

NCCC-170

Research Advances in Agricultural Statistics

Joint meeting with USSES (SCC-013)

Annual meeting held at Cargill Innovation Campus, Elk River, Minnesota

June 22-23, 2017

Members Present: Nora Bello (KS), Bruce Craig (IN, Admin.), Philip Dixon (IA), Sara Duke (USDA-ARS), Susan Durham (UT), Ed Gbur (AR), Carla Goad (OK), Matt Kramer (USDA-ARS), Nick Keuler (WI), Neil Paton (Cargill), Raul Macchiavelli (PR), Larry Madden (OH), Bahram Momen (MD), Julia Sharp (SC), John Stevens (UT), Rob Tempelman (MI), Kathy Yeater (USDA-ARS)

Others Present: William Bridges (SC), JungAe Lee (AR), Kelci Miclus (SAS), Jason Osborne (NC), Aaron Rendahl (MN), Brian Rice (IL), Esperanza Shenstone (IL), Qiong Hu (Cargill), Tatiana Lust (Cargill), Andrea Ostrom (Cargill), Travis Wolter (Cargill)

2017 Officers: Ed Gbur, Chair; Susan Durham, Secretary; Nora Bello, Program Chair; Neil Paton, Local Arrangements

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

Minutes:

Technical program: The meeting began at 9:00 a.m. on Thursday, June 22, 2017 with opening remarks by Dr. David Cook, Director of R&D and Managing Director of the Cargill Innovation Campus.

Presentations ended at approximately 5:00 p.m. The technical program consisted of the following presentations:

Jason Osborne, <i>NC State Univ.</i> , Chris Franck, <i>VPI and SU</i> , Dennis Boos, <i>NC State Univ.</i> , Bong Choi, <i>SAS Institute</i>	The All Configurations Maximum Interaction F-test for Non-additivity and the hiddenf Package in R
Elaine Sotherden and William Bridges, <i>Clemson Univ.</i>	Possible Advantages of Matching Concepts in Agricultural Experiments with Blocks
Philip Dixon, <i>Iowa State Univ.</i>	Pooling of variances: the skeleton in the mixed model closet?
William Bridges, <i>Clemson Univ.</i> , Walter Stroup, <i>Univ. of Nebraska</i> , Nora Bello, <i>Kansas State Univ.</i> , Bruce Craig, <i>Purdue Univ.</i>	Overview of Statistics as a Scientific Discipline and Practical Implications for the Evaluation of Faculty Excellence
Kelci Miclus, Russ Wolfinger, Luciano da Costa e Silva, Lauro Hose Moreira Guimaraes, <i>SAS Institute</i>	Multi-Trait Genomic Selection in Plant Breeding Programs
Brian Rice and Alexander Lipka, <i>Univ. of Illinois</i>	The Influence of Peak GWAS Associations on Genomic Prediction Accuracy
Esperanza Shenstone and Alexander Lipka, <i>Univ. of Illinois</i>	Genome Wide Association Study for Non-normally Distributed Traits: A Case Study for Stalk Lodging in Maize

John Stevens, *Utah State Univ.*

Imputation and paired samples in microRNA profiling

Kathleen M Yeater, *USDA-ARS*

Metabolomics: Challenges and Success

Business meeting: The business meeting began at about 9:00 a.m. on Friday, June 23, 2017. Ed Gbur presided. The following items were discussed:

- (1) The organizers were thanked for a productive and enjoyable meeting: Neil Paton for local arrangements and Nora Bello for the technical program.
- (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, 2016 to September 30, 2017 (or since last year's report) that are related to or inspired by their participation in NCCC-170 as soon as possible.
- (4) The 2018 meeting will be held in Arkansas at the Agricultural Experiment Station with Ed Gbur as the local host. Tentative dates are June 28-29, 2018. John Stevens will serve as program chair. The 2019 meeting is tentatively planned for Illinois. Tentative sites suggested for future meetings were Iowa State and SAS Institute.
- (5) 2016-2017 is the first year of the current project. The group reviewed objectives and discussed the initial progress toward those objectives as they relate to the expected outcomes and impacts, especially providing continuing education and statistical support to the scientific community in the review and editorial process.
- (6) With a new project comes a new participant list. Several individuals who participate in the annual meetings are not official participants according to NIMSS and vice versa. 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 only if they intend to participate.
- (7) Bruce Craig and William Bridges led a discussion of two position papers entitled "Overview of statistics as a scientific discipline and practical implications for the evaluation of faculty excellence" and "The position description as a practical guide for evaluation of interdisciplinary statistics faculty." The papers are the result of formal and informal discussions at these meetings as well as at the Joint Statistics Meetings. Both documents and a list of signees will be posted on the project website.

The business meeting adjourned at approximately 10:00 a.m. After a short break, the group reconvened for a tour of the Cargill facility and the annual group photograph for posting on 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:

Larry Madden taught a one-day workshop entitled “Meta-analysis for evidence synthesis” at the Annual Meeting of the American Phytopathological Society (APS), August 2017. San Antonio, TX.

Nora Bello, Nick Keuler, and Kevin McCarter taught a one and a half day workshop in conjunction with the Joint Annual Meetings of the American Dairy Science Association and American Society of Animal Sciences with focus on the application of general and generalized linear mixed models to research problems in the animal and food sciences. 61 participants. June 2017. Pittsburgh, PA.

Nora Bello taught three day workshop on the application of general and generalized linear mixed models for experimental design and data analysis of research problems in animal health and production. 25 participants. May 31 to July 2, 2017. Kansas State University. The workshop was sponsored by Shell US.

Nora Bello taught two day workshop on mixed models for repeated measures data at the XXI Annual Meeting of the Argentinean Chapter of the International Biometrics Society (Grupo Argentino de Biometria). Approximately 50 participants. September 2016. Corrientes, Argentina.

Kathy Yeater and Maria Villamil presented a half-day workshop entitled “Multivariate Analysis: Tools for understanding complex systems” at the ASA-CSSA-SSSA Meetings. November 2016. Phoenix, AZ.

Kathy Yeater presented an introduction to JMP for researchers at the U.S. Meat Animal Research Center, Clay Center, NE. February 2017.

Rob Templeman presented a half-day workshop entitled “An introduction to SAS” at the Center for Statistical Training and Consulting at Michigan State. November 2016.

Rob Templeman presented a half-day workshop entitled “Introduction to generalized linear models” at the Center for Statistical Training and Consulting at Michigan State. February 2017.

Rob Templeman presented a half-day workshop entitled “Determining the right standard errors and statistical tests using mixed models” at the Center for Statistical Training and Consulting at Michigan State. March 2017.

Presentations:

Bello N.M., Gonclaves M. On linear and non-linear mixed modeling of dose responses: Lessons learnt. David H. Baker Amino Acid Symposium, 2016 Midwest Chapter Meetings of the American Society of Animal Sciences. DesMoines, Iowa. March 2016. (*Invited Keynote Address*)

Bello N.M. Brief tour of Structural Equation Models: Rethinking causal inference in beef cattle. Kansas State University Center for Outcomes Research and Education. February 2016. (*Invited*)

Bello N.M. Towards reproducible research in animal health and production: Thoughts from Statistics. Center for Outcomes Research and Epidemiology. Kansas State University. February 2017. *(Invited)*

Bello N.M. Further thoughts for reproducible research in animal health and production (Part II). Center for Outcomes Research and Epidemiology. Kansas State University. May 2017. *(Invited)*

Bello N.M. A closer look at low-expression RNASeq transcripts: Motivations from the prairie. Department Seminar Series at the University of Kansas Cancer Center. Kansas City, Kansas. July 2016. *(Invited)*

Madden, L. V. Network meta-analysis for evidence synthesis in the plant and agricultural sciences. Central European Network of the International Biometric Society (IBS), August 2017. Vienna, Austria. *(Invited)*

Stevens J.R. Annotation Tools for Multivariate Gene Set Testing in Non-Model Organisms. Animal Reproduction and Biotechnology Laboratory Seminar, Colorado State University Department of Biomedical Sciences, October 2016. *(Invited)*

Bishop M.O., Stevens J.R., and Isom S.C. Statistical Methods for Assessing Individual Oocyte Viability Through Gene Expression Profiles. ENAR Spring Meeting, Washington DC, March 2017.

Bishop M.O., Stevens J.R., and Isom S.C. Statistical Methods for Assessing Individual Oocyte Viability Through Gene Expression Profiles. Kansas State University Conference on Applied Statistics in Agriculture, April 2017.

Pillai S.M., Hoffman M.L., Jones A.K., McFadden K.K., Stevens J.R., Zinn S.A., Reed S.A., and Govoni K.E. Poor maternal nutrition during gestation alters muscle gene expression in fetal offspring. Annual meeting of the American Society of Animal Science, July 2017.

Stevens J.R. The academic applied statistician -- transitioning domain-specific data into statistics research. Joint Statistical Meetings, Baltimore MD, August 2017.

Bello N.M. Honing in on low-expression RNASeq transcripts: Motivations from the prairie. Applied Bioinformatics Seminar Series at Kansas State University. February 2016.

Yeater, K.M. Introduction to JMP. U.S. Meat Animal Research Center, Clay Center, NE. February 2017.

Yeater, K.M. Tools for Researchers: Omics using JMP Genomics Software. VA SAS Users' Group, Richmond, VA. May 2017.

Yeater, K.M. What is a GLMM? And, how do I analyze it? U.S. Meat Animal Research Center, Clay Center, NE. June 2017.

Craig, B.A., Hurwitz, S, Sampson, P.D., Smith, H.S., and Wiest, M. Teaching a Statistical Consulting Course. Joint Statistical Meetings, Chicago, Illinois, August 2016. (Panel discussion)

Craig, B.A., Chen, N., and Wijayawardana, S.R. Assessing Inter-rater Agreement of Immunohistochemistry Scores. 28th International Biometric Conference, Victoria, Canada, July 2016.

Lawrence, G.B., Sabo, R., Scanga, S.E., Momen, B. Is recovery of forest soils from acidic deposition accelerating watershed release of atmospherically deposited nitrogen accumulated over past decades? American Geophysical Union, Fall General Assembly 2016.

Macchiavelli, R.; P. Torres-Saavedra, J. Chavarría-Carvajal, A. Calvo-Alfaro, Liz Terán-Herrera. Semi-parametric mixed beta regression models for disease severity in plants: Modelling Black Sigatoka in banana crops. 61st ISI World Statistics Congress, Marrakech, Morocco, July 2017.

Casanoves, F.; R. Macchiavelli; J. Di Rienzo. Non-linear mixed model implementation in InfoStat: an Interface with the nml Library. 61st ISI World Statistics Congress, Marrakech, Morocco, July 2017.

Giménez, G., Rubio, N., Haique, A., Macchiavelli, R.. Métodos alternativos para predecir categorías de frutos en base a curvas de crecimiento simuladas: modelo generalizado mixto multicategorico y support vector machine (SVM). XXI Reunión Científica del Grupo Argentino de Biometría., Corrientes, Argentina. 2016.

Piccardi, M., Macchiavelli, R., Balzarini, M. Ajuste de curvas de lactancia que derivan de un aborto. XXI Reunión Científica del Grupo Argentino de Biometría, Corrientes, Argentina. 2016.

Padilla, Ingrid Y., Vilda L. Rivera, Norma I. Torres, Raul Macchiavelli, Jose Cordero, David Kaeli, and Akram Alshawabkeh. Assessment of Links Between Contamination in Karst Groundwater and Water Quality in Drinking Water Systems., NIEHS Environmental Health Science FEST, Durham, NC, December 2016.

Di Rienzo, J.; R. Macchiavelli; Casanoves, F. Non-linear mixed model implementation in InfoStat. XXVIII International Biometric Conference, Victoria, Canada, July 2016.

Murphy, M., D. Hodgson, N. M. Bello. On accuracy and precision of oxygen flow meters. International Veterinary Emergency and Critical Care Symposium. September 2017. Nashville, TN

Sharpe, S., L. Johnson, N. M. Bello, O. Parrish and M. Gallart. Rapid evolution in a disturbed environment: Evolutionary response of native grass *Andropogon virginicus* to heavy metals in an abandoned mine site. Switchgrass IV: Prairie and Native Grass International Conference. Lincoln, NE. August 2017.

Sharpe, S., L. Johnson, N. M. Bello, M. Gallart and O. Parrish. Rapid adaptation in a contaminated environment: Evolutionary adaptive response of old field grass *Andropogon virginicus* to heavy metals in abandoned lead and zinc mines. Joint Annual Conference of the American Society of Naturalists, the Society for the Study of Evolution and the Society of Systematic Biologists. Portland, OR. June 2017.

Sharpe, S., L. Johnson, N. M. Bello, M. Gallart and O. Parrish. Rapid adaptation in a disturbed environment: Evolutionary adaptive response of native grass *Andropogon virginicus* to heavy metals in an abandoned mine site. 2017 Botany Conference. Fort Worth, TX. June 2017.

Chitakasempornkul, K. , E. Cha, M. Sanderson, A. Jager, N. Cernicchiaro, T. Schroeder, D. G. Renter and N.M. Bello. Accounting for data architecture on structural-equation-based modeling of feedlot performance outcomes. Kansas State University Conference on Applied Statistics in Agriculture. April 2017.

Chitakasempornkul, K., M. B. Menegatgs, S. S. Dritz, M. A. D. Goncalves, A. Jager, M.D. Tokach, R. D. Goodband and N.M. Bello. Exploring biological relationships between reproductive outcomes in

high-performing gilts and sows following nutritional management during late gestation. Kansas State University Conference on Applied Statistics in Agriculture. April 2017.

Cha, E., M. Sanderson, N.M. Bello, N. Cernicchiaro, A. Jager and D. G. Renter Network assessment of the relationship between Bovine Respiratory Disease Morbidity and performance in feedlot cattle. Kansas State University Conference on Applied Statistics in Agriculture. April 2017.

Books:

Di Rienzo, Julio Alejandro; Raúl E. Macchiavelli; Fernando Casanoves 2017. Modelos lineales generalizados mixtos: aplicaciones en InfoStat. Córdoba: Digital Book, PDF (InfoStat Software Estadístico / Di Rienzo, Julio Alejandro) ISBN 978-987-42-4985-2

Publications:

Bello, NM, Kramer, M, Tempelman, RJ, Stroup, WW, St-Pierre, NR, Craig, BA, Young, LJ, and Gbur, EE. 2016. Short communication: On recognizing the proper experimental unit in animal studies in the dairy sciences. *Journal of Dairy Science* 99, 8871-8879. [Article highlighted in *Journal of Dairy Sciences* as “Best Research Practices”]

Mohammadi, S., S.S. French, L.A. Neuman-Lee, S.L. Durham, Y. Kojima, A. Mori, E.D. Brodie, Jr., and A. Savitzky 2017. Corticosteroid responses of snakes to toxins from toads (bufadienolides) and plants (cardenolides) reflect differences in dietary specializations. *General and Comparative Endocrinology* 247, 16-25. doi: 10.1016/j.ygcen.2017.03.015

Skinner, H.M., A.M. Durso, L.A. Neuman-Lee, S.L. Durham, S.D. Mueller, and S.S. French 2016. Effects of diet restriction and diet complexity on life history strategies in side-blotched lizards (*Uta stansburiana*). *Journal of Experimental Zoology* 325(9), 626-637. doi: 10.1002/jez.2056

Tepedino, V.J., L.C. Arneson, and S.L. Durham 2016. Pollen removal and deposition by pollen- and nectar-collecting specialist and generalist bee visitors to *Iliamna bakeri* (Malvaceae). *Journal of Pollination Ecology* 19(8), 50-56.

Ogata, E.M., W. W. Wurtsbaugh, T.N. Smith, and S.L. Durham 2017. Bioassay analysis of nutrient and *Artemia franciscana* effects of trophic interactions in the Great Salt Lake, USA. *Hydrobiologia* 788(1), 1-16. doi: 10.1007/s10750-016-2881-9

Denlinger, D.S., A.Y. Li, S.L. Durham, P.G. Lawyer, J.L. Anderson, and S.A. Bernhardt 2016. Comparison of in vivo and in vitro methods for blood feeding of *Phlebotomus papatasi* (Diptera: Psychodidae) in the laboratory. *Journal of Medical Entomology* 53(5), 1112-1116. doi: 10.1093/jme/tjw074

Messina, F.J., and S.L. Durham 2015. Loss of adaptation following reversion suggests trade-offs in host use by a seed beetle. *Journal of Evolutionary Biology* 28, 1882-1891. doi: 10.1111/jeb.12704

Flint, C.G., X. Dai, D. Jackson-Smith, J. Endter-Wada, S.K. Yeo, R. Hale and M.K. Dolan 2017. Social and Geographic Contexts of Water Concerns in Utah. *Society & Natural Resources* 30(8), 885 - 902. DOI: 10.1080/08941920.2016.1264653.

Bushman, B.S., L. Wang, X. Dai, A. Joshi, J.G. Robins and P.G. Johnson. 2016. Responses of Tolerant and Susceptible Kentucky Bluegrass Germplasm to Salt Stress. *Hort Science* 141(5), 449 - 456.

Hass, Z, DePalma G, Craig, BA, Xu, H, and Sands, LP. 2017. Unmet Need for Help With Activities of Daily Living Disabilities and Emergency Department Admissions Among Older Medicare Recipients. *Gerontologist* 57(2), 206 - 210.

Rivera, RL, Maulding, MK, Abbott, AR, Craig, BA, and Eicher-Miller, HA. 2016. SNAP-Ed (Supplemental nutrition assistance program-education) increases long-term food security among Indiana households with children in a randomized controlled study. *Journal of Nutrition* 146(11), 2375 - 2382.

Xavier, A, Muir, WM, Craig, BA, and Rainey, KM. 2016. Walking through the statistical black boxes of plant breeding. *Theoretical and Applied Genetics* 129(10), 1933-1949.

Osei-Boadi Anguah, K, Lovejoy, JC, Craig, BA, Gehrke, MM, Palmer, PA, Eichelsdoerfer, PE, and McCrory, MA 2017. Can the palatability of healthy, satiety-promoting foods increase with repeated exposure during weight loss? *Foods* In press.

Cabezòn, FA, Schinckel, AP, Leòn, YL, and Craig, BA. 2017. Analysis of lactation feed intakes for sows with extended lactation lengths. *Translational Animal Science*. In press.

Gallagher, P, Craig, BA, Luttermoser, T, and Buczkowski, G. 2017. Paired Competition Analysis using Mixed Models. *Proceedings of the Kansas State University Conference on Applied Statistics in Agriculture*. In press.

Lakshmikantha H. Channaiaha, Minto Michaelb, Jennifer C. Acuffb, Randall K. Phebusb, Harshavardhan Thippareddic, Maureen Olewnika, George Milliken 2017. Validation of the baking process as a kill-step for controlling Salmonella in muffins. *International Journal of Food Microbiology* 250(5), 1-6

Michaela A. Schenkelberg, Richard R. Rosenkranz, George A. Milliken, Kristi Menear, David A. Dzewaltowski 2017. Implications of Social Groups on Sedentary Behavior of Children with Autism: A Pilot Study. *Journal of Autism and Developmental Disorders* 47 (4), 1223–1230.

Dale E. Bauman, Normand R. St-Pierre, George A. Milliken, Robert J. Collier, Joseph S. Hogan, Jan K. Shearer, K. Larry Smith, William W. Thatcher. 2016. Recombinant bovine somatotropin: Overview and results from a recent meta-analysis of effects on health and welfare of dairy cows. *The AABP Proceedings* 48, 73-78.

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- Singh, V., N. Burgos, S. Singh, D. Gealy and E. Gbur 2017. Impact of volunteer rice infestation on yield and grain quality of rice. *Pest Management Science* 73, 604-615. DOI: 10.1002/ps.4343.
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- Brennan, R.B., J.T. Scott, A.N. Sharpley, H.T. Lally, H.P. Jarvie, M.J. Bowes, Haggard, M. and E.E. Gbur 2017. Linking soil erosion to instream dissolved P cycling and periphyton growth. *Journal of the American Water Resources Association*, 1-13. DOI: 10.1111/1752-1688.12534.
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Mila, A. L. and Madden, L. V. 2017. Introduction to Bayesian analysis of Phytopathological data using SAS. *Plant Health Instructor*. <http://www.apsnet.org/edcenter/Pages/phi.aspx>. DOI: 10.1094/PHI-A-2017-0603-01.

Thomson, J., K.M. Yeater, L. Zurek, and D. Nayduch 2016. Abundance and accumulation of *Escherichia coli* and *Salmonella Typhimurium* procured by male and female house flies (Diptera: Muscidae) exposed to cattle manure. *Annals of the Entomological Society of America* 110, 37-44.

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Flores, C., R. Macchiavelli, O. Bosques, and R. Toledo 2016. Calidad y Estado Fisiológico del Café al momento de la Cosecha y su Efecto en el Rendimiento en Puerto Rico. *Journal of Agriculture of the University of Puerto Rico* 100: 27-41.

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Other project related activities:

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

Current specific goals for the 2016-2021 project:

- (1) To identify, foster and coordinate cooperative research efforts in statistics among statisticians serving food and agriculture research programs.
- (2) To provide continuing education and statistical support to the scientific community in the review and editorial process.
- (3) To address the statistical design and analysis issues associated with studies involving technologies that typically produce a large number of spatially and/or temporally correlated variables per observations but small sample sizes (e.g., -omics, informatics, and -metrics).
- (4) To address concerns associated with the development and implementation of generalized linear mixed model techniques and software used by statisticians and researchers.
- (5) To address meta-analysis issues associated with multi-location, multi-investigator projects including those in which study treatments and/or designs may differ by location.

Impacts:

- (1) Education of members leading to cooperative research efforts and improved consulting and teaching by individual members.
- (2) Cooperative research efforts among some members and information exchange on new developments among all members in the areas of generalized linear mixed models and the analysis of high dimensional, large volume data (i.e., Big Data).
- (3) Members continuing to offer workshops and, where appropriate, alternative means of continuing education and support for subject matter scientists, reviewers, and technical editors on valid design and statistical analysis of studies.