

The Regional Feedstock Partnership: Herbaceous Energy Crops and CRP Land for Biomass Production

20-23 May 2013

Feedstock Supply and Logistics Peer Review

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Goal/Objectives

- Development of more accurate cost supply information and improved communication with partners in the biomass feedstock supply chain
 - Replicated field trials across regions to determine the impact of residue removal on future grain yield.
 - Replicated field trials to develop energy crops within geographical regions.
 - Regional assessment of feedstock resources which can be used to determine supply curves.
- Long term field data is the best and most direct way to determine commercial viability

Quad Chart Overview

Timeline

- Project start date: 01/15/2007
- Project end date: 09/30/2013
- Percent complete: 80%

Barriers

- Ft-A: Resource availability and cost
- Ft-B: Sustainable production
- Ft-C: Crop genetics

Budget

- Funding for FY11
 - DOE: \$1,150,637
 - Cost share: \$287,659
- Funding for FY12: \$0
- Funding for FY13: \$0
- Years the project has been funded/average annual funding
 - 6 years @ \$755,512/yr

Partners

- Collaborations: Sun Grant, DOE, USDA-ARS, Land-Grant Universities, National Labs
- Project management: Herbaceous lead, species leads, field trial PIs

Project Overview

- Field trials initiated in 2008, or added later as needed, on multiple selected species
- Development of regional and national yield estimates for sustainable biomass supply systems

Presentation Outline

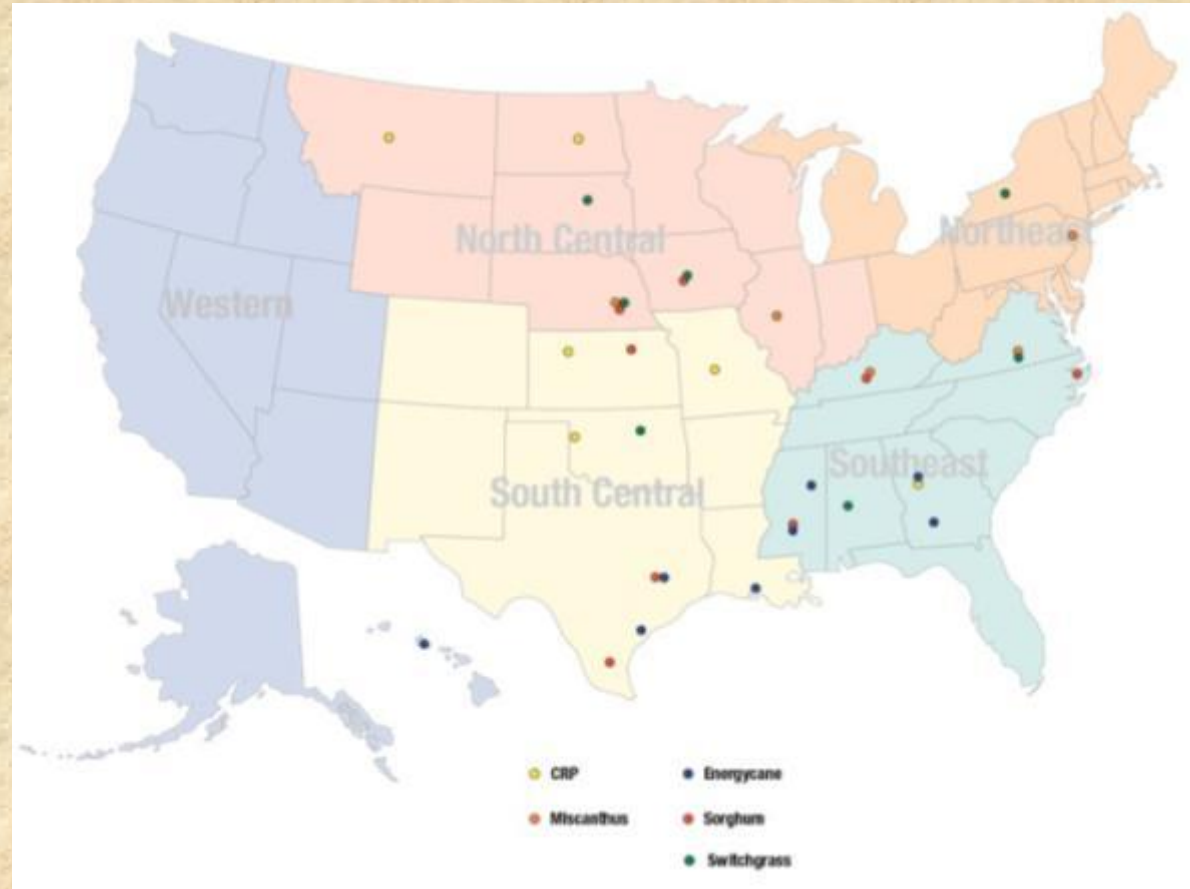
- General Approach
- Overall Technical Progress and Accomplishments
- Species discussion
 - Energycane
 - CRP
 - Miscanthus
 - Switchgrass
- Project Relevance
- Critical Success Factors
- Future Work
- Summary

1 - General Approach

- Perform replicated field trials of diverse herbaceous biomass feedstocks at different locations for assessing potential expansion of these feedstocks as a bioenergy resource
- Selected species and scale (field or small plot)
 - Energycane (small plot)
 - CRP (field scale)
 - Miscanthus x giganteus (small plot; sustainability site)
 - Switchgrass (field scale; sustainability site)
- Management approach: herbaceous lead, species leads, field trial PIs

2 - Overall Technical Progress and Accomplishments

- Establishment of 34 (\pm) replicated field trials across US
 - Energycane (8)
 - CRP (6)
 - Miscanthus (5)
 - Switchgrass (6)
- Sustainability trials
 - Miscanthus (1)
 - Switchgrass (1)



Energycane

- Hybrid of sugarcane and wild cane (*S. spontaneum*)
- Bred for high fiber, high biomass
- Tolerance to cold weather
- Fermentable sugars



Energycane Collaborators and Locations

- Bill Anderson via Wayne Hanna (USDA via UGA, Tifton, GA)
- Brian Baldwin (MSU, Starkville, MS)
- Ronnie Schnell (TAMU, College Station, TX)
- Joe Bouton (UGA, Athens, GA) – 2008 addition
- Kenneth Gravois (LSU, St. Gabriel, LA)
- Bisoondat Macoon (MSU, Raymond MS)
- Anna Hale (ARS-SRU, Houma, LA)
- Richard Ogoshi (U Hawaii, Waimanalo) – 2009 addition
- Ted Wilson, et al. (TAMU, Beaumont, TX)



Energycane Approach

- Plots 10 x 6 m (governed by germplasm availability)
- Four replicates
- Genotype by location (five genotypes common to all locations)
- Locally adapted cultivar at each location



Energycane Technical Progress/Results to Date



Four-Year Mean DM Yield by Location** (and range)

Energycane Genotype	Athens, GA	S-ville, MS	Tifton, GA	B-mont, TX	St. Gbrl, LA	W-nalo, HI*
	----- Yield (US tons/A)-----					
Ho 02-144	9.04 (2.5 -12.4)	10.68 (3.5-14.1)	13.55 (10.1-15.8)	14.41 (0-18.2)	7.19 (6.3-8.0)	16.41 (13.4-19.5)
Ho 02-147	7.35 (2.8-9.9)	6.88 (2.2-8.6)	14.57 (11.2-16.1)	16.51 (0-22.3)	8.81 (6.2-9.8)	18.32 (17.0-19.6)
Ho 06-9001	8.89 (3.3-12.4)	12.35 (4.7-14.1)	16.60 (11.1-18.9)	18.65 (0-25.4)	7.32 (6.9-8.0)	18.64 (18.4-21.5)
Ho 06-9002	8.96 (3.0-11.8)	10.73 (3.3-14.0)	17.34 (12.6-19.5)	21.32 (0-29.9)	7.09 (6.4-7.5)	17.21 (12.9-21.5)
Ho 72-114	5.56 (1.1-9.2)	7.11 (3.1-8.7)	16.34 (12.6-18.1)	14.61 (0-23.3)	8.21 (6.1-8.9)	20.20 (19.3-21.2)
L79-1002			7.53 (3.7-14.8)			

* Two year mean; **Missing Raymond and College Station

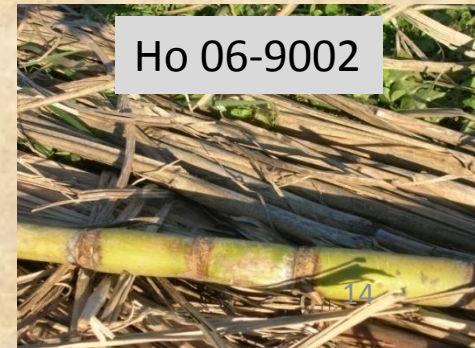
Issues/Major Factors

Location	Issue/Major Factor	Status
College Station, TX Raymond, MS	La Niña/El Niño year	Delayed harvest, but higher yields
Athens, GA	January 2011 7-day freeze	Recovering from
Starkville, MS	Warm winter temperatures	Even warmer this year
Tifton, GA	Smut outbreak	L79-1002 only



Energycane Summary

- Tip smut IS a problem in susceptible genotypes
- Location impacts cell wall content, mostly lignin
- Spring onset of growth different
 - Early onset in genotypes closer to sugarcane can lead to higher yields at the southern locations
 - Early onset of genotypes not good for maximum growth in the “North” (spring frost)
- Yield varies by genotype and location
- Warm winters confound ability to determine cold hardiness
- Location matters, with Tifton, GA; Beaumont, TX then Bryan, TX topping locations
- Ho 06-900X seems best adapted to most locations tested, but are the lowest sugar



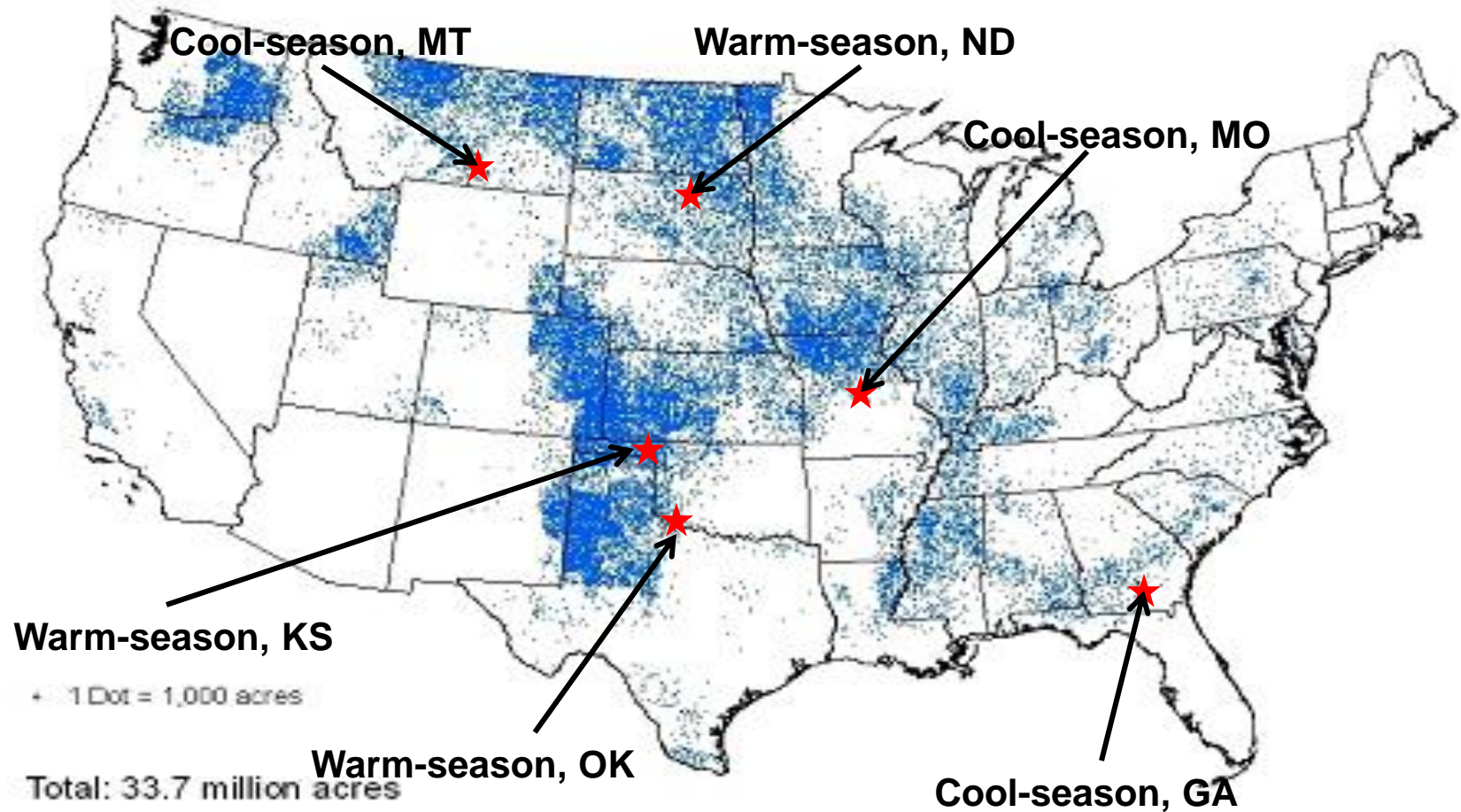
CRP Trial Locations (Lee-UI; Adler-ARS)

- North Dakota – E. Aberle
- Kansas – K. Harmony
- Montana – C. Chengci
- Georgia – C. Jordan
- Missouri – R. Kallenbach
- Oklahoma – G. Kakani



CRP Research Sites

FY 2009 CRP Enrollment



Source: USDA FSA

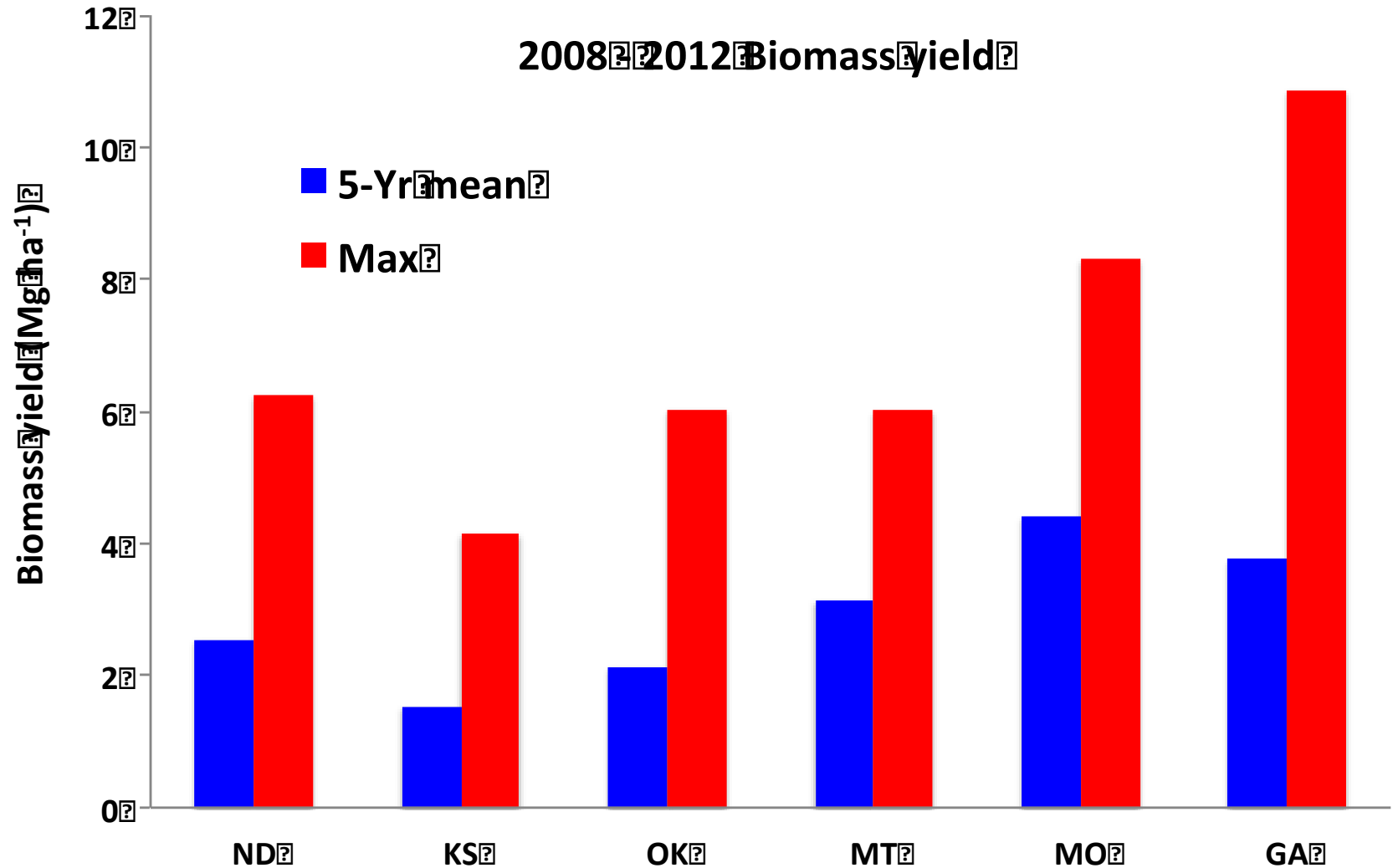
CRP Technical Progress/Results to Date



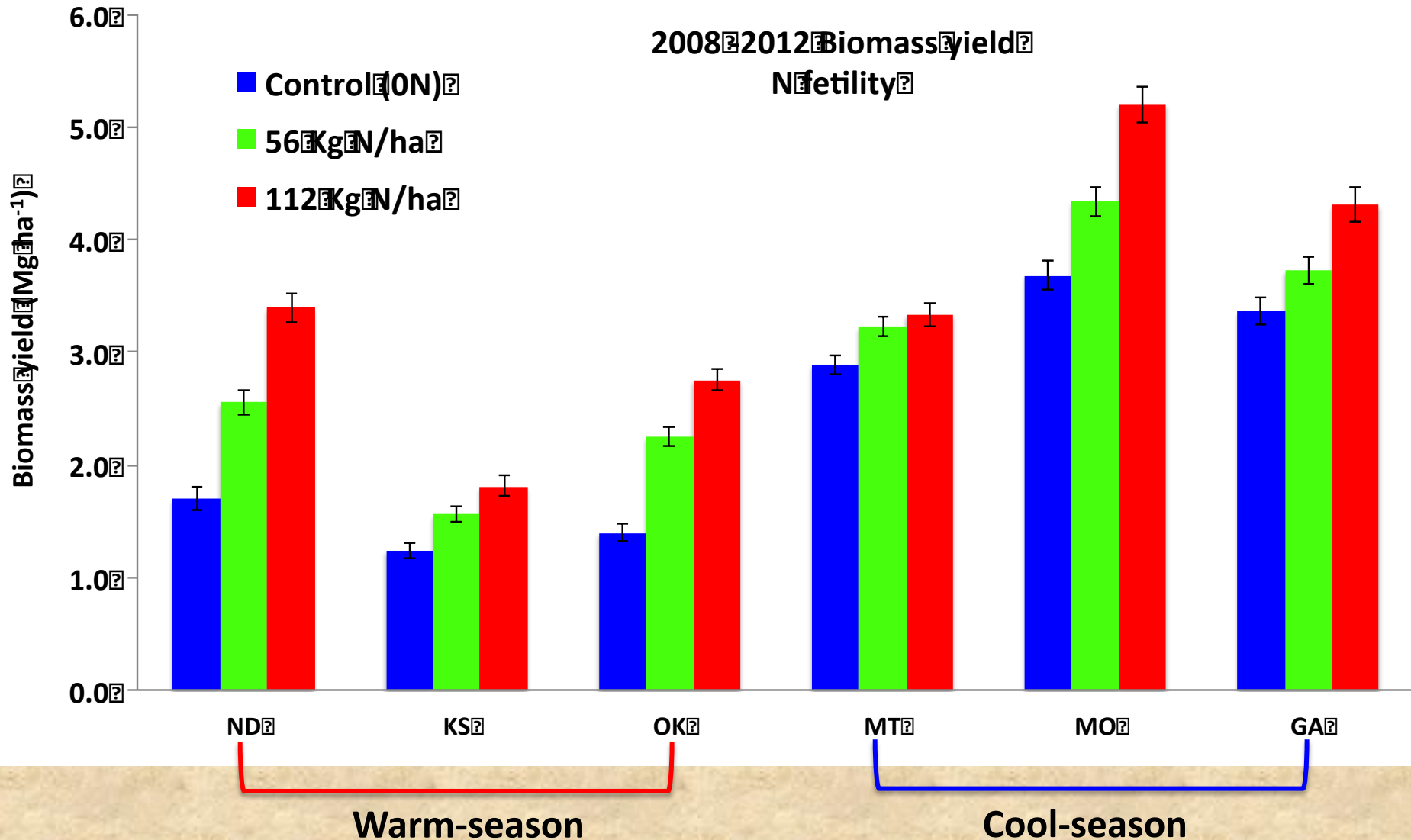
CRP Project Progress

- Field setup: Spring 2008
 - Baseline soil sampling: completed in 2008
 - Fertilization: every spring since 2008
- Biomass harvest: every summer and fall since 2008
 - Biomass yield and dry matter
 - Biomass samples to INL
- Species composition: every year since 2008
- Feedstock composition
 - Total N
 - Neutral detergent fiber (NDF) and acid detergent fiber (ADF) used to estimate cellulose and hemicellulose
 - Acid detergent lignin (ADL)
 - Ash

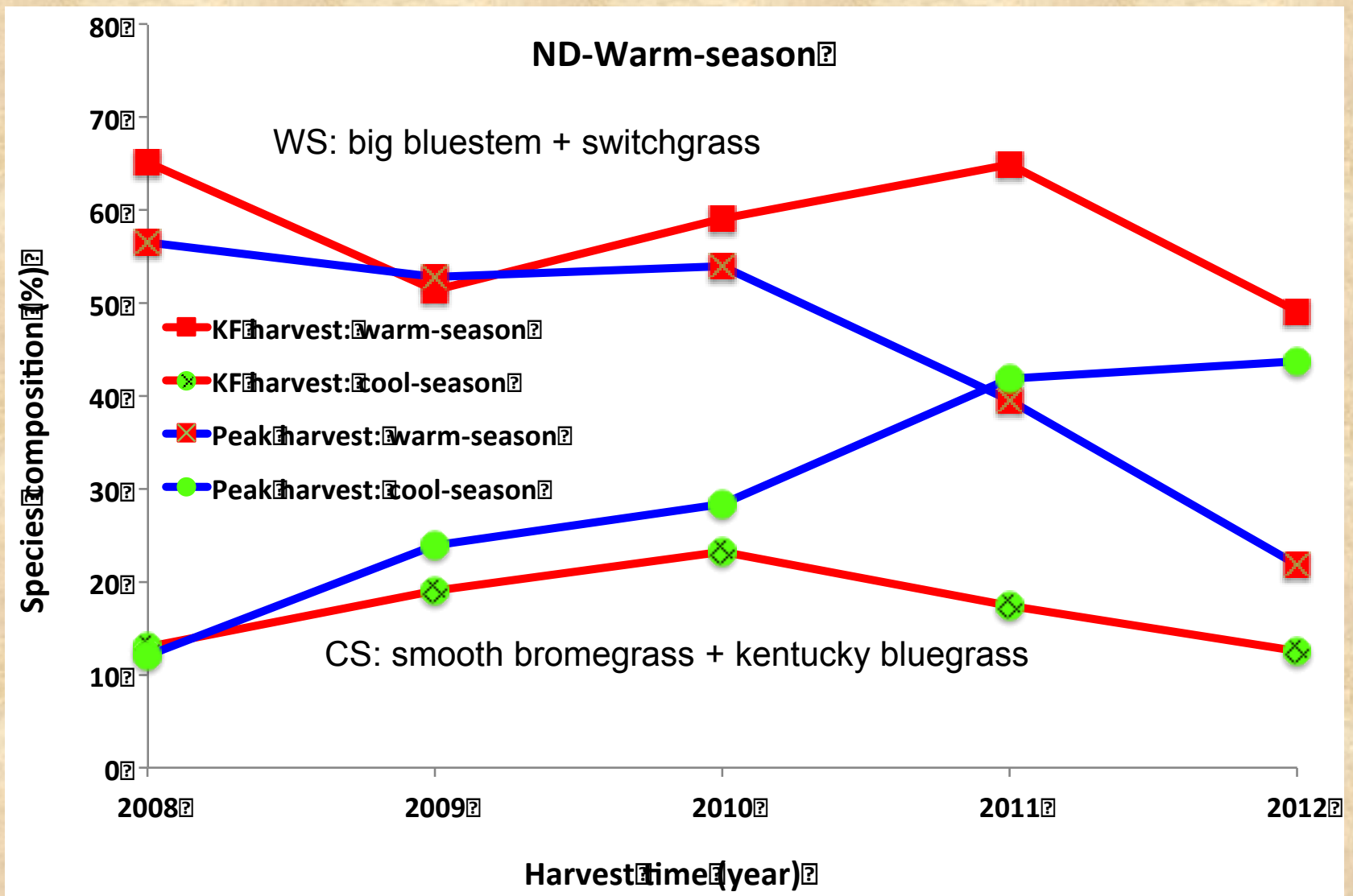
Biomass Production in CRP



N Effect on CRP Biomass Production



Harvest Timing Effect on Species Composition



CRP Summary (2008-2012)

- CRP land has a potential for biomass production. However, sustainable management practices are required to maximize biomass production
 - Optimizing N fertilization and harvest timing
 - Considering legume species as a supplemental N source
 - Delaying harvest for stand longevity depending on species composition
- Precipitation during the growing season was one of the major factors limiting biomass production
- This result will provide base information
 - for a projection of feedstock production in US CRP land
 - for economic analysis

Miscanthus x giganteus Trial Locations (Voigt-UI; Davis-ARS)

- Illinois – Tom Voigt
- Kentucky – David Williams
- Nebraska – Roch Gaussoin
- New Jersey – Stacy Bonos
- Virginia – John Fike (2010)



Miscanthus Approach

- 12-10 m x 10 m plots with 100 plants on 1-m spacing
- 4 replications at each location
- Annual N fertility treatments (0, 60, 120 kg N ha⁻¹) using urea
- Plants in IL, KY, NE, and NJ planted in 2008 (75% IL replanted in 2009); VA planted in 2010.

Sample Plot
Layout



Miscanthus Technical Progress/Results to Date



20 May 2013

M. x giganteus Growth Across Seasons



Season 1-KY
August 14, 2008



Season 2-KY
October 19, 2009



Season 3-NE
August 11, 2010

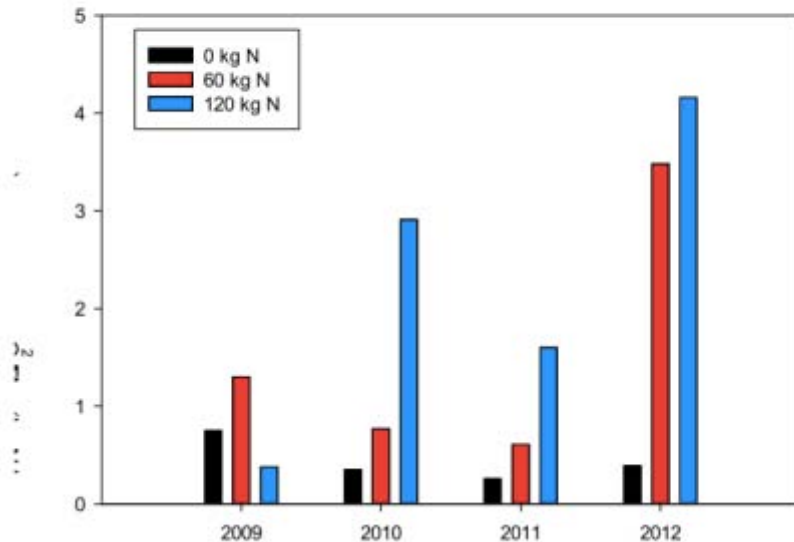
2009 – 2012 Miscanthus Biomass Yields (Dry Mg ha⁻¹)

Location	2009	2010	2011	2012
Nebraska	15.6	27.4	31.2	23.7
Illinois	3.0	15.6	20.6	10.0*
Kentucky	17.1	19.0	19.0	12.8
New Jersey	16.9	9.7	18.6	15.9
Virginia	-	-	9.4	16.7

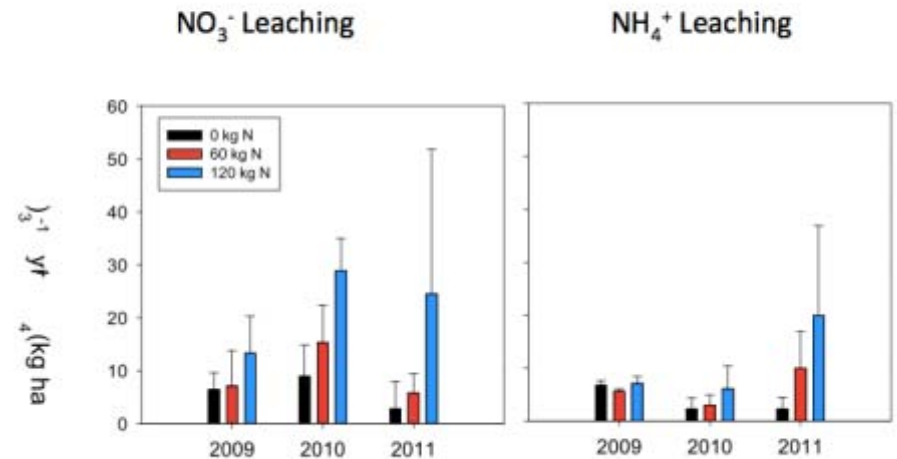
* Significant yield differences; 0<60=120

Miscanthus Sustainability Results

Urbana N₂O Emissions



Urbana Resin Lysimeters



Courtesy Morgan Davis



Sun Grant/DOE 2008 – 2012 Summary

- Winterkill can be an issue during the first winter following planting.
- Dry growing seasons have reduced *M. x giganteus* yields.
- Through the five growing seasons, only IL in 2012 had a significant yield response to N.
- When it is determined that *M. x giganteus* requires N fertilization, additional research will be required to fine-tune the N rates based on location and environment.

Maughan et al., 2011. GCB-Bioenergy; Behnke et al., 2012. Bioenergy Research

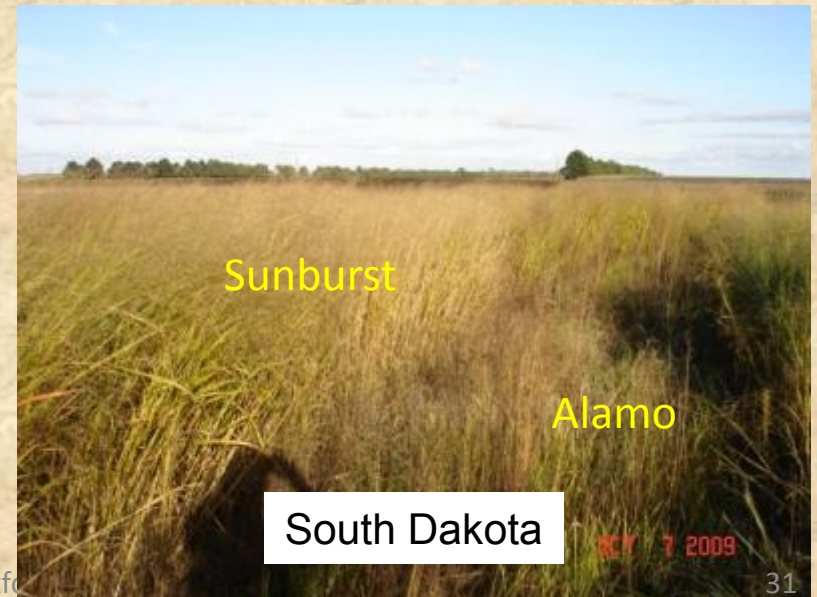
Switchgrass Trial Locations (Owens-SDSU; Mitchell-ARS)

- Alabama – David Bransby (2010)
- New York – Don Viands
- Oklahoma – Rodney Farris
- South Dakota – Vance Owens
- Virginia – John Fike
- Iowa – Emily Heaton (2009)
- Nebraska – Rob Mitchell (2009)



Switchgrass Approach

- Field scale (0.4 to 0.8 ha experimental units)
- Four replicates across landscape
- Nitrogen (0, 56, 112 kg ha⁻¹) applied in 2009 and 2010 to all sites established in 2008 or 2009
- Locally adapted cultivar at each location



Switchgrass Technical Progress/Results to Date



Progress/Results to Date

- Initial soil characteristics utilizing minimum soil data set
 - Total organic carbon; soil pH; Total N; Bulk density; Soil-test P and K
- Yield using standard equipment
- Subsamples from plots for chemical characterization
 - Samples from windrow and/or from bales have been sent to INL
 - Samples are also being analyzed locally for other estimates of biomass quality



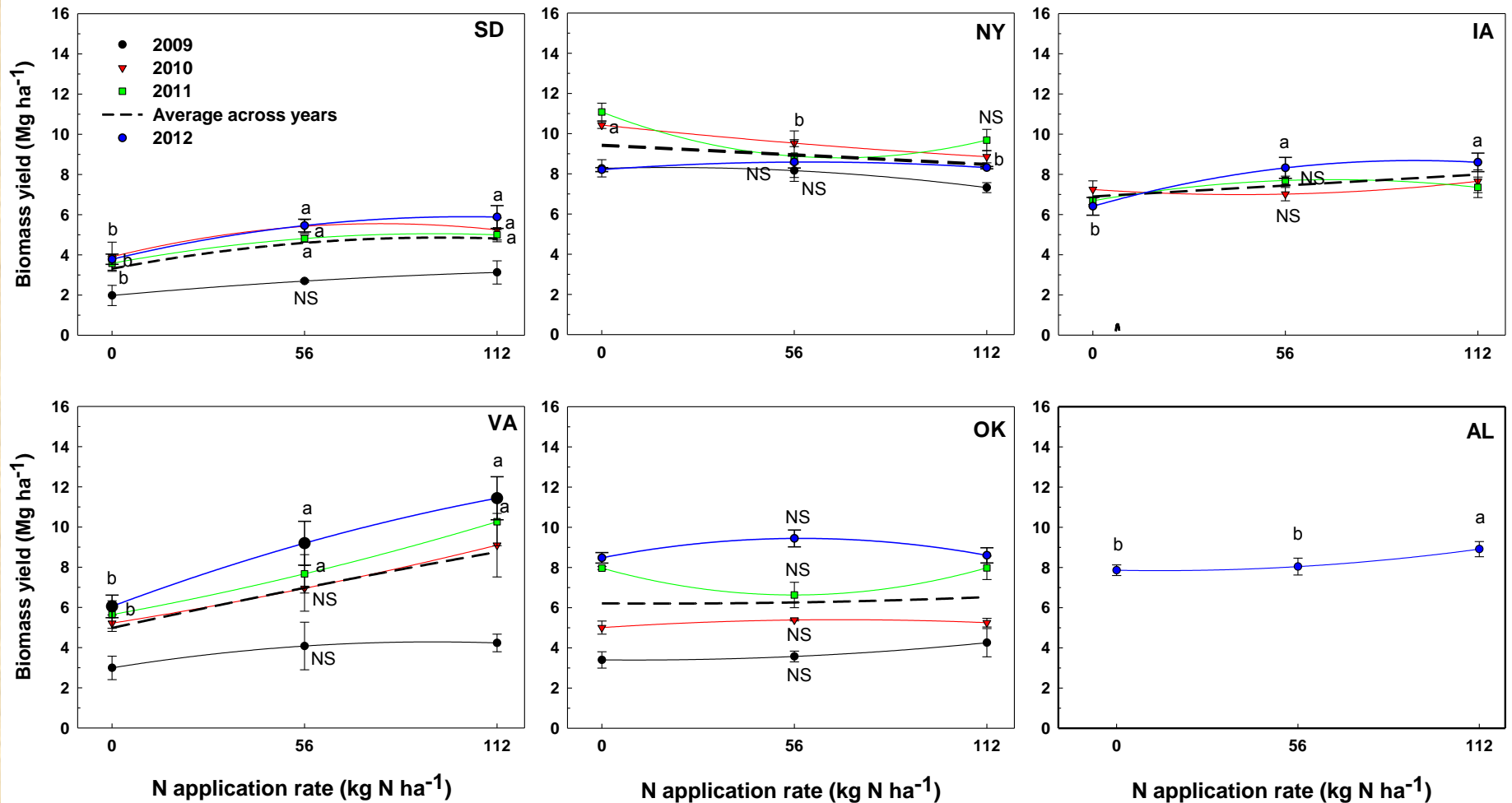
Alabama 2012



South Dakota—2009 (left) and 2012 (right)

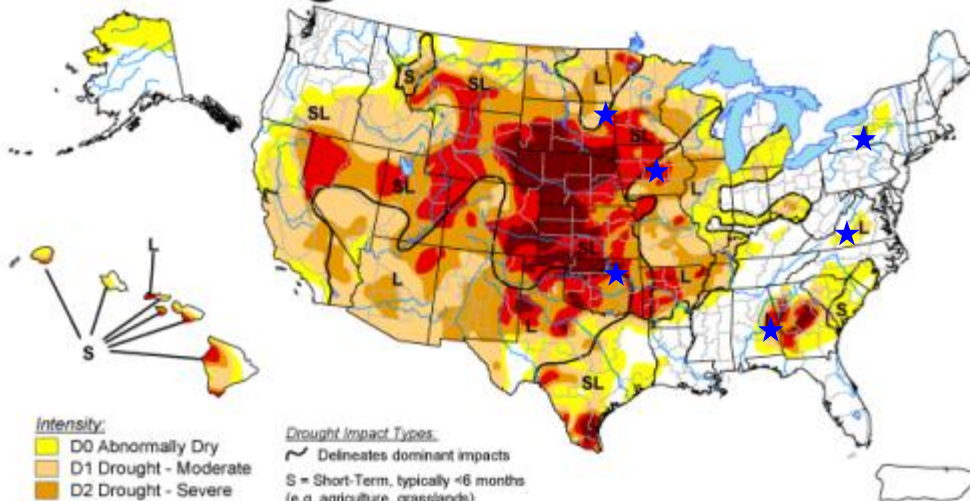


Switchgrass response to N at common treatment locations (IA, NY, OK, SD, VA) and harvest timing at NE



U.S. Drought Monitor

October 30, 2012
Valid 7 a.m. EDT



- Intensity:**
- D0 Abnormally Dry
 - D1 Drought - Moderate
 - D2 Drought - Severe
 - D3 Drought - Extreme
 - D4 Drought - Exceptional

Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)



Released Thursday, Nov
Author: Michael Brewer/L. Love-Brotak, NOAA

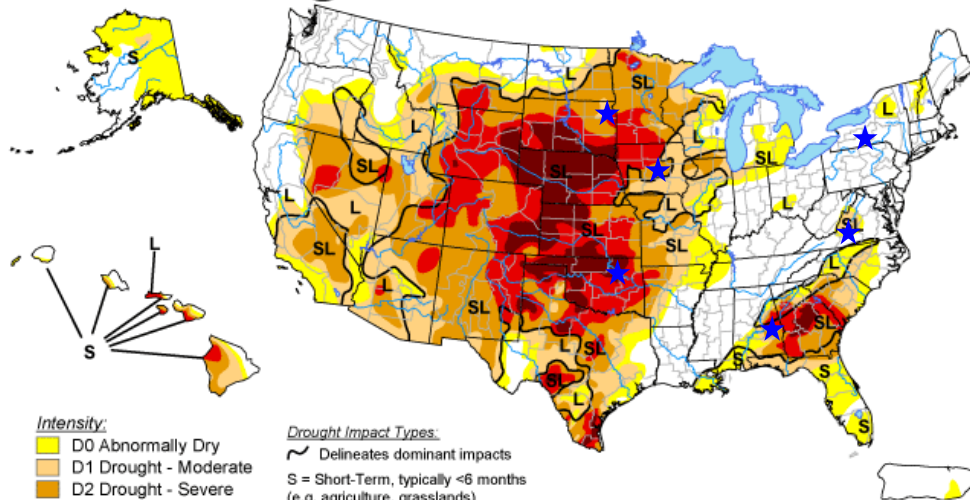
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu/>

Drought

U.S. Drought Monitor

January 29, 2013
Valid 7 a.m. EST



- Intensity:**
- D0 Abnormally Dry
 - D1 Drought - Moderate
 - D2 Drought - Severe
 - D3 Drought - Extreme
 - D4 Drought - Exceptional

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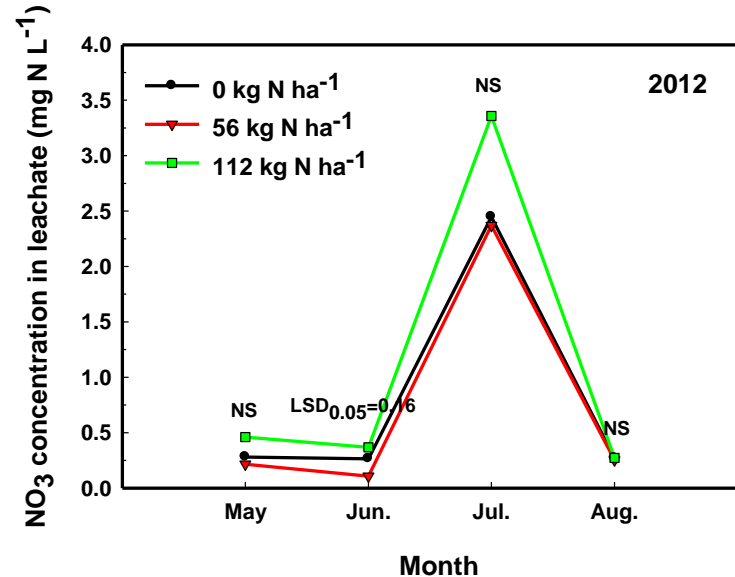
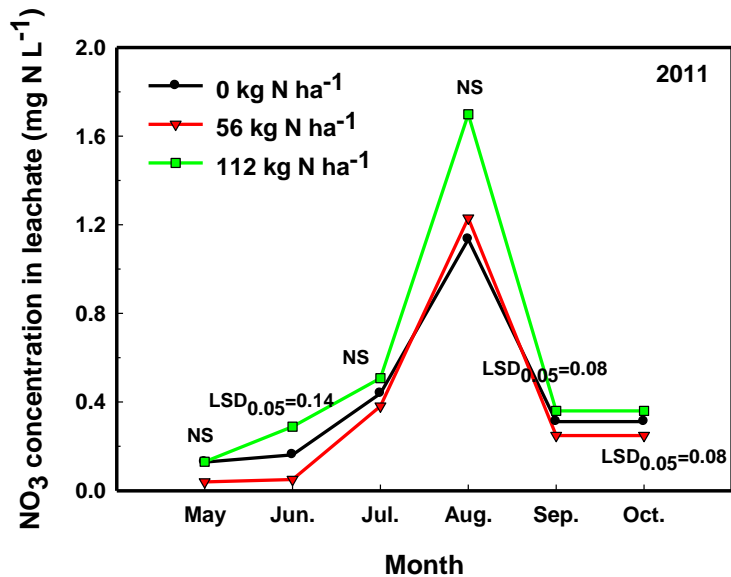
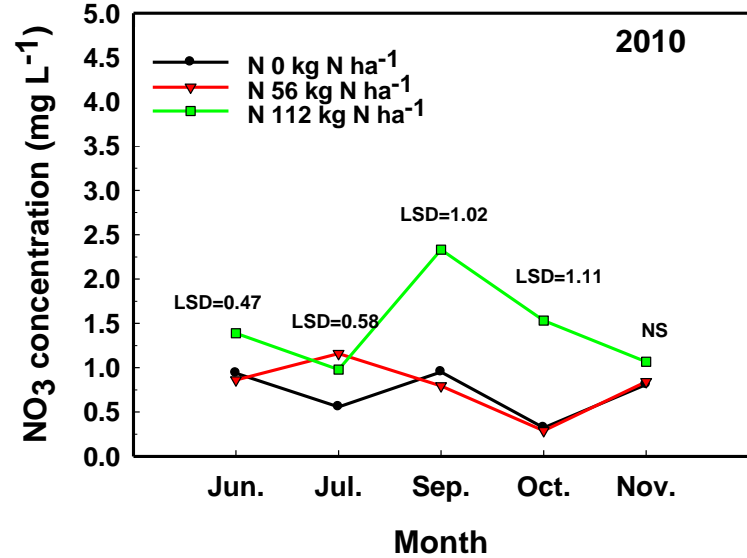
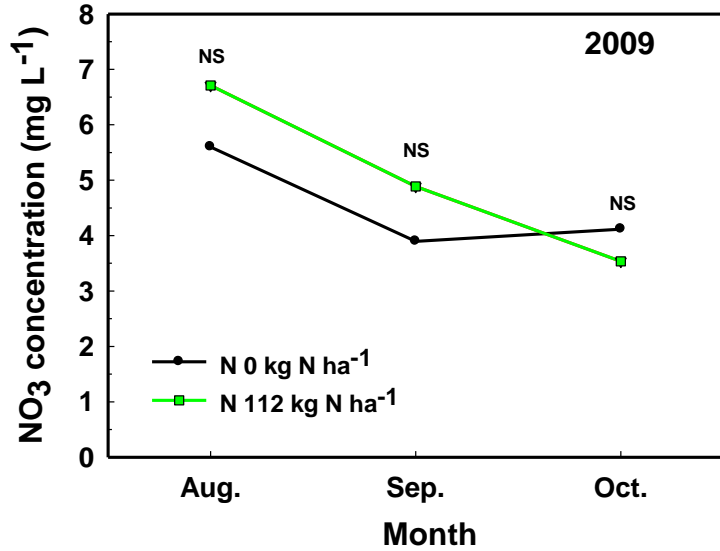
Released Thursday, January 31, 2013

Author: Mark Svoboda, National Drought Mitigation Center

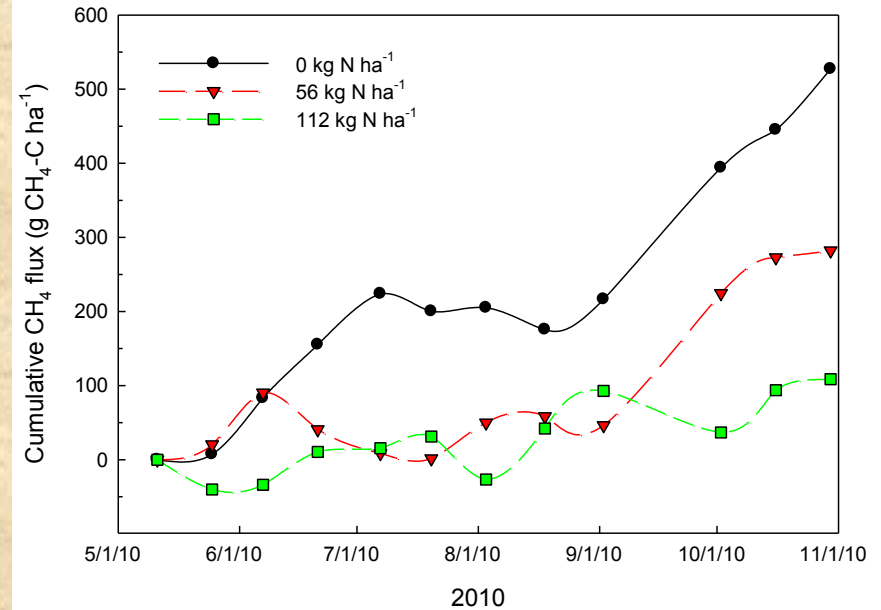
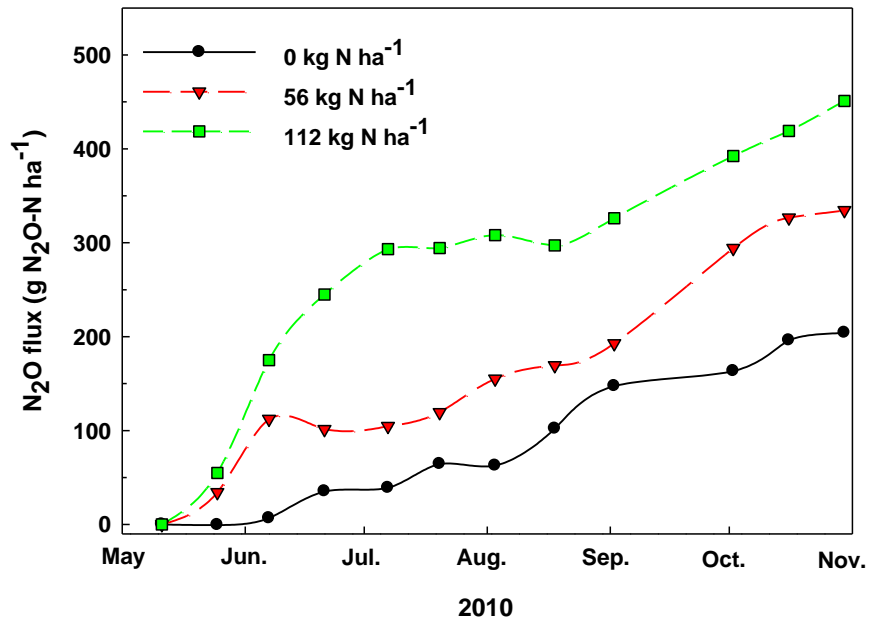
Switchgrass Sustainability Results



Monthly NO₃ concentration in leachate collected from lysimeters placed 1 m deep (Bristol, SD)



Cumulative N₂O (left) and CH₄ (right) flux in 2010 in SD. Values are averaged across summit and toeslope landscape positions.

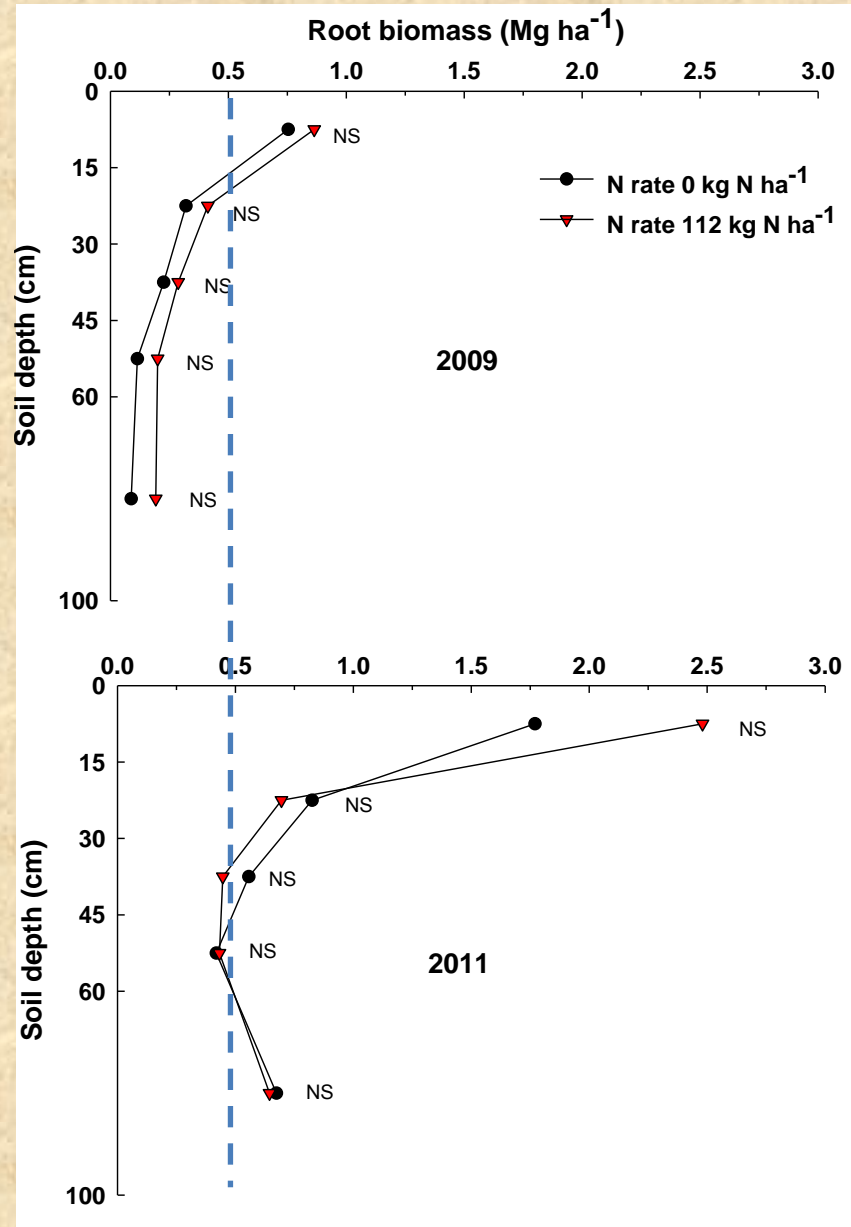


Total N₂O flux has decreased each year (2010-2012) which probably reflects annual precipitation patterns.

Switchgrass root biomass at various depths the year after establishment (Bristol, SD)



20 May 2013



Switchgrass Summary

- Switchgrass yield not consistently affected by N application
- N removal increases with N application
- Root biomass tends to increase with N
- Nitrate leaching higher with high N rate
- Cumulative N₂O emissions affected by N application and season of growth

3 – Project Relevance

- Multi-year, region-specific, yield and composition data for potential feedstocks to help with construction of feedstock supply curves to better understand ability to meet future biomass production goals
- Developing baseline productivity for various species across regions; will have 3-6 years data for nearly all field trial sites after 2013
- Data regarding sustainable production systems being accumulated for each species and CRP
- Selected sites are gathering environmental sustainability data to better understand effect of feedstock production and management on soil C, water use, and GHG
- Field trial data being submitted to KDF
- All of this is highly relevant to industry as biorefineries are sited and to policy makers as they evaluate bioenergy practices

4 - Critical Success Factors

- Establishment, management, and production of diverse energy crops
 - Seeding year costs and production
 - Consistent supply
- Feedstock resources, productivity, and environmental sustainability
 - Baseline to be established utilizing current cultivars and technologies
 - Strength of this project is time
- Challenges
 - Weather...
- Key deliverable and positive impact is an increased database for yields of multiple species in diverse geographic regions

5 - Future Work

- Collect yield data for each species in 2013
- Data from all field trials entered in KDF using appropriate templates
- Sustainability data collected at switchgrass and miscanthus sites
- Reports by species and overall herbaceous energy crops will be completed
- Create national yield potential maps

ID	Task Name	Start	Finish	2013				2014				
				Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3		
1	Manage research sites	3/1/13	5/30/14									
2	Collect yield data at all locations	7/1/13	2/28/14									
3	Collect sustainability data at select locations	4/1/13	11/29/13									
4	Quarterly and final reports	5/1/13	9/30/14									
5	Naitonal yield potential maps	5/1/13	12/31/13									

Summary

- Location and genetics influence production
- Challenges exist: weather, moisture, yield
- Critical baseline, multi-year data being gathered for these species
- Management affects sustainability measures
- Long-term evaluation critical

Additional Slides

Response to Previous Reviewers' Comments

- Reviewer comment: “It will be important to report in the literature products from this project those hypotheses, premises, and expectations that proved not to be true. We tend not to publish negative results, but in this type of project, those constitute important new knowledge that needs to be passed forward.”
- Response: Important point and we completely understand the need to publish results. Several publications from this work have already been published or are in review.
- Reviewer comment: “Very wide variation in yields so should some of the field sites be discontinued for the production of biomass?”
- Response: Yield variation is expected both within a given location (due to weather factors primarily) and across locations (due to differences in variety, species, soil and environmental conditions, etc.). I think this is why it is important to not discontinue a site with poor yields.
- Previous comment: “They are close to making recommendations for which crops are most suited for which states or regions based on the yields of switchgrass, Miscanthus, sorghum, energy cane and CRP land. These recommendations should be the ultimate outcome of the project along with recommended agronomic practices.”
- Response: Species leads are putting together summary reports and findings that will help guide development of best agronomic practices for specified crops.

Publications and Presentations

▪ Peer Reviewed

- Agindotan, B.O., N.E. Okanu, A.O. Oladeinde, T.B. Voigt, S.P. Long, M.E. Gray, and C.A. Bradley. (2012) Detection of *Switchgrass mosaic virus* in *Miscanthus* and other grasses. Canadian Journal of Plant Pathology. DOI:10.1080/07060661.2012.752763.
- Ahonsi, M.O., B.O. Agindotan, D.W. Williams, R. Arundale, M.E. Gray, T.B. Voigt, and C.A. Bradley. 2010. First report of *Pithomyces chartarum* causing a leaf blight of *Miscanthus x giganteus* in Kentucky. Plant Disease. 94(4):480.
- Anderson, E.K., A.S. Parrish, T.B. Voigt, V.N. Owens, C.H. Hong, D.K. Lee. 2013. Nitrogen fertility and harvest management of switchgrass for sustainable bioenergy feedstock production in Illinois. Industrial Crops and Products. (In Press).
- Anderson, E.K., T.B. Voigt, G.A. Bollero, and A.G. Hager. (In Press) Evaluation of methods to control *Miscanthus x giganteus*. Weed Technology.
- Anderson, E.K., T.B. Voigt, G.A. Bollero, and A.G. Hager. (In Press) Rotating a field of mature *Miscanthus x giganteus* to glyphosate-resistant crops. Agronomy Journal.
- Anderson, E.K., S.K., T.B. Voigt, G.A. Bollero, and A.G. Hager. 2010. *Miscanthus x giganteus* response to preemergence and postemergence herbicides. Weed Technology. (24)4: 453-460.
- Anderson, E., R. Arundale, M. Maughan, A. Oladeinde, A. Wycislo, and T. Voigt. 2011. Growth and agronomy of *Miscanthus x giganteus* for biomass production. Biofuels 2(2): 167-183.
- Arundale, R.A., F.G. Dohleman, E.A. Heaton, J.M. McGrath, T.B. Voigt, and S.P. Long. (2013) Yields of *Miscanthus x giganteus* and *Panicum virgatum* decline with stand age in the Midwestern USA. Global Change Biology – Bioenergy. (In Press).
- Behnke, G.D., M.B. David, and T.B. Voigt. (In Press) Greenhouse gas emissions, nitrate leaching, and biomass yields from production of *Miscanthus x giganteus* in Illinois, USA. BioEnergy Research. DOI 10.1007/s12155-012-9191-5. (<http://www.springerlink.com/content/n2t6552hw14257g4/fulltext.pdf>)
- Gonzalez-Hernandez, J.L., G. Sarath, J.M. Stein, V. Owens, K. Gedye, and A. Boe. 2009. A multiple species approach to biomass production from native herbaceous perennial feedstocks. In Vitro Cell. Dev. Biol.-Plant 45:267-28.
- Heaton, E.A., N. Boersma, J.D. Caveny, T.B. Voigt and F.G. Dohleman. 2010. Miscanthus for biofuel production. eXtension Bioenergy Feedstock Community of Practice. http://www.extension.org/pages/Miscanthus_for_Biofuel_Production

Publications and Presentations

▪ Peer Reviewed

- Heaton, E.A., F.G. Dohleman, F. Miguez, J.A. Juvik, V. Lozovaya, J. Widholm, O.A. Zobotina, G.F. Mclsaac, M.B. David, T.B. Voigt, N.N. Boersma, and S.P. Long. 2010. Miscanthus: a promising biomass crop. *Advances in Botanical Research*. 56:75-135.
- Hong, C.O., V.N. Owens, D.K. Lee, and A. Boe. 2012. Switchgrass, big bluestem, and indiagrass monocultures and their two- and three-way mixtures for bioenergy in the northern Great Plains. *Bioenerg. Res.* (doi:10.1007/s12155-012-9252-9)
- Lee, D.K., E. Aberle, C. Chen, J. Egnolf, K. Harmony, G. Kakani, R.L. Kallenbach, and J.C. Castro. 2012. Nitrogen and harvest management of Conservation Reserve Program (CRP) grassland for sustainable feedstock production. *GCB bioenergy* (In press, online first).
- Maughan, M., T. Voigt, A. Parrish, G. Bollero, W. Rooney, and D.K. Lee. (2012) Forage and energy sorghum responses to nitrogen fertilization in Central and Southern Illinois. *Agronomy Journal*.
- Owens, V.N., Hong, C.O., Farris, R., Fike, J.H., Heaton, E., Mayton, H.S., and Viands, D.R. (2013). Nitrogen Use in Switchgrass Grown for Bioenergy across the USA. *Bioenergy Res.* (in review).
- Pyter, R.J., F.G. Dohleman, T.B. Voigt. 2010. Effects of rhizome size, depth of planting and cold storage on *Miscanthus x giganteus* establishment in the Midwestern USA. *Biomass and Bioenergy*. 34 (10):1466-1470.
- Sanderson, M.A., M. Schmer, V. Owens, P. Keyser, and W. Elbersen. 2012. Crop management of switchgrass. In A. Monti (ed), *Switchgrass: a valuable biomass crop for energy*. Springer-Verlag London Ltd., London, United Kingdom.
- Tulbure, M.G., M.C. Wimberly, and V.N. Owens. 2012. Response of switchgrass yield to future climate change. *Environ. Res. Lett.* (doi:10.1088/1748-9326/7/4/405903)
- Tulbure, M.G., M.C. Wimberly, A. Boe, and V.N. Owens. 2012. Climatic and genetic controls of yields of switchgrass, a model bioenergy species. *Agriculture, Ecosystems and Environment* 146:121–129.
- Watrud, L.S., J.R. Reichmann, M.A. Bollman, B.M. Smith, E.H. Lee, J.D. Jastrow, M.D. Casler, H.P. Collins, S. Fransen, R.B. Mitchell, V.N. Owens, B. Bean, W.L. Rooney, D.D. Tyler, and G.A. King. 2012. Chemistry and microbial functional diversity differences in biofuel crop and grassland soils in multiple geographies. *Bionerg. Res.* (doi:10.1007/s12155-012-9279-y)
- Woli, K.P., M.B. David, J. Tsai, T.B. Voigt, R.G. Darmody, and C.A. Mitchell. (2011) Evaluating silicon concentrations in biofuel feedstock crops Miscanthus and switchgrass. *Biomass and Bioenergy*. doi:10.1016/j.biombioe.2011.03.007.

Publications and Presentations

▪ Professional Meetings and Invited Presentations

- Owens, V., D. Bransby, R. Farris, J. Fike, E. Heaton, C.O. Hong, C. Hopkins, H. Mayton, R. Mitchell, and D. Viands. 2012 Switchgrass response to N fertilizer across diverse environments in the US. 2013 Regional Feedstock Partnership Annual Meeting, 25-27 March 2013, Tunica, MS.
- Owens, V. 2013. Multi-use grasses—The intersection between forage and bioenergy crops in a changing climate. Bioenergy Crops in Central Illinois, Argonne National Laboratory, 8 March 2013.
- Owens, V., D. Bransby, R. Farris, J. Fike, E. Heaton, C.O. Hong, C. Hopkins, H. Mayton, R. Mitchell, and D. Viands. 2012 Switchgrass response to N fertilizer across diverse environments in the US. 2012 National Sun Grant Conference, 2-5 Oct. 2012, New Orleans, LA.
- Hong, C.O., V.N. Owens, T. Schumacher, D. Clay, S. Osborne, M. Lehman, and J. Schumacher. 2012. Nitrogen losses from switchgrass as affected by nitrogen fertilizer rate. 2012 National Sun Grant Conference, 2-5 Oct. 2012, New Orleans, LA.
- Mayton and Viands. 2011. Field-Scale Yield of Switchgrass Under Varying Nitrogen Management Treatments In New York State. In ASA Abstracts
- Urbana, IL. University of Illinois Center for Advanced Bioenergy Research Seminar. *Is Miscanthus x giganteus A Commercial Crop?* January 28, 2013.
- Tunica, MS. Sun Grant Feedstock Partnership Annual Meeting. *Miscanthus x giganteus Update*. February 14, 2013.
- Illinois Energy Farm Field Tours to view Sun Grant/DOE *Miscanthus x giganteus* Bioenergy Field Trials: Argentinian U.S. Farm Tour, October 2; Energy Farm Open House, Oct. 10.
- New Orleans, LA. 2012 Sun Grant National Conference: Science for Biomass Feedstock Production and Utilization. *Miscanthus x giganteus Biomass Feedstock Production and Sustainability Studies in the Eastern U.S.* Oct. 4.
- Meadville, PA. Perennial Grass Energy in the Northeast Short Course. *Ecological Impacts of Miscanthus x giganteus Production*. Oct. 25.
- Illinois Energy Farm Field Tours to view Sun Grant/DOE *Miscanthus x giganteus* Bioenergy Field Trials: Third Pan American Congress on Plants and Bioenergy, July 17; two groups of Argentinian farmers, Aug. 14 and Sept. 1; Research Farm Superintendents, Sept. 12.
- Big Flats, NY, August 10, Perennial Biofeedstock Energy Tour and Presentations, Midwest Biomass Energy Perspective, *Miscanthus Production Research, and the Invasive Species Issue*, Aug. 10.

Publications and Presentations

▪ Professional Meetings and Invited Presentations

- Energy Biosciences Institute. *Feedstock Production/Agronomy Program Updates*. May 16. Urbana, IL.
- Champaign, IL Rotary Club. *Bioenergy Feedstock Activities at the U. of I. Energy Farm*. June 11. Champaign, IL.
- IL High School Agriculture Instructor Energy Farm Field Tour showing Sun Grant *Miscanthus x giganteus* Study. June 18. Urbana, IL.
- USDA-sponsored NCERA 221/WERA 10 Meeting. *Only Mowed Once a Year – Biomass Feedstock Research and Production*. June 21. Corvallis, OR.
- The Sun Grant/DOE Herbaceous Feedstock Partnership *Miscanthus x giganteus* Bioenergy Field Trial was presented at the University of Illinois Master Gardener Convention Energy Farm Tour, University of Illinois Energy Farm Field Day, and Association of Applied Biologists Energy Farm Tour.
- The role of *Miscanthus* in U.S. bioenergy production. Dalian, World Congress of Bioenergy – 2011. China. April 26.
- *Miscanthus x giganteus* productivity: The effects of management in different environments. 2011 Regional Sun Grant/DOE Biomass Feedstock Partnership Meeting. Knoxville, TN
- Biomass feedstock grasses – selection and agronomy. University of California-Berkeley 101 Workshop. Berkeley, CA.
- Baldwin, B., W. Anderson, J. Blumenthal, E.C. Brummer, K. Gravois, A. Hale, and L.T. Wilson. 2013. Energycane (*Saccharum* spp) sugarcane goes North. 245th National Meeting of American Chemical Society, Carbohydrates Division. Biofuels, bioproducts, and biomass from sugar feedstocks. New Orleans, LA. 8 Apr .
- Baldwin, B., W. Anderson, J. Blumenthal, E.C. Brummer, K. Gravois, A. Hale, J.R. Parish, and L.T. Wilson. 2012. Regional testing of energycane (*Saccharum* spp) genotypes as a potential bioenergy crop. 2012 National Conference: Science for Biomass Feedstock Production and Utilization. New Orleans, LA. 2-5 Oct.
- Baldwin, Brian S.(Plenary Speaker) 2012. Factors impacting feedstock and bio-based fiber composition. 20th BioEnvironmental Polymer Soc. BEPS. Denton, TX. 18-21 Sep.
- Baldwin, Brian. 2011. The southeastern U.S.: Biomass powerhouse. Soil and Water Conserv. Soc. Ann. Conf. Washington, D.C. 17 July.
- Tucker Porter, Chengci Chen, Rick Lawrence, and Bok Sowell. 2012. Effect of fertilization and growing season on CRP pastureland as a biofuel feedstock. S1041: The Science and Engineering for A Biobased Industry and Economy Committee Meeting and Symposium. 7 August, 2012. Washington D.C.

Publications and Presentations

▪ Professional Meetings and Invited Presentations

- Chengci Chen, Johnna Hesel, Tucker Porter, and DoKyoung Lee. 2012. Nitrogen application and harvest timing affect biomass yield and composition on CRP grassland. Sun Grant Initiative 2012 National Conference: Science for Biomass Feedstock Production and Utilization. October 2-5, 2012. New Orleans, LA.
- Chengci Chen, and Anton Bekkerman. 2012. Investigating the viability of camelina sativa as an energy crop in central Montana. Sun Grant Initiative 2012 National Conference: Science for Biomass Feedstock Production and Utilization. October 2-5, 2012. New Orleans, LA .
- Baldwin, Brian S., J. Brett Rushing, Edward Richard, Thomas Tew, Anna Hale, 2010. Energycane: Sugarcane gone North. Seventh Annual Bioenergy Feedstock Symposium. Champaign, IL. 11-12 Jan.
- Owens, V.N. 2010. Bioenergy crop production and utilizations systems in the USA. Symposium on the BCRC Building Dedication-Current Status of Biomass/Bioenergy Technology and Way to Low Carbon Green Growth. Bioenergy Crop Research Center, National Institute of Crop Science, Rural Development Administration, Muan, Korea. 7-9 Dec. 2010.
- Owens, V.N. 2010. Production, utilization, and environmental impacts of perennial grasses for bioenergy in the USA. Gyeongsang National University, Jinju, Korea, 3 Dec. 2010.
- Owens, V.N. 2010. Production, utilization, and environmental impacts of perennial grasses for bioenergy in the USA. Jinju National University, Jinju, Korea, 2 Dec. 2010.
- Owens, V.N., C.O. Hong, S. Osborne, T. Schumacher, and D. Clay. 2010. Environmental impact of growing herbaceous perennials for bioenergy. ASA-CSSA-SSSA Annual Meeting. Long Beach, CA, 31 Oct.—4 Nov. 2010.
- Maughan M., F. Miguez, T. Voigt, S. Bonos, J. Murphy, R. Gaussoin, D. Williams, and G. Bollero. 2009. Miscanthus x giganteus growth and survival in IL, IN, KY, NE, and NJ. In Annual Meetings Abstracts. Pittsburgh, PA. November 1-4. American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, Madison, WI.
- Baldwin, B., D.K. Lee, V. Owens, W. Rooney, and T. Voigt. 2009. U.S. Dept. of Energy Regional Biomass Feedstocks Partnership. Bioenergy Symposium, AAIC. Termás de Chillán, Chillán Chile. 15-19 Nov.
- Rushing, J.R., B.S. Baldwin, E.P. Richard, T.L. Tew. 2009. Evaluation of cellulosic energy feedstocks for production in north central Mississippi USA. Fiber and Cellulosics Division AAIC. . Termás de Chillán, Chillán Chile. 15-19 Nov.
- Owens, V.N., B. Baldwin, D.K. Lee, W. Rooney, and T. Voigt. 2009. The Regional Feedstock Partnership: herbaceous energy crops and CRP land for biomass production across environmental gradients. US DOE Biomass 2009: Fueling our Future, Washington, DC, 17-18 March, 2009.

Publications and Presentations

- **Professional Meetings and Invited Presentations**

- Owens, V.N., B. Baldwin, D.K. Lee, W. Rooney, and T. Voigt. 2009. Regional Cellulosic Feedstocks. Sun Grant Initiative Briefing on Regional Cellulosic Bioenergy, Washington, DC, 13 March 2009.
- Owens, V.N., B. Baldwin, D.K. Lee, W. Rooney, and T. Voigt. 2009. The Regional Feedstock Partnership: herbaceous energy crops and CRP land for biomass production across environmental gradients. Sun Grant Initiative Energy Conference, Washington, DC, 10-13 March, 2009.
- Owens, V.N., D.K. Lee, W. Rooney, and T. Voigt. 2009. The Regional Feedstock Partnership: herbaceous energy crops and CRP land for biomass production across environmental gradients. World Congress on Indust. Biotech. and Bioproc. Montreal, QC, Canada, 19-22 July 2009.