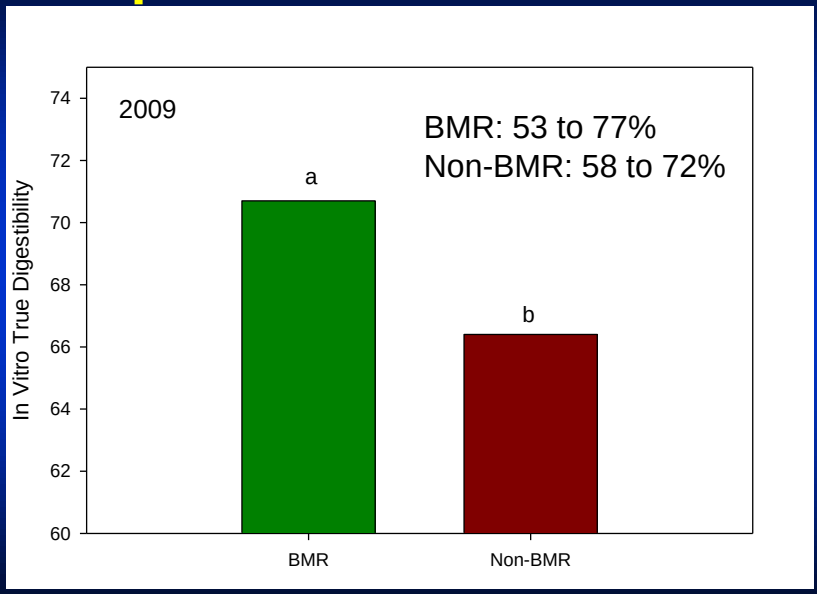
First Harvest-SAVT 2009

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

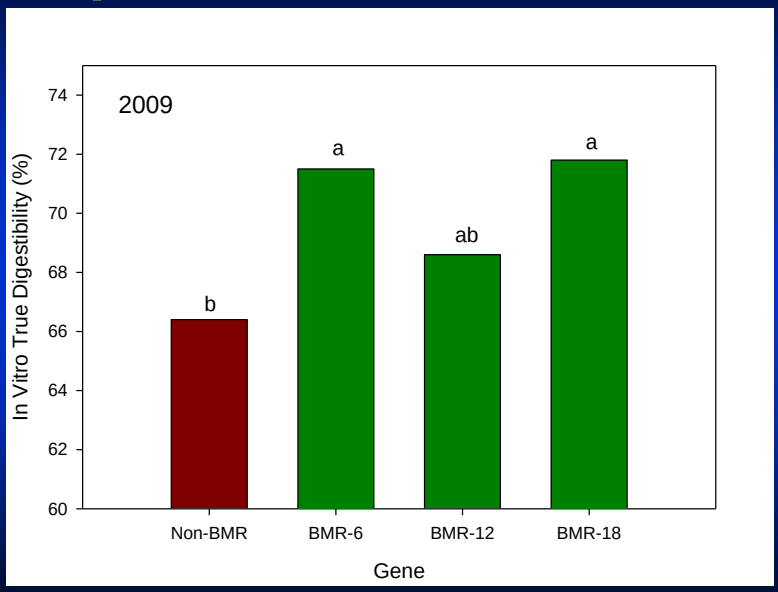
Yield and Digestibility-2009



Impact of BMR Trait-2009



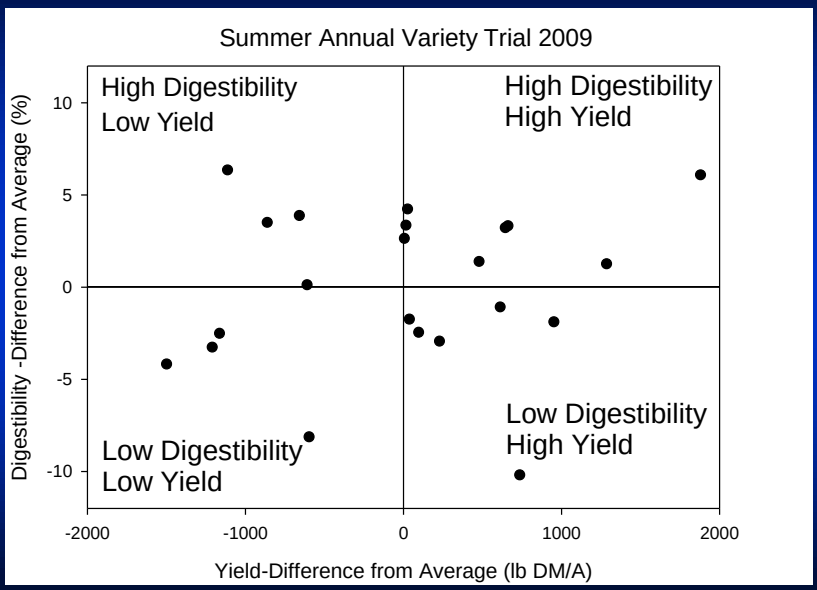
Impact of BMR Gene-2009



Range of Means within Gene

Gene	IVTD Range	Varieties
	%	
Non-BMR	63-68	5
6	65-72	8
12	58-75	4
18	66-74	2

Yield and Digestibility-2009



Variety Performance

- Above average yield and digestibility for both 2009 and 2010
  - Xtragraze, SS, BMR-6, Evergreen Seed
  - AS9301 or SS140, SG, BMR-6, Advanta Seed
  - AS6501, SS, BMR-6, Advanta Seed
  - 22050, SS, BMR-6, Advanta Seed



Variety Performance

- Above average yield and digestibility for both 2009, 2010, and 2011
  - AS9301 or SS140, SG, BMR-6, Advanta Seed
  - AS6501, SS, BMR-6, Advanta Seed



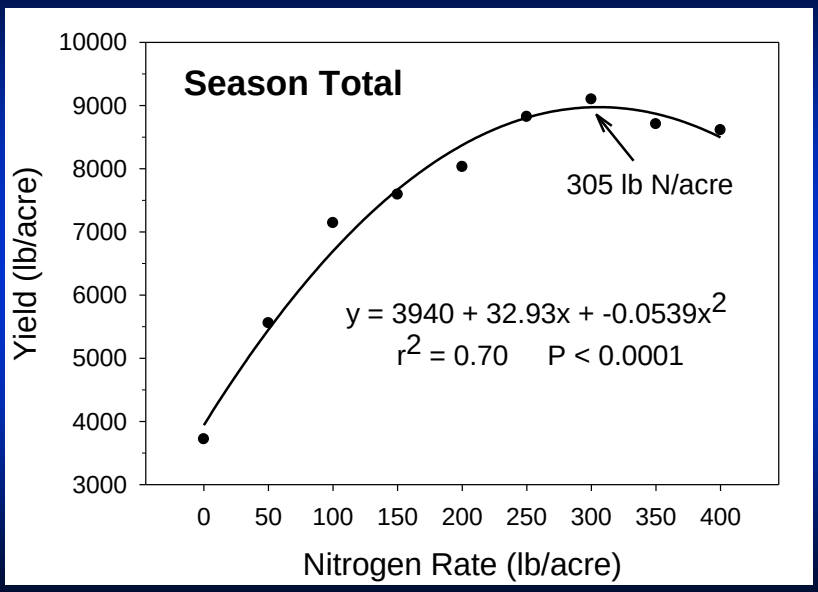
Summary and Recommendations

- BMR trait increased digestibility
- No single BMR gene appeared to be superior
- Range in digestibility was great within both BMR trait and BMR gene
- Need to consider both yield and digestibility when selecting or recommending varieties

Crabgrass

- Well adapted to mid-Atlantic 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
- Can accumulate nitrates

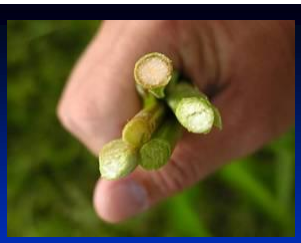
Nitrogen Rate: Total Seasonal Yield



Forage Quality

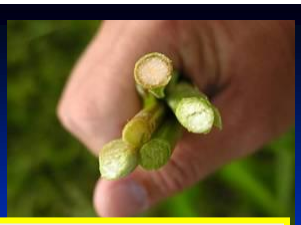
- In Vitro Digestibility
  - 75 to 90% (Teutsch et al., 2005)
- Crude Protein
  - 6 to 14% (Teutsch et al., 2005)
  - Increased with nitrogen fertilization
- Average Daily Gain (Dalrymple, 1994)
  - Poor to fair quality crabgrass: 0.6 to 1.5 lb/day
  - Medium quality crabgrass: 1.85
  - Excellent quality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

Summer Annuals



- Supply forage during summer deficit periods
- Opportunities
  - fast germination and emergence
  - rapid growth
  - high productivity and quality
  - flexibility of utilization
- Challenges
  - Annual establishment cost?
  - increased risk of stand failures
  - Limited growth due to drought

Summer Annuals



- Supply forage during summer deficit periods

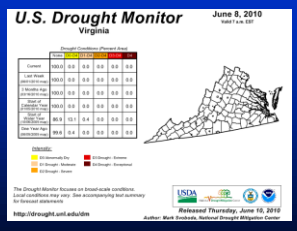
Profitable grazing systems will be based on well adapted perennial sods that are supplemented with annuals.

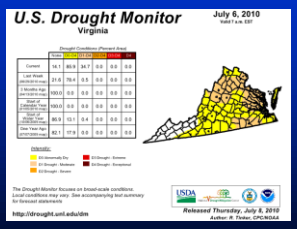
  - Annual establishment cost
- increased risk of stand failures
  - Limited growth due to drought

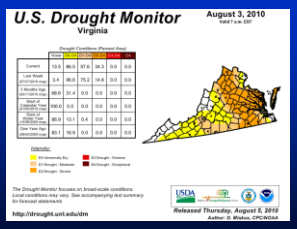
Drought Corn/Sorghum

Materials and Methods

- Corn planted and forage sorghum alone or in a mixture in late May
  - 2, 4, 6, and 8 lb forage sorghum/A
  - BMR dwarf forage sorghum
- 100 lb N/A at seeding
- Harvested at soft stage



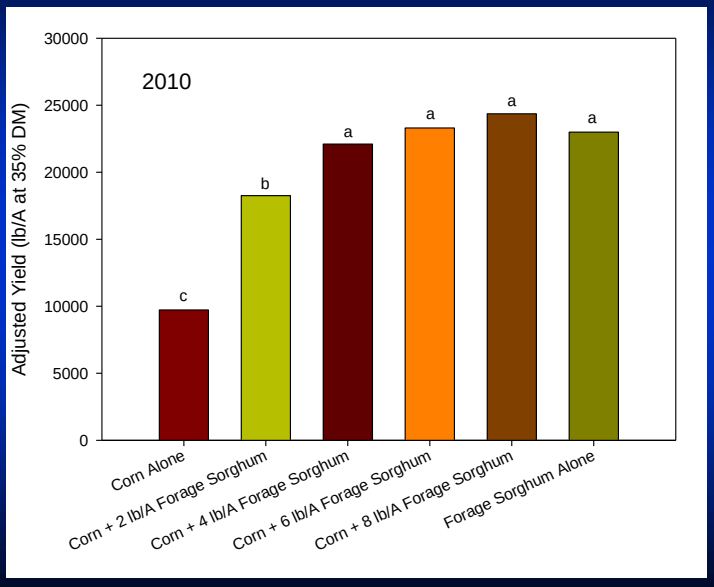




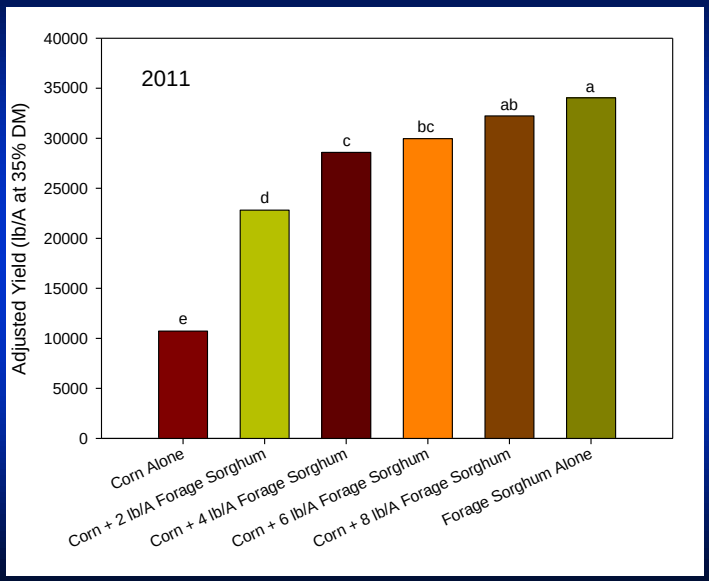
Summer of 2010

Summer 2010

Corn and Forage Sorghum-2010

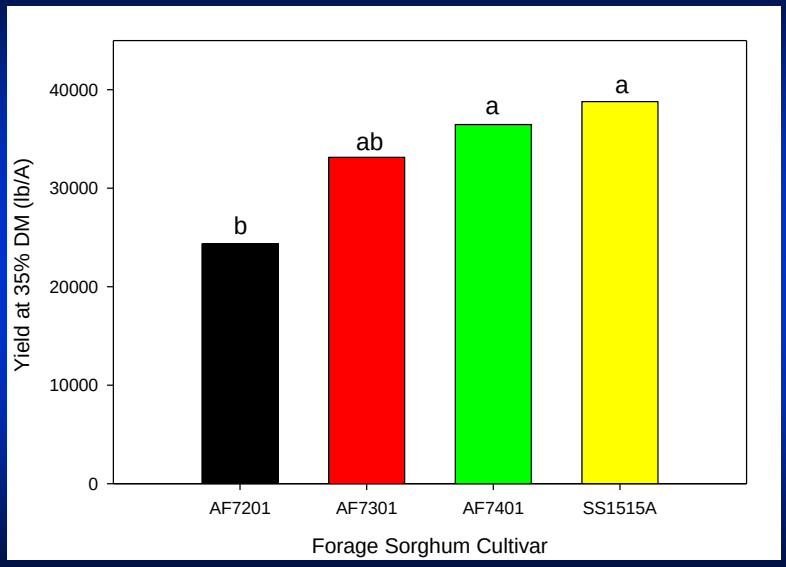


Corn and Forage Sorghum-2011

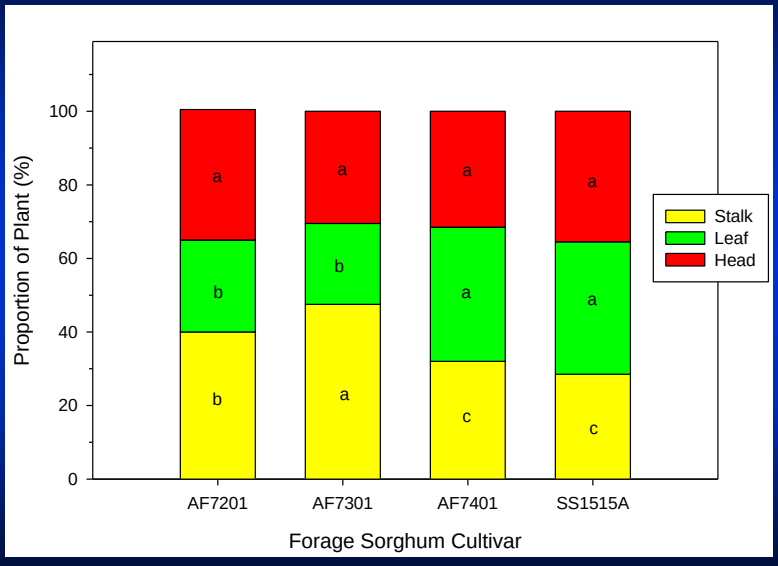


2012 Forage Sorghum Variety Trial

Adjusted Silage Yield in 2012

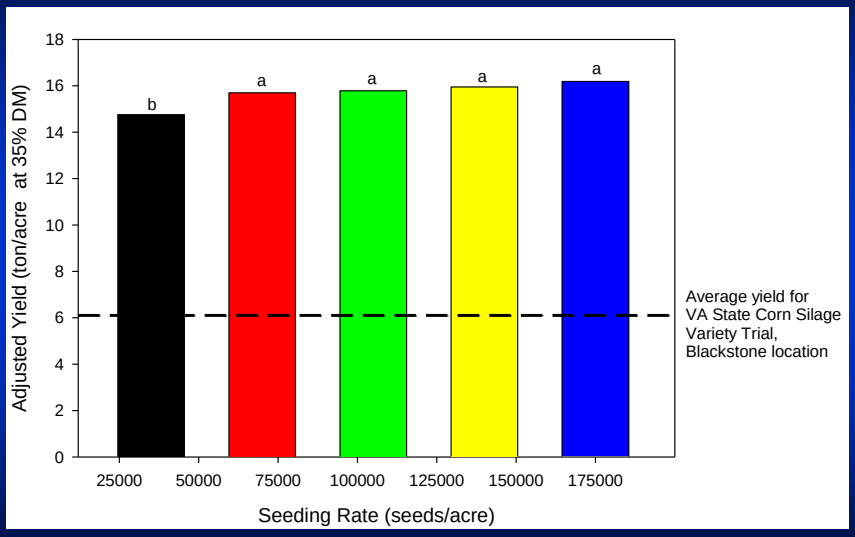


Plant Yield Components in 2012



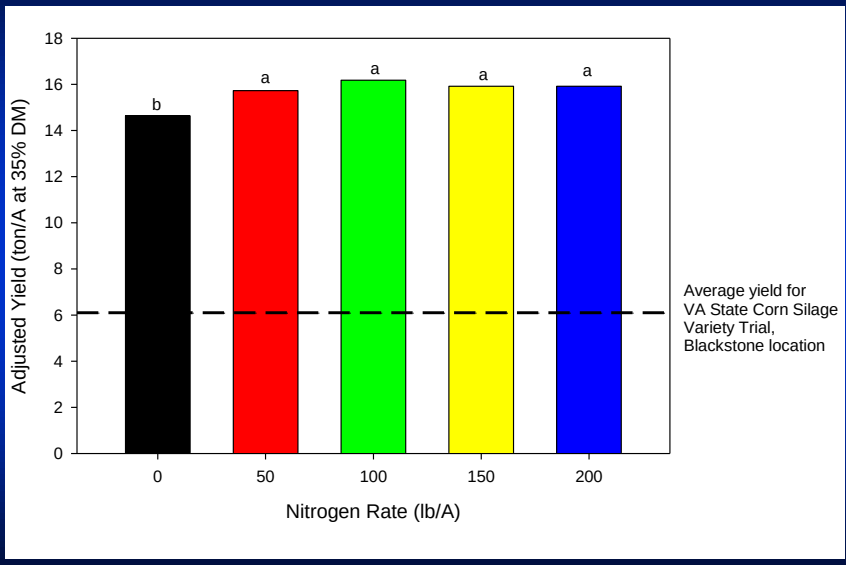
2012 Seeding and N Rate Study

Seeding Rate Averaged Over N Rate

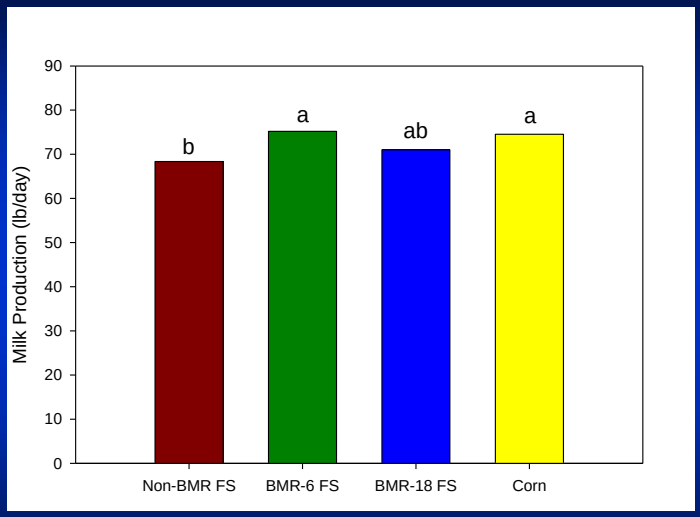


Drought Stressed Corn in 2011

N Rate Averaged Over Seeding Rate



Dairy Cow Performance



Oliver, A.L., R.J. Grant, J.F. Pedersen, and J. O'Rear. 2004. Comparison of brown mid-rib-6 and -18 forage sorghum with conventional sorghum and corn silage in diets of lactating dairy cows. J. Dairy Sci. 87:637-44.

Silage Budgets

Fixed Costs	Forage Sorghum @14 ton/A	Corn @14 ton/A
Seed	14.00	57.00
Fertilizer	190.00	239.00
Lime	14.00	14.00
Herbicdes	40.00	30.00
Fuel, Oil, Repairs	25.00	25.00
Preharvest Labor	12.00	12.00
Crop Insurance	15.00	15.00
Interst	10.00	12.00
Total Preharvest Costs	**320.00**	**404.00**
Variable Costs		
Fuel, Oil, Repairs	44.00	44.00
Harvest Labor	34.00	34.00
Total Harvest Costs	**78.00**	**78.00**
Misc. Costs	35.00	35.00
Total Costs per Acre	**433.00**	**517.00**
Total Costs per ton	**30.93**	**36.93**

Where does forage sorghum fit into silage production systems?

- NOT going to replace corn!!!
- Best fit on droughty soils that are marginal for corn silage production
- Geographic areas that are prone to drought?
- Delayed or late silage plantings
- Rotation with corn for Johnsongrass control




Discussion