NCCC-170
Research Advances in Agricultural Statistics
Joint meeting with USSES (SCC-013)
Annual meeting held at University of Maryland
June 23-24, 2016

Members Present: Nora Bello (KS), Bruce Craig (IN, Admin.), Sara Duke (USDA-ARS), Susan Durham (UT), Ed Gbur (AR), Carla Goad (OK), Alex Lipka (IL), Larry Madden (OH), Bahram Momen (MD), Walt Stroup (NE), Mark West (USDA-ARS), Kathy Yeater (USDA-ARS)

Members Absent: John Aleong (VT), Jennifer Clarke (NE), Xin Dai (UT), Mark Hinds (Pioneer Hi-Bred), Ken Koehler (IA), Raul Macchiavelli (PR), Kevin McCarter (LA), David Meek (USDA retired), Margaret Nemeth (Monsanto retired), Guilherme Rosa (WI), Dan Schmoldt (USDA, NIFA rep.), Bahman Shafii (ID), Julia Sharp (SC), Subramania Sritharan (OH), Rob Tempelman (MI), Maria Villamil (IL), Linda Young (USDA), Jun Zhu (WI)

USSES Present: William Bridges (SC), Jerry Davis (GA), Lin Luo (GA), Bahram Momen (MD),

Others Present: William Bowerman (MD), Elizabeth Claassen (SAS), Nick Keuler (WI), Matt Kramer (USDA-ARS), Yu Mo (MD), Dan Nettleton (IA), Neil Paton (Cargill), Ellen Paparozzi (NE), Perla Reyes (KS), Bryan Vinyard (USDA-ARS)

2016 Officers: Ed Gbur, Chair; Susan Durham, Secretary; Kathy Yeater, Program Chair; Bahram Momen, Local Arrangements

NCCC-170 Website: http://www.uark.edu/misc/ncr170/

Minutes:

Technical program: The meeting began at 8:30 a.m. on Thursday, June 23, 2016 with opening remarks by Dr. William Bowerman, Chair of the Dept. of Environmental Science and Technology at the University of Maryland. Presentations ended at approximately 5:00 p.m. The technical program consisted of the following presentations:

Elizabeth Claassen *JMP Analytical Development*	Predictive Modeling in an n < p World
Sara Duke *USDA ARS*	Where is Research Going: Long Term Agro-Ecosystem Research Initiative
W. Bowerman, H. Pittman, L. Fuentes *Univ. of Maryland*, K. F. Leith, M. C. Wierda, *Clemson Univ.,* F. Bourland *Univ. of Arkansas*, D. Jones *Cotton Inc*, W. Bridges *Clemson Univ.*	Evaluating and Improving Eagle Monitoring and Cotton Variety Testing
Yu Mo, Bahram Momen, Michael S. Kearney *Univ. of Maryland*	Quantify remote sensing phenology using a nonlinear mixed model
N. M. Bello, A. Jager, E. Cha, M. Sanderson, N. Cernicchiaro, D. Renter *Kansas State Univ.*	Rethinking Causal Inference from Observational Data: a structural equation modeling approach

Business meeting: The business meeting began at about 9:00 a.m. on Friday, June 24, 2016. Ed Gbur presided. The following items were discussed:

(1) The organizers were thanked for a productive and enjoyable meeting: Bahram Momen for local arrangements and Kathy Yeater for the technical program. Ed Gbur was thanked for his work as chair and webmaster of the committee.

(2) Presenters who wish to post their talk on the project website should send a pdf of the talk to Ed Gbur (egbur@uark.edu).

(3) The annual report and impact statement are due shortly after the annual meeting. Participants need to send Ed Gbur (egbur@uark.edu) accountings of all activities (workshops, papers, presentations, grants, awards, teaching related items, etc.) from October 1, 2015 to September 30, 2016 (or since last year's report) that are related to or inspired by their participation in NCCC-170 as soon as possible.

(4) The current NCCC-170 project is scheduled to end on September 30, 2016. The project renewal has been approved for October 1, 2016 through September 30, 2021.

(5) The 2017 meeting will be held in Elk River, Minnesota at the Cargill Experiment Station with Neil Paton as the local host. Tentative dates are June 22-23, 2017. Nora Bello will serve as program chair. The 2018 meeting is tentatively planned for Idaho and for Arkansas in 2019. Illinois will serve as a backup location if needed and otherwise as a tentative site for 2020.

(6) The group reviewed progress toward objectives of the current project.

(7) The group reviewed objectives of the new project. The new project retains four objectives from the current project and adds an objective identified during the 2015 meeting to provide continuing education and statistical support to the scientific community in the review and editorial process. The "Expected Outcomes and Impacts" section identifies "the sort of things we should be thinking about."

(8) With a new project comes a new participant list. Several persons who participate in the annual meetings are not official participants in the project, and not everyone from the current project is listed as a participant in the new project. The same state and institution can be represented by multiple people, only one of whom is designated as a voting member. Ed encouraged people to join if they intend to participate.

(9) Elizabeth Claassen announced the JMP Discovery Summit, to be held at SAS headquarters in Cary, NC on September 19-23, 2016.

The business meeting adjourned at approximately 9:40 a.m. After break, the group reconvened for a discussion on how to train and advance applied statisticians in professional and academic settings. We forgot to take the annual group photograph for the project web site.

Accomplishments: Statisticians who consult and do research in an Agricultural Experiment Station environment enable land grant institutions to perform their agricultural research missions more effectively

and efficiently than would otherwise be possible. However, most stations have at most one or two professional statisticians who are not, and cannot be expected to be, experts in every area of statistics. This multi-state committee brings together statisticians to work cooperatively to determine the best current approaches to common statistical problems and to help guide future directions of sound statistical practice. In addition to producing group outputs such as workshops, the committee serves as a resource for its members and a sounding board for new ideas in their applied statistical research. As a result, all members are able to provide more effective assistance to agricultural researchers addressing national research priorities than they would without NCCC-170.

Outputs:

Workshops:
George Milliken taught a short course entitled "Experimental Design and Analysis of Mixed Models" at the FDA Center for Veterinary Medicine in Washington D.C., September 30-October 1, 2015.

Julia Sharp presented a webinar module entitled "Introductory Statistics" to the American Dairy Science Association's Fatty Acid Form in November 2016. She and Billy Bridges presented a webinar module entitled "What is Meta-analysis" to the same group in April 2016.

Larry Madden presented a one day workshop entitled "Meta-analysis for evidence based agriculture" at the ASA-CSSA-SSSA International Meetings in Minneapolis, MN. November 2015.

Kathy Yeater presented a workshop entitled "So you want to do a: RNAseq experiment, Differential Gene Expression Analysis" at the USDA Meat Animal Research Center, Clay Center, NE. August 16, 2016.

Larry Madden presented a one day workshop entitled "Generalized linear mixed models for data analysis in plant pathology" at the Annual Meeting of the American Phytopathological Society. July 2016.

Walt Stroup presented the American Statistical Association (ASA) Traveling Course entitled "Introduction to Generalized Linear Mixed Models using SAS" twice in October, 2015, one in Dallas, TX and one in San Antonio, TX; two courses in November 2015, one in Indianapolis, IN, one in Cincinnati, OH. Each was to local ASA Chapter

Presentations:
Lipka, A.E. Exploration, embellishment, and implementation of statistical approaches for genome-wide association studies and genomic selection. Corn Breeding Research Meeting, Jacksonville, FL March 17, 2016. (*Invited*)

Lipka, AE, AH Chen, W Metcalf and LS Mainzer Introducing elements of high performance computing and two-way epistasis into genome-wide association studies with stepwise model selection. Plant and Animal Genome Maize Workshop, San Diego, CA. January 9, 2016. (*Invited*)

Yeater, K. Multivariate Analysis: Tools for Understanding Complex Systems. Agroecosystem Management and Grain, Forage, and Bioenergy Research Units, Lincoln, NE (April 26, 2016), U.S. Meat Animal Research Center, Clay Center, NE (April 28, 2016), and Center for Grain and Animal Health Research, Manhattan, KS (May 2, 2016).

Villena, O.C, E. Landa, B. Momen, P.T. Leisnham, and J.H. Sullivan JH. The effects of UV radiation on tire deterioration and pollutant release on competition between *Aedes albopictus* and *Culex pipiens* mosquitoes. *2015 Ecological Society of America Annual Meeting*. Baltimore, MD.

Zhou, L. and R.J. Tempelman. 2015.Strategies for estimating hyperparameters based on single-step Bayesian models (Abstract: *Journal of Dairy Science* 98 (Suppl. 2): 579).

Chen, C., J.P. Steibel, and R.J. Tempelman. 2015.Reassessing hierarchical Bayesian genome-wide association analyses (Abstract: *Journal of Dairy Science* 98(Suppl. 2): 580).

Lu, Y., M.J. Vandehaar, D.M. Spurlock, K.A. Weigel, L.E. Armentano, C.R. Staples, E.E. Connor, Z. Wang, M. Coffey, R. Veerkamp, Y deHaas, N.M. Bello, and R.J. Tempelman. 2015. Hierarchical Bayesian inference on genetic and non-genetic components of partial efficiencies determining feed efficiency in dairy cattle (Abstract: *Journal of Dairy Science* 98(Suppl. 2): 573).

Chen, C., J.P. Steibel, and R.J. Tempelman. 2016. Exploring sparsities of genome wide association analyses based on different sparsities of prior specifications. 5th International Conference on Quantitative Genetics, Madison, WI, USA, June 12-17, 2016 (*Poster*).

Lu, Y., M.J. Vandehaar, D.M. Spurlock, K.A. Weigel, L.E. Armentano, C.R. Staples, E.E. Connor, Z. Wang, M. Coffey, R.F. Veerkamp, Y deHaas, M.D. Hanigan, and R.J. Tempelman. 2016.Genome-wide association analyses based on alternative strategies for modeling feed efficiency. 5th International Conference on Quantitative Genetics, Madison, WI, June 12-17, 2016 (*Poster*).

Lu, Y., M.J. Vandehaar, D.M. Spurlock, K.A. Weigel, L.E. Armentano, C.R. Staples, E.E. Connor, Z. Wang, M.D. Hanigan, and R.J. Tempelman. 2016. Modeling genotype by environment interaction over multiple covariates for feed efficiency in dairy cattle. Poster presented at the 5th International Conference on Quantitative Genetics, Madison, WI, June 12-17, 2016.

Johnson, L., J. Alsdurf, N.M. Bello, A. Smith and M. Knapp. Phenotypic variation of the dominant prairie grass Andropogon gerardii and its predicted response to climate change across Midwest grasslands. 2016 Botany Conference. Savannah, GA. July 30 - August 3, 2016.

Johnson, L., M. Galliart, N.M. Bello, M.J. Polland, P. St. Amand, M. Knapp, B.R. Maricle, S.G. Baer and D. Gibson. Adaptive ecotypic variation and genetic divergence of an ecologically dominant prairie grass across the Great Plains precipitation gradient. 2016 Botany Conference. Savannah, GA. July 30 - August 3, 2016.

Galliart, M., P. St. Amand, J. Polland, N.M. Bello, M. Knapp, S.G. Baer, D. Gibson, B.R. Maricle and L. Johnson. Adaptive ecotypic variation and genetic divergence of a widespread grass, big bluestem, across a Great Plains climate gradient. 2016 American Genetic Association Annual Meeting. Asilomar, CA. July 14-17, 2016.

Ou, Z., R.J. Tempelman, J.P. Steibel, C.W. Ernst, R.O. Bates, C. Chen and N.M. Bello. Heteroskedastic extensions for genome-wide association studies. Joint Annual Meetings of the American Society of Animal Sciences and the American Dairy Science Association. Salt Lake City, UT. July 19-23, 2016.

Craig, B.A. Disk Diffusion Breakpoint Determination Using an Errors-in-Variables Model Approach, University of Texas Medical Branch at Galveston, April 2016.

Craig, B.A., Chen, N., and Wijayawardana, S.R. Assessing Inter-rater Agreement of Immuno-histochemistry Scores, University of Texas Medical Branch at Galveston, April 2016.

Sanchez, DL, Hu S, V AE, Lipka AE, and Lubberstedt T. A comparison between GBS and SNP chip marker systems in molecular profiling of doubled haploid exotic introgression lines in maize. 58th Annual Maize Meeting, Jacksonville, FL; March 17-20, 2016.

Hu, S, Wang Cuiling, Sanchez DL, Lipka AE, Liu P, Yin Y, Xu M, and Lubberstedt T. Brassinosteroid and Gibberellin control of plant height in a phenotypic selected introgression library in maize. 58th Annual Maize Meeting, Jacksonville, FL; March 17-20, 2016.

Chen, AH, and Lipka AE. Genome-Wide Association Study (GWAS) Using Targeted Marker Subsets to Account for Population Structure and Relatedness Identifies More Genomic Signals Associated with Polygenic Traits in Maize (Zea mays L.). ASA, CSSA, SSSA International Annual Meetings, Minneapolis, MN; November 15-18, 2015.

Kramer M and Font E. Strategies for reducing control group size in experiments using live animals. Conference on Applied Statistics in Agriculture, April 2016. Kansas State Univ., Manhattan KS.

Kramer M. P-value Controversy. Annual Joint Statistics Meetings, Aug 2016.

Duke, S. Practical Statistics: Real Data in Agriculture. Symposium of Practical Statistics, University of the Incarnate Word in San Antonio, TX, January 15, 2016.

Other project related activities:
Kathy Yeater is co-editing a book for ACSESS (ASA-CSSA-SSSA Publications) currently titled *Applied statistics in agricultural, biological, and environmental sciences.* All chapters are submitted and under final review. It is anticipated that final editing will commence near the end of FY16 and full publication will occur in early FY17. Current members and/or recent attendees of NCCC-170 that are chapter authors include: Philip Dixon, Kevin McCarter, Walt Stroup, Maria Villamil, and Kathy Yeater.

Dan Nettleton and Rob Tempelman were guest editors of a special issue on "Statistical Genomics and Transcriptomics in Agriculture" for the December, 2015 issue of *Journal of Agricultural, Biological, and Environmental Statistics* (http://link.springer.com/journal/13253/20/4/page/1).

Nora Bello is a co-PI on a USDA AFRI grant in the Foundational Program A1221 entitled *Risk Management Strategies to Reduce the Impacts of Bovine Respiratory Disease Complex in Commercial Feeder Cattle*". PI is David Renter, College of Veterinary Medicine, Kansas State University. The grant award was $489,466 for 2015-2019. The grant was ranked the number 1 proposal by its review panel.

Walt Stroup participated in a Roundtable Luncheon entitled *On P-values* at the 2015 Joint Statistics Meetings (JSM) to consider an American Statistical Association (ASA) policy of use of P-values in research publications. He was also an invited participant on a panel discussion entitled *With Great Power Comes Great Responsibility: Harnessing the Extraordinary Power of Statistics* on this topic at JSM 2016. ASA has since published a policy statement on the topic.

Larry Madden maintains a website (http://www.oardc.ohio-state.edu/aps-statsworkshop/default.htm) with statistical software code (SAS) and PowerPoint presentations on a range of data-analytic subjects. The material is based heavily on previously presented workshops.

Bruce Craig directed an Undergraduate Research Experience (URE) Purdue-Columbia during the Summer and Fall 2015 for Yinneth Lorena Leon Velasco on the topic of *Applications of linear and nonlinear mixed models: a) Semantic Richness and Word Learning in Children with Autism Spectrum Disorder*, and b) *Feed Intakes of Sows Lactation*. He also directed a URE during the Fall 2015 and Spring 2016 for Patrick Gallagher on the topic of *Mixed model analysis of paired competition studies (entomology)*.

Bruce Craig hosted of Olusanya Olubusoye, LISA 20/20 Fellow, from the University of Ibadan, Nigeria, in March 2016 during his visit to the Purdue Statistics Department's consulting service.

Bruce Craig participated in a panel discussion entitled *The Non-Technical Skills Needed to Be an Effective Statistical Consultant* at the 2015 Joint Statistical Meetings in Seattle, WA. Other panelists were C. Holloman, M. Clayton and M. Wiest.

Bruce Craig participated in a panel discussion entitled *Teaching a Statistical Consulting Course* at the 2016 Joint Statistical Meetings in Chicago. Other panelists were S. Hurwitz, P.D. Sampson, H.S. Smith, and M. Wiest.

Bahram Momen reported that NCCC-170 activities have helped him in his consulting and mentoring of many graduate students and faculty members in designing their research and analyzing the data.

Sara Duke is a co-PI on a USDA-NIFA grant with the University of the Incarnate Word in San Antonio, TX entitled *Strengthening the Agricultural Statistics Pipeline at Hispanic-Serving Institutions*. The grant was funded for September 2015 to August 2019.

Current specific goals retained for the 2016-2021 project:
(1) Educate project members in statistical issues and methodology related to statistical problems related to new complex data types collected on relatively few experimental units. Application areas include agricultural analytics, informatics, -omics, and -metrics.

(2) Continue to offer updated and expanded mixed model and generalized linear mixed model workshops upon request from subject matter groups.

(3) Develop web-based educational materials and workshops for agricultural scientists including statistical assistance in the review and editorial process of agricultural publications.

Impacts:
(1) NCCC-170 fosters research to identify and develop statistical methodology applicable to agricultural research and provides a forum for sharing and educating both statisticians and subject-matter scientists in the agricultural, environmental and natural sciences. As a result, all members are able to provide more effective assistance to agricultural researchers addressing national research priorities than they would be without NCCC-170.

(2) Project members provide continuing education for scientists in agriculturally related disciplines in modern statistical analyses of designed experiments in general and specifically in the areas of generalized linear mixed models, statistical techniques in genomics applications, and meta-analysis. Examples of such activities and their immediate impacts for the current reporting period are listed in the Accomplishments section of this report.

(3) Project members collaborate in research projects with scientists in agricultural related disciplines to develop and use proper statistical design and analysis methodology well beyond standard textbook applications. These efforts often result in competitive grant participation and refereed publications. Each of these impacts is listed in the Accomplishments and Publications sections of this report.

Publications:

Bryant, R.J., K.M. Yeater, and A.M. McClung (2015). Effect of nitrogen rate and the environment on physicochemical properties of selected high amylose rice cultivars. *Cereal Chemistry*. 92(6):604-610.

Eizenga, G.C., J.D. Edwards, K.M. Yeater, S.R. McCouch, and A.M. McClung (2016). Transgressive variation for yield components measured throughout the growth cycle of Jefferson rice (*Oryza sativa*) X *O. rufipogon* introgression lines. *Crop Sci*. 56. In press.

Funk, P.A., K. Elsayed, K.M. Yeater, G.A. Holt, and D.P. Whitelock (2015). Could cyclone performance improve with reduced inlet velocity? *J Powder Technology* 280:211-218.

Yeater, K.M., and M.B. Villamil (2016). Multivariate Methods for Agricultural Research. In *Applied statistics in agricultural, biological, and environmental sciences*. B. Glaz et al (ed.). ASA, CSSA, and SSSA, Madison, WI. In press.

Neuman-Lee, L.A., H.B. Fokidis, A.R. Spence, M. Van der Walt, G.D. Smith, S. Durham, and S.S. French (2015). Food restriction and chronic stress alter energy use and affect immunity in an infrequent feeder. *Functional Ecology*. In press.

Ranglack, D.H., S. Durham, and J.T. du Toit (2015). Competition on the range: science vs. perception in a bison-cattle conflict in the western USA. *Journal of Applied Ecology* 52: 467-474.

Tepedino, V.J., S. Durham, S.A. Cameron, and K. Goodell (2015). Documenting bee decline or squandering scarce resources. *Conservation Biology* 29: 280-282.

Momen B, Behling SJ, Sullivan JH, Lawrence GB. (2015). Photosynthetic and growth response of sugar maple (*Acer saccharum*, Marsh) mature trees and seedlings to calcium, magnesium, and nitrogen additions in the Catskill Mountains, NY, USA. *PLoS ONE,* 10:1-14. DOI:10.1371/journal.pone.0136148.

Khan S, Jackson RT, Momen B. (2016). Impact of acculturation and its factors on metabolic syndrome on South Asian American adults in community health centers. *Journal of Public Health*. DOI: 10.1007/s10389-016-0726-7.

Khan S, Jackson RT, Momen B. (2016). The relationship between diet quality and acculturation of immigrated South Asian American adults and their association with metabolic syndrome. *PLoS ONE.* In press.

Cartwright J, Dzantor EK, Momen B. (2016). Soil microbial community profiles and diversity in limestone cedar glades. *CATENA*. In press.

Olsen VBK, Momen B, Langsdale S, Galloway G, Link E, Brubaker K, Matthias R, Hill R. (2016). An approach for improving flood risk communication using realistic interactive visualization. *Journal of Flood Risk Assessment*. In Press.

Hu, X., Edwards, S., Madden, L.V., and Xu, X. (2015). Combining models is more likely to give better predictions than single models. *Phytopathology* 105: 1174-1182.

Willyerd, K. T., Bradley, C. A., Chapara, V., Conley, S. P., Esker, P. D., Madden, L. V., Wise, K. A., and Paul, P. A. (2015). Revisiting fungicide-based management guidelines for leaf blotch diseases in soft red winter wheat. *Plant Disease* 99: 1434-1444.

Madden, L.V., Shah, D.A., and Esker, P.D. (2015). Does the *P* value have a future in plant pathology? *Phytopathology* 105: 1400-1407.

Madden, L.V., Piepho, H.-P., and Paul, P.A. (2016). Statistical models and methods for network meta-analysis. *Phytopathology* 106: 792-806.

Yang, W., C. Chen, J.P. Steibel, C.W. Ernst, R.O. Bates, L. Zhou, and R.J. Tempelman (2015). A comparison of alternative random regression and reaction norm models for whole genome predictions. *Journal of Animal Science* 93: 2678-2692.

Lu, Y., M.J. Vandehaar, D.M. Spurlock, K.A. Weigel, L.E. Armentano, C.R. Staples, E.E. Connor, Z. Wang, N.M. Bello, and R.J. Tempelman (2015). An alternative approach to modeling genetic merit of feed efficiency in dairy cattle. *Journal of Dairy Science* 98:6535-6551.

Chen, C. and R.J. Tempelman (2015). An integrated approach to empirical Bayesian whole genome prediction modeling. *Journal of Agricultural, Biological, and Environmental Statistic*s 20:491-511.

Tempelman R.J. (2015). Statistical and computational challenges in whole genome prediction and genome wide association analyses for plant and animal breeding. *Journal of Agricultural, Biological, and Environmental Statistics* 20:442-466.

Manzanilla-Pech, C.I.V., R.F. Veerkamp, R.J. Tempelman, M.L. van Pelt, K.A. Wiegel, M.J. Vandehaar, T.J. Lawlor, D.M. Spurlock, L.E. Armentano, C.R. Staples, M. Hanigan, and Y. deHaas (2016). Correlations between feed intake-related traits and conformation traits in two separate dairy populations: the Netherlands and United States. *Journal of Dairy Science* 99:443-457.

Ou, Z., R.J. Tempelman, J.P. Steibel, C.W. Ernst, R.O. Bates, and N.M. Bello (2016).Genomic prediction accounting for residual heteroskedascity. *Genes, Genomes, Genetics* 6(1):1-13.

Mota, R.R., R.J. Tempelman, P.S. Lopes, I. Aguilar, F.F. Silva, and F.F. Cardoso (2016).Genotype by environment interaction for tick resistance of Hereford and Braford beef cattle using reaction norm models. *Genetics, Selection Evolution* 48:3

Vandehaar, M.J., L.E. Armentano, K. Weigel, D.M. Spurlock, R.J. Tempelman, and R.F. Veerkamp (2016). Harnessing the genetics of the modern dairy cow to continue improvements in feed efficiency. *Journal of Dairy Science* 99:4941-4954.

Mota, R.R., P.S. Lopes,R.J. Tempelman, F.F. Silva, I. Aguilar, C.C.G. Gomes, and F.F. Cardoso (2016). Genome-enabled prediction for tick resistance in Hereford and Braford beef cattle via reaction norm models. *Journal of Animal Science* 94:1834-1843.

DePalma, G., Turnidge, J, and Craig BA (2016). Determination of disk diffusion susceptibility testing interpretive criteria using model-based analysis: development and implementation. *Diagnostic Microbiology and Infectious Disease*. In press

Dhillon, J, Craig, BA, Leidy, HJ, Amankwaah, AF, Osei-BoadiAnguah, K, Jacobs, A, Jones, BL, Jones, JB, Keeler, CL, Keller, CEM, McCrory, MA, Rivera, RL, Slebodnik, M, Mattes, RD, and Tucker, RM (2016). The effect of increased protein intake on fullness: A meta-analysis and its limitations. *Journal of the Academy of Nutrition and Dietetics*. In press.

Dhawan, D, Paoloni, M, Shukradas, S, Choudhury, DR, Craig, BA, Ramos-Vara, JA, Hahn, N, Bonney, PL, Khanna, C and Knapp, D. (2015). Comparative gene expression analyses identify luminal and basal subtypes of canine invasive urothelial carcinoma that mimic patterns in human invasive bladder cancer. *PLoS ONE* 10(9): e0136688.

Running CA, Craig, BA, Mattes, RD (2015). Oleogustus: The unique taste of fat, *Chemical Senses* 40(7), 501–516.

Smartt, A.D., K.R. Brye, C.W. Rogers, R.J. Norman, E.E. Gbur, J.T. Hardke and T.L. Roberts (2015). Chamber size effects on methane emissions from rice production. *Open Journal of Soil Science* 5, 227-235.

Brye, K., M. Helton, H. Liechty, M. Blazier, C. West, E. Gbur, M. Savin, and E. Mason (2015). Carbon dioxide emissions from switchgrass and cottonwood grown as bioenergy crops in the Lower Mississippi River Alluvial Valley. *Biomass and Bioenergy*. 83, 383-392.

Norman, C.R., K.R. Brye, E.E. Gbur, P. Chen and J. Rupe (2015). Long term effects of alternative residue management practices on soil water retention in a wheat-soybean, double crop system in Eastern Arkansas. *Open Journal of Soil Science* 5, 199-209.

Salmeron, M., E. Gbur, F. Bourland, N. Buehring, L. Earnest, F. Fritschi, B. Golden, D. Hathcoat, J. Lofton, A. Thompson, T. Miller, C. Neely, J.G. Shannon, T. Udeigwe, D. Verbree, E. Vories, W. Wiebold and L. Purcell (2016). Yield response to planting date among soybean maturity groups for irrigated production in the U.S. Midsouth. *Crop Science* 56, 747-759. DOI:10.2135/cropsci2015.07.0466.

Singh, V., N. Burgos, S. Singh, S. Abugho, L. Earnest, E. Gbur and R. Scott (2016). Herbicide and winter flood treatments for controlling volunteer rice off-season. *Crop Protection* 79, 87-96.

Rogers, C.W., R.J. Norman, T.J. Siebenmorgen, B.C. Grigg, J.T. Hardke, K.R. Brye and E.E. Gbur (2016). Nitrogen, harvest moisture, and cultivar selection effects on rough rice and milling yields. *Agronomy Journal* 108, 1-9.

Brye, K.R., R.L. McMullen, M.L. Silveira, J.M.D. Motschenbacher, S.F. Smith, E.E. Gbur and M.L. Helton (2016). Environmental controls on soil respiration across a southern US climate gradient: A meta-analysis. *Geoderma Regional* 7, 110-119.

Smartt, A.D., K.R. Brye, C.W. Rogers, R.J. Norman, E.E. Gbur, J.T. Hardke and T.L. Roberts (2016). Characterization of methane emissions from rice production on a clay soil in Arkansas. *Soil Science* 181, 57-67.

Smartt, A.D., K.R. Brye, C.W. Rogers, R.J. Norman, E.E. Gbur, J.T. Hardke and T.L. Roberts (2016). Previous crop and cultivar effects on methane emissions from drill-seeded, delayed-flood rice grown on a clay soil. *Applied and Environmental Soil Science*. DX.DOI.ORG/10.1.1155/2016/9542361. 13 pp.

Hill, Z.T., J.K. Norsworthy, L.T. Barber, T.L. Roberts and E.E. Gbur (2016). Assessing the potential for Fluridone carryover to six crops rotated with cotton. *Weed Technology* 30(2), 346-354.

Akehi, K, Long, B, Warren, AJ, Goad, C. (2016). Ankle joint angle and lower leg musculotendinous unit responses to cryotherapy. *Journal of Strength and Conditioning Research*. In press.

Dunn, B.L., T. Cavins and C. Goad (2016). Effect of applying calcium chloride and three milk supplements to poinsettia 'Prestige Red'. *Journal of Plant Nutrition* 39(1), 45-50. http://dx.doi.org/10.1080/01904167.2015.1086791

Al Sharqi, S., N. T. Dunford and C. Goad (2015). Acid and enzymatic degumming of wheat germ oil. *Transactions of the ASABE* 58(6): 1861-1866 DOI 10.13031/trans.58.11031.

Al Sharqi, S., N. T. Dunford and C. Goad (2015) Enzymatic wheat germ oil degumming, *Transactions of the ASABE* 58(6): 1867-1872. DOI 10.13031/trans.58.11032.

Basyouni, R., B. L. Dunn and Carla Goad (2015). Use of Nondestructive Sensors to Assess Nitrogen Status in Potted Poinsettia (Euphorbia pulcherrima L. (Willd. Ex Klotzsch)) Production. *Scientia Horticulturae* 192: 47–53.

Dunn, B.L. and Carla Goad (2015). Effect of Foliar Nitrogen and Optical Sensor Sampling Method and Location for Determining Ornamental Cabbage Fertility Status. 74 *Hortscience* 50(1).

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